Public Input

in support of an

Environmental Impact Statement

for

Nuclear Fuel Services, Inc.

40-year License Renewal Request –

A MAJOR FEDERAL ACTION

November 17, 2009

(BINDER #2)

ENFORCEMENT ACTION TRACKING SYSTEM
LICENSE HISTORY REPORT
Sorted By: EA Number

Supplement = <ALL>

Initiator: All Regions Cumulatively
License Type = All
Case Status = Closed

Date Range: 01/01/1999 thru 12/31/2001
Date Type: 01 INSPECTION DATE

Severity Level: = 4

EA # ES/TYPE	LICENSEE FACILITY	INSP DATE HQ DATE	SUPPL CD HIGHEST SL	PROPOSED CP DATE	IMPOSED CP DATE	AMT PAID DATE	ACTION DATE	ENF CONF DATE
2000-067	NUCLEAR FUEL SERVICES, INC.							
SLM / FF	ERWIN, TN						NUREG:	

Keywords:
010401 - Reactor Ops - Functional Area - Training
030105 - Safeguards - Sec. Org./Procedures - Failure to Follow Proc.
090100 - General Keywords - Willful - Willful

ISSUE: 1	09/09/1999	6,_,_	$0	$0	$0	NOV
		4				04/11/2000

Facts: 10 CFR 70.3 and 70.9 and License conditions. Failure to follow procedures. Senior shift supervisor directed NFS operators to electrically acknowledge that they had received training before the training occurred.

TOTAL VIOLATIONS: 1 SL I : 0 SL II : 0 SL III : 0 SL IV : 1 SL V : 0

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2002-01-28

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

January 7, 2009

EA-08-103

Mr. David L. Kudsin
President
Nuclear Fuel Services, Inc.
P.O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: NUCLEAR REGULATORY COMMISSION OFFICE OF INVESTIGATIONS REPORT NO. 2-2006-017 AND NFS INSPECTION REPORT 07000143/2008401

Dear Mr. Kudsin:

This refers to an investigation initiated on April 20, 2006, by the U.S. Nuclear Regulatory Commission's (NRC) Office of Investigations (OI) at NFS. The purpose of the investigation was to determine whether fitness for duty requirements were willfully violated in connection with a Fitness for Duty incident which occurred in March 2006. A Factual Summary, included as Enclosure 1 to this letter, provides details of the OI investigation.

Based on the OI investigation, seven apparent violations of NRC requirements were identified and are being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. The current Enforcement Policy is located on the NRC's Web site at www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html.

The seven apparent violations are summarized as follows:

- On March 9, 2006, a senior executive of NFS consumed alcohol less than 5 hours before a scheduled working tour, in apparent violation of 10 CFR 26.20, "Written policy and procedures", subparagraph (a)(1);

- Despite detection of alcohol on the senior executive's breath and observance of behavior indicating questionable fitness, NFS failed to relieve the senior executive of his duties and failed to perform for-cause testing to determine his fitness for duty, in apparent violation of 10 CFR 26.24, "Chemical and alcohol testing", subparagraph (a)(3); 10 CFR 26.27, Management actions and sanctions to be imposed", subparagraph (b)(1); and NFS-HR-08-001-A, Fitness for Duty Program, Sections E.3.b. and E.3.d. There are four examples of this apparent violation, two of which were willful: (1) On March 7, 8 and 9, 2006, a security manager detected alcohol on the breath of the senior executive but with careless disregard of applicable requirements, did nothing to remove or initiate removal of the employee for cause testing; (2) On March 9, a senior security manager detected alcohol on the employee's breath and observed the senior executive engage in an inappropriate angry outburst directed at an NRC inspector. In deliberate violation of applicable requirements, the senior security manager took no action to remove or initiate removal of the senior executive for cause testing; (3) On March 9, the senior executive made inappropriate comments of a sexual nature to a female radiation technologist employee in the presence of another radiation technologist employee and their supervisor. Although one radiation technologist believed that the employee appeared

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and acted impaired, and the other radiation technologist commented that the senior executive must have been drunk, neither the radiation technologists nor their supervisor took any action to remove or to initiate removal of the senior executive for cause testing; and (4) On March 9, 2006, an NFS security guard and his supervisor detected alcohol on the senior executive's breath, and the security guard believed that the senior executive appeared and acted impaired, but neither the guard nor the supervisor took any action to remove or initiate removal of the senior executive for cause testing.

- On April 5, 2006, NFS granted the senior executive Self-Referral Rehabilitation Status in the NFS Employee Assistance Program after he had been notified of an ongoing Fitness for Duty investigation, in apparent violation of 10 CFR 26.20, "Written Policy and procedures", subparagraph (a), and NFS-HR-08-001-A, Fitness for Duty Program, Section G, Employee Assistance Participation.

- Sometime after April 5 and before April 30, 2006, on behalf of NFS, an NFS executive provided the NRC with information which was materially inaccurate, in apparent violation of 10 CFR 70.9, "Completeness and accuracy of information". Specifically, correspondence addressed to NRC stated that the NFS senior executive had entered a substance abuse rehabilitation program when, in fact he had not done so. The executive provided the inaccurate information with careless disregard to its accuracy. The inaccurate statement was material because it was capable of influencing NRC decisions regarding the NFS response to the March 9, 2006, violation of 10 CFR 26.20(a)(1).

- On April 11, 2006, in apparent violation of 10 CFR 70.9, "Completeness and accuracy of information", a senior NFS manager placed a letter in the senior executive's personnel file, and on June 8, 2006, NFS provided this letter, which was not accurate in all material respects, to the NRC. Specifically, the letter stated that the senior executive had entered a substance abuse rehabilitation program when, in fact, the senior executive had not done so. The inaccurate statement was material because it was capable of influencing NRC decisions regarding the NFS response to the March 9, 2006, violation of 10 CFR 26.20(a)(1). falsifying of records

- In May 2006, in apparent violation of 10 CFR 26.27, "Management sanctions and actions to be imposed", subparagraph (b)(1), and the NFS Fitness for Duty Program, Procedure No. NFS-HR-08-001, Section L. 2. "Impaired Workers", NFS failed to determine the senior executive's fitness to safely and competently perform his duties and responsibilities before returning him to duty. The contract professional retained by NFS to perform a determination of the senior executive's fitness to return to duty could not make the required determination because pertinent information had not been supplied to and considered by the contractor, who subsequently advised NFS that the senior executive was fit to return to duty. As a result, NFS failed to make the determination required by 10 CFR 26.27(b)(1) and Procedure No. NFS-HR-08-001 that the senior executive was fit to safely and competently perform his responsibilities. The information not supplied or considered was that: the smell of alcohol was detected on the senior executive not only March 9, 2006, but also on March 7 and 8, 2006; the senior executive consumed alcohol on March 9, 2006 less than 5 hours before a scheduled working tour; the meeting in which the senior executive was "hot-headed" was an important meeting with regulators of NFS, NRC and the U. S. Department of Energy: the senior executive made inappropriate comments of a sexual nature to a female employee on March 9, 2006;

and the senior executive had been convicted in 1979 of driving under the influence of alcohol, for which his license was suspended and for which he was fined.

- NFS did not provide appropriate training to ensure that employees understood their roles and responsibilities in implementing its Fitness For Duty Program and that employees understood 10 CFR Part 26, "Fitness for Duty Programs", requirements associated with the consumption of alcohol within 5 hours of any scheduled working tour, in apparent violation of 10 CFR 26.21, "Policy communications and awareness training", subparagraphs (a)(1) and (5); 10 CFR 26.22, "Training of supervisors and escorts", subparagraphs (a)(1), (a)(2) and (a)(4); 10 CFR 26.24, "Chemical and alcohol testing", subparagraph (a)(3); 10 CFR 26.27, "Management actions and sanctions to be imposed", subparagraph (b)(1); and NFS-HR-008-001-A, Fitness for Duty Program, Section N.2. There are two examples to this violation: (1) NFS did not ensure that employees understood that fitness for duty of an employee may be questionable based solely on detection of the smell of alcohol on the employee, and did not ensure that employees understood that aberrant behavior which may require for cause testing means not only behavior out of the ordinary for a particular employee, but also behavior which is aberrant in general; and (2) NFS training sessions and materials failed to expressly and clearly indicate that no employee may consume alcohol within 5 hours of any scheduled working tour, but only indicated that consumption of alcohol within 5 hours of a scheduled working tour may be grounds for cause testing.

In addition, based on the OI investigation, multiple apparent violations by two NFS employees and two NFS contractors of 10 CFR 70.10, "Deliberate misconduct", were identified. Specifically, materially incomplete or inaccurate information was submitted to NFS and to contractors of NFS which, in turn, caused or contributed to failures in NFS implementation of 10 CFR Part 26 requirements and of NFS programs and procedures. The apparent violations of 10 CFR 70.10 are being addressed in separate correspondence to the individual employees and contractors.

Before the NRC makes its enforcement decision, we are providing you an opportunity to either: (1) respond to the apparent violations within 30 days of the date of this letter or (2) request a predecisional enforcement conference. If a conference is held, it will be closed to public observation in accordance with the NRC Enforcement Policy because the findings are based on an NRC Office of Investigations report that has not been publicly disclosed.

If you choose to provide a written response, it should be clearly marked as a "Response to Apparent Violation EA-08-103," and should include: (1) the reason for the apparent violation, or, if contested, the basis for disputing the apparent violation; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further violations; and (4) the date when full compliance will be achieved.

Your response may reference or include previously docketed correspondence, if the correspondence adequately addresses the required response. If an adequate response is not received within the time specified or an extension of time has not been granted by the NRC, the NRC will proceed with its enforcement decision.

In addition, please be advised that the number and characterization of the apparent violations described herein may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

If you choose to request a PEC, the conference will afford you the opportunity to provide your perspective on the apparent violations and any other information that you believe the NRC should take into consideration before making an enforcement decision. The topics discussed during the conference may include: information to determine whether a violation occurred, information to determine the significance of a violation, information related to the identification of a violation, and information related to any corrective actions taken or planned to be taken.

In lieu of a predecisional enforcement conference, you may also request Alternative Dispute Resolution (ADR) with the NRC in an attempt to resolve this issue. Alternative Dispute Resolution is a general term encompassing various techniques for resolving conflicts outside of court using a neutral third party. The technique that the NRC has decided to employ is mediation. Additional information concerning the NRC's ADR program is described in the enclosed brochure (NUREG/BR-0317) and can be obtained at http://www.nrc.gov/about-nrc/regulatory/enforcement/adr.html. The Institute on Conflict Resolution (ICR) at Cornell University has agreed to facilitate the NRC's program as a neutral third party. Please contact ICR at 877-733-9415 within 10 days of the date of this letter if you are interested in pursuing resolution of this issue through ADR. Additionally, please contact Mr. Michael Ernstes, Chief, Plant Support Branch 2, Division of Reactor Safety, at (404) 562-4540, within 10 days of the date of this letter to notify the NRC of your intended response.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and Enclosure 2 will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. After completion of enforcement related activities in this matter and should the NRC conclude that escalated enforcement is warranted, Enclosure 1 will also be made available electronically for public inspection. To the extent possible, if you choose to respond, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

For administrative purposes this letter is issued as Inspection Report 07000143/2008401.

Should you have any questions concerning this letter, please contact me at (404) 562-4601 or Mr. Michael Ernstes at (404) 562-4540.

Sincerely,

/RA/

Kriss M. Kennedy, Director
Division of Reactor Safety

Docket No.: 70-143
License No.: SNM-124

Enclosures: 1. Factual Summary, NRC Office of Investigations Report No. 2-2006-017
2. NUREG/BR-0317

cc: See Page 5

cc w/Encl:
B. Marie Moore
Vice President
Safety and Regulatory Management
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P.O. Box 337, MS 123
Erwin, TN 37650

cc w/o Encl:
Debra Shults
Manager
Technical Services
Division of Radiological Health
3rd Floor, LNC Annex
401 Church Street
Nashville, TN 37243-1532

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

July 6, 2009

Nuclear Fuel Services, Inc.
ATTN: Mr. David Kudsin
President
P.O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: NRC INSPECTION REPORT NO. 70-143/2009-010

Dear Mr. Kudsin:

This letter refers to the information gathering visit from April 27 – 29, 2009 and the inspection conducted from May 18 - 22, 2009, at the Nuclear Fuel Services (NFS) facility in Erwin, TN. The purpose of the visit and the inspection was to determine whether activities authorized under the license were conducted safely and in accordance with NRC requirements. At the conclusion of the inspection on May 22, 2009, the findings were discussed with yourself and members of your staff.

As part of the February 2007 Confirmatory Order, NFS was required to implement a safety culture improvement plan. Two pieces of a strong safety culture are an effective corrective action program and a safety conscious work environment. This inspection was conducted to assess the effectiveness of NFS's corrective actions program and its safety conscious work environment.

The procedure used for this inspection (71152) applies to facilities which are required to have a corrective action program (CAP) that meets the criteria detailed in 10 CFR Part 50 Appendix B. Currently, NRC does not regulate NFS's safety conscious work environment; however, NFS is required to implement a CAP as detailed in its license. Any findings identified through this inspection were assessed against NFS's licensing basis; the criteria detailed in 10 CFR Part 50 Appendix B was used as a reference point for NFS's corrective action program and does not represent new requirements for the facility.

Based on the results of this inspection, no cited violations or deviations were identified. The inspection consisted of a detailed review of the implementation of the corrective action program for the period May 2007 to April 2009. The inspection results indicate that NFS has made improvement in certain elements of a corrective action program, including the willingness of employees to identify problems as they arise. However, the inspection also indicated that there is room for improvement in the facility's corrective action program with regard to the aspects of "evaluation of issues" (specifically, the application of extent of condition reviews) and "effectiveness of corrective actions" (i.e., implementing corrective actions to successfully prevent reoccurrence). Finally, the results of interviews with employees indicate that NFS has made progress in cultivating a safety conscious work environment among the radiation protection organization.

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The NRC intends to conduct an additional PI&R inspection, likely in the first quarter of 2010, to assess NFS's efforts to enhance its corrective action system. The results from this and the 2010 inspections will provide data to the NRC's evaluation of the effectiveness of NFS's safety culture improvement initiative.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, and its enclosure, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/readingrm/adams.html.

Should you have any questions concerning this inspection, please contact us.

Sincerely,

/RA/

D. Charles Payne, Chief
Fuel Facility Inspection Branch 1
Division of Fuel Facility Inspection

Docket No. 70-143
License No. SNM-124

Enclosure: NRC Inspection Report No. 70-143/2009-010

cc w/encl:
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Nuclear Fuel Services, Inc.
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B. Marie Moore
Director, Safety and Regulatory Management
Nuclear Fuel Services, Inc.
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cc w/encl: (Cont'd on page 3)

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SIGNATURE	MC 7/6/09	Via email 7/2/09	Via email 7/1/09	Via email 7/2/09	Via email 7/6/09	Via email 7/2/09
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DATE	7/ /2009	7/ /2009	7/ /2009	7/ /2009	7/ /2009	7/ /2009
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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.:	70-143
License No.:	SNM-124
Report No.:	70-143/2009-010
Licensee:	Nuclear Fuel Services, Inc.
Facility:	Erwin Facility
Location:	Erwin, TN 37650
Dates:	April 27 through April 29, 2009 (Information gathering visit) May 18 through May 22, 2009 (Inspection)
Inspectors:	M. Crespo, Senior Fuel Facility Inspector, Team Leader D. Merzke, Senior Project Inspector G. Smith, Resident Inspector R. Prince, Senior Fuel Facility Inspector J. Pelchat, Senior Fuel Facility Inspector L. Pitts, Fuel Facility Inspector (In-training)
Accompanying Personnel:	S. Vias, Chief, Reactor Projects Branch 7, DRP J. Shea, Director, Division of Fuel Facility Inspection
Approved by:	D. Charles Payne, Chief Fuel Facility Inspection Branch 1 Division of Fuel Facility Inspection

Enclosure

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc.
NRC Inspection Report 70-143/2009-010

The inspection consisted of reviews of Problem Identification Resolution and Correction System entries, walkdowns of process areas and interviews with plant personnel. The inspection results are outlined below.

Problem Identification and Resolution

- No findings of regulatory significance were identified.
- The licensee was adequately identifying and entering issues into the corrective action program (CAP).
- The licensee's performance in determining and implementing effective corrective actions did not meet the expectation of Inspection Procedure 71152 based on the number of reoccurring issues identified. In addition, the corrective actions tended to focus only on repairing the broken equipment without broadening the scope of the corrective actions to address the reasons why the equipment broke initially.
- The licensee demonstrated inconsistent use of extent of condition evaluations to ensure that root causes from one area were not present in others.
- The licensee was adequately evaluating industry operating experience. The licensee's lessons learned evaluations, which at times had identified effective corrective actions, were not formally evaluated and tracked.
- The licensee was not effectively entering self-assessment items into the corrective action program.
- The expectation that all employees are responsible for reporting safety concerns was being communicated by plant management.

Attachment:
Partial List of Persons Contacted
Inspection Procedures Used
List of Items Opened, Closed and Discussed
List of Documents Reviewed

REPORT DETAILS

1. Summary of Plant Status

Fuel manufacturing, training activities, and scrap recovery processes were operated throughout the inspection period. Blended low enriched uranium (BLEU) Preparation Facility (BPF) activities operated normally during the inspection period.

2. Problem Identification and Resolution

a. Assessment of the Corrective Action Program

(1) Inspection Scope

The inspectors reviewed the licensee's corrective action program (CAP) procedures which described the administrative process for initiating and resolving problems primarily through the use of problem identification, resolution, and correction system (PIRCS) reports. To verify that problems were being properly identified, appropriately characterized, and entered into the CAP, the inspectors reviewed PIRCS entries that had been issued between May 2007 and April 2009. Where possible, the inspectors independently verified that the corrective actions were implemented as intended. To help ensure that samples were reviewed across all plant areas, the team selected a representative number of PIRCS entries that were identified and assigned to the major plant departments, including operations, maintenance, health physics, and security. These PIRCS entries were reviewed to assess each department's threshold for identifying and documenting plant problems, thoroughness of evaluations, and adequacy of corrective actions. The inspectors reviewed selected PIRCS entries, verified corrective actions were implemented, and attended meetings where PIRCS entries were screened for significance to determine whether the licensee was identifying, accurately characterizing, and entering problems into the CAP at an appropriate threshold.

The inspectors conducted plant walkdowns of plant areas to assess the material condition and to observe any deficiencies that had not been previously entered into the CAP. The inspectors reviewed PIRCS entries, maintenance history, and completed work orders (WOs) for various components to verify that problems were being properly identified, appropriately characterized, and entered into the CAP.

The team conducted a detailed review of selected PIRCS entries to assess the adequacy of the root-cause and apparent-cause investigations of the problems identified, when appropriate. The inspectors reviewed these evaluations against the descriptions of the problems described in the PIRCS and the guidance in licensee procedure NFS-GH-918, "Directed Investigation Program," Rev. 6, as well as the PIRCS Investigation Guidelines. The inspectors assessed if the licensee had adequately determined the cause(s) of identified problems, and had adequately addressed reportability, common cause, generic concerns, and extent-of-condition. The review also assessed if the licensee had appropriately identified and prioritized corrective actions to prevent recurrence.

The team reviewed available site trend reports, to determine if the licensee effectively monitored identified issues and initiated appropriate corrective actions when adverse trends were identified.

The inspectors attended various plant meetings to observe management oversight functions associated with the corrective action program. These included the PIRCS Screening meetings, Corrective Action Review Board (CARB) meeting, and the Safety and Safeguards Review Council meeting.

Documents reviewed are listed in the Attachment.

(2) Assessment

Identification of Issues

The team determined that the licensee was generally effective in identifying problems and entering them into the CAP. There was a low threshold for entering issues into the CAP. This conclusion was based on a review of the requirements for initiating PIRCS as described in licensee procedure NFS-GH-65, "Problem Identification," management expectation that employees were encouraged to initiate PIRCS for any reason, and the very few deficiencies that inspectors identified during plant walkdowns not already entered into the CAP. Site management was actively involved in the CAP process and focused appropriate attention on significant plant issues, as evidenced by the number of "management by walking around" (MBWA) observation forms initiated.

The licensee did not have a formal trending program in place for early identification of adverse trends. However, the Quality Assurance (QA) department did identify negative trends through periodic audits. For example, issues regarding control of contractors and Lockout/Tagout (LOTO) compliance. Issues identified by QA were appropriately entered into PIRCS.

Additionally, the team reviewed the monthly self-assessment status report for the corrective action program, and determined this document to be essentially a trend report, tracking performance indicators such as numbers of PIRCS initiated by month, as well as timeliness of problem resolution. The report accurately identified trends and documented areas needing improvement, such as effectiveness of corrective actions. However, the team noted that no PIRCS were initiated as a result of the conclusions in the monthly report.

Based on reviews and walkdowns of the Fuel Manufacturing Facility (FMF), the Oxide Conversion Building (OCB), and the Blended Low Enriched Uranium Preparation Facility (BPF), the inspectors determined that, in general, deficiencies were being identified and placed in the CAP. However, inspectors noted many flanges and fittings which appeared to be leaking a caustic solution that had not been entered into PIRCS. Interviews determined this to be a long-standing problem. A self-assessment observation which stated that "the area appeared in poor shape to the uninitiated" was indicative of a tolerance for this degraded condition. In accordance with the guidance in licensee procedure NFS-GH-65, an example of a qualified problem to be reported in PIRCS is a "Spill, leak or release of radiological or non-radiological liquid, solid, or airborne

contaminants indoors or outdoors." The failure to initiate PIRCS for this degraded condition was contrary to licensee procedures but was determined to be of minor safety significance as the leaks did not appear to be active.

Prioritization and Evaluation of Issues

Based upon the evaluation of specific PIRCS reviewed by the inspection team during the onsite period, the team concluded that problems were generally prioritized in accordance with the licensee's CAP guidance as described in approved procedures. Prioritization level for each PIRC written was reviewed at the PIRCS screening meeting, and investigation levels were assigned based on safety significance. Management reviews of PIRCS conducted by the CARB were thorough, and adequate consideration was given to corrective actions for the most significant PIRCS. However, the team determined that investigations assigned to PIRCS were not always consistent with the PIRCS "Investigations Guidelines" for initiation of apparent cause and small team root cause investigations. The team identified several examples where guidelines called for a minimum of a small team root cause investigation for which there was either no investigation assigned, or an apparent cause investigation was assigned instead.

The team noted that seldom was there adequate documentation to support conclusions for apparent cause investigations. PIRCS requiring apparent cause investigations would solely document the apparent causes determined using the TapRoot root cause methodology. The lack of documentation in some cases made it difficult for inspectors to determine the adequacy of the apparent cause investigations to support their conclusions. For example, in PIRCS 10918, initiated due to errors found in checkweigh sheets, the apparent cause was determined to be "A task was performed in a hurry or a shortcut used," with no amplifying information documented to support that conclusion.

The team also identified that the applicability of extent of condition reviews were not formally evaluated as part of the PIRCS evaluation process. Extent of condition was occasionally considered during evaluation of PIRCS, but the evaluation process was not formalized. The team identified several examples of PIRCS that appeared to warrant an extent of condition review, but one was not performed or limited to the process area in which the failure occurred. The following are some examples: PIRCS 17584, corrective actions for a level switch failure limited to FMF; PIRCS 12186, corrective actions involving the improper troubleshooting of clog limited to the process area where problem occurred; PIRCS 16605, application of extent of condition review limited to FMF; and PIRC 16579, corrective actions regarding improper rigging by contractors limited to the contractor that made the error.

Additional observations by the team are detailed below. The events identified by the team were indicative of ineffective evaluation of issues but did not constitute violations of regulatory requirements.

- PIRCS 9938 was initiated as a result of work stoppage due to contaminated product material. The PIRC problem stated "Suggest investigating initial rework of material to understand why reworked material is still contaminated." The apparent cause investigation did

not address why the reworked material was still contaminated. The corrective actions focused on reprocessing the material instead of determining the cause of the contamination and initiating corrective actions to prevent recurrence.

- PIRCS 10678 was initiated as a result of a failed bearing on a ventilation fan and was assigned a small team root cause investigation. There was no documentation to verify that similar bearings for other ventilation fans were inspected as part of an extent-of-condition evaluation. Additionally, the licensee was unable to determine the actual failure mechanism, stating that routine preventive maintenance is performed on the fans, and routine checks are made for temperature and vibration. However, there was no indication that the PM records were reviewed, or when the last checks for vibration were made prior to failure. The licensee documented the root cause as "Problem not anticipated," which appeared to be inadequate to determine corrective actions to prevent recurrence.

- PIRCS 16179 was initiated as the result of an NRC violation regarding the failure to perform a required annual inspection of fire dampers. The licensee's review determined that these inspections were not included on the Safety-Related Equipment (SRE) or Preventative Maintenance (PM) programs to assure that they were performed. There was no documentation to verify that the licensee had determined the extent of condition through examining the lists of required inspections to ensure all required inspections were listed.

- PIRCS 15943 was initiated following a failure of IROFS FIRE6-1 during routine testing. The cause of the failure was the malfunction of a SRE air solenoid valve. This valve was fitted with a speed control device equipped with a screw-needle valve to control the rate that air was bled from the valve. The licensee investigation determined that the adjustment screw was fully closed preventing any air from being bled from the valve, therefore preventing the valve from performing its design function. The screw was readjusted which allowed the SRE valve to operate as intended. However, the actual cause of how the adjustment screw became fully closed was not determined. The licensee did not document whether an extent of condition evaluation was performed to assess other similar model valves in this or other comparable IROFS.

- PIRCS 16741 was initiated following a failure of IROFS FIRE6-6 during routine testing. The failure was caused by the malfunction of an SRE air solenoid valve (a model of valve different from the documented finding immediately discussed above). The licensee's corrective action was to replace the valve with a newer model successfully used in another part of the plant. The valve's actual cause of failure was not determined. No documentation existed to support the decision made to change the type of valve nor was there an evaluation performed documenting why the newer valve would

improve performance. In addition, the licensee did not document whether an extent of condition evaluation was performed to assess other similar valves in this or other comparable IROFS.

The team determined that the licensee had generally conducted root cause analyses in compliance with its CAP procedures. The licensee consistently applied the TapRoot causal-analysis methodology to all cause investigations.

The team determined that reportability determinations had been completed consistent with the guidance contained in NFS-HS-A-50, "Guidelines for Government Agency Notification."

Effectiveness of Corrective Actions

Based on a review of corrective action documents, interviews with licensee staff, and verification of completed corrective actions, the team determined that overall, corrective actions were timely, commensurate with the safety significance of the issues, and generally effective in correcting the immediate problem, but not effective at preventing recurrence. The team determined that the licensee appeared to have a "broke-fix" approach that resulted in actions primarily focused on correcting the symptoms to problems and not necessarily focused on the identification of the root or apparent causes. Several repetitive events identified by the team were indicative of ineffective corrective actions, but they were not violations of regulatory requirements:

- PIRCS 10918 was initiated due to errors found in checkweigh sheets. The corrective actions were to fix the errors and reissue the documents. There were no actions implemented to correct the cause of the problem. Five weeks later, PIRC 11293 was initiated as a result of multiple additional checkweigh sheet errors.

- PIRCS 9148 was initiated as a result of a spill following changing of a filter in a glove box. PIRCs 17369 and 18348 were initiated as a result of spills encountered during subsequent change-outs of the same filter. The reoccurrence of the problem led the team to conclude that the true root cause had not been found and therefore the corrective actions were ineffective.

- PIRCS 9786 was initiated due to foreign material being found while processing a product. The cause was attributed to a deteriorating gasket. The same condition occurred approximately five weeks later. Two years later, PIRCS 17712 documented the same condition and cause, finally culminating in the licensee changing vendors and gasket material.

- PIRCS 11611 was initiated as a result of a filter change which resulted in a spill and contamination event. No corrective actions were initiated to prevent recurrence. Two years later, PIRC 17506

was initiated due to a repeat event. Corrective actions included procedure changes, new training requirements, and an equipment modification.

- PIRCS 12815 was initiated after a container of material was discovered in a storage rack not approved for that type of material. The licensee determined root causes of the event to be a failure of configuration control of the storage system and a failure to train personnel to be knowledgeable of the storage requirements. The licensee's investigation specifically indentified the following lessons learned:

  1. "When installing new storage units or equipment in an area, the units/equipment should be designed to meet the current requirements of the area" [configuration control]; and,

  2. "Appropriate personnel were not adequately trained with regards to (storage of) material and associated security requirements."

  While the licensee did provide immediate training to personnel working in this area, none of the corrective actions implemented by the licensee addressed configuration control or ongoing employee training or training for new employees, as identified in the lessons learned.

The team determined that effectiveness reviews were initiated for some corrective actions, but there was no formal guidance in assigning those reviews. With the exception of those conducted and tracked by QA, effectiveness reviews were not given unique corrective action numbers for tracking, nor were due dates for completion typically assigned. The team determined that effectiveness reviews were focused primarily on the implementation of the corrective action instead of on how effective the corrective action was in addressing the original problem. The team identified one example where an effectiveness review was not timely. In PIRCS 721, initiated due to a scale not having an SRE tag attached, an effectiveness review was assigned to corrective action 378. The corrective action was to include SRE training in all clerk and supervisor job requirements. The corrective action was completed in June 2003, but the effectiveness review never completed. Upon questioning, it was determined the job requirements subsequently changed, and so the effectiveness review was not performed.

The team noted that the licensee was not consistent in documenting immediate or subsequent corrective actions initiated on the PIRCS. Several PIRCS were closed with no documentation of any corrective actions having been performed. The team identified the following additional examples of ineffective corrective actions:

- PIRCS 14405 was initiated as a result of a nitric acid pump being replaced with an incorrect pump. The small team root cause investigation documented five root causes. However, there were no associated corrective actions associated with two of those root

causes: inadequate pre-job briefs and lack of supervision. The inspectors determined that the overall corrective actions were adequate because the corrective actions associated with the other identified root causes were sufficient to prevent recurrence.

- PIRCS 12194 was initiated to perform a common cause analysis due to violations identified by NRC inspectors. As part of the investigation, several areas for improvement were identified and communicated separately to the Director, Safety and Regulatory Management, none of which were documented in the corrective action program.

- PIRCS 14537 was initiated on July 22, 2008, and its apparent cause evaluation had three corrective actions associated with it. However, the corrective actions were never implemented due to a software glitch that caused a PIRCS entry to be effectively "lost" within the computerized system. The manager assigned to approve the apparent cause corrective actions did not exist. The three corrective actions assigned were given initial completion dates of February 28, 2009. However, as of the date of the inspectors' review, no activity associated with the corrective actions had commenced. The inspectors noted that no PIRCS audit function was able to uncover this anomaly. The inspectors brought this issue to attention of licensee management.

The licensee generated PIRCS report number 18828 to document, evaluate, and, if necessary, implement corrective actions for the items identified during this inspection.

(3) Conclusions

No findings of regulatory significance were identified. The licensee was adequately identifying and entering issues into the CAP. However, the licensee's performance in determining and implementing effective corrective actions for issues indicated room for improvement. In addition, the licensee demonstrated inconsistent use of extent of condition evaluations for issues.

b. Assessment of the Use of Operating Experience (OE)

(1) Inspection Scope

The team examined the licensee's program for reviewing industry operating experience and interviewed the OE Coordinator to assess the effectiveness of how external and internal operating experience data was handled at the plant. In addition, the team selected operating experience documents (e.g., NRC generic communications, 10 CFR Part 21 reports, vendor notifications, and plant lessons learned), which had been issued since May 1, 2007, to verify whether the licensee had appropriately evaluated each notification for applicability to the NFS plant, and whether issues identified through these reviews were entered into the CAP. Documents reviewed are listed in the Attachment.

(2) Assessment

Despite the lack of a formal operating experience program at NFS, the team determined the licensee was evaluating external operating experience in the form of NRC generic communications and vendor bulletins. For NRC generic communications, the Safety and Safeguards Review Council (SSRC) reviewed Information Notices and Regulatory Issue Summaries for applicability to the site. Licensee staff proactively search the communications located on the NRC public website for issues potentially applicable to NFS. The operating experience coordinator indicated that Part 21 issues were being evaluated at the site; however, the team could not find any documentation to confirm that such evaluations were being performed. The Part 21 issues sampled by the team were not applicable to the plant. The team reviewed PIRCS initiated as a result of vendor bulletins and notifications, and verified that appropriate corrective actions were implemented where necessary.

The team determined that lessons learned identified as a result of PIRCS investigations were not being formally tracked, nor were they being communicated to the licensee staff. This resulted in recommendations not being implemented in a timely manner and problem recurrence. Capturing these lessons learned as internal operating experience and communicating these lessons to all staff would increase the probability of preventing recurring problems.

The team identified the following examples where the lack of corrective actions associated with lessons learned resulted in recurring problems. These issues did not constitute violations of regulatory requirements:

- PIRCS 9786 was initiated due to foreign material being found while processing a product. The lesson learned was that gasket material on the vessel in question requires periodic replacement. The same condition occurred approximately five weeks later. The licensee changed vendors and initiated use of a new gasket material nearly two years after identification of the lesson learned following a reoccurrence of the issue. The inadequate initial corrective actions stemmed from the licensee's apparent cause investigation which determined this issue to be a "tolerable failure."

- PIRCS 10918 was initiated due to errors found in checkweigh sheets. The lesson learned from the apparent cause investigation was that checksheets should be issued one at a time, but there was no corrective action associated with that conclusion. Five weeks later, PIRCS 11293 was initiated as a result of multiple checksheets being issued that still contained errors. The conclusion of the PIRCS screener was "Lessons learned is not intended to be a procedure." The PIRCS was closed out without any subsequent corrective actions. Subsequently, Quality Control's normal practice was modified to issue checksheets one at a time, which incorporated the lesson learned.

(3) Conclusions

No findings of regulatory significance were identified. The licensee was adequately evaluating industry operating experience. The licensee's lessons learned evaluations, which at times had identified effective corrective actions to prevent reoccurrence, were not formally evaluated and tracked.

c. Assessment of Self-Assessments and Audits

(1) Inspection Scope

The team reviewed licensee QA audits, department self-assessments, including those which focused on problem identification and resolution, and MBWA observation forms, to verify that findings identified through the licensee self-assessment program were entered into the CAP. The team also reviewed procedure NFS-GH-945, Self Assessment Program," Rev. 1, to verify self-assessment activities were being performed consistent with the licensee's procedure.

(2) Assessment

The team determined that QA audits were thorough, critical, and effective in identifying issues and directing attention to areas that needed improvement. Licensee weaknesses and issues identified in these audits were entered into the CAP. The team verified that corrective actions associated with the licensee's findings were appropriate and were implemented in accordance with the licensee's corrective action procedures.

The team also reviewed a number of MBWA observation forms. The licensee credits MBWA observations as part of their self-assessment program. The forms documented management observations in areas of safety, facilities condition, personnel work practices, maintenance, radiological protection, security, and conduct of operations. Many of the observation forms reviewed identified issues that needed improvement or were determined to be unacceptable in several areas, but there was no amplifying information provided. Some forms documented areas needing improvement for which an entry into PIRCS was required by procedure, such as pipes, vessels, and roofs leaks, but no entries in the CAP could be found. Additionally, many forms identified recommendations for improvement, but the team found no mechanism for translating these recommendations into actions, such as a PIRCS entry.

The team also determined that functional area managers, such as those for the CAP and configuration management, were unaware of the requirement to maintain self-assessment action lists for long term corrective actions, as described in NFS-GH-945. The team determined this to be contrary to the procedure in that long term corrective actions from self-assessments were being tracked through other means.

(3) Conclusions

No findings of regulatory significance were identified. The licensee was not effectively entering self-assessment items into the CAP.

d. Safety Conscious Work Environment

(1) Inspection Scope

The team randomly interviewed on-site workers regarding their knowledge of the corrective action program and their willingness to write PIRCS or raise safety concerns. During technical discussions with members of the plant staff, the inspectors conducted interviews to develop a general perspective of the safety-conscious work environment at the site. The interviews were also conducted to determine if any conditions existed that would cause employees to be reluctant to raise safety concerns. The inspectors reviewed the licensee's Employee Concerns Program (ECP) and interviewed the ECP coordinator.

(2) Assessment

Based on the interviews conducted and the PIRCS reviewed, the team determined that licensee management emphasized the need for all employees to identify and report problems using the appropriate methods established within the administrative programs, including the CAP and ECP. These methods were readily accessible to all employees. Based on discussions conducted with a sample of plant employees from various departments, the inspectors determined that employees felt free to raise issues, and that management encouraged employees to place issues into the CAP for resolution. The inspectors did not identify any reluctance on the part of the licensee staff to report safety concerns.

The inspectors reviewed ongoing efforts within the Radiation Protection (RP) department related to the establishment of an environment supportive of raising safety concerns. Based on discussions with RP managers, the inspector found that individuals were aware of the need to continually emphasize to their staff the importance of raising safety issues and management's support of the program. Every individual interviewed within the RP organization by the inspectors, stated that they would not hesitate to raise a safety concern and noted that management had established an environment supportive of raising concerns. The inspectors reviewed the lesson plan that addressed "stop-work" authority for Radiation Protection personnel. The inspector noted that as part of the RP group's implementation of human performance initiatives that stop-work authority has been included as a human performance tool.

(3) Conclusions

No findings of regulatory significance were identified. The expectation that all employees are responsible for reporting safety concerns was being communicated by facility management.

3. Exit Meeting

The inspection results were presented to members of the licensee's staff at various meetings throughout the inspection period and were summarized with yourself and members of your staff on May 22, 2008. Proprietary information was discussed but not included in the report.

ATTACHMENT

1. PERSONS CONTACTED

Partial List of Licensee's Persons Contacted

D. Kudsin, President
T. Lindstrom, Vice President
M. Moore, Director, Safety & Regulatory
R. Crowe, PIRCS Manager
J. Pugh, Director Operational Support
R. Bond, Senior Project Director, HEU Operations
R. Droke, Licensing Director
R. Shackelford, Nuclear Criticality Safety Manager
M. Tester, Sr. Manager, Radiation Control
K. Weir, Security Director

2. INSPECTION PROCEDURE USED

IP 71152 Identification and Resolution of Problems

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

None

4. LIST OF DOCUMENTS REVIEWED

Procedures
SOP 392, "Work Request Procedure," Rev. 19
SOP 409 Section 1, "General Requirements for BLEU Preparations and Assoc. Facilities," Rev. 23
SOP 409, Section 8, "U-Metal Oxidation and U-Oxide Dissolution," Rev. 28
SOP 409 Section 10, "U-Al Dissolution," Rev. 23
NFS-CAP-Effect-Eval, Assigning and Performing Effectiveness Evaluations, Rev. 0
NFS-ECP-001, Overview of Employee Concerns Program Services and Methods, Rev. 0
NFS-HS-E-02, "Emergency Criticality Evacuation," Rev. 35
NFS-GH-56, "Management Measures Identification and Implementation for IROFS," Rev. 5
NFS-GH-01, "Contamination Control," Rev. 28
NFS-GH-65, "Problem Identification," Rev. 4
NFS-GH-72, "Accident Precursor Identification and Evaluation," Rev. 1
NFS-GH-918, "Directed Investigation Program," Rev. 6
NFS-GH-922, "The NFS Problem Identification, Resolution, and Correction System," Rev. 8
NFS-GH-945, "Self-Assessment Program"

Procedures (cont.)
NFS-MGT-04-006, "NFS Safety and Compliance Conscious Work Environment Policy," Rev. 2
OPR-TB-May09-03, "Operations Support of Maintenance Work"
PIRCS Investigation Guidelines, Rev. 2
PIRCS Risks Definitions Table, Rev. 3
LOA-2062-027-2, "Initiating and Observing U-Oxide Dissolver and U-Aluminum Transfers"

Work Requests
WR 113033

Self-Assessments
2008 Annual Self-Assessment Report
Monthly Self-Assessment Status Report, Corrective Action Program, April 2009
NFS Configuration Management Program Self-Assessment, May 2009
QA-07-09, Quality Assurance Audit Review of the Incident Investigations Management Measure
QA-08-05, Quality Assurance Audit of the Lockout/Tagout Program
QA-08-21, Quality Assurance Audit Report of the NFS Configuration Management Program
QA-09-05, Quality Assurance Audit Report of SNM-124 Management Measure: Maintenance of Items Relied On For Safety

Other Documents
MPB-008-017, Non-Conformance Trend Analysis Report for the Third Quarter of 2008
MPB-009-001, Non-Conformance Trend Analysis Report for the Fourth Quarter of 2008
Nonconformance Trend Analysis Report for the Fourth Quarter of 2008, January 21, 2009
RT-PRACT-RAD-WORK-CTRL, "Radiological Work Coverage," November 2006

PIRCS

7837	11611	14308	15021	16748
9148	11690	14335	15054	16892
9786	11711	14339	15134	16893
9788	11872	14342	15136	16896
9816	12084	14382	15197	16898
9841	12186	14405	15258	16908
9938	12194	14432	15258	16937
10124	12527	14484	15269	16939
10151	12815	14537	15270	16947
10252	13086	14663	15285	16963
10317	13087	14754	15322	16998
10454	13261	14766	15590	17000
10458	13492	14774	15943	17179
10519	13903	14790	16179	17221
10678	14106	14825	16188	17281
10738	14131	14873	16211	17369
10918	14134	14886	16220	17506
11288	14161	14893	16271	17584
11293	14207	14912	16452	17678
11393	14278	14915	16579	17712
11466	14281	14942	16605	18191
11552	14287	14964	16664	18348
11608	14292	14987	16741	18828

Significant Investigations

PMK Group, Inc.

This investigation began after an NRC inspection in February 2004. The investigation substantiated that an employee of PMK Group, Inc., a materials licensee, willfully disregarded NRC regulations by leaving a moisture density gauge, containing 11 millicuries of cesium-137 and 44 millicuries of americium-241, unattended at a heavy demolition site. As a result, the gauge was severely damaged, and the gauge's radioactive material could not be accounted for. The investigation determined that the demolition company's front-end loader accidentally crushed the gauge with a 250-ton excavation machine, and the employee admitted that he was responsible for leaving the gauge unattended despite his training and experience and that his action had contributed to the destruction of the gauge. As a result of the investigation, a Notice of Violation (Severity Level III) and Proposed Imposition of Civil Penalty ($7,500) was issued against the licensee on August 23, 2004. Three Severity Level IV violations were also identified during the inspection.

Nuclear Fuel Services, Inc.

An investigation was initiated to determine whether a Nuclear Fuel Services (NFS) supervisor falsified transfer records of special nuclear materials. During the investigation, the supervisor admitted willfully authorizing the transfer of the subject materials without conducting the required verifications prior to, and during, the transfer. On March 29, 2004, the NRC issued a Notice of Violation (Severity Level III) to NFS, the licensee, and issued a Notice of Violation (Severity Level III) to the supervisor.

Kewaunee

An investigation was initiated to determine whether Nuclear Management Company (NMC) contract workers, employed by Day and Zimmerman Nuclear Power Systems (DZNPS) at the Kewaunee Nuclear Plant, violated fitness-for-duty (FFD) regulations by failing to report FFD concerns about a DZNPS foreman.

The investigation revealed that although FFD concerns about the DZNPS foreman were brought to the attention of a DZNPS superintendent by several contract employees, the superintendent failed to take any action to ensure that the concerns were investigated. At the time the FFD concerns were raised, the superintendent observed the foreman but took no action to verify the foreman's condition, nor were the concerns reported to Security. The superintendent subsequently admitted that he might have smelled alcohol on the foreman's breath.

The investigation concluded that the DZNPS superintendent deliberately provided false information to both OI and a licensee investigator about being told of the FFD concerns. On December 30, 2003, NRC issued a Notice of Violation (Severity Level III) and Proposed Imposition of Civil Penalty ($60,000) to NMC, citing the superintendent's failure to take corrective measures, including investigating the circumstances or sending the employee to for-cause FFD testing.

City Hospital

This investigation resulted from a March 2001 NRC inspection, during which the inspectors identified potential falsification of xenon gas clearance rate calculations and dose calibrator accuracy evaluations. The investigation determined that a former health physicist (HP) consultant/radiation safety officer (RSO) deliberately violated NRC requirements by falsifying xenon clearance rate calculations records at NRC-licensed facilities, including City Hospital, Martinsburg, West Virginia, Culpeper Hospital, Culpeper, Virginia, and Warren Memorial Hospital, Front Royal, Virginia. OI also substantiated that the former HP consultant/RSO deliberately falsified academic credentials and a radiological certification issued by the American Board of Radiology. The NRC staff issued an order prohibiting the HP consultant/RSO from engaging in NRC-licensed activities for 3 years.

Thereafter, OI provided information to a Federal grand jury in concert with the Office of Criminal Investigations, Food and Drug Administration (FDA), regarding his activities at NRC-licensed facilities. The investigations by the NRC and the FDA resulted in the filing of a criminal information on July 22, 2004, in the Western District of Virginia, charging the former HP consultant/RSO with 38 counts of mail fraud, in violation of 18 U.S.C. § 1341, for falsely and fraudulently portraying himself as a health physicist and RSO qualified to inspect and service mammography equipment and other medical facilities using radioactive materials. Pursuant to the criminal information, the former HP consultant/RSO pleaded guilty to all counts on July 22, 2004, and is awaiting sentencing.

MC0506 20119
2005-02-28
2004

[redacted]

Item Number: FC900662 **Last Updated:** 07/03/1995

Narrative:

THE LICENSEE REPORTED THE DISCOVERY OF CONTAMINATED SLUDGE IN AN OLD DIGESTER AT THE CITY WASTE TREATMENT PLANT. PLANS WERE MADE TO DECONTAMINATED IT PRIOR TO RENOVATION. ANALYSIS YIELDED [redacted] IN THE [redacted] WITH A DRY WEIGHT OF [redacted] DRY WEIGHT.

Event Date: 11/11/1990 **Discovery Date:** 11/11/1990 **Report Date:** 11/11/1990

Licensee/Reporting Party Information:

Agreement State Regulated:	NO	Reciprocity:	NONE		
License Number:	SNM-0124	Name:	NUCLEAR FUEL SERVICES, INC.		
NRC Docket Number:	07000143	City:	ERWIN		
NRC Program Code:	21210	State:	TN	Zip Code:	376509718
Responsible NRC Region:	2				

Site of Event:

Site Name ERWIN State: TN

Additional Involved Party:

License Number:	NA	Name:	NA		
		City:	NA		
		State:	NA	Zip Code:	NA

Other Information:

NRC Reportable Event:	Y	Abnormal Occurrence:	N
Agreement State Reportable Event:	N	Investigation:	Y
Atomic Energy Act Material:	Y	Record Complete:	
Consultant Hired:	N	Event Closed:	Y

Event Cause:

FCP - FUEL CYCLE PROBLEMS

Cause: NOT REPORTED

RLM - RADIOACTIVE MATERIAL REL.

Cause: NOT REPORTED

Corrective Actions Information:

Action Number:	Corrective Action:
FCP	
1	NOT REPORTED
RLM	
1	NOT REPORTED

Release of Material or Contamination Information:

Type or Release or Contamination:	Activity: Ci	Activity: GBq	Radionuclide:	Effect of Release or Contamination:
SURFACE	NR	NR	U-OXIDE	

Source of Radiation:

FCP

Source Number: 1

Source/Material:	FUEL FABRICATION MATERIAL	Radionuclide or Voltage (kVp/MeV):	U-OXIDE		
Device Name:	NA	Activity:	NR Ci	NR GBq	
Manufacturer:	NUCLEAR FUEL SERVICE				
Model Number:	NR				
Serial Number:	NR				

RLM

Source Number: 1

Source/Material:	FUEL FABRICATION MATERIAL	Radionuclide or Voltage (kVp/MeV):	U-OXIDE		
Device Name:	NA	Activity:	NR Ci	NR GBq	
Manufacturer:	NUCLEAR FUEL SERVICE				
Model Number:	NR				
Serial Number:	NR				

[redacted]

[redacted]

Reporting Requirements:

FCP

Reporting Requirement: NRCB 91-01 - Loss of criticality safety controls.

Mode Reported: Written

RLM

Reporting Requirement: 20.0405(a)(1)(v) - old - (SUPERSEDED) THE 30 DAY WRITTEN REPORT OF LEVELS OF RADIATION OR CONCENTRATIONS OF RADIOACTIVE MATERIAL IN AN UNRESTRICTED AREA IN EXCESS OF 10 TIMES ANY APPLICABLE LIMIT SET FORTH IN THIS PART OR LICENSE.

Mode Reported: Written

References:

Reference Number:	Entry Date:	Retraction Date:	Coder Initials:	Reference Type:
900247	08/19/1994		CDB	OLD ASSIGNED ITEM NUMBER
[redacted] - Unmarked Legacy Reference				
900318	08/19/1994		CDB	OLD ASSIGNED ITEM NUMBER
[redacted] - Unmarked Legacy Reference				
NR	08/19/1994		CDB	PRELIMINARY NOTIFICATION
[redacted] - Unmarked Legacy Reference				

[redacted]

Kathy Holmes

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

JAN 10 1991

Docket No. 70-143
License No. SNM-124

Nuclear Fuel Services, Inc.
ATTN: Mr. Charles R. Johnson
President
P. O. Box 337, MS 123
Erwin, TN 37650

Gentlemen:

SUBJECT: NRC INSPECTION REPORT NO. 70-143/90-29

This refers to the Nuclear Regulatory Commission (NRC) inspection conducted by C. A. Hughey on December 10-14, 1990. The inspection included a review of activities authorized for your Erwin facility. At the conclusion of the inspection, the findings were discussed with those members of your staff identified in the enclosed Inspection Report.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observation of activities in progress.

Within the scope of the inspection, no violations or deviations were identified.

In accordance with 10 CFR 2.790(a), a copy of this letter and its enclosure will be placed in the NRC Public Document Room.

Should you have any questions concerning this letter, please contact us.

Sincerely,

Douglas M. Collins

Douglas M. Collins, Chief
Radiological Protection and
Emergency Preparedness Branch
Division of Radiation Safety
and Safeguards

Enclosure:
NRC Inspection Report

cc w/encl:
State of Tennessee

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report No.: 70-143/90-29

Licensee: Nuclear Fuel Services, Inc.
Erwin, TN 37650

Docket No.: 70-143 License No. SNM-124

Facility Name: Nuclear Fuel Services, Inc.

Inspection Conducted: December 10-14, 1990

Inspectors: for C. W. Hughey — Date Signed 1/8/91

S. S. Adamovitz — Date Signed 1/7/91

for D. W. Jones — Date Signed 1/7/91

Approved by: John P. Potter, Chief — Date Signed 1/8/91
Facilities Radiation Protection Section
Radiological Protection and
Emergency Preparedness Branch
Division of Radiation Safety
and Safeguards

SUMMARY

Scope:

This routine, unannounced inspection was conducted in the areas of plutonium decommissioning and environmental monitoring.

Results:

In the areas inspected, violations or deviations were not identified.

Bioassay techniques for Plutonium-239 were discussed (Paragraph 2).

The revision of a calibration procedure to include lapel sampler flow calibration will be tracked as an Inspector Followup Item (IFI) (Paragraph 2).

The use of bubble suits during decommissioning activities was very effective in reducing potential internal exposures (Paragraph 2).

Results

Training of employees prior to the beginning of decommissioning activities was adequate (Paragraph 3).

Contamination problems around the Decontamination and Volume Reduction Facility had been minimal (Paragraph 4).

The current status of the licensee's projects to decommission the waste ponds (Paragraph 6), the plutonium facilities (Paragraph 5), and the Building 110 underground laboratory tank (Paragraph 5) were discussed.

The status of the burial trenches on CSX Railroad property was discussed (Paragraph 7).

The status of the old digester at the Town of Erwin Publicly Owned Treatment Works was reviewed (Paragraph 8).

The licensee's program for the shipment of plutonium contaminated wastes to a licensed burial site was examined including waste classification, packaging for shipment, and generation of the shipping papers. The implementation of a quality assurance plan for radwaste shipment preparation will be tracked as an IFI (Paragraph 9).

Gaseous effluents from decommissioning activities were reviewed. The implementation of a procedure for gaseous effluent result evaluation will be tracked as an IFI (Paragraph 10).

Liquid effluents for the period October 1-December 12, 1990, were within license limits (Paragraph 11).

Cond
Addendum
this project.

Condition 9 of Lic
Plutonium Facilities
license. Section 7.1
bioassay requirements du.

Urine/fecal (In-vitro) samples were
required, and were sent to an offsite
licensee indicated that the analytical sens
(Pu)-239 were about 0.2 dpm per sample for the fec
0.02 dpm per liter for the urine analyses. Due to the insolu
of the plutonium in the facilities being decommissioned; however, fecal
analyses were much more sensitive and quicker in quantifying and
discovering potential for uptakes. Internal dose assessments from

Kathy Helm

REPORT DETAILS

1. Persons Contacted

Licensee Employees

T. Bennett, Decommissioning Supervisor
*M. Brennan, Health Physics Analyst
S. Feagins, Safety and Environmental Data Analyst
*K. Hensley, Material Control and Accountability Director
R. Holley, Radiation Monitor Manager
R. Ideker, Project Manager, Pond Decommissioning
J. Kirkpatrick, Project Manager, Plutonium Facility Decommissioning
J. Lyles, Environmental Specialist
*A. Maxin, Safety Director
D. Paine, Vice President, Safety and Regulatory Management
*G. Rosenberger, Health Physics Analyst

Other licensee employees contacted during this inspection included security force member, technicians, operators, and administrative personnel.

Ecotek

B. Biddle, Engineer II
S. Toler, Health Physicist II
*M. West, Project Manager, Plutonium Building Decommissioning

*Attended exit interview

2. Internal Dose Assessment (83822)

a. Bioassay Analyses

Condition 7 of the Plutonium Facilities Decommissioning Plan Condition Addendum identifies the radiation protection program associated with this project.

Condition 9 of Licensee No. SNM-124 incorporates the licensee's Plutonium Facilities Decommissioning Project Plan Addendum into the license. Section 7.1 of that plan, Internal Dose Assessment, specifies bioassay requirements during decommissioning activities.

Urine/fecal (In-vitro) samples were being collected quarterly, as required, and were sent to an offsite vendor for analyses. The licensee indicated that the analytical sensitivities for plutonium (Pu)-239 were about 0.2 dpm per sample for the fecal analyses and about 0.02 dpm per liter for the urine analyses. Due to the insoluble nature of the plutonium in the facilities being decommissioned; however, fecal analyses were much more sensitive and quicker in quantifying and discovering potential for uptakes. Internal dose assessments from

bioassay measurements were calculated using a commercially available software program based on ICRP-30 methodology.

Whole body counts (In-vivo) were being performed as required at the licensee's facility. Since Pu-239 could not be measured directly by the counter's thin-window germanium detectors, intake/uptake quantification was accomplished by measuring the amount of americium (Am)-241 at (62 keV) which was a contaminant resulting from the beta decay of Pu-241. A predetermined Am-241/Pu-239 ratio was used to quantify any uptake. The Am-241/Pu-239 ratio of the material in building 110 was determined previously by a vendor who relied on detailed gamma spectroscopic results of the building and knowledge of the feed materials that were processed when the building was being actively used. A similar survey of building 234 was planned prior to beginning decommissioning activities there. In-vivo analytical sensitivity for Pu-239, based on a one hour count, was about 100 nanocuries depending on chest wall thickness and other factors.

b. Lapel Sampler Calibrations

Condition 14 of License No. SNM-124 states that for activities of the Safety Department required by this license, the licensee shall establish, maintain, and follow Safety Department procedures which have been reviewed and approved by Safety Department Management.

Section 7.5 of the Plutonium Facilities Decommissioning Project Plan Addendum, "Personal (Lapel-Type) Air Monitoring," discusses the requirements for breathing zone air samples.

The inspector observed the semi-annual flow calibration of a lapel sampler. The sampler was calibrated against a primary gas flow standard that was calibrated against a National Institute of Standards and Technology (NIST) traceable standard. The sampler was verified to be operational at several flow rates and was then adjusted to a rate of 3.2 liters per minute. Calibration data was recorded by the technician on a data sheet; however, no procedure was used to perform the calibration. Further investigation by the inspector revealed that a procedure did not exist. By the end of the inspection, the licensee indicated that Procedure NFS-HS-A05, "Calibration of Radiation Monitoring Instruments," would be revised to included lapel sampler calibrations by March 31, 1991. The revision of the procedure will be tracked as an Inspector Followup Item (IFI) (70-143/90-29-01).

During the inspection, the inspectors randomly verified that air samplers used during decommissioning activities were within current calibration frequencies.

c. Use of Bubble Suits

Since November 1990, workers in the Decontamination and Volume Reduction Facility (DVRF) had been consistently using bubble suits

during decommissioning activities. Licensee representatives indicated that since the use of these suits began, there had been a significant decrease in internal exposure dose assignments (approximately a factor of 10). The bubble suits were manufactured by Rich Industries and were 2 piece units that covered the entire body (Model 3931, 0.012 gauge thickness). The suits were not reused after each wearing. To reduce the possibility of contamination, Radiation Monitors cut the workers out of the suits upon exiting the DVRF decontamination cell. As discussed in Report No. 90-26, a direct protection factor was not allowed for the suit because it was not certified for use as per the requirements of 10 CFR 20.103(e); however, internal exposures could be quantified by the wearing of a lapel breathing zone air sampler underneath the suit.

No violations or deviations were identified.

3. Training (83822)

Section 5.0 of the Plutonium Facilities Decommissioning Project Plan Addendum discussed the training requirements for employees prior to performing plutonium decommissioning work.

The inspector reviewed the tests, scores, lesson plans and training aids for training sessions conducted July 10-14, 1989 and April 30 - May 4, 1990. The lesson plans covered the required subject areas specified in the licensee addendum and the tests appeared to sufficiently challenge a student's knowledge of the material presented. A random review of test results did not indicate any subject area weaknesses.

No violations or deviations were identified.

4. Contamination Surveys (83822)

Section 7.6 of the Plutonium Facilities Decommissioning Project Plan Addendum discussed the surface and personnel contamination survey requirements during decommissioning activities.

Routine contamination surveys were being performed, as required by license addendum, in and around the DVRF daily, weekly and monthly. Contamination problems around the facility had been minimal because the licensee and their contractor had aggressively worked to keep them from occurring. The inspector was informed that only two contamination incidents had occurred at the DVRF since beginning decommission activities.

As required by licensee addendum, the inspectors observed that all personnel exiting the controlled areas associated with plutonium decommissioning were surveyed for contamination by Radiation Monitors. No personnel contaminations were observed during the week of the inspection.

No violations or deviations were identified.

5. Plutonium Facility Decommissioning (83822, 88035)

Condition 87 of license no. SNM-124, Amendment 60 identifies conditions for the decontamination and decommissioning of inactive facilities.

Condition 8 of the Plutonium Facilities Decommissioning Plan Condition Addendum identifies the environmental protection program which includes liquid and gaseous effluent monitoring and environmental surveillance.

The inspectors observed work activities in Building 110 and the Decontamination and Volume Reduction Facility (DVRF) and discussed the current schedule for the continuing plutonium facilities decommissioning activities with cognizant licensee and vendor representatives. Work was continuing for glove box removal in Building 110 with four glove boxes remaining to be moved. The completion date for the removal of the glove boxes was estimated to be the end of December, 1990 or the first of January, 1991. The last glove box to be moved from Building 110 would be the laboratory fume hood which contained the most residual contamination. The licensee was evaluating the need to construct a secondary containment for the fume hood prior to removal, due to the deteriorated condition of the box. A procedure for the removal of the building's vent ductwork was not yet available. Although the current schedule identified January, 1990 for removal of the ductwork, the licensee informed the inspector that removal would probably be delayed until mid-1991.

Update Bldg. 110 glovebox

?

The licensee had not yet shipped any of the processed contaminated materials offsite to a licensed vendor for disposal but was planning the first shipment of Class A waste during the next week. The inspectors reviewed the licensee's program for radwaste classification and shipment and this is discussed in further detail in Paragraph 9 of this report.

The inspectors examined the Building 110 underground lab tank area and noted that access to the area was permitted only through Building 110. As discussed in a previous Inspection Report (70-143/90-26), the licensee planned to remove the tank from the ground and store it onsite. Buildings 110 and 234 had been considered as storage options for the tank but currently the licensee was planning to store the tank in Building 310 which had sufficient security for plutonium storage. However removal of the tank and storage in Building 310 might constitute a technical violation of the Environmental Protection Agency's (EPA) land bans if the tank contained hazardous materials.

Mixed waste?

The inspector also reviewed the draft procedure, NFS-DCM-PR-017, "Excavation of the 110 Lab Tank," Revision 0, which had been revised since the inspector's first review (70-143/90-08). The procedure described physical steps and radiation protection requirements for the tank removal but again did not adequately address potential problems with the removal process such as inseepage of contaminated groundwater. The inspector and licensee and vendor representatives discussed the need to include or reference other documents for contingency plans. The licensee agreed to modify the procedure prior to providing NRC RII a copy per the commitment documented in

the Inspection Report No. 70-143/90-08. The licensee's current schedule identified January 28-31, 1991 for removal of the concrete cap and dirt cover. Actual evacuation of the tank was scheduled for February 18-20, 1991. However, the inspector was informed that excavation of the tank was contingent upon the weather and that excavation may have to be delayed until the fall, 1991 during the region's dry season.

No violations or deviations were identified.

6. Waste Pond Decommissioning Project (88035, 88045)

Condition 87 of license no. SNM-124, Amendment 60 identifies conditions for the decontamination and decommissioning of inactive facilities.

The inspectors discussed the status of the pond decommissioning project with licensee personnel. The licensee had received concurrence from the US EPA and the State of Tennessee for the pond's resampling plan and the current schedule identified December, 1990 for initiating resampling.

The licensee continued to hold discussions with the US EPA to determine whether filtration and moisture removal by a filter press for the sludge constituted a process which would alter the leachability of the materials contained in the sludge. The licensee had submitted an amendment to the resampling plan to the US EPA which described performing the filter process on a pilot scale. Core samples would be collected from 18 randomly selected pond grids (a grid is a 10 foot by 10 foot section of the pond) and a composite prepared for each pond from sections of the 18 cores. The composite would be processed through the filter press and five pressed sediment samples from the each composite would be analyzed for hazardous constituents per the Toxicity Characteristic Leaching Procedure (TCLP). The licensee had not yet received concurrence from the US EPA regarding this amendment. If EPA concurred with this amendment, the drummed sludge would not have to be reanalyzed for hazardous constituents per TCLP.

No violations or deviations were identified.

7. NFS Burial Trenches on CSX Railroad (RR) Property (88035)

Status DO lease with CSX?

The inspectors discussed the status of the burial trenches on CSX RR property with cognizant licensee representatives and examined the area. Installation of the storm drain had been completed and approximately two feet of fill material had been added to the top of the burial trenches and as a result of the grading operation, the markers for the borders of the trenches had been destroyed. The licensee had engineering surveys to identify the location of the trenches and planned to replace the markers when construction was complete.

In Inspection Report No. 70-143/90-23, the inspector erroneously reported that the new lease agreement currently being negotiated included a stipulation to allow NFS to install trench monitoring wells on RR property downgradient of the trenches. This was apparently a misunderstanding of

licensee representative's comments. The inspector was informed during the current inspection that the lease agreement allowed the establishment of wells on the leased property but that, for correct monitoring of burial trenches, wells would have to be established on other RR property. The lease had not yet been signed and the licensee planned to separately pursue permission to establish the appropriate monitoring wells.

No violations or deviations were identified.

8. Town of Erwin Publicly Owned Treatment Works (POTW) (88045)

The inspector discussed the status of the old digester at the POTW with licensee representatives and toured the POTW facility accompanied by a licensee representative and the POTW supervisor.

The POTW facility was equipped with two digesters which were used to process sanitary sewage by bacterial action. The new digester used a heated process for digesting the sludge while the old digester used an unheated or cold process. Construction of the new digester was completed in December, 1988. Once the new digester began to be used, the old digester was used intermittently as a holding tank to store processed sludge from the new digester prior to transfer of the sludge to the drying beds. After drying, the sludge was currently being taken to a private farm to be spread in pasture land as fertilizer. Previously, the sludge had been used onsite at the POTW for backfill during construction activities.

Sludge removed from farmers field? from Peter?

The licensee and the State of Tennessee had been splitting samples of the processed fluid sludge on a monthly basis and analyzing the samples for uranium. The collection point for the sludge was the transfer pipe to the drying beds. The inspector reviewed monthly licensee data for the sludge from 1987 to May, 1990. Uranium-234 values ranged from 10 pCi/gm dry to 550 pCi/gm dry with most values between 100 pCi/gm dry to 300 pCi/gm dry. The 1989 data was also labelled to identify whether the sludge came from the old or new digester. In all cases, uranium-234 concentrations were higher for samples collected from the old digester. The old digester values ranged from 120 pCi/gm dry to 280 pCi/gm dry while the new digester values were all less than 100 pCi/gm dry. The inspector also reviewed graphed data for the average uranium-234 concentrations for the years 1986 to 1989. The following table presents the graphed data:

Calendar Year	Average U-234 Concentration (pCi/gm dry)
1986	550
1987	220
1988	140
1989	80

The decrease in the average uranium-234 concentration in the sludge can be attributed to NFS's efforts to eliminate radioactively contaminated liquids discharged to the sanitary sewer and to the use of the new digester during 1989. Discussions with the POTW supervisor indicated that NFS was the sole source of the elevated uranium concentrations in the sludge.

The inspector reviewed average annual gross alpha data for the NFS municipal sewer based upon volume weighted averages:

Calendar Year	Municipal Sewer Average Gross Alpha Concentration (pCi/l)
1981	3710
1982	6350
1983	2950
1984	763
1985	733
1986	831
1987	748
1988	224
1989	254
1990 (first half)	220

Discussions with the licensee indicated that the major change in sewer effluents occurred in 1987 when the liquid discharges from the onsite laundry and the Building 105 laboratory were routed to NFS's wastewater treatment facility rather than being discharged directly to the sewer. The current inputs to the municipal sewer were toilet, sink, and shower discharges from the following buildings: 100, 105, 220, 234, 320, 345, and 350. Building 220 also contained a laboratory sink which discharged to the sewer. Storm water run-off for the NFS site entered a series of drainage ditches that flowed to the Banner Spring Branch, which was not part of the sewer system.

As reported in previous inspection reports (70-143/88-31, 70-143/89-07), POTW personnel planned to clean the old digester at some point and remove all of the accumulated sludge. On August 6, 1990, licensee and State of Tennessee visited the POTW and collected split samples from two locations in the top sludge layer in the old digester. This layer was less dense than the fluid sludge and was estimated to be five to six feet thick. The samples were analyzed by the licensee's vendor for radioisotopes and the following

results were reported:

		pCi/gm dry	wet/dry (gm)
Sample #1	uranium-234	1310	399/76
	uranium-235	28.8	
	uranium-238	24.8	
Sample #2	uranium-234	1350	370/70
	uranium-235	29.3	
	uranium-238	18.9	

Based upon these values, the licensee calculated the percent enrichment to be 15.3 percent and 19.4 percent. The total uranium-234 activity in the top sludge layer was calculated by the inspectors to be 0.068 curies assuming the sludge layer was six feet thick and the sludge density was 1.0 gm/ml; and using the tank diameter of 45 feet and average isotopic values. The POTW supervisor informed the inspector that the fluid sludge was below the top sludge layer and that a layer of heavy silt and deposits had accumulated in the bottom of the tank. The supervisor also indicated that there was no way to measure the thickness of the bottom sediment layer which could contain sufficient uranium residue to require disposal as a radioactive waste. In examining the old digester, the inspector noted that the tank was not full and that the top of the sludge appeared to be approximately six feet below the top of the tank. The POTW supervisor informed the inspector that the overall height of the tank was 21 feet so that the fluid sludge and sediment would be approximately nine feet high in the tank. The POTW supervisor also informed the inspector that the last transfer from the old digester to the drying beds occurred October 17, 1990.

No violations or deviations were identified.

9. Shipment of Plutonium Contaminated Wastes (86750)

Condition 9 of License No. SNM-124 incorporates the licensee's Plutonium Facilities Decommissioning Project Plan Addendum into the license. Section 2.3 of that plan specifies the requirements for classification and packaging for shipment of waste destined for disposal.

The inspectors reviewed the following procedures which were applicable to the decommissioning project: NFS-DCM-PR-02, Revision 0, "Shipping for Processing, Storage, or Burial" and NFS-DCM-PR-03, Revision 1, "Packaging for Shipment to Processing, Storage, or Burial." These procedures provided guidance for properly classifying, marking, labeling, and inspecting packages of waste generated from the plutonium decommissioning activities and for producing an accurate manifest of radioactive materials contained in each shipment. The procedures were found to provide adequate guidance for those activities.

The licensee indicated that a shipment of waste was scheduled for the week following this inspection and that it was to consist of fifty 71-gallon square steel drums and four B25 boxes. The licensee's records pertaining to one of the drums scheduled for shipment were examined. The licensee used a nondestructive assay (NDA) measurement system to determine the activity content of each compacted bale of waste. The results of those measurements were then manually entered into the computerized Material Tracking System (MTS). The MTS generated a report which provided an optimized listing, with regard to activity content per drum, of assignments of compacted bales for each drum. This listing was then used for filling the drums. The MTS also produced a "Radioactive Shipment Manifest Form" for the scheduled shipment. For the drum selected for review, the activities assigned to the compacted bales in the drum were traced through the records system from the NDA measurements to the activities listed on the manifest for that drum. No discrepancies were noted. The licensee indicated that detailed checks had been performed on the shipment preparation process beginning with the transfer of the NDA measurement data into the MTS through the information presented on the manifest but no formal quality assurance (QA) plan had been developed for the process. The licensee also indicated that a QA plan would be developed and implemented by January 31, 1991. The licensee's implementation of a QA plan for the shipment preparation process will be tracked as an inspector followup item (70-143/90-29-02).

No violations or deviations were identified.

10. Gaseous Effluents from Decommissioning Activities (88035)

Condition 9 of License No. SNM-124 incorporates the licensee's Plutonium Facilities Decommissioning Project Plan Addendum into the license. Section 8.2 of that plan specifies the requirements for surveillance and monitoring of the gaseous effluents from the facilities involved in the plutonium decommissioning project.

The inspectors reviewed procedure NFS-DCM-PR-04, Revision 1, "Health Physics Procedure for Plutonium Decommissioning" which provided guidance for sampling frequencies, evaluating and reporting analytical results, and actions to be taken when those analytical results indicated that the activity concentrations of the effluents had exceeded licensed limits. The procedure was found to provide adequate guidance for those functions and the guidance provided therein was in accordance with the surveillance and monitoring requirements specified in Section 8.2 of the decommissioning plan.

The inspectors reviewed the analytical results for the daily and 7-day samples taken during November 1990 from each of the following stacks:

27-Bldg. 234 Production Glove Boxes
28-Bldg. 234 Room Air and Cell Atmosphere
29-Bldg. 234 Wet Process Station
224-Bldg. 234 Scrap Recovery Process Station
583-Bldg. 234 Plutonium Laboratory Exhaust
103-Bldg. 110 Laboratory Glove Boxes
104-Bldg. 110 Laboratory Glove Boxes
554-Bldg. 110 Room Air

The inspectors determined that, for the period reviewed, the gaseous effluents had been sampled and analyzed at the required frequencies. The licensee indicated that whenever the measured activities were higher than typical levels, a process engineer was notified and the process engineer was responsible for determining whether an assignable cause could be identified. It was also noted that the licensee's analytical results for the daily samples were recorded in units of disintegrations per minute (dpm) whereas the decommissioning plan and the guidance procedure specify the licensed limits and action limits in units of microcuries per milliliter (uCi/ml). The licensee indicated that an implementing procedure would be established to formalize the process of evaluating analytical results and making the required notifications whenever licensed or action limits are exceeded, pursuant to the plan and guidance procedure. The licensee also indicated that this new procedure would be implemented by March 31,1991. The licensee's implementation of this new procedure will be tracked as an inspector followup item (IFI) (70-143/90-29-03).

No violations or deviations were identified.

11. Radiological Effluent Monitoring (88035, 88045)

Section 25 of License No. SNM-124, Amendment 60 Amendment 60 requirements regarding liquid effluents. Subsection 423 dated August 30, 1976, the license specifies liquid sampling locations, analytical requirements, and the frequencies for collection and analysis.

As a result of the elevated discharge from the high enriched uranium scrap recovery facility to the Waste Water Treatment Facility (WWTF) during the last week of November 1990, the liquid effluents from the WWTF were examined. The activity concentrations for liquid discharges during the period October 1 through December 12, 1990 were reviewed. The inspectors determined that the license limits for the activity concentrations of the liquid discharges from the WWTF were not exceeded during the period reviewed.

No violations or deviations were identified.

12. Exit Interview

The inspection scope and results were summarized on December 14, 1990, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

Bioassay techniques for Plutonium-239 were discussed (Paragraph 2).

The revision of a calibration procedure to include lapel sampler flow calibration will be tracked an an Inspector Followup Item (Paragraph 2).

The use of bubble suits during decommissioning activities was very effective in reducing potential internal exposures (Paragraph 2).

Training of employees prior to the beginning of decommissioning activities was adequate (Paragraph 3).

Contamination problems around the Decontamination and Volume Reduction Facility had been minimal (Paragraph 4).

The current status of the licensee's projects to decommission the waste ponds (Paragraph 6), the plutonium facilities (Paragraph 5), and the Building 110 underground laboratory tank (Paragraph 5) were discussed.

The status of the burial trenches on CSX Railroad property was discussed (Paragraph 7).

The status of the old digester at the Town of Erwin Publicly Owned Treatment Works was reviewed (Paragraph 8).

The licensee's program for the shipment of plutonium contaminated wastes to a licensed burial site was examined including waste classification, packaging for shipment and generation of the shipping papers. The implementation of a quality assurance plan for radwaste shipment preparation will be tracked as an IFI (Paragraph 9).

Gaseous effluents from decommissioning activities were reviewed. The implementation of a procedure for gaseous effluent result evaluation will be tracked as an IFI (Paragraph 10).

Liquid effluents for the period October 1-December 12, 1990, were within license limits (Paragraph 11).

Item Number	Category, Description, and Reference
70-143/90-29-01	IFI: Revise Calibration procedure to include lapel sampler flow calibration (Paragraph 2).

70-143/90-29-02	IFI: Implementation of QA plan for radwaste shipment preparation process (Paragraph 9).
70-143/90-29-03	IFI: Implementation of procedure for gaseous effluent analytical result evaluation (Paragraph 10).

Erwin Record

Motion filed in sludge suit

02/03/04

By Rebekah Harris -- Staff Writer

A motion has been filed by representatives of Erwin Utilities and Scott Street, both defendants in a pending lawsuit, limiting the scope of inspection and testing of Erwin's sewage treatment works.

The plaintiffs, Danny M. and Michael Seth Jones are suing Erwin Utilities and Scott Street, along with Todd Love and Theodore Love Jr., for $4.5 million on charges that Seth Jones, who worked as a farmhand for the Loves, suffered health problems because of sewage sludge distributed for use as a fertilizer.

Representatives for the Joneses filed a motion in October, requesting permission to examine the Erwin Utilities District Sewer Plant for the purposes of inspection, measuring , photographing, testing and sampling various stages of the sludge process.

However, in November, representatives for Erwin Utilities and Street filed a motion for a protective order to prohibit plaintiffs from collecting samples without providing a description of the samples and analyses that plaintiffs desire to take and from collecting samples of liquid effluent from Erwin's treatment works.

Attorneys for EUD and Street, say "samples of liquid effluent cannot be relevent to the allegations that Seth Jones has been harmed by biosolids from the treatment works and could not reasonably lead to discovery of relevant information."

Danny Jones filed the complaint last January as conservator for his son, Michale Seth Jones, and alleged that the EUD provided the Loves with Class B sewage sludge to be used as fertilizer on their fields. Michael Seth Jones was employed by the Loves from 1999-2002, and his duties often included picking up the sludge from EUD, transporting it to the Love farm and spreading it on the fields. The class B sludge still contained detectable pathogens.

The Jones' claim that as a result of handling Class B sludge, Michael Seth Jones developed several illnesses. According to the lawsuit, he began to develop respiratory problems including bronchitis and shortness of breath.

During his time of employment with the Loves, his conditions worsened. He began to suffer from chest and arm pain, shortness of breath, and a feeling that he was choking on mucus, the lawsuit says.

Since 2001, Michael Seth Jones' health has deteriorated, leaving him unable to maintain a job or participate in many leisure activities. In February of 2002, doctors performed a sternotomy, which involves splitting the sternum and pulling apart the rip cage to have access to the lungs.

"Cultures were taken from wedgest cut from each lung," the lawsuit said. "He had a large mediastinal mass removed along with his thymus. The thymus had become enlarged in its fight to rid Seth's lungs of pathogens."

In addition, the lung biopsies showed the pathogen Enterococcus Faecalis, which is "a rare gram positive streptoccous species found in sewage sludge." The right lung biopsy showed the bacteria Nocardia, which is also a bacteria found specifially in human waste. A new court date has not yet been set for the pending suit.

Peter Stockton Comments to NRC Public Meeting, 2/3/09

⇒ Great job staff for recognizing there is a security problem at the power plants. Unfortunately, they were voted down on recent DBT increase and security information transparency issue.

⇒ We are agnostic on a policy statement. The current one states that reactor operators should not be drunk or asleep in the control room. The policy statement seems self-evident. But, the process of trying to identify these culture problems can be productive.

⇒ Problem starts at the top with NRC Commissioners

- A year ago POGO interviewed each Commissioner. Some simply don't believe there is a serious terrorist threat to the nuclear power plants. One measure of this problem is the vote last week to turn down the staff recommendation to make the DBT more robust (the number of adversaries included and number of lethal weapons available to terrorists, 50 cal. Bangalore torpedoes and RPGs).
- One Commissioner made misleading and disparaging remarks to Congress about a security whistleblower in a Senate Peach Bottom hearing, that lead to an IG investigation
- Recently, Commissioners voted against increasing the transparency and public information about the results of security inspections. (TA-18)
- President Obama should appoint someone to the Commission who has a commitment to nuclear security. This is an opportunity to show that he is serious about his commitment to prevent nuclear terrorism.

⇒ Since 2002, POGO has interviewed or met with several hundred security officers. From those interviews, we believe security culture is a real problem.

⇒ Security officers recognize that the DBT is unrealistic and that they would be cannon-fodder in a real attack. They refer to the DBT as the "Dollar Based Threat."

- BRE - are iron coffins
- They know they won't get effective outside help because of timelines
- They know they will be outgunned
- Excessive overtime leads to lack of attentiveness
- When questioned about the lame DBT—NRC claims, "that is all you can expect of private guard force." This is dangerous. This attitude trickles down to create a culture.

⇒ There is too much advance notice of security tests (force-on-force). There is a culture of wanting the plants to look good. Not a culture of: How well protected are the power plants? Should win overwhelmingly-no surprise, no speed, or no violence of action (the major advantages that terrorists have).

⇒ NFS/BWXT serious problems with DBT

⇒ Security officers' concerns are not taken seriously by the security contractor or the licensees. Security officers stop bringing up issues when nothing gets addressed. In a number of cases they are afraid to bring up issues because the fear of retaliation, including the threat to their jobs.

⇒ No real whistleblower protections.

⇒ Contractor and licensee responses to problems that are raised by saying "we don't have the money" or "we're in compliance with NRC regulations."

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⇒ At Peach Bottom, security officers went to the press instead of the NRC—didn't trust the NRC

⇒ Regional offices
- McGaffigan experiences with Region 1 at Salem Hope Creek
- Peach Bottom OIG report, no heads roll
- March 2007 "no safety problems," but then in September 2007, hearing about a potential video, it then became "possible safety problems"

⇒ Enforcement/Fines $65K, sleeping guards cost NRC $500K for investigations

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RULES AND DIRECTIVES BRANCH USNRC

Submitted: September 11, 2008

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The Project On Government Oversight's Public Comments

Docket ID	NRC-2008-0413
Docket Title	Security Inspection and Security Performance Assessment of NRC Licensees
Document ID	NRC-2008-0413-0001
Document Title	Possible Improvements to the Level of Openness and Transparency of Information Associated With NRC Security Inspection and Security Performance Assessment of NRC Licensees

RECEIVED

Weaknesses of the Current System of Public Access to Security Information

The Project On Government Oversight (POGO) is an independent nonprofit that investigates and exposes corruption and other misconduct in order to achieve a more accountable federal government. POGO has conducted a number of investigations into nuclear security and found numerous weaknesses. We have also found that there is a lack of public access to security information.

The Nuclear Regulatory Commission (NRC) is hiding behind 9/11 as an excuse not to inform the public of pertinent information. In contrast to the NRC, recent force-on-force (FOF) tests at the Lawrence Livermore National Laboratory (LLNL) were by DOE's own words "catastrophic," as the adversarial force overwhelmed the guard force and gained access to highly enriched uranium (HEU) and plutonium in both theft and Improvised Nuclear Device (IND) scenarios. POGO learned about some of the specifics of the failure, and DOE admitted to others. Compensatory measures were put in place. Once the story got out in a major news magazine, important improvements were ordered throughout the complex in training, performance testing of high-tech weapons, etc. The public discussion of this failure and the resulting improvements were not considered a roadmap to terrorists.

NRC's annual *Report to Congress on the Security Inspection Program for Commercial Power Reactor and Category I Fuel Cycle Facilities: Results and Status Update* and NRC's cover letters to its security inspection reports are meaningless to the public for many reasons, including:

- *Absence of Pertinent Information* – As all politics are local; so is the concern over the security of nuclear power plants. Given the risks and the history of events such as security lapses at Peach Bottom, Indian Point, and Salem and Hope Creek nuclear power plants, the public wants to know how well the facility in their backyard is able to handle the terrorist threat. NRC Commissioners and staff have assured us that once vulnerabilities are discovered during FOF tests, compensatory measures are implemented to eliminate the vulnerabilities prior to

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the NRC leaving the plant. Yet, the NRC does not provide the public even the most basic information on security inspections and FOF tests, such as:

- *Which.* The *Report to Congress* does not state the number of FOF performance tests NRC's contractor adversary force ran against the guard forces at unnamed nuclear power plants. The general tenor of the NRC's reports to Congress is that the vast majority of the plants are well protected. However, the reports leave major information gaps such as the number of findings at each of the plants. If you live in Westchester County and are concerned about security at the Indian Point nuclear power plant, what does this *Report* tell you if it does not name the power plant?

- *What.* NRC's cover letters to its security inspection reports do not adequately inform the public about the criteria used in evaluating security at the plants.

- *How.* NRC's cover letters do not tell the public how the security investigations are carried out.

- *Incomplete Information* – As NRC does not provide the number of FOF that are run, and other basic information, it is hard to determine the credibility of its statement in the 2007 *Report to Congress* that there were only a total of five findings from security inspections.

  - A staff member at POGO has been present at more than 50 FOF tests at the Department of Energy's (DOE) nuclear weapons sites and found that at the majority, there were significant failures at some and less serious failures at the others. Thus, it is hard to believe that NRC had so few findings.

- *Weak Measures* – The information provided to the public is even less telling about the security of commercial power reactors and Category I fuel cycle facilities given the serious weaknesses in NRC's FOF performance tests:

  - Nuclear power plants are protecting against a Design Basis Threat (DBT) that is unrealistically low–not only the number of attackers, but the kinds of weapons the mock-terrorists are allowed to bring to the fight.

  - The plant is told six to eight months ahead of time that there will be a FOF test.

  - The plants are allowed to choose which guards are to be tested. (Obviously, the youngest and best shots are chosen, and the unit is heavily trained in the lead up to the test).

- The guards know within a 2-3 hour window that an attack will take place. In the military, this is called "leaning forward in the fox hole." Surprise, of course, is the greatest advantage attackers have. There is none in the NRC tests.

- The DBT for Category I facilities at Nuclear Fuel Services (NFS) in Erwin, TN and Nuclear Products Division of BWXT in Lynchburg, VA is significantly below the DBT for DOE sites with the very same types of special nuclear material. For example, the number of attackers in the NFS DBT is slightly larger than the power plants, but less than half that of the Pantex Plant.

- Unlike DOE sites with the same material, NRC's Category I DBT scenarios do not guard against the threat of terrorists creating an Improvised Nuclear Device (IND). These NRC licensees have a large inventory of highly enriched uranium (HEU)—the material terrorists are most interested in acquiring because INDs are so easy to create using it.

    - The 2007 NRC *Report to Congress* indicates that the major security concern is terrorists stealing special nuclear material. It fails to mention that an equally significant risk is of terrorists constructing an IND on site, which can take only minutes. To steal HEU, terrorists have to get in and out of the facility; with an IND, they only have to get in the facility.

    - The NRC may actually be unaware of the exact risk its Category 1 licensees face when it comes to IND creation. Sources have told POGO that DOE refuses to share its information with the NRC on the timelines to create an IND.

Recommendations

- POGO believes that after FOF performance tests are conducted and the guard force is unable to protect the target sets, the NRC should release a good deal of information about the results without revealing current vulnerabilities.

    - Information that should be released regarding FOF tests and security inspections include:
        1. the results;
        2. what other failures occurred;
        3. why the failures happened;
        4. when;
        5. if the adversaries got to the target sets;

6. what damage could have occurred;
7. any other generic problems that may be present at other power plants; and
8. how the problems got corrected.

If the information is made public, it would have a ripple effect throughout the industry because other plants do not want to be embarrassed. For example, because of the publicity surrounding the films of sleeping guards at the Peach Bottom Atomic Power Station, other power plants, the nuclear power industry in general, and DOE weapons facilities became more vigilant. One licensee told his staff to watch for potential inattentiveness and overtime hours "because we don't want a Peach Bottom here."

- Address serious vulnerabilities in NRC's security apparatus:
  - Install more barriers and delay mechanisms to extend timelines from the site perimeter to the targets sets.
  - Increase training and performance testing of high-tech weapons such as Remote Operated Weapon System (ROWS).
  - Address the vulnerabilities of Bullet Resistant Enclosures (BRE).
  - Bolster the DBT for Category I facilities to account for INDs.
- NRC should demand that it be briefed by the DOE on the critical information about the timelines to create an IND.
- NRC should explain the incredible discrepancy between the DBTs of Erwin, TN and Lynchburg, VA with those of the Pantex Plant.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

NUCLEAR FUEL SERVICES, INC.
ERWIN, UNICOI COUNTY, TENNESSEE
EPA FACILITY ID: TND003095635
MAY 29, 2007

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

Agency for Toxic Substances & Disease Registry ..... Julie L. Gerberding, M.D., M.P.H., Administrator
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Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

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1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

PUBLIC HEALTH ASSESSMENT

NUCLEAR FUEL SERVICES, INC.

ERWIN, UNICOI COUNTY, TENNESSEE

EPA FACILITY ID: TND003095635

Prepared by:

Site and Radiological Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies

are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention:
Manager, ATSDR Records Center
Agency for Toxic Substances and Disease Registry
1600 Clifton Road (E-60)
Atlanta, GA 30333

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Summary

The Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from an individual (the petitioner) to evaluate the Nuclear Fuel Services, Inc. (NFS) site for inclusion on the Superfund list. The concerns listed by the petitioner include contamination of groundwater with volatile organic compounds (VOCs) and the use of radioactive materials. Other concerns included cancer rates in the community and concern for the contamination of the Nolichucky River and releases to the air from plant operations. The petitioner also raises issues related to the NFS history of operational violations.

This public health assessment will only address the concerns raised regarding the presence of volatile organic compounds. The concerns regarding radioactive materials will not be addressed as explained in the following paragraph.

ATSDR Legislative Authority

ATSDR derives its authority to address environmental contaminant issues at this site from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as codified at 42 USC 9601 within the United States Code. However, CERCLA excludes any releases of specific radioactive materials that are considered source, byproduct, or special nuclear material (42 USC 9601(22)). Therefore, those portions of the petition request concerning the use, releases, or potential releases of various types of nuclear materials can not be addressed by ATSDR. ATSDR is investigating other avenues by which the petitioners' concerns for the nuclear and radiological issues can be addressed. ATSDR will address the releases of volatile organic compounds to the air, surface water, and groundwater as well as the presence of uranium and other naturally occurring radioactive materials in the groundwater.

Background

Site Description and History

Nuclear Fuel Services, Inc. (NFS) operational history began in 1957 in Erwin, Tennessee. Initially, the facility was operated as the Davison Chemical Division of W.R. Grace Co. prior to being renamed as NFS (1).

Erwin is a town of about 6,000 people located in Unicoi County about 15 miles south of Johnson City and 120 miles northeast of Knoxville. Unicoi County covers about 200 square miles in northeast Tennessee and has a population of about 20,000. The area surrounding Erwin is mostly within the Cherokee National Forest.

The land area of NFS, itself, covers approximately 64 acres in the southern part of Erwin. The site is bordered by Interstate 26, the Riverview Industrial Site, and property belonging to the CSX Railroad, both to the west. Interstate 26 lies north of the facility and the Love Chapel Elementary School is about 1 mile south of the site. NFS sits about 30 feet above the Nolichucky River that runs by Interstate 26; whereas, the mountains rise to about 5,000 feet a few miles from the site.

The town of Erwin and surrounding areas include residential, commercial, industrial, and farming areas. The site is underlain by unconsolidated alluvium at various depths consisting of silts and clays, clayey sand, and sand with varying amounts of gravel and cobble. The alluvium coarsens with depth into cobbles and boulders. Alluvium is sediment such as a riverbed deposited by flowing water. This cobble/boulder zone overlies weathered, fractured bedrock consisting of steeply sloping beds of shale or shale interbedded with dolomite and siltstone (2).

One of the primary activities of NFS's Erwin Plant is to prepare high-enriched uranium to be processed into fuel for the Department of Energy's Naval Reactor Program. The US Department of Energy supplies the uranium processed at NFS for this and other purposes. Other activities performed at this facility include the processing of high-enriched uranium scrap to recover the uranium, laboratory operations for manufacturing support and new development, and waste treatment and packaging for shipment. NFS also performs commercial work for the private sector and leases space to the private sector at their facility. These activities include cleaning of uranium hexafluoride cylinders and downblending of high-enriched uranium and converting it to low-enriched uranium compounds (BLEU) to be used in the commercial sector. Other site activities include, or once included, converting uranium hexafluoride to either uranium oxides, uranium tetrafluoride, and/or metallic uranium. NFS also in the past manufactured reactor fuel materials composed of either uranium or thorium, and recovery of these isotopes, production of thorium metals, and production of mixed oxide fuels containing uranium.

NFS currently is regulated for environmental corrective action and decommissioning activities by the US Nuclear Regulatory Commission (NRC), the state, and the US Environmental Protection Agency (EPA). The facility is a licensee of the NRC and a permitted EPA Resource Conservation and Recovery Act (RCRA) facility. As such, the facility must establish a system for controlling hazardous waste from its generation until its ultimate disposal. NFS is an active facility and CERCLA regulations do not necessarily apply as the law specifically excludes any releases from the nuclear fuel operations. These nuclear releases are under regulatory authority of the NRC and the hazardous waste and hazardous waste constituents are regulated by the EPA and the State of Tennessee.

Under regulatory oversight by the NRC, NFS is in the process of decommissioning on a project-by-project basis. This includes the former pond area in the unused northern portion of the site or areas and buildings in need of decontamination to protect the environment, in accordance with NRC, EPA, Tennessee Department of Environment and Conservation (TDEC), and all applicable federal and state regulations. Decommissioning is the process converting a nuclear facility to a condition that is safe to public health and safety or the environment. The decommissioning activities at NFS include removal of contaminated soils, sediments, debris, and disassembly of equipment and buildings. The wastes generated are recycled when possible or are containerized and then transported to EPA and NRC approved radioactive waste burial grounds in other states.

The site also generates low-level radiological waste generated from laboratory processes and trash. This waste also contains elemental mercury used during analytical testing of its products. This results in the generation of mixed wastes which are regulated both by the NRC and the EPA as well as the state. The laboratory trash consists generally of paper, gloves, and discarded laboratory equipment. EPA documentation states that the analytical procedure is necessary to confirm that the sample of NFS product meets applicable customer quality standards. The nature of the product and specifics regarding the analysis are considered Confidential Restricted Data

per the United States Department of Energy as it is related to national defense and security. The mercury is recycled as much as possible during the analytical procedure to limit the amount of mixed mercury waste generated.

NFS also operates an outdoor firing range is in nearby Jonesborough, Tennessee for training and maintaining proficiency of its security forces. The range is in residential area and adjacent to a business.

In the early history of NFS, several processes required the use of degreasing agents containing volatile organic compounds (VOCs)[1] such as tetrachloroethylene (PCE). Since the 1970s, NFS reportedly stopped the use of VOCs in their processes although during its use, a large amount of VOCs were released to the environment via either spills (such as in the maintenance areas) or venting. Per applicable laws and permits in effect at the time, NFS also released radioactive materials into the waste holding areas, the on-site ponds which ultimately reached the Nolichucky River. In 1991, NFS began partial remediation of the site. These activities included removing the sludges from Ponds 1, 2, and 3, and removal of accessible waste in the Pond 4 area. The wastes identified in Pond 4 groundwater inflowing prior to this remediation included VOCs, tributyl phosphate, and pthalates (3). The removal was and continues to be under authorization from the NRC, EPA, and the state. Excavation of the low-level waste burial area began in 1997.

In 1992-1993, a RCRA permit was jointly issued to NFS by EPA and the state for the operation of a mixed waste storage area. Additionally, this RCRA permit required the systematic investigation of releases of hazardous wastes constituents to the environment and the subsequent correction action and cleanup.

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[1] In this document the term volatile organic compound, VOC, refers only to perchloroethylene (PCE) and its breakdown products produced in the environment.

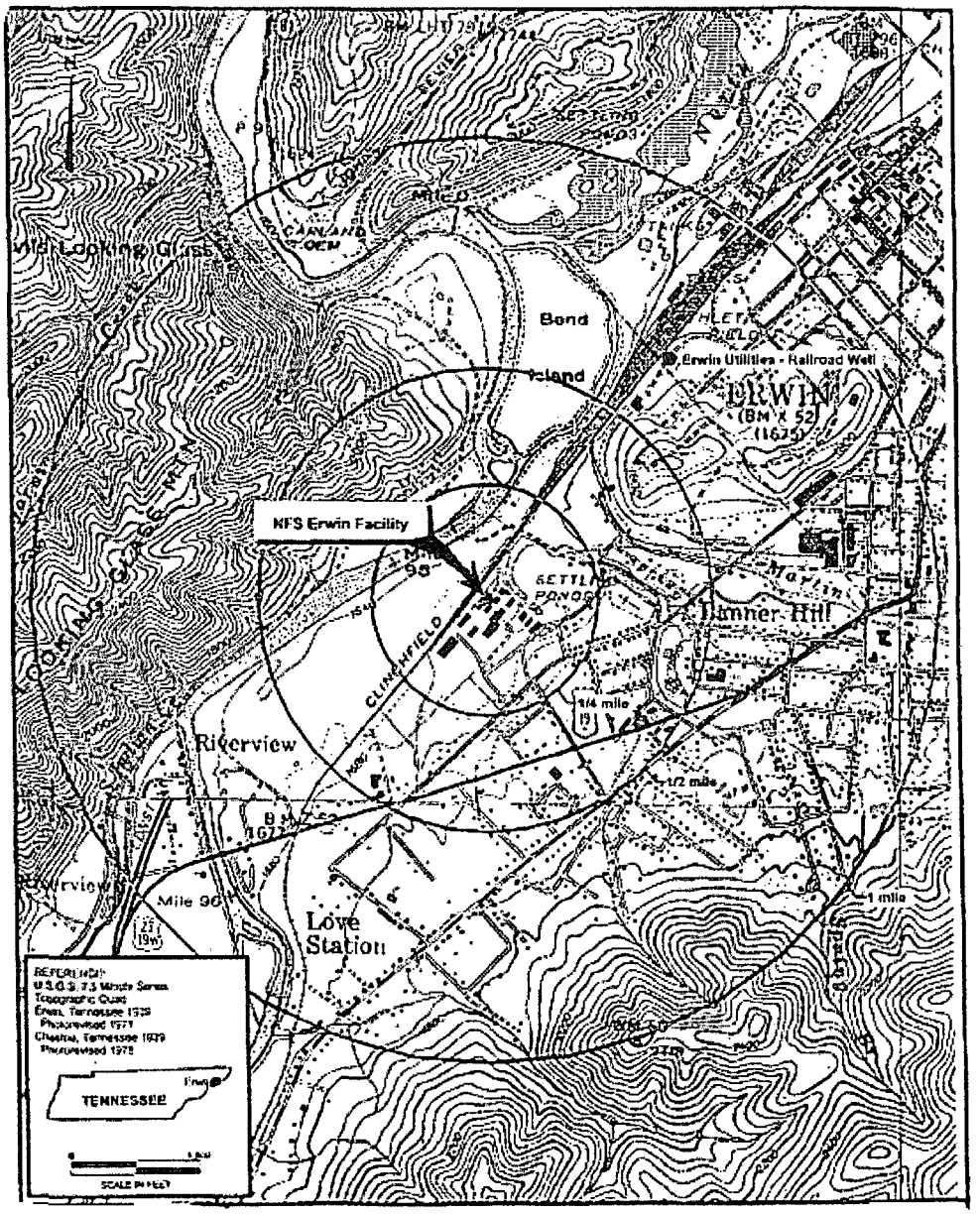

Figure 1. NFS site location.

In September 1996, pursuant to the RCRA permit investigations, the US EPA Region IV concluded that there was a plausible pathway for human exposure to the PCE plume in groundwater, but there was no current exposure. A pump and treat system was installed and operated to remediate the contaminant plume and prevent further migration.

In 2000, as part of a RCRA Corrective Measures Study, NFS developed a pilot study to enhance the anaerobic degradation of the VOCs contaminating the groundwater as this would accelerate the remediation. The field pilot study involved the injection of a molasses carbon source into the groundwater. As a carbon source, the molasses stimulates the naturally occurring bacteria in the groundwater to more efficiently degrade the VOCs. Besides reducing the concentration of VOCs, the system also immobilizes uranium migration by converting the uranium to an insoluble precipitate in the groundwater using a patented technology (4).

Current activities on the site include the processing of nuclear fuel products and the chemical conversion of these materials with the potential for production of ammonia gases or other nitrogen containing compounds.

NFS has had numerous NRC violations resulting from poor documentation of chain of custody and location of special nuclear material. None of these violations was for actual loss of material, but for a lack of accounting for where quantities of material were moved within the facility.

Site Visit

In February 2006, representatives from ATSDR traveled to Erwin to meet with representatives from NFS, local officials, state and federal (NRC and EPA) regulators, the Tennessee Department of Health representative, a local plastics company in the industrial park downgradient from the site, and members of the public. During this visit, ATSDR collected community concerns. These concerns include releases of radioactive materials, safety issues, and emergency response and notification of the surrounding area. ATSDR also placed public announcements in local media outlets advertising the meetings and methods whereby community concerns could be relayed to ATSDR.

Demographics, Land Use, and Natural Resource Use

In the 2000 census, Unicoi County's population was 17,667 of which 51.2% were female. Its racial makeup was 98% white and 1.9% Hispanic or Latino. The average household size was 2.3 individuals. The population of Erwin was 5,610 with 53.7% of the population female. The racial composition was 97.8% white with 125 individuals of other racial backgrounds as defined by the US Census Bureau. Furthermore, 97.3% of the Erwin population lived in 1559 single family households with an average family of 2.2 individuals. Those between the ages of 18 and 65 numbered 4,503 with 299 below the age of 5 and the remaining population, 1283, 65 years of age or older (5). The population within a one mile radius of NFS was estimated to be 2,638 consisting of 186 children under the age of 6 and 472 females between the ages of 15 and 44, child-bearing age (Figure 2).

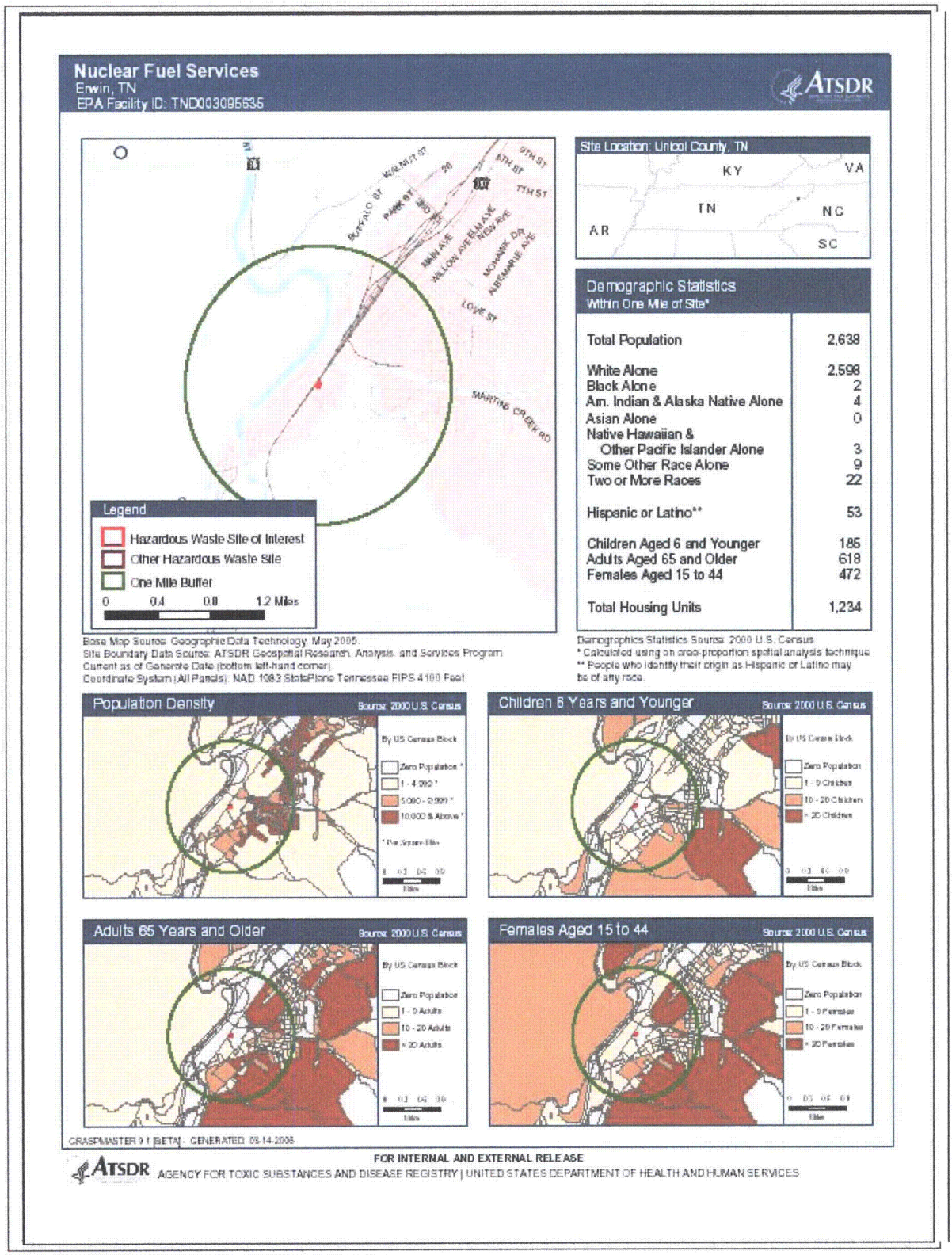

Figure 2. Demographic distribution around the NFS facility

Within the vicinity of NFS lie three bodies of surface water--Banner Spring Branch, Martin Creek, and the Nolichucky River. Banner Spring Branch is completely contained within the NFS property boundary and is thought to arise from fracture flow originating in the surrounding mountains. Banner Spring flows toward the north and west ultimately flowing into Martin Branch at the northwest corner of the site. At one time Banner Spring Branch flowed through the site but NFS diverted and channelized the spring. Now it follows the site boundary prior to emptying into Martin Creek. Prior to the channelization of Banner Spring Branch, the land was marshy and NFS constructed holding ponds in this area (1). Martin Creek forms in the Unaka Mountains southeast of Erwin, flows into North Indian Creek which enters the Nolichucky River about 1.5 miles north of NFS. The flow rates of these creeks range from 300 to 5,000 gallons per minute.

The state of Tennessee Wildlife Resources Agency, Fisheries Management Division maintains a state fish hatchery specializing in both rainbow trout and brown trout within a mile northeast of NFS. It has 14 outdoor concrete raceways, a hatchery building, and a manager's residence. The facility's water supply consists of about 30 artesian wells that are hydrologically upgradient from the NFS operations. The source of the artesian well water is thought to be produced by the down gradient flow of groundwater associated with the surrounding mountains. This same flow may form the Banner Spring Branch.

The Nolichucky River is a major river draining the Blue Ridge Mountains of western North Carolina and upper East Tennessee and is considered a receiving stream for surface water runoff. The river enters Unicoi County, Tennessee, flowing through ranges known locally as the Bald Mountains and the Unaka Mountains. The flow rate of the river averages about 14,000 gallons per minute at Embreeville about 8 miles up river from the facility. The Nolichucky River ultimately flows into the French Broad River that merges with the Holston River, forming the Tennessee River outside of Knoxville, Tennessee. The majority (64%) of the Nolichucky River watershed is in Tennessee with the remainder in North Carolina. Many of the streams in the watershed are impaired by silt accumulation and livestock grazing (6).

The City of Erwin obtains its drinking water from both springs and wells; 6 public supply wells are within 5 miles of NFS. The closest well, the Railroad Well, however, is about 3500 feet northeast of NFS and hydrological tests indicate that this well does not draw from beneath the NFS nor from areas downgradient of the facility. NFS reports that there are no private wells between their operation and the river (7). Furthermore, Erwin Utilities informed ATSDR that they are aware of only one private well in Erwin and that well is both upgradient and uphill from NFS.

The geology underlying the area consists of bedrock formations and karst features. Karst geology has been defined as areas where chemical dissolution has enlarged joints, fractures, bedding planes, or other openings in soluble, underlying bedrock; karst is also characterized by sinkholes, caves, and disappearing streams (8).

The geology consists of 3 limestone (dolomite) formations and a formation consisting of sandstones, siltstones, shale, limestone, and other dolomitic species of rock. The bedrock is also covered with deep soils and alluvium which is made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel (12). The depth of the alluvium ranges from 6 to 15 feet with cobbles and boulders at the deeper depths. Below the alluvium lies

tilted beds of shale that are fractured so groundwater flow is directed downward until solid bedrock is reached. Although the groundwater is replenished mostly from rain and surface waters, there is some upward flow as a result of the surrounding groundwater flow down the mountains with their fractured geological formations (9,11).

Groundwater under NFS and immediately downgradient is not used as a supply either to NFS or other industrial activities associated with the industrial park. In general the groundwater is moving toward the river as discussed in the groundwater model report released in 1997. Furthermore, it appears that the upward gradient from the bedrock aquifer would limit the downward migration of the contaminants.

The nearest well is to the north of the site and upgradient (Railroad Well) and hydrological tests indicate that this well is not affected by draw down from water withdrawn beneath the NFS (Figure 3) (9, 10). The groundwater typically flows toward the north-northwest (7). Other water features include ephemeral springs that rapidly appear following local rains that average about 45 inches per year. The US Geological Survey estimates that about 22% of the rain recharges the groundwater in the area. An environmental indicator assessment states that groundwater beneath NFS enters the backwater area of the river via an upflow (11).

Meteorological information for the Erwin area was obtained from documentation prepared for the Nuclear Regulatory Commission (12). The typical wind direction at the facility follows the valley topography in a southwest to northeast direction with an average wind speed of less than 8 miles per hour during daylight. Typically, the wind direction reverses directions during the evening hours. This reversal is related to unequal land heating and the presence of the mountains in the area.

Health Outcome Data

Typically, health outcome data consist of information derived from databases such as morbidity/mortality data, cancer incidence, birth defects data or any site-specific community health records and/or health studies. Health outcome data can provide information on various aspects of the health of people living around site. It may reveal whether people living or working near a site are experiencing adverse health effects at a rate higher than would be expected to occur. Health outcome data can constitute a key source of information for conducting public health assessments. However, site-specific health outcome data are rarely available or of sufficient or adequate quality to enable linking health outcomes with site-related exposures; health outcome data will not prove a cause or an effect. Discussions were held with representatives of the Tennessee Department of Health, Johnson City office, and from the East Tennessee State University in Johnson City. The state has limited reliable health data for this area of Tennessee.

The state of Tennessee is in the process of improving its cancer registry; however, the existing registry is neither certified by the North American Association of Central Cancer Registries, Inc. (NAACCR) nor the CDC[2]. Other registries, such as morbidity, mortality, birth defects, and other disease registries are not available for the state of Tennessee. NAACCR is a professional organization that "develops and promotes uniform data standards for cancer registration;

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2 Information from the CDC NPCR program at http://www.cdc.gov/cancer/npcr/naaccr.htm and accessed on April 27, 2007.

provides education and training; certifies population-based registries; aggregates and publishes data from central cancer registries; and promotes the use of cancer surveillance data and systems for cancer control and epidemiologic research, public health programs, and patient care to reduce the burden of cancer in North America." NAACR further states that "one of the fundamental necessities of cancer surveillance is for users of cancer information to be assured that case definitions, coding practices, and conversions of medical terminology to useful categories is standardized. This enables compilation of case-specific information into useful and meaningful registers. It also enables meaningful comparison of data across different registries."[3]

The CDC has maintained a National Program of Cancer Registries since 1994. The program develops data sets for member states (including Tennessee). However, as the Tennessee Cancer Registry is not certified as discussed above, the expanded dataset for the state is not included. The program web site can be accessed via the internet at the following address http://www.cdc.gov/cancer/npcr/datarelease.htm (accessed on April 27, 2007).

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3 Information from the NAACCR web site, http://www.naaccr.org/ accessed on April 27, 2007.

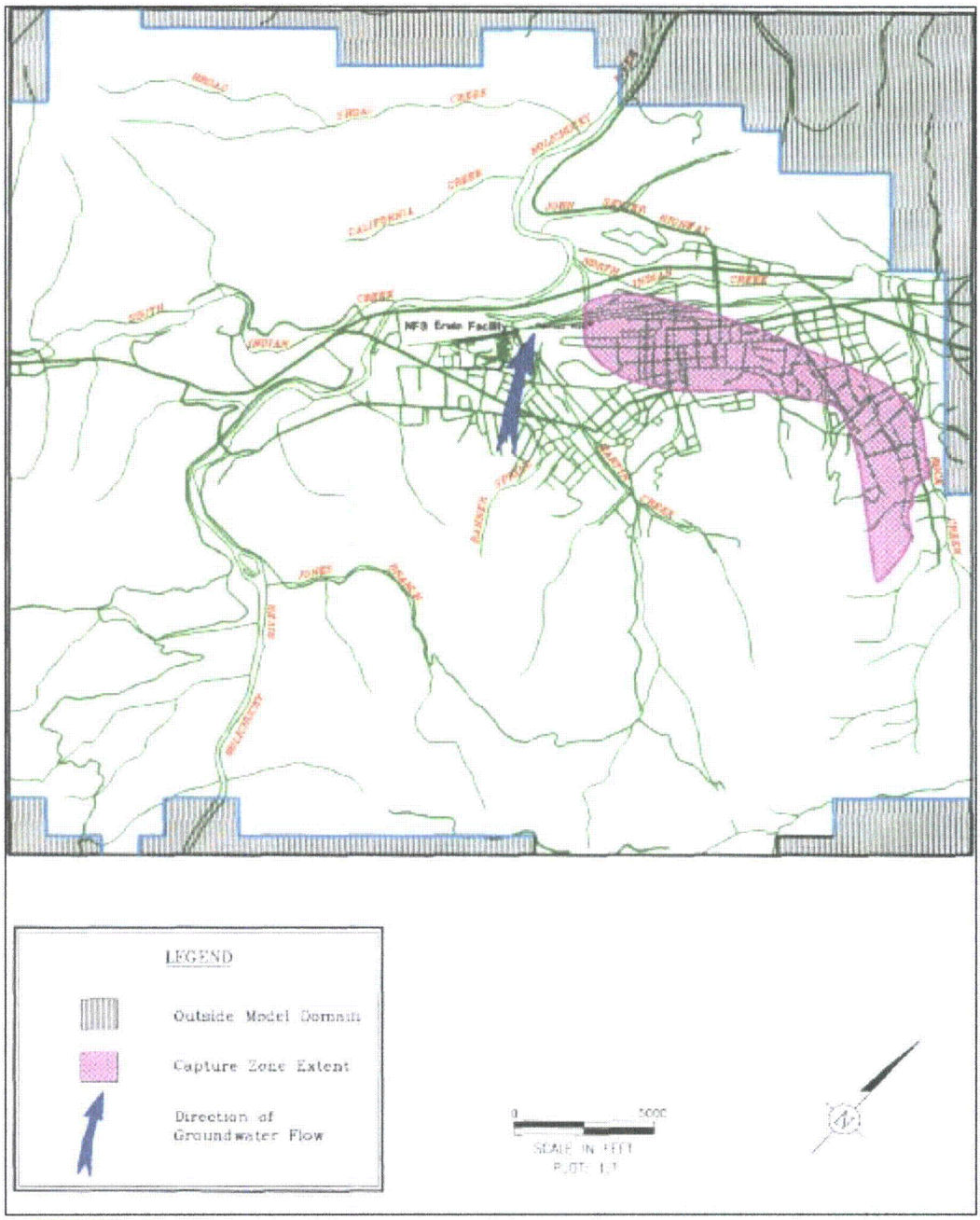

Figure 3. Railroad Well capture zone analysis for 1000 gpm.

Community and Petitioner Health Concerns

Based on information received from the petitioner, the major community concern is cancer with 36 cancers reported in a self-administered survey in the area bordering the facility. The other concerns raised by the petitioner include degradation of the air and quality, and the perceived lack of environmental monitoring of these two potential pathways. ATSDR received additional public health concerns at two public meetings held in Erwin in February and August 2006. These concerns and the ATSDR response are included in Appendix A.

Concerns of the petitioner and the community related to the nuclear operations at the site were forwarded to the appropriate federal agency, the Nuclear Regulatory Commission (NRC). ATSDR met with the NRC to discuss these concerns.

Environmental Contamination and Other Hazards

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as codified at 42 USC 9601 within the United States Code gives the legislative authority to ATSDR to evaluate releases from hazardous waste sites. CERCLA further defines a release in many ways such as a spill, leak, emptying, discharge, leaching, dumping, or disposing of hazardous material in an uncontrolled manner. *However*, CERCLA also excludes any releases of specific radioactive materials that are considered source, byproduct, or special nuclear material (42 USC 9601(22)). By definition, source material is uranium and/or thorium in any physical or chemical form that contain by weight 1/20 of one percent (0.05 percent) or more of these elements. Source material does not include special nuclear material (SNM). SNM is material containing among other radionuclides, enriched uranium or plutonium. By-product material is any material made radioactive following exposure to SNM or the waste associated with ore processing.

ATSDR receives it authority to address hazardous releases from the CERCLA; therefore, those portions of the petition request concerning releases or potential releases of various types of nuclear materials can not be addressed by this public health assessment nor by ATSDR. ATSDR is investigating other avenues by which the petitioner concerns for the nuclear and radiological issues can be addressed. ATSDR will address the releases of volatile organic compounds to the air, surface water, and groundwater.

NFS conducted a remedial alternatives analysis (RAA) to select an appropriate technology for controlling and/or remediating groundwater. The RAA identified enhanced anaerobic bioremediation and reductive precipitation (EABRP) as the selected technology that would best remove the organic contaminants from the groundwater. This technology involves enhancing the natural biological degradation of the PCE and its degradation products. The system works by supplying an additional organic carbon source (molasses) as an energy substrate to the naturally occurring bacteria within the groundwater system. The molasses accelerates oxygen depletion in the water that is conducive to the degradation of the PCE through the removal of chlorine atoms (reductive dechlorination), replacing them with hydrogen atoms. NFS also adds ferrous sulfate that precipitates the soluble uranium as insoluble precipitate, thus immobilizing any uranium in the water.

On-Site Contamination

The Nuclear Fuel Services site was not required to perform environmental sampling for non-radioactive materials for many years. These non-nuclear materials included organic and inorganic chemicals and metals. ATSDR, however, reviewed quarterly and annual RCRA Facility Investigation and Interim Measures Progress Reports submitted to the regulatory authorities for the years 1997 through 2004. Other documents reviewed included water sampling data for the Nolichucky River for the years 1993 through 2004 and National Pollution Discharge Elimination System (NPDES) reports covering the 1999 through 2004 time frame. Not all the reports reviewed are referenced in this public health assessment; however, the data reported in this public health assessment covers the three year period 2002, 2003, and 2004.

Prior to 1984, NFS disposed of various materials on their property as allowed by the laws in effect at that time. The disposal areas included landfills, ponds, and other types of impoundments such as trenches. To enable proper site assessment and site remediation, EPA initially divided the waste operations into 23 solid waste management units (SWMUs) and 7 areas of concern (AOC). Based on analyses of the SWMUs as required by the RCRA permit, 11 required no additional actions, 5 units are under institutional controls with the remaining SWMU requiring interim measures to alleviate waste issues. The AOC remedial activities included 4 areas under institutional control, 2 areas requiring either interim actions or remediation, and the remaining AOC, required no further action.

In 2005, planned activities for the SWMU and AOC locations included soil removal and confirmatory sampling, quarterly and annual inspections, groundwater remediation and related activities including pilot testing, installation of tanks to assist in the groundwater remediation, and additional sampling of surface water and sediments in the Nolichucky River (7).

Releases from NFS have contaminated the groundwater beneath the facility. An extensive monitoring program identified PCE, TCE, cis-1,2 DCE, vinyl chloride, and uranium in the water beneath the plant that flows toward the river. NFS installed a series of monitoring wells within their operational boundaries and another 21 monitoring wells off-site. Many of the well locations are depicted in Figure 4. In 1997, the NFS groundwater monitoring program consisted of sampling approximately 54 monitoring wells. The program's purpose was regulatory in design and helped to further define areas of groundwater contamination as well as its movements. Groundwater contamination is mostly associated with the former pond areas (SWMU 1, 2), underground storage tanks (SWMU 18), Building 130 Scale Pit (SWMU 20), and the radiological waste burial grounds (SWMU 9) (9). According to the Environmental Indicator assessments (13, 14, 15), the plume in 1996-2004 covered an area of approximately 13 acres (600 feet by 900 feet) in the northernmost portion of the facility and extended an additional 5 to 8 acres off the NFS property toward the Nolichucky River. The contaminants in the on-site plume included PCE, TCE, cis-1,2 DCE, vinyl chloride, and uranium; whereas, the off-site plume contains PCE, TCE, cis-1,2 DCE and vinyl chloride.

From these monitoring wells, NFS reported the concentrations of the contaminants in the groundwater within the facility boundary. The results of the onsite sampling, shown in Table 1, indicated that the average concentration of PCE was 1.7 milligrams per liter (mg/L) with the maximum measured concentration of 8.4 mg/L. The maximum concentrations of the PCE degradation products ranged from 1.6 mg/L for dichloroethylene to 0.01 mg/L for trichloroethylene and vinyl chloride. These results are also given in Table 1.

Monitoring data for the groundwater plume in 2002, indicated that the maximum concentration of PCE in the alluvial aquiver exceeded 13,000 micrograms per liter (μg/L) and extended beyond the west boundary of the facility toward the industrial park. According to the EPA, the apparent source of the PCE plume is one of the maintenance shop areas within the NFS fence line.

Environmental sampling and analyses of groundwater collected during RCRA activities indicated the presence of uranium, PCE, and its degradation products in the groundwater beneath the NFS facility. The uranium plume was about 0.7 acre (250' by 120') and exceeded the EPA Maximum Contaminant Level (MCL; 30 micrograms per liter; μg/L). Uranium concentration in the groundwater plume ranged from approximately 30 to 1,100 pCi/L. The area of the PCE groundwater plume exceeding the National Drinking Water Maximum Contaminant Level (MCL = 0.005 mg/L) was approximately 19 acres (1200 ft by 700 ft). PCE concentrations in this plume ranged from approximately 0.005 milligrams per liter (mg/L) to 14 mg/L. Associated PCE degradation product concentrations are also present in portions of the PCE groundwater plume (15). The EPA also has a Maximum Contaminant Level Goal (MCLG) that is not enforceable and the MCLG for the contaminants is zero.

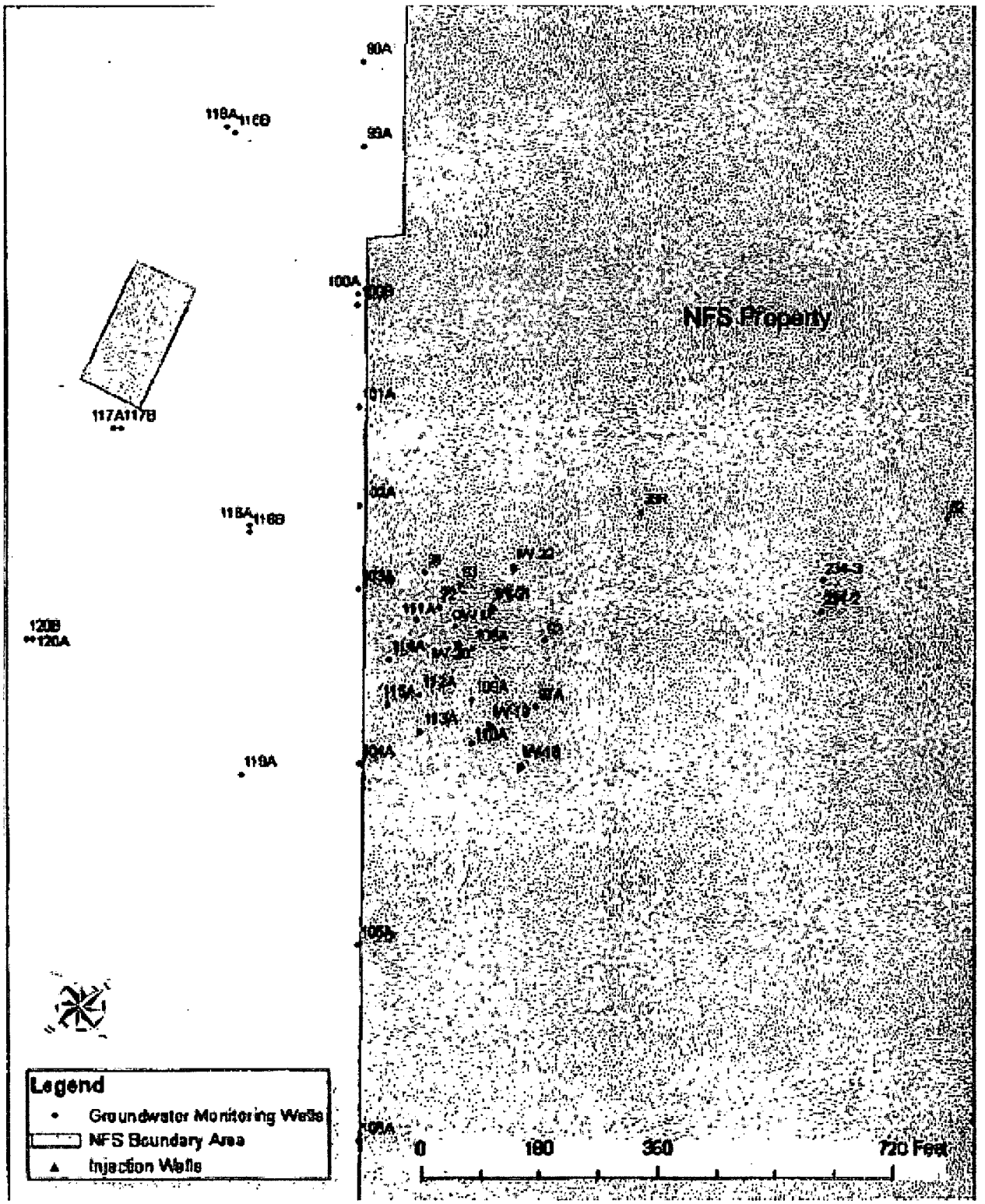

Figure 4. On-site and off-site monitoring well locations

Table 1. Contaminant concentrations in on-site wells

Well Number	PCE	TCE	DCE	Vinyl Chloride	Tributyl phosphate
71	0.021	0.011	1.324	0.728	18.43
72	0.585	0.115	0.507	0.07	6.21
93	0.005	0.09	1.665	0.515	81
94	0.03	0.005	0.005	0.01	0.01
108a	4.8	0.005	0.005	0.01	0.55
109a	0.34	0.077	0.22	0.03	0.01
111a	8.4	0.005	0.6	0.01	0.01
112a	0.099	0.013	0.01	0.01	0.01
114a	0.009	0.005	0.005	0.01	0.01
114b	0.92	0.073	0.059	0.01	0.01
28	1.27	0.157	0.433	0.101	0.07
102a	0.944	0.028	0.029	0.006	0.02
103a	4.956	0.223	0.401	0.021	0.02
average	1.721	0.062	0.405	0.118	8.182
geometric mean†	0.294	0.027	0.095	0.029	0.103
MCL‡	0.005	0.005	0.07	0.002	--

*values expressed as milligrams per liter; data from the Groundwater risk assessment at Nuclear Fuel Services, Inc. and adjacent industrial park site (9)

†The geometric mean represents the central tendency of a distribution if the numbers do not appear to be evenly distributed.

‡MCL – maximum contaminant level, a legally enforceable concentration of contaminants in drinking water.

Off-Site Contamination

Monitoring of organic contaminants outside the property boundary of NFS has been very limited. RCRA reports indicate there are 9 monitoring wells outside the fence line and west of the railroad property. Of these wells, Well 120 lies inside the boundary of the Riverview Industrial Park. The other wells, 116 through 118, are either outside the industrial park or between the park and NFS (Figure 4).

The sampling results have been reported in numerous RCRA Facility Investigation reports from the EPA. In 2002, a private engineering and environmental services company was hired by a facility in the industrial park to sample the monitoring well installed by NFS outside their boundaries and within the industrial park area.

The private company's results indicated the presence of volatile organic compounds as well as the presence of radioactive materials in the groundwater obtained from the industrial park. Table 2 shows the results of the sampling in these off-site wells and the Maximum Concentration Level (MCL) for these contaminants. The MCL is the federal limit for contaminants in drinking water. EPA has also established a goal for these contaminants in drinking water, the Maximum Contaminant Goal Level (MCGL) and that value is set at zero (0). Table 3 gives the 3 year

averages in these wells. During the sampling and monitoring effort in 2000, the extent of the groundwater plume was mapped with the results shown in Figure 5. At that time, the maximum concentration of PCE was 13 mg/L and the lowest concentration found was below the MCL for this contaminant and below the analytical limits of detection.

Within a year of the 2000 sampling round and following the bioremediation with molasses and iron, the plume had expanded as expected. However, the maximum contamination of PCE in the monitoring wells decreased, the maximum detected concentration was greater than 5 mg/L beneath the CSX property; the lowest concentration detected was less than 0.1 mg/L, was below the MCL for this contaminant and below the analytical limits of detection (Figure 6).

The naturally occurring radioactive elements uranium and thorium were detected in wells below the MCL for these contaminants. Other radioactive materials detected included technetium-99 and various plutonium isotopes. The technetium-99 was below the MCL for that radionuclide, as was the plutonium.

Releases to the atmosphere from NFS were not reported in any documentation supplied to ATSDR from the state or EPA. However, the EPA Toxic Release Inventory (TRI) database contains release information on over 500 chemicals or chemical categories from industrial processes. NFS reports their total chemical releases to the TRI system; however, neither uranium nor plutonium are required to be included in the TRI list of reported chemicals. Furthermore, concentrations are not reported, only the total amounts of materials released are given. The TRI data are available from the EPA on their internet site at the following web address: http://www.epa.gov/tri/tridata/tri04/index.htm#what (accessed on April 27, 2007).

The TRI data reported for 2004 indicates that NFS released 103 pounds of nitrates and nitrogen compounds to the air, 25,620 pounds to surface waters, and 4,050 pounds were sent to EPA approved landfills. NFS does not perform environmental air sampling for non-radiological materials as this is not required by the EPA for their operations.

ATSDR received data from the Tennessee Department of Environment and Conservation on annual sampling of the Erwin Utilities Railroad Well located north of the site. The well was sampled for both regulated and unregulated volatile organic compounds. Chloroform was detected at 0.00114 milligrams per liter (mg/L) and 0.00151 mg/L in 2006 and 2007, respectively. There is no established MCL for this unregulated contaminant. For regulated contaminants, tetrachloroethylene (PCE) was detected at 0.000856 mg/L and 0.00158 mg/L in 2006 and 2007, respectively. The established MCL for this contaminant is 0.005 mg/L. No other volatile organic compounds were detected in the Railroad Well.

Table 2: Contaminant concentrations in off site groundwater; 3 year average*

Contaminant and MCL†	Quarter 1 average mg/L	Quarter 2 average mg/L	Quarter 3 average mg/L	Quarter 4 average mg/L	3 year Average mg/L
Tetrachloroethylene 0.005 mg/L	0.442	0.484	0.479	0.413	0.455
Trichloroethylene 0.005 mg/L	0.02	0.019	0.019	0.017	0.019
Cis 1,2 dichloroethylene 0.07 mg/L	0.032	0.027	0.024	0.048	0.033
Trans 1,2 dichloroethylene 0.1 mg/L	0.013	0.009	0.008	0.009	0.010
Vinyl Chloride 0.002 mg/L	0.019	0.017	0.015	0.018	0.017

* data expressed in milligrams per liter of water; data derived from USEPA RCRA Facilities Investigation reports covering 2002, 2003, and 2004 for off-site monitoring wells

†Maximum Contaminant Level – legally enforceable concentration allowed in public drinking water

Physical and Other Hazards

No physical hazards to the public were observed at the site as the site has a physical security force to limit any trespassing. Worker safety and health is addressed by the site's health and safety plan associated with regulatory oversight by both the Nuclear Regulatory Commission and the Tennessee Occupational Safety and Health Administration.

No noticeable odors were detected during the site visit and facility tour which included portions of the blending facility.

Other hazards associated with the site are the presence of hazardous chemicals and radioactive materials, heavy equipment used in the ongoing remediation work and in normal plant operations.

Table 3. Contaminant concentrations in off-site monitoring wells in 1997*

Well Number	Tetrachloro-ethylene (mg/L)	Trichloro-ethylene (mg/L)	Cis 1,2 dichloroethylene (mg/L)	Trans 1,2 dichloroethylene (mg/L)	Vinyl Chloride (mg/L)
116a	0.48	ND	ND	ND	ND
116b	2.4	0.091	0.11	ND	ND
117a	0.15	ND	ND	ND	ND
117b	0.5	ND	ND	ND	ND
118a	ND	0.005	0.003	ND	ND
118b	ND	0.011	0.007	ND	0.0002
119a	0.13	0.011	0.003	ND	ND
120a	0.29	0.016	0.012	ND	ND
120b	0.46	0.018	0.014	ND	ND
121a	0.062	0.005	0.003	ND	ND
121b	0.097	0.005	0.003	ND	ND
Average	0.416	0.022	0.022	ND	ND
MCL	0.005	0.005	0.07	0.01	0.002

*Data from Nuclear Fuel Services (1997).

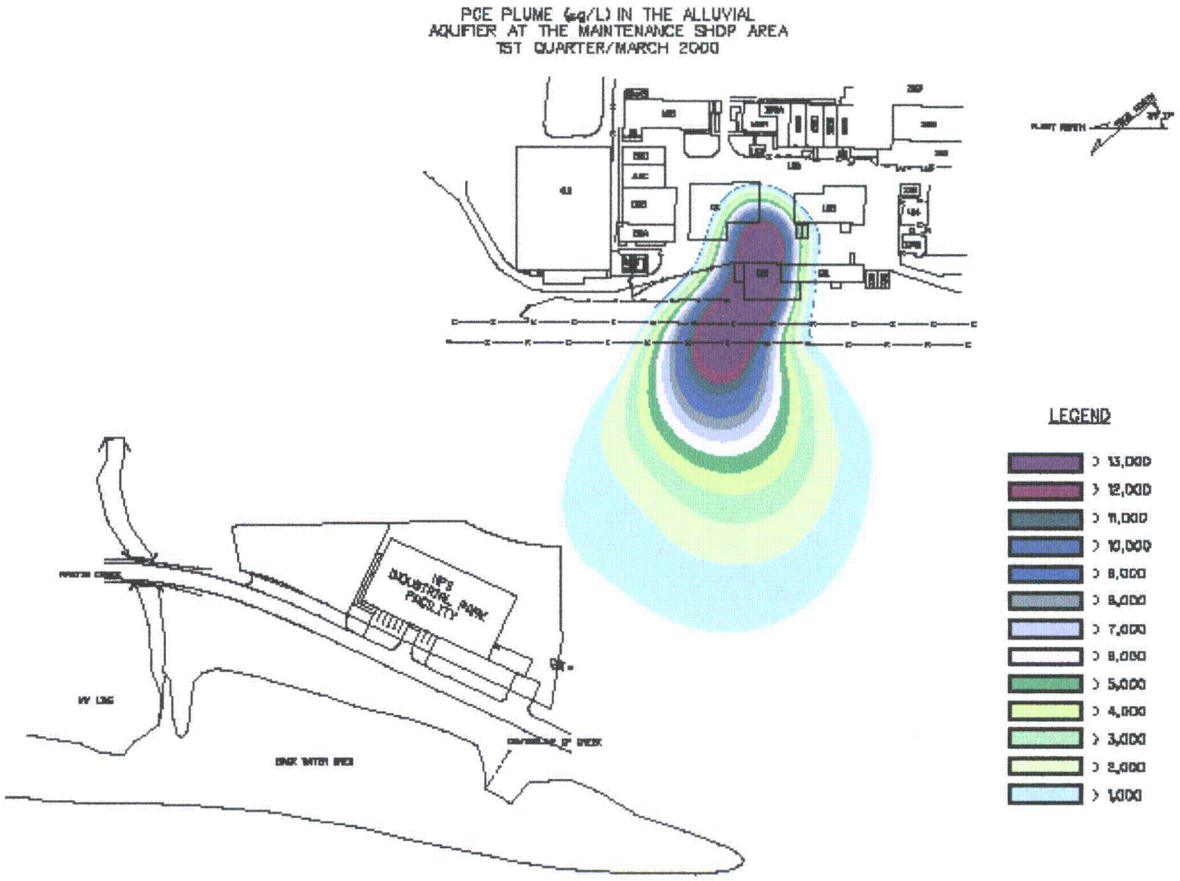

Figure 5. Off site contamination, March 2000

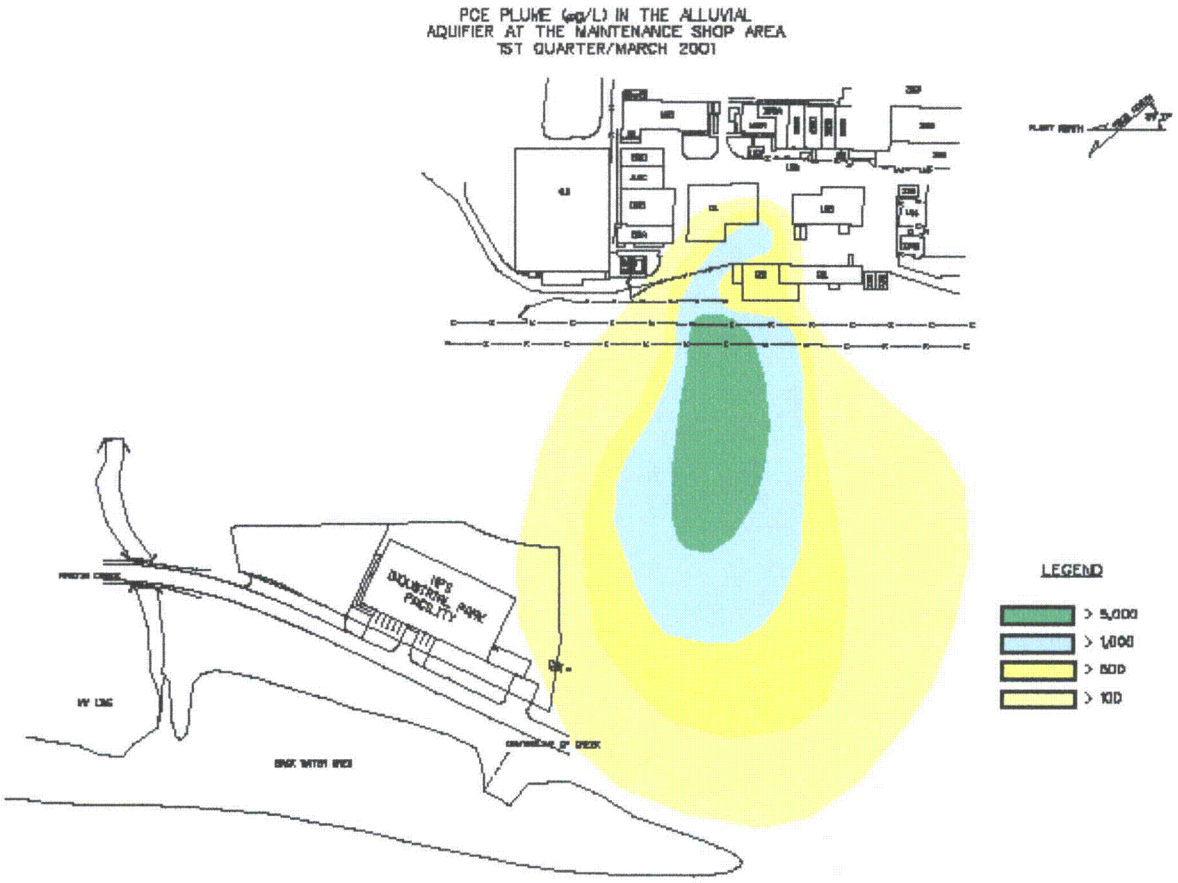

Figure 6. Off site contamination, March 2001

Pathways Analysis

An environmental exposure pathway consists of five elements:

(1) a source of contamination; (2) an environmental medium in which the contaminants may be present or into which it may migrate; (3) points of human exposure; (4) routes of human exposure, such as inhalation, ingestion or dermal absorption; and (5) a receptor population. A completed exposure pathway exists in the past, present, or future if all five of the elements of an exposure pathway link the contaminant source to a receptor population. A potential exposure pathway exists if there is insufficient data for one or more of the five elements linking the source of the contamination to the receptor population or if modeling replaces sampling data. A pathway can be eliminated if one or more of the five elements do not exist or the pathway is unlikely to occur. A future completed exposure pathway occurs when the contamination at a point of exposure exists and that contamination would expose a receptor population if the population were present. Future potential pathways exist if the contamination does not currently exist at a point of exposure but might migrate to some point of exposure. Figure 7 represents typical exposure pathways for a generic hazardous waste site.

The fact that completed exposure pathways exist at hazardous waste sites, does not necessarily suggest the potential for adverse health effects. The evaluation of the exposure pathways with respect to health effects appears in a subsequent section of this public health assessment.

This section contains discussion of the potential for contaminants to present public health hazards via environmental exposure pathways in the past, in the present, and in the future.

Exposure Evaluation Process

A release of a contaminant from a site does not always mean that the substance will have a negative impact on a member of the off-site community. For a substance to pose a potential health problem, exposure must first occur. Human exposure to a substance depends on whether a person comes in contact with the contaminant, for example by breathing, eating, drinking, or touching a substance containing it. If no one comes into contact with a contaminant, then no exposure occurs and thus no health effects can occur. Even if the site is inaccessible to the public, contaminants can move through the environment to locations where people could come into contact with them.

> The five elements of an exposure pathway are (1) source of contamination, (2) environmental media, (3) point of exposure, (4) route of human exposure, and (5) receptor population. The source of contamination is where the chemical or radioactive material was released. The environmental media (e.g., groundwater, soil, surface water, air) transport the contaminants. The point of exposure is where people come in contact with the contaminated media. The route of exposure (e.g., ingestion, inhalation, dermal contact) is how the contaminant enters the body. The people actually exposed are the receptor population.

ATSDR evaluates site conditions to determine if people could have been or could be exposed to site-related contaminants. When evaluating exposure pathways, ATSDR identifies whether exposure to contaminated media (soil, water, air, waste, or biota) has occurred, is occurring, or will occur through ingestion, dermal (skin) contact, or inhalation. ATSDR also identifies an exposure pathway as *completed* or *potential,* or *eliminates the pathway from further evaluation*. Completed exposure pathways exist if all elements of a human exposure are present. A potential pathway is one that ATSDR cannot rule out because one or more of the pathway elements cannot be definitely proved or disproved. A pathway is eliminated if one or more of the elements are definitely absent.

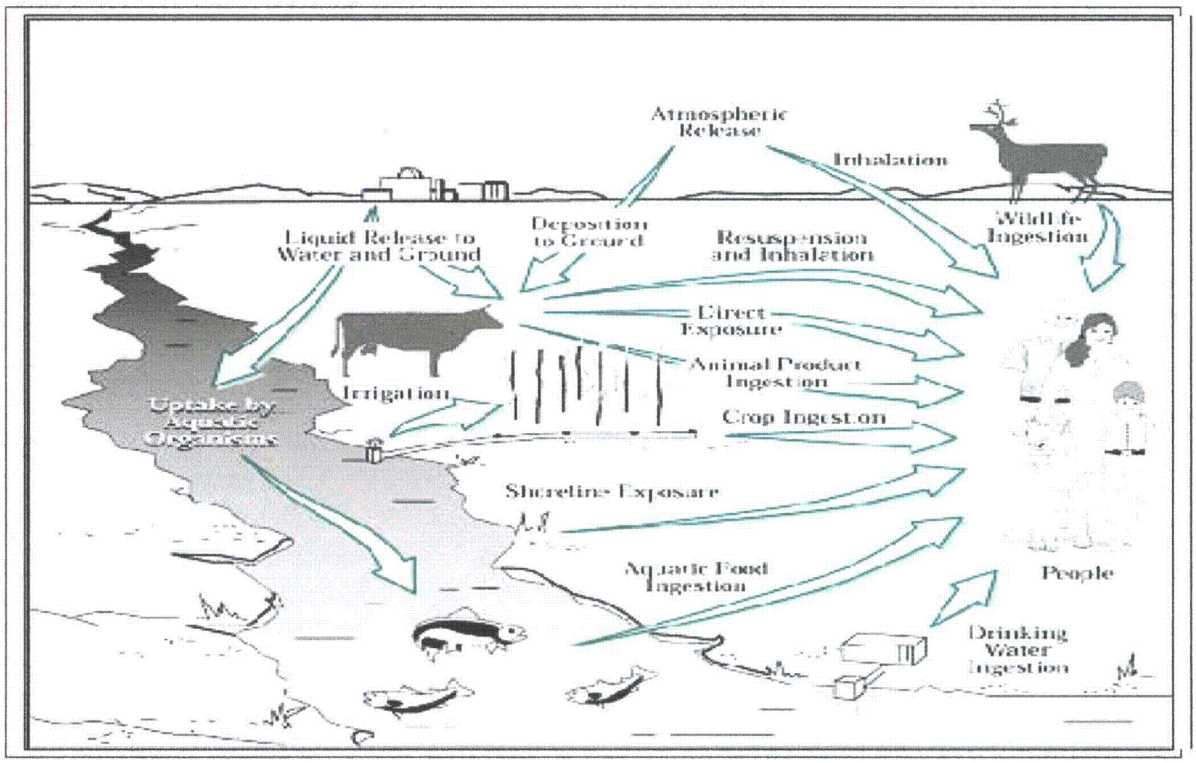

Figure 7. Potential Exposure Pathways

Assessing Health Effects

Exposure does not always result in harmful health effects. The type and severity of health effects that a person can experience depend on the dose, which is based on age at exposure, the exposure rate (how much), the frequency and/or duration of exposure (how long), the route or pathway of exposure (breathing, eating, drinking, or skin contact), and the multiplicity of exposure (combination of contaminants). Once a person is exposed, characteristics such as his or her age, gender, nutritional status, genetics, lifestyle, and health status influence how he or she absorbs, distributes, metabolizes, and excretes the contaminant. The likelihood that adverse health outcomes will actually occur depends on site-specific conditions, individual lifestyle, and genetic factors that affect the route, magnitude, and duration of actual exposure—an environmental concentration alone will not cause an adverse health outcome.

More information about the ATSDR evaluation process can be found in ATSDR's Public Health Assessment Guidance Manual at http://www.atsdr.cdc.gov/HAC/HAGM/ or by contacting ATSDR at 1-888-42-ATSDR. An interactive program that provides an overview of the process ATSDR uses to evaluate whether people will be harmed by hazardous materials is available at http://www.atsdr.cdc.gov/training/public-health-assessment-overview/html/index.html.

A. Completed Exposure Pathways

This public health assessment focuses on exposures to volatile organic compound releases to the environment by way of the surface water, groundwater, and air. As stated earlier in this section, exposure pathways are complete when contaminants are traceable through the 5 elements comprising an exposure pathway.

Environmental sampling has shown the presence of volatile organic compounds in the groundwater. An evaluation of scenarios whereby an individual would consume this water indicates that groundwater is not a source of drinking water. Nor do data suggest that contaminants have migrated against the normal groundwater flow toward the Railroad Well that serves as a source of drinking water for the community. No data were identified indicating contamination of private wells by these contaminants.

NFS has sampled the Nolichucky River for the presence of volatile organic compounds. The sampling location was along the backwash areas near the mouth of Martin Creek. These data do not indicate the presence of volatile organic compounds contamination at levels of public health concern. Furthermore, this portion of the river is not used because of the nature and conditions of the marshy backwash area.

Data suggest that the groundwater beneath the NFS facility migrates toward the Nolichucky River and flows into the river. The State of Tennessee reported that the downstream quality of public water processed from the river is considered excellent.

The EPA Toxic Release Inventory data reports that NFS has released nitrate and other related compounds to the atmosphere. However, air sampling for these contaminants and other non-radiological contaminants has not occurred.

B. Potential Exposure Pathways

Nuclear Fuel Services, Inc. reported that they have not used PCE and its breakdown products since the 1970s. However, past uses resulted in spills, releasing the chemicals to the air and to the soils ultimately contaminating the groundwater. Groundwater sampling results and concentration maps for VOCs show very high levels of the contaminant suggesting that large volumes of these compounds were spilt on the ground around the maintenance areas prior to the 1970s on the NFS property. ATSDR did not locate any surface soil sampling or atmospheric sampling around these areas that occurred at the time of these spills. As VOCs are no longer used, there will be no current or future exposures to these contaminants via the air pathway. No current uses of groundwater occur in the downgradient areas and restrictions to the use of groundwater in this area are restricted.

Other potential exposure pathways that could result in human exposures include the release of nitrates and nitric acids as well as ammonia compounds to the surface and the air.

NFS is currently seeking a waste water permit to allow them to divert processing water, currently stored on site, to the municipal sewage system. Until that permit is granted, the potential for exposures to waste water containing nitrogen compounds such as ammonia exists.

Not directly related to site contaminants but associated with NFS is the firing range in Washington County used by their security forces. The contaminants associated with this type of activity include residue from spent gunpowder including various heavy metals and the heavy

metals associated with the fired bullets. These heavy metals include, but are not limited to, copper, lead, zinc, steels, and brass. The concerns expressed to ATSDR include migration of these contaminants to local surface waters that serve as sources of public water supplies to downstream communities.

Public Health Implications

The Nuclear Fuel Services, Inc. site released volatile organic compounds to the ground, contaminating both surface soils on site and the groundwater. Although these releases occurred in the past, there are no current or future uses for the off-site groundwater as the community is on public water supplies. Furthermore, the public well closest to the facility is hydraulically upgradient and has not been impacted by these releases. Additionally, the facility-wide enhanced bioremediation and reductive dechlorination project (RCRA corrective action) has proven to be very effective at remediating the PCE contaminated groundwater.

Without a completed exposure pathway, adverse health effects related to these releases are unlikely.

C. Community Health Concerns Evaluation

Members of the community in Erwin and surrounding cities and towns have expressed a variety of concerns to ATSDR. The concerns ranged from impacts on environmental quality (air, water) in Erwin, other towns in Tennessee and North Carolina, perceived increases in cancer rates and self-reported cancer including colon and multiple myeloma, thyroid disease, Alzeheimer's Disease, multiple sclerosis, skin, and joint ailments. Concern also was raised regarding the firearms training facility located in Washington County.

ATSDR addresses these comments and concerns in Appendix A, entitled "Public Concerns received by ATSDR following the February and August 2006 site visits."

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

The evaluation performed by ATSDR at the Nuclear Fuel Services, Inc. site did not find any current exposure pathways for any chemical. Moreover, there is insufficient evidence to show completed exposure pathways to organic chemicals.

Conclusions

ATSDR has evaluated the releases of volatile organic compounds to the environment surrounding the Nuclear Fuel Services, Inc. facility in Erwin, Tennessee. The releases of these

materials may have occurred in the 1950s, 1960s, and 1970s; there was little or no monitoring of the environmental media at that time.

Current conditions related to the groundwater indicate that the groundwater is not being used as a source of drinking water nor has the contamination impacted public water sources. The levels of contaminants in the bordering Nolichucky River are not at levels of a public health hazard.

Using the protocols developed by ATSDR to evaluate pathways of exposure to populations around potentially contaminated or contaminated sites, ATSDR considers the NFS facility hazard rankings as such:

1. Past Conditions – There is no verifiable information that groundwater was not used prior to the 1980s. Furthermore, there is a historical lack of both on-site and off-site sampling of atmospheric releases. ATSDR considers the site an **Indeterminant Public Health Hazard**. This category applies to sites where critical information is lacking (missing or has not yet been gathered) to support a judgment regarding the level of public health hazard from past exposures.

2. Current and Future Conditions –ATSDR ranks this site as **No Apparent Public Health Hazard**. As there are no completed exposure pathways existing whereby the groundwater would be used as a source of public water. The lack of knowledge about the karst formations is of concern for there is insufficient data to determine if the contaminants associated with groundwater in this area will impact public wells in the future. Because the contaminants present in the groundwater are a mixture of many volatile organic compounds, health effects of mixtures may be an issue. However, no available studies directly characterize health hazards and dose-response relationships for exposures to "whole" mixtures containing 1,1,1-trichloroethane, 1,1-dichloroethane, trichloroethylene, and tetrachloroethylene. Furthermore, physiologically based pharmacokinetic (PBPK) models have not been developed to predict dispositional and toxicological outcomes of joint action of mixtures of these four chemicals. Similarly, interactions of heavy metals with other heavy metals or organic compounds are unknown at this time.

3. Based on all available information, ATSDR concludes that although some exposure might be occurring as a result of site conditions via the atmospheric exposure pathways, exposures are not at levels likely to cause adverse health. Say something about mixtures.

4. As previously stated, CERCLA legislation directing ATSDR activities excludes the evaluation of the radioactive materials released from this site. The conclusions of this public health assessment do not apply to the issues surrounding the use of radioactive materials by the Nuclear Fuel Services, Inc

Recommendations

ATSDR has evaluated the issues associated with the release of organic contaminants associated with the Nuclear Fuel Services, Inc. facility. Based on concerns received by ATSDR, the following recommendations are made:

1. A community education plan should be initiated by the appropriate agency to inform the area residents as to the nature and migration of the contaminants. This should include the movement of contaminants in the groundwater
2. ATSDR should meet with the public to discuss the findings of this public health assessment
3. If ATSDR receives any requests for a basic radiation safety and information presentation from the communities, those requests will be routed to both the Nuclear Regulatory Commission and Nuclear Fuel Services.
4. Inform the EPA about the concerns about lead exposure and migration as related to the gun range in Washington County.

Public Health Action Plan

ATSDR will coordinate with local officials and media outlets to set up public meetings to disseminate the findings of this public health assessment.

ATSDR will begin formulating an action plan to discuss the health impacts of the site to present to the public.

ATSDR will forward the concerns regarding the gun range to the site and to the EPA for their evaluation.

ATSDR will contact the local emergency response organizations and hospital for the purposes of their activities in event of NFS accidents.

Author

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Appendix A

ATSDR Response to
Public Concerns received following the February and August 2006 site visits

Comment	Response
I would like to know what became of the CDC study that took place many years ago in Erwin regarding the possible impact on public health by Nuclear Fuels Services. I personally know that this investigation took place, but there wasn't a public report citing the results of this study. Please inform me of those results.	ATSDR is unaware of any CDC studies performed many years ago. ATSDR did check with the National Institute of Occupational Health and Safety, CDC (NIOSH). They have been evaluating NFS as part of the Energy Employees Occupational Illness Compensation Program. Many of the NFS employees may qualify as Atomic Worker Employees. NIOSH met with several workers and former workers on July 21, 2005, to discuss this program. On February 14, 2006, NIOSH released their evaluation and the report is available at their web site: http://www.cdc.gov/niosh/ocas/wrgrace.html
My family is very concerned regarding the project in Erwin, Tenn. So much of what Tenn. does negatively impacts its neighbors in the valley. Please reconsider this project as I believe it could have a negative impact on our beautiful mountains.	Thank you for your concern. ATSDR accepted the petition request because of the concerns raised and the potential impact the contaminants could have on the surrounding area.
I, as so many others, have to work on the 16th and will not be able to attend the meetings that day concerning the health effects of the NFS site in Erwin, Tn. We live in Greeneville and Greene County Tn. (this is downstream on the Nolichucky river) this river is near the NFS site, and supplies our public water systems. We are VERY concerned with any health effects from this site. What are the known human health effects from exposure to the substances released at this NFS site in Erwin Tn.? When will the "public health assessment" be done? Will this be public information? Will appreciate your expedient reply on this matter	ATSDR has reviewed the contaminants from the site and the water quality of the Nolichucky River. The river data was obtained from the Tennessee Department of Environmental Conservation and the Southern Appalachian Man and the Biosphere Program. As stated in the public health assessment, there are no current completed exposure pathways at levels associated with human hazards; therefore, no adverse health effects would be expected.
I read the article published in The Erwin Record, Erwin, TN, on February 21, 2006, titled "Health agency hears concerns over illnesses feared from NFS". I live on Washington Street and I have been diagnosed with Multiple Sclerosis. I have had several lymph nodes removed due to unexplained fevers, weight loss, lymphadenopathy, etc. My illness developed when I moved to Washington Street. My house was built in the 1930's and we have done extensive remodeling	Although multiple sclerosis (MS) is the most common neurological disease disabling young adults in the United States, the cause of this disease is unknown. Evidence indicates that it is a complex disease with multiple causes determined by both environmental factors and genetic susceptibility. The ATSDR Division of Health Studies is

since we moved in. I worked inside this home doing medical transcription spending all my time there from the time we moved in until approximately a year ago. My health continued to deteriorate during this period of time. I began working outside my home a year ago and I have improved considerably since then. I have been told by many well-educated individuals that there may be something in my home environment that caused my illness. With the continued improvement in my health after getting away from the house during the day and now this article, I believe there may be something to this assumption.	currently working on two studies concerning MS. These are "Determining Prevalence of Multiple Sclerosis and Amyotrophic Lateral Sclerosis (ALS) in Communities Living Around Hazardous Waste Sites" and "Case-Control Study of Environmental Exposures and Genetic Susceptibility with Multiple Sclerosis." You can reach the division by calling toll-free 1-888-422-8737 (1-888-42-ATSDR)
I grew up in the big green two-story house which I think is now owned by NFS. When W.R. Grace built "the plant" down where Mrs. Home's frog pond used to be, we had no idea what was in store. The security and regulations then were few and far between. As kids, we would still go down there and walk around the fence to see the stuff that leaked out of the big tanks. The ground was always wet. When we heard the alarm go off, we ran to the upstairs bedroom to watch the men in white suits run up the hill. Orange smoke came out of the smokestacks. My aunt was a secretary there and one night came and took us away from our house because "something" was about to happen "down at the plant". Never knew what. I know we ate radiation straight from Mama's garden. Our beloved little dog died of cancer. My dad died at 56 with colon cancer. Our next door neighbor died of colon cancer; I doubt she was 60. A friend and close neighbor had extensive colon cancer in his early 30's. I had a huge lymphoma removed from my heart at the age of 30. My brother had kidney failure in his early 30's. My sister and I both have thyroid nodules and weird protein levels in our blood that can lead to multiple myelosis. These all have to be watched closely. At the age of only 64, I also have an autoimmune disease that makes life difficult. People in Erwin are still brainwashed about NFS. Those that know the truth have died or moved away. My mother died of heart failure at 65. I believe her heart was broken.	According to the American Cancer Society (www.cancer.org), colon cancer is the third most common cancer in the country and risk factors include family history of colon cancer or polyps, diet, weight, alcohol consumption, and smoking. The risk of colon cancer also increases after age 50. ATSDR has had much experience with issues related to the thyroid gland. Thyroid nodules are common in the population with their presence in women greater than in men, the cause of which are usually unknown. What is known, however, is that radiation-induced thyroid disease is associated with the intake of radioactive iodine. These were not present at NFS in the past nor are they currently present, based on the operational history and nuclear materials used at the site. The autoimmune organizations, (www.aaarda.org) indicate that about 75 percent of autoimmune diseases occur in women, most frequently during the childbearing years. These types of diseases are the 4th leading cause of disability in women. As with cancer, little is known about the causes of autoimmune disease.

I live in the NC county (Yancey) adjacent to and downwind from Erwin TN. As a (now retired) health care professional, I have observed over many years what appears to be higher than average occurrences per capita of several debilitating diseases here. Multiple sclerosis, various unusual types of cancer, spina bifida, clefting/midline developmental disabilities among others are more prevalent in the local population than would be expected. While nobody is yet able, or willing to point the finger toward the Erwin plant (or Oak Ridge for that matter) there is suspicion that airborne products from this facility passing through this area in highest concentration could be a factor in these statistics. Certainly further study is warranted.	Wind data collected during the 1990s show that the predominant wind direction at the plant is from the southwest to the northeast during the day, reversing at night. This places Yancey County outside the area that would be influenced by any air releases as the county is southeast of the site and separated by the mountains. ATSDR is in the process of completing public health assessments for Oak Ridge facilities operated by the Department of Energy. Besides soil, water, and biota, the agency also evaluated air releases. Our findings were that no air releases would have impacted Yancey County for several reasons. These include the fact that wind directions in the Oak Ridge area follow the valleys running from the west to the east. The height of the Oak Ridge releases was not sufficient for any contaminants to travel the approximate 125 miles between your county and the facility, especially as the mountain terrain would effectively block those releases.
We have been concerned for years about the nuclear fuel plant in Erwin. We are downwind here in Yancey County and we have a higher than normal incidence of certain cancers. I object to any expansion of that facility, and also to the recently announced plans to ship more waste to Barnwell SC. If you are looking for answers to specific questions, contact me.	The weather data for Erwin shows that the predominant wind direction is from the south or southwest at about 10 miles per hour. Yancey County is southeast of Erwin would not receive sufficient winds because of its direction and the intervening mountains.
I would like to send an email to Marilyn Palmer re growing up very close to NFS	Marilyn Palmer's email address is myr4@cdc. She can also be reached by calling toll-free 1-888-422-8737 (1-888-42-ATSDR)
My daughter lived almost all of her childhood in Yancey County. She had thyroid cancer. Her thyroid was removed and she had to take iodine radiation two times. She seems to be fine now. I also had two cats die of cancer. If you need to contact me, do so by e-mail. I am living in Mexico at this point.	Typically thyroid cancer is associated with the intake of radioactive iodine, produced by nuclear reactors or atomic weapons testing. There is no indication in NIOSH documents that NFS used radioactive iodine in their processes.

I am the sister of [name withheld – medical confidentiality] and all she has stated is true. I have two friends that worked in the chemical department at NFS before regulations were implemented. Both now have a lot of health issues. One friend has hand skin problems and the other friend has growths on hand and feet joints and also has muscle problems.	Thank you for your concern. We have passed your comment on to the Tennessee Department of Health

Before I begin please let me apologize for using all capital letters. I cannot type, I use one finger to type and I am also a bad speller. I am writing about Nuclear Fuel Services, Inc. in Erwin, Tn. They process radioactive material that is too dangerous a practice to continue. There location near the Nolichucky River where the Jonesborough water department gets their water could be harmed by contaminants leaching into the river. The river is also used for white water rafting and sport fishing. I live about seven miles by road from their site and probably closer if there was an accident that could contaminate the air. I would also like to make you aware of another problem I have with Nuclear Fuel Services lack of concern for people and the environment Nuclear Fuel Services located in Unicoi County needed a shooting range so that there rent a cop security force could train/qualify. According to Nuclear Fuel Services to meet federal regulations. Some how they got Washington County (where I live) to let them have it here. This shooting range is at the foot of Cherokee National Forest. It is right next to a road, along side a sawmill, very close to peoples homes and within a quarter mile of the Nolichucky River. There is also a stream called dry creek only a short distance away which flows into the Nolichucky River. The roadside ditches which flow into dry creek and the Nolichucky River are down hill from where they are shooting. This is the same river where Jonesborough gets its water and the same river that they can contaminate in Erwin. There is a pump station on the river that pumps water to the treatment plant, all in close proximity to the shooting range, about a quarter mile each way. The problem with this range is that it is wide open! They shoot lead bullets into the ground. There is no way to stop a stray round from killing people.	The EPA does not certify, approve, or manage the lead migration issues associated with gun ranges. However the EPA has published national guidance on best management practices to assist owners and operators of lead issues associated with gun ranges located outdoors. The guidance can be found at http://www.epa.gov/region2/waste/leadshot/ (accessed on May 2, 2006). The US Department of Interior also has information on gun range management that can be found at http://www.doi.gov/greening/sustain/shooting.html (accessed May 2, 2006. Lead bullets also must dissolve before they enter the water supply. Acidic soils and acid rain can result in a very slow dissolving of these bullets. The acidic conditions at the range can be controlled with the application of materials such as lime. We will inform NFS of your concern. ATSDR was established by Congress to review the health effects resulting from exposures to chemical contaminants present in the environment from hazardous waste sites. Noise is considered a physical hazard and noise level limits are established by the National Institute for Occupational Safety and Health. We will inform them of your concern.
Nuclear Fuel Services not only has their people shooting there they also let many of the local and state cops use it, they use hand and long guns plus full automatic weapons. There is also grenades used and the Tennessee highway patrol explodes bombs. All the lead and powder residue end up leaching into the drinking water used by	

thousands of people. There are also a lot livestock, cows and horses that drink untreated ground water. This also effects the fish in the Nolichucky River along with other wildlife, deer, birds and any other living things that need water. I would like to comment on something I noticed while reading about ATSDR. Why do you not include noise as a community health concern, I think it should be included. If you were here when Nuclear Fuel Services rent a cops, the Tennessee highway patrol or the Unicoi swat team were shooting, exploding bombs and grenades I think you would agree that noise is a pollution. Please help!	

I was not able to attend your open meeting concerning Nuclear Fuel Services in Erwin, TN on Feb.16, 2006. I do have the following comments to make concerning NFS. My back ground includes military service as an optometrist and being trained as the Nuclear, Biological and Chemical Warfare Officer for Bassett Army Hospital in Fairbanks, Alaska. Since living in Erwin I have served on The Unicoi Co. Board of Health, The School Board and as a County Commissioner: My family and I moved to Erwin in May of 1974. At that time we lived in a house adjacent to NFS property. I had looked at the NFS facility and made the decision that I was not placing my family's health in jeopardy by living close to NFS. We lived adjacent to NFS for more than two years with no unusual health problems. I raised three children at that house arid all of them are in good health. Two of the three have healthy children of their own. I provided safety glasses for NFS employees from 1976 through 1999. I was not an employee of NFS, but I was a contractor for safety glasses. In my optometry practice in Erwin since 1974, I have not noticed any unusual ocular health problems which would indicate any damage related to radiation. The cataract rate of persons living in the NFS Plant vicinity does not seem to be higher than the general Unicoi County area, and the Unicoi County rate does not seem to be higher than the national averages. I had one employee of NFS with a benign iris tumor arid I do not recall any retinal tumors from NFS employees. I find it interesting that people from outside of our community seem to complain the most If there is a health issue It is mental stress placed on our citizens by people from other locations. It is my opinion that NFS is a good member of our community. They have demonstrated their concerns for our community by being active in the United Way, Chamber of Commerce and have added a lot of support for our school system. They have also provided the best job opportunities for Unicoi County residents of any of our plants. I am proud to have NFS in our community. I appreciate the positive attitude that you displayed on your trip to Erwin.	Thank you for your comment.
Erwin drinking water contamination -- especially of the Railroad Well -- is the main issue that the ATSDR needs to investigate, in my opinion. In a package postmarked April 1st, you will receive materials that support my concerns about	ATSDR reviewed various data sources in which groundwater was tested, sampled, and characterized with respect to groundwater flow. In these documents, the evidence is clear

the health impacts of heavy metal, chemical & radiologic contaminants that have entered Erwin's ground and drinking water due to NFS's operations in Erwin. NFS also discharges into the Nolichucky River, the source of Jonesborough's & Greeneville's municipal water supplies. The Blended Low Enriched Uranium project at NFS is projected to increase the discharges into the Nolichucky of Uranium, Thorium and Plutonium -- the latter two by hundreds of thousands of times. Please look for my package of materials early in the next business week.	that the contamination in the groundwater associated with NFS does not impact the Railroad Well. As you know, this well is about ½ mile north of the facility. Studies of the water-table height indicate that the well is up-gradient (up-stream). Sampling of the Railroad Well has shown the presence of chloroform and PCE; however, the levels of these contaminants are not considered a public health hazard.
hi, questions on what contaminants and their results in humans if exposed during childhood to adult. In reference to personal issues dealing with children born around 1955. I know several people ages 50-60 that were born and raised in Erwin that now suffer from Alzheimer symptoms with no parental history of Alzheimer's. Seems to be more than just happens stance for such a small town with so many people in the average age group of early 50-60 to be having memory loss and unable to function.	ATSDR has no information regarding an association of the site organic contaminants in groundwater and the occurrence of Alzheimer's Disease. According to the Alzheimer's Association, the disease is the most common form of dementia. Age is the greatest known risk factor and most individuals with the illness are 65 and older. The likelihood of developing Alzheimer's approximately doubles every five years after age 65. After age 85, the risk reaches nearly 50 percent. For more information, please visit their internet site at www.alz.org Furthermore, ATSDR was not able to identify any pathway whereby organic contaminants could have impacted the population around the site as the ground water is not used as a public water supply.

It seems that weekly we hear of more who are victims of cancer, some very young children. Since I a am not a health professional, I do not know why. Did the Japanese not have much cancer after World War II? Our drinking water comes from the Nolichucky River, some 25-30 miles downstream from Erwin. If it is allowed to continue to operate it could cause unhealthy, lasting results for an extended area since the river flows finally into the Gulf.	It is true that the Japanese survivors of the atomic bombing did develop cancer. However, the doses they received were quite different from the doses of radiation released by NFS as reported to state and federal regulators. By law, ATSDR is not permitted to evaluate radionuclide releases from sites such as NFS. ATSDR, however, did evaluate the water quality of the Nolichucky River as it is a source of drinking water for both the towns of Greeneville and Jonesborough. The evaluation used data from the state as well a public/private group, Southern Appalachian Man and the Biosphere Program, indicates that although the river itself has pollution issues, the quality of the drinking water produced by these two towns is of excellent quality.
My concern is for the school children in Erwin and for those of us who must drink the water from the Nolichucky River. What provisions do you have in place to protect the school children in Erwin, and those of us who must drink the water from the Nolichucky River in the event of a nuclear release from NFS. Last winter, floodwater rose to within one foot of Highway 81 near the Devil's Looking Glass, a rock formation over the fault line. What is the travel time via groundwater from the NFS plant to the Nolichucky River? What is the setback distance from the plant for land-based unauthorized vehicles? And what protection is in place to deter saboteurs from using weapons of war aimed at this plant? I suggest that you get some gas masks that fit the school children in Erwin along with a supply of potassium iodide tablets. I further suggest that you see that the water companies have filters that filter out nuclear contamination. We need an immediate warning system to inform school authorities, and the water companies of nuclear releases, i.e., telephone backed up by ham radio.	ATSDR is aware of the water quality of the Nolichucky River. The City of Erwin obtains their drinking water from groundwater wells that are not impacted by operations at NFS. The Tennessee Division of Water Supply considers the intakes at Jonesborough and Greeneville to be a high susceptibility based on the upstream industrialized areas as well as both urban and rural areas. The Clean Water Act classifies the river as not meeting water quality standards or which has impaired uses. Nonetheless, the City of Jonesborough does have an excellent water quality in their drinking water supply.

NFS owns 17 acres in Washington County for a firing range where target practice and explosives may be causing the ground and surface water to become contaminated with lead and other toxins. The range is across from Dry Creek which runs into the Nolichucky River just upstream of the town of Jonesborough drinking water intake pipe. My personal concern that the surface and groundwater sources of Erwin, Jonesborough, and Greeneville municipal drinking water supplies may be tainted by a cocktail of chemicals and radionuclides deposited on the ground or discharged into surface water. I believe it is imperative for the ATSDR to analyze the constituent elements in the Railroad Well especially. That well could be the mechanism by which groundwater contamination is distributed to Erwin homes and businesses. The Sierra Club and the Tennessee Clean Water Network wanted to pay for analysis of a water sample from the well. We were hoping to test for Technetium-99.	ATSDR has reviewed various data sources concerning the drinking water quality for both Jonesborough and Greeneville. The state of Tennessee has classified the Nolichucky River as an impacted stream. However, the quality of the water following treatment by the water utilities is considered excellent quality. If one is on a private well, ATSDR recommends that a test of the well water be performed to include not only chemical contamination but coliform contamination. Currently, the Railroad Well is not suppling water to the public distribution system for the city of Erwin.
We grew up in Erwin, back in the early 60's where the nuclear plant is. We swam in the swimming pool that had water furnished from the water that was a drain off from the nuclear plant. Now we all have these diseases and want to know if they are related. We don't think they had the regulations in the 60's that they do now. Any information would be appreciated. A lot of people have moved away so we don't know their status, but would love to know any information you could provide. The plant is called Nuclear Fuel Services in Erwin, Tn.	ATSDR is attempting to locate the position of the swimming pool as current documentation does not indicate its presence. You are correct with regards to the regulations. Nuclear regulations as well as chemical regulations have changed since the 1960s. The Nuclear Regulatory Commission updated their protection regulations (10 CFR 20) in the 1970s and again in the 1990s.

Although not directly relayed to ATSDR – an individual believes that cancer rates in Unicoi county have tripled since 1980.	ATSDR received several comments and correspondence regarding the cancer rates in Unicoi County and Erwin. Many of these concerns were based on knowledge or interviews with local residents. These are called door-to-door surveys and are not considered usable. Cancer is a group of diseases with many potential causes and affected tissues such as the prostate, lung, breast, liver, and colon. States attempt to establish and maintain cancer registries; however, the Tennessee registry is not of sufficient quality to verify local assertions.
According the Guinness Book of World Records, in 1981 or 1982, NFS released tons of uranium. The following year edition of the book did not have the information.	ATSDR is attempting to contact the Guinness publisher to obtain copies of the report. We have also tried to find documentation on the internet and various library sources in Atlanta.
Surface water monitoring in 2002 indicated cyanide in Banner Spring Branch, a creek that flows through NFS's reservation then into the Nolichucky River.	In the information you supplied, the cyanide was attributed to Solid Waste Management Unit (SWMU) 1 in the north part of the site. As of 2006, Banner Spring Branch has been rerouted and is not in contact with that portion of the site. SWMU 1 is currently undergoing remediation with the contaminated soil being removed
There are a number of fault lines in close proximity to NFS. It is my understanding that those fault lines could enable contaminants to travel a considerable distance. Please also note that may area residents (like me) take their drinking water from wells.	The fault line maps you provided to ATSDR show that the site lies between two fault lines. Since they do not extend through the NFS property, it is highly unlikely that contaminants would move through the fault lines directly. If one is on a private well, ATSDR recommends that a test of the well water be performed to include not only chemical contamination but coliform contamination.
In 1998, NFS underestimated the wastewater COD (chemical oxygen demand). The site claims it was based on an incorrect calculation method. This error was not noticed by TDEC (Tennessee Department of Environmental Conservation).	This issue is of a regulatory nature. ATSDR suggests you contact either the Tennessee Department of Environmental

What other discharges has NFS failed to report or has NFS under-reported?	Conservation or the US EPA.
An indication of the very generic and infrequent sampling (only monthly) done by TDEC is attached. Greeneville also samples for gross alpha and gross beta, but only monthly and with so large a margin of error to make the data almost useless for public oversight. Data prepared by the commentor indicates that NFS contributes to water and sediment significant alpha emitters, especially in Banner Spring Branch and Martin's Creek – both of which flow into the Nolichucky River	Under typical environmental monitoring guidelines, monthly surface water samples are normal, even around nuclear and non-nuclear power plants. The EPA regulations for drinking water outline the steps of the analyses to be performed on drinking water samples. Since the concentrations of gross alpha radiation and gross beta radiation reported by the state are below the Maximum Contaminant Levels, no further analyses are warranted.
A letter to Tennessee Congressman Bill Jenkins requesting that he direct ATSDR to conduct a thorough analysis of the rate of cancer in Erwin even if the ATSDR needs to perform primary data collection to fulfill this mandate. This request relates to the claim of the commentor that on Washington Street there are 40 households and 19 cancers and non-Hodgkins lymphomas are directly linked to exposure to radioactivity.	ATSDR considers additional health activities if the pathway analysis indicates contaminants have intercepted a media that is used for human consumption and that the concentration in that medium is present at a level considered a public health hazard. The evaluation of the chemical contaminants at the Nuclear Fuel Services site showed to ATSDR that the organic chemicals in the groundwater do not impact the public water supplies in Erwin and the public water quality of the communities downstream is classified as excellent by the State of Tennessee.
I am concerned that Nuclear Fuels has no method of informing the public of any emergencies. There does not appear to an alert system. I would also like a public meeting to discuss radiation and health, detection, emergency response (verbal communication to ATSDR during the February 2006 meetings).	ATSDR will contact the local emergency responders and hospitals to ascertain the plans in place with NFS. ATSDR will be glad to hold meetings to discuss the radiation and health issues in a general discussion. However, as mentioned in this document, we cannot legally discuss operations at the NFS facility.

ATSDR also received concerns regarding the use of nuclear materials at NFS. However, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, Superfund) excludes facilities such as Nuclear Fuel Services, Inc. from evaluation by ATSDR. ATSDR has forwarded these concerns to the US Environmental Protection Agency (EPA), the US Nuclear Regulatory Commission (NRC), the State of Tennessee, and Nuclear Fuel Services, Inc. for their information.

Appendix B

Response to Community Comments
Public Comment Release

Comments received during Public Comment period are presented here along with the ATSDR response. Unless the comments are from government agencies, ATSDR does not public the names or affiliations of those who submitted comments.

Comments received that pertain to the use of radioactive materials or other issues related to the Nuclear Regulatory Commission (NRC) and its license with Nuclear Fuel Services, are not included in this table. However, ATSDR has supplied those comments, after removing identifiers, to the NRC, EPA, and the state of Tennessee. As has been stated in this document, ATSDR is prohibited from addressing these issues by law unless the site is listed on the National Priorities List of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Comment Received	ATSDR Response
<u>Failure to Include Radioactive Substances in the Assessment</u> It is disturbing to note that ATSDR failed to assess the public health risks associated with radioactive substances at the Nuclear Fuel Services (NFS) site, claiming a lack of legislative authority to do so under 42 USC 9601 (22). This is particularly confusing since ATSDR has included radioactive substances in Public Health Assessments (PHAs) at numerous other sites. In fact, one such site is Oak Ridge, TN (EPA Facility ID: TN18900900003), which handled many of the same substances as NSF, including special nuclear material (SNM), enriched uranium and plutonium. The Agency's most recent PHA for the Oak Ridge facility was dated November 18, 2005. The following (with emphasis added) is an excerpt from page 1 of that PHA: *To expand on the efforts of TDOH, ATSDR scientists conducted a review and a screening analysis of TDOH's Phase I and Phase II screening-level evaluation of past exposure (1944 to1990) to identify contaminants of concern for further evaluation. Based on this review,* ***ATSDR scientists are conducting public health assessments (PHAs) on the release of iodine 131, mercury releases from the Y-12 plant, PCBs, radionuclides from White Oak Creek, uranium releases from the Y-12 plant, uranium and fluoride releases from the K-25 complex, and other topics such as the Toxic Substances Control Act (TSCA) incinerator and off-site groundwater.*** *In conducting these PHAs, ATSDR scientists are*	The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA; Superfund) is very specific as to what issues can be addressed by ATSDR unless the site is listed on the National Priorities List. The federal regulation can be found in the United States Code, Title 42, Section 9601 (22) where a release is defined. The code specifically excludes ***"release of source, byproduct, or special nuclear material from a nuclear incident, as those terms are defined in the Atomic Energy Act of 1954 [42 U.S.C. 2011 et seq.], if such release is subject to requirements with respect to financial protection established by the Nuclear Regulatory Commission under section 170 of such Act [42 U.S.C. 2210], or, for the purposes of section 9604 of this title or any other response action, any release of source byproduct, or special nuclear material from any processing site designated under section 7912(a)(1) or 7942(a) of this title, and (D) the normal application of fertilizer."*** ATSDR did perform public health assessments of many of the former Atomic Energy Commission (AEC) sites such as the Oak Ridge Reservation because those locations were listed on the National Priorities List of the Superfund. The AEC was dissolved ultimately forming the Nuclear Regulatory Commission and the Department of Energy. The legislative directive in 42 USC 9601(22) defines releases for the purposes of Superfund and this referenced section specifically excludes Nuclear Regulatory Commission (NRC)-licensed sites. ATSDR derives its authority from Superfund. The Office of General Council, CDC/ATSDR has affirmed on many occasions that ATSDR does not have the legal authority to evaluate NRC-

evaluating and analyzing the information and findings from previous studies and investigations to assess the public health implications of past and current exposure. This PHA documents ATSDR's screening of recent (1990 to 2003)1 environmental data, addresses whether additional chemicals require further evaluation, and discusses the public health implications related to estimated exposures. Polychlorinated biphenyls (PCBs), mercury, and the groundwater pathway are not addressed in this PHA; those chemicals will be evaluated in separately released PHAs. Further, it is not clear that there is any legislative directive in 42 USC 9601 (22) that would prohibit ATSDR from including radioactive substances, including SNM, in their PHA of the Nuclear Fuel Services site. If there is anything in the statute that specifically precludes ATSDR from including these radioactive substances, please direct us to that text. Neglecting to assess risk to public health from radioactive substance is particularly troubling since "ATSDR derives it authority to address environmental contaminant issues at this site from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)..." The CERCLA Priority List of Hazardous Substances (http://www.atsdr.cdc.gov/cercla/05list.html) includes many of the toxic and radioactive substances likely to be associated with past and present operations at the Nuclear Fuels Services facility.	license holders. ATSDR agrees with your comment regarding the neglecting of radiological materials at this site; however, health issues are not overlooked at this site since both the state of Tennessee and the NRC have expertise in the evaluation of radiation induced human health effects.
Site Description The ATSDR report discussed the geological features of the site,	ATSDR geologists and hydrogeologists re-evaluted both the groundwater modeling around the site as well as US Geological Survey data and the link you provided. We have modified our

acknowledging that the site is underlain by unconsolidated alluvium consisting of silts, sands, cobble, and gravel. These medium typically allow rapid movement of shallow ground water. It was noted that the alluvium overlies fractured bedrock, consisting of "steeply sloping beds of shale or shale interbedded with dolomite and siltstone." According to a state geologic map of Tennessee (http://www.state.tn.us/environment/tdg/bigmap.shtml), the site may also consist of limestone. While features, such as fractured bedrock mentioned in the ATSDR report clearly provide a mechanism for downward movement of ground water, limestone offers additional attributes for migration of contaminated ground water through solution channels. Unfortunately, these features, as well as nearby fault lines and runoff from the mountains, provide excellent mechanisms for rapid lateral and downward movement of contaminated groundwater and consequential migration of contaminants.	discussion on the underlying site geology as appropriate.
Volatile Organic Compounds (VOC) and Ground Water Contamination Despite the fact that ATSDR's PHA could have included numerous non-radioactive chemicals associated with NFS, the agency chose to focus on only Tetrachloroethylene (PCE) and its degradation products: Trichlorethylene (TCE) , Cis 1,2 dicloroethylene, Trans 1,2 dichloroethylene and Vinyl Chloride (VC), stating, "Since the 1970's, NFS stopped the use of VOCs in their processes." While the report was careful to note that the author's use of VOC referred only to PCE and its breakdown products (including TCE), it is misleading to say that the use of this solvent ceased in the 1970s. In fact, documents on file at TN Department of Environment and Conservation (TDEC) indicate	ATSDR utilizes a process whereby environmental contamination is evaluated through a pathway analysis. This analysis helps identify how contaminants move through the environment, how they might come in contact with humans and at what concentrations. Once these factors are evaluated, the next step is to choose those contaminants that exceed a health based screening value. If a contaminant exceeds that health based screening, it then becomes a contaminant of concern. For this site, only PCE and its degradation products met those requirements. ATSDR realizes that NFS uses many other chemicals in their activities; however, releases to the environment of these other chemicals are within the legal limits of their permits obtained from both the EPA and the state of Tennessee.

that TCE was still being used in 1987. For the sake of public trust, the report should have mentioned this fact. Based on sampling data provided in the PHA, there was no evidence that sampling had been done for trichloroacetic acid. This is troubling since this metabolite of TCE is considered teratogenic and associated with congenital heart malformations. While we are deeply concerned that PCE was the sole focus of ATSDR's PHA, we are sorely disappointed that the agency neglected to mention the far-reaching potential for the public's exposure to this chemical and its breakdown products, given the geologic makeup of the site. To add perspective to our concern, we cite former EPA Administrator Carol Browner: *"Given that a five gallon bucket of TCE spread throughout an aquifer could contaminate up to 800 million gallons of groundwater at levels above drinking water standards, leading to enormous cleanup costs, it is imperative to control and minimize such sources."* (Excerpted from Statement of EPA Administrator Carol Browner before the House of Representatives Subcommittee on Water Resources and Environment, October 29, 1997) While Ms Browner provided a hypothetical example, widespread contamination of TCE has been well documented across the country. One dramatic example occurred in Le Roy, NY. In Dec 1970, a train derailment caused a spill of 30,000 gallons of TCE. Volunteer firefighters responded by flushing the area with a million gallons of water, in an effort to dilute the solvent. Twenty years later, contaminants found their way to about 40 households and businesses that required alternative water supplies, first bottled water, then water treatment systems. According to the	Thank you for your comment. ATSDR was not aware of the data indicating that TCE was still being used as late as 1987. The reports received by ATSDR were required under the Resource Conservation and Recovery Act (RCRA) and TCE was not listed in those reports for the years ATSDR requested. We contacted and visited the local state office for additional information. TCE in humans is metabolized to trichloroacetic acid. However, in groundwater TCE is metabolized to dichloroethylene and vinyl chloride but only in groundwater with anaerobic environments. Aerobic conditions in groundwater do not result in TCE biodegradation to DCE and VC. Therefore, there is no reason to sample for the trichloroacetic acid. ATSDR received and reviewed the environmental data to which we were limited to by law. We also reviewed public drinking water data quality reports from the state of Tennessee for the downstream communities of Jonesborough and Greenville. The state reports indicated there were no contaminants related to the releases from NFS detectable in those water systems. Thank you for your comments from the EPA. It is true that DNAPLs do not necessarily follow groundwater flow and that the geology around NFS most probably consists of karst (fractured) rock formations. According to the US Geological Survey in a 1997 report on karst regions of Tennessee, DNAPL movement in karst formations has been studied in several locations, but only a few reports have been published. In most cases, field data show that DNAPL descended until the fracture system pinched out. In other cases, confining units stopped or deflected DNAPL movement. For more information, please see the USGS report available at http://pubs.usgs.gov/wri/wri974097/index.html (accessed on

New York State Department of Health, contaminants had spread at least 3 miles and to three counties. One well, 3 miles from the spill site had TCE levels over 120 ppb. It is well known that PCE and TCE are a dense non-aqueous phase liquids (DNAPLs). DNAPLs are chemicals that are heavier than water and fairly insoluble in water. DNAPLs do not readily mix with water and tend to sink, finding their way, often in pure phase, through even tiny cracks in rock. Once in fractured bedrock, they can move both horizontally and vertically, making it nearly impossible to predict their path of migration, let alone remove them from geologically complex environments. Ground water studies of the site indicated a large plume of solvent contamination. In 1996-2004, it was estimated to cover 13 acres on site and an additional 5-8 acres off site toward the Nolichucky River. It is highly likely that fractured bedrock and other complex geological features at the site have provided mechanisms for extensive migration of contaminants beyond those identified in the plume. While pump and treat systems, such as the one installed at the site, are often effective in hydraulically controlling migration of contaminants, they have not proven to be effective in recovering DNAPLs that have found their way into the deeper ground water system. Therefore, it is very possible that PCE and its metabolites have already migrated far from the site, including to private and public water supplies. As was mentioned in the PHA, the city of Erwin obtains its drinking water from springs and wells and there are six public supply wells within 5 miles of NFS. There are three surface water bodies within the vicinity of NFS, including the Banner Spring Branch, Martin Creek and the Nolichucky River, as well as "ephemeral springs that rapidly appear following local rainfalls that average about 45 inches per year." All of these water features can play a significant role in the movement of contaminants.	February 16, 2007) An ATSDR geologist/hydrogeologist reviewed this report and supplied the following statement that has been incorporated into the public health assessment: The elevated concentrations of PCE as mentioned in the public health assessment are above the limits set forth under the Safe Drinking Water Act. The monitoring wells around NFS are not used as public supply so the elevated levels cannot be enforced under that law. While the EPA has established goals for drinking water, the MCGL, only the MCL values are legally enforceable. Nonetheless, we have added a statement in the public health assessment to indicate the contaminant goal of the EPA for these contaminants. We are unaware of any regulation determining the number of monitoring wells at a Superfund site. Typically, the number of wells is determined for each site based on numerous assessments such as environmental assessments, groundwater assessments and other types of environmental investigations. The ATSDR comment is meant to include all potential contaminants that might be present in an individual's private well. ATSDR suggests that you contact the state health or environmental department. Water quality issues are released by the Tennessee Department of Environment and Conservation (TDEC), Division of Water Supply (615-532-0191) and Division of Water Pollution Control (615-532-0625). These divisions are in Nashville. TDEC also has an environmental field office in Johnson City (423-854-5400).

PCE contamination was found in the alluvial aquifer at levels exceeding 13,000 µg/L, extending beyond the west boundary of the facility in 2002. The legally enforceable limit (MCL) for PCE in drinking water is 5 µg/L. However, ATSDR neglected to explain that the maximum contaminant level goal (MCGL) for PCE is 0 µg/L. A MCGL is a level of a contaminant in drinking water below which there is no known or expected risk to health. The same MCGL of 0 µg/L has been established for TCE and vinyl chloride, which are both breakdown products of PCE. While 54 monitoring wells have been installed on site and 21 off-site, there are inherent problems with relying on monitoring wells to characterize DNAPL contamination. In addition to the propensity of DNAPLs to migrate through fractured rock, PCE has a tendency to form an arrowhead shaped plume in saturated zones, with Vinyl chloride at the front end of the plume. According to groundwater experts at Waterloo University, incorrect placement and depth of the wells can lead to mischaracterization of a plume. It is not unusual at CERCLA sites to place up to five monitoring wells per acre. The strategically placed wells, at varying depths, aid in determining contaminants and their movement. However, to adequately assess and protect public health, it seems prudent to ensure that public and private water supplies are regularly tested for the full range of toxic and radioactive substances associated with past and current activities at NFS. Therefore, it was disturbing to read ATSDR's Response to Public Concerns (Appendix A of the PHA) *"If one is on a private well, ATSDR recommends that a test of the well water be performed to include not only chemical contamination but coliform contamination."* There was no clear message to residents to have their well water tested for radioactive materials, nor was there guidance on how such tests could be obtained. Comprehensive	

analyses for all contaminants of concern would likely to be cost-prohibitive for most area residents, especially if they were to test periodically to ensure consistent water quality. For these reasons, it seems appropriate for ATSDR to recommend that the State Health Department produce a fact sheet on water quality concerns, well as a establish water testing program for area residents on private wells.	
While the PHA noted that past and/or present industrial activities at the site involved high-enriched uranium, uranium hexafluoride, thorium and mercury, the report made no mention of a major plutonium processing project, which operated at NFS for several years until 1970. According to information gathered for and during the *Hearing on Erwin Nuclear Fuel Services before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce House of Representatives,* (Sept 18, 1986) plutonium disposal occurred on the plant property (page 12). Based on testimony contained in the hearing record, it is likely that plutonium contamination is widespread on plant property. While decommissioning of the interior of the building took place in the 1990's, the building itself was torn down by contractors, reportedly without proper decommissioning. It is very possible that this activity caused widespread contamination of plutonium off site through fugitive releases. There was also no mention that an incinerator was in operation at the facility for a number of years, which no doubt added to area deposition of contaminants. The PHA report noted that NFS has had numerous NRC violations, claiming that they were a result of accounting errors and "poor documentation of chain of custody" but that "none of these violations was for actual loss of material."	The plutonium activities associated with the site as well as any uranium and thorium operations are exempt from Superfund as stated at the beginning of these comments and in the public health assessment. If allowed by law, ATSDR would evaluate the operations using the radioactive materials at the Nuclear Fuel Services, Inc. site. ATSDR has met with the Nuclear Regulatory Commission Region II office in Atlanta. This office oversees activities for NFS. Your comment has been relayed to their senior staff. Thank you for your comment. ATSDR has informed the NRC of your comment.

In fact, "NSF has a history of significant accidental releases. In 1962, over *10 kilograms of UF6 was released. In 1964, over 4 kilograms of UF6 was released. In 1979, over 3 kilograms of UF6 was released and in 1981 over 150 grams (exact amount to be determined) was released." (Source: Hearing before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce House of Representatives, Ninety-Ninth Congress Sept 18, 1986 Serial No, 99-178). In 1979, NSF lost 48.4 pounds of highly enriched uranium. While initially there was great concern about theft of the material, through a series of calculations based on assumptions, the NRC was able to account for all but 11.26 pounds of it by estimating how much of it had vaporized to the air, was absorbed into flooring, remained as residue or had been disposed of. (Source: Associated Press, Oct. 31, 1980, "Report Supports Theory of No Security Breach in Uranium Loss"). This long and well-documented history of "loss" of radioactive materials should have prompted ATSDR to call for a full and comprehensive Public Health Assessment, especially since material loss was attributed to environmental releases. * Due to poor quality of copy, the exact number is not legible and could be more than 10 kilograms.	
Health Outcome Data ATSDR's PHA noted: "The state has limited reliable health data for this area of Tennessee." In Oct, 1988, the National Institute of Health (NIOSH) released a report of their Health Hazard Evaluation (HHE) for Nuclear Fuel Services. The HHE investigators found that "Several health problems related to kidney disease are unusually common in both	ATSDR was aware of the NIOSH study and reviewed that study prior to the release of the public health assessment. That worker study is only one small part of the overall health of the Unicoi and Tennessee health data. The state of Tennessee is in the process of developing a cancer registry; however, the existing registry is neither certified by the North American Association of Central Cancer Registries, Inc. nor the CDC. Other registries, such as morbidity, mortality, birth defects, and other disease

NFS workers and in dairy workers from a nearby plant" and suggested that the health problems "apparently reflect[ed] a regional rather than an occupational problem." The report recommended further study "to understand and prevent kidney problems in the region." Curiously, the NIOSH HHE was not listed in ATSDR's list of references, nor was it mentioned in their Public Health Assessment (PHA). Workers and local residents have openly shared their health concerns with ATSDR and are convinced that the community has, for some time, experienced a high rate of specific cancers (lung, bone, liver, kidney and skin), as well as an increased incidence of multiple sclerosis, birth defects and kidney disease. Despite the well-documented toxic and radioactive contamination issues associated with this site, as well as the antidotal information provided, it seems outrageous that ATSDR would rank this site as: **"No Apparent Public Health Hazard."** The absence of data does not justify this ranking without strong recommendations for a full-scale epidemiological study of the workers and the community. ***Since there are serious gaps in scientific knowledge about toxicity, bioavailability, exposure, and synergistic interaction effects, we recognize that is impossible to accurately assess the full impacts that toxic and radioactive substances are having on public health. However, we are disturbed that ATSDR's PHA seemed intentionally limited in scope and did not include all relevant, available data. Therefore, we strongly urge ATSDR to revise their recommendations and call for a comprehensive health action plan that will truly assess the health risks of those who may be affected by historic releases from the NFS facility.***	registries are available for the state of Tennessee. The Tennessee Department of Health has been working with ATSDR to address these health concerns The NIOSH study focused on the nuclear operations and the use of uranium in the processing of materials at the site. As previously stated, ATSDR cannot address any issues associated with nuclear operations. Furthermore, the inclusion of the dairy farmers in the study and the results of that group would indicate that kidney issues are not associated with the facility and were related to a "stone belt" present in the southeastern United States. This was stated in the report. Nonetheless, because the study involved workers and the use of radioactive material, we did not cite this study. ATSDR is aware of the issues associated with cancer and other illnesses in Erwin and the surrounding areas. We have spoken with the Tennessee Department of Health as well as the individual petitioning ATSDR. The state and the individual would like to perform a door-to-door survey of the residents to better define the health issues. ATSDR has also suggested that East Tennessee State University be involved in this endeavor as well. ATSDR's finding of "No apparent public health hazard" is only based on the information contained in the public health assessment; that is, the finding is based on the occurrence of volatile organic compounds in the groundwater and the chance that individuals would come into contact with the contamination at levels associated with levels of public health concern.

First of all, I can't understand how or why the state of Tennessee and the County of Unicoi could issue [a] license to NFS to operate inside a city limits like they do; we are surrounded by mountains and when the wind is not blowing the air just sits here and [doesn't] move anywhere. I understand the NRC has rules and laws NFS has to go by or they [are] fined, but things at the plant still don't go just right. From reading the paper, NFS has fires, they have leaks inside the plant. They have accidents as most plants do. I worry they (NFS) could at any time have a bad accident at a time when the wind was just right and a lot of people in this small town would suffer because of [an] accident NFS had. And if NFS was not located inside a city not near[ly] as much harm to so many people would be felt. This plant and the work they do is well needed in the US. I am glad we have companies that do this kind of work; however, I think the companies or plants that work with substances such as nuclear fuel should not be placed in side a city where a lot of people live. I understand not even the CEO or president of Nuclear Fuel Services Inc. resides in this city or county nor most of the employees just under him do either. Does that tell you anything? Thank you; hope you will consider these comments.	Thank you for your comment. The granting of the license and the location of the facility are issues that are regulated by the Nuclear Regulatory Commission and the State of Tennessee. ATSDR has passed your concerns over to the appropriate individuals in those agencies. The internal operations as well as the health and safety of plant operations are under the regulatory auspices of the Nuclear Regulatory Commission and the on-site inspectors at the facility. As stated above, ATSDR has passed your concerns to that agency. Thank you for your comments and concerns.
Why is the NFS site not listed as a NPL or Federal Superfund Site?	A NPL site is a Superfund site. NFS is not proposed or listed as an NPL site because its major function as a nuclear operation is exempt from the Superfund law. For more information, please see the information supplied at the beginning of these comments.
In order to insure that the public's health and the environment is	ATSDR reviewed the environmental data that the agency was

protected, there needs to be more extensive review of existing environmental data. There also needs to be independent on and offsite environmental testing conducted in order to capture the extent of the pollution, and identify all pathways of exposure. This should include and incorporate all pollutants that have been identified to date. Pollutants released and or discharged by other companies on the NFS site should be reviewed as well.	legally allowed to review. Those data concerned the release of materials other than radioactive or nuclear material. Because the facility was not required to monitor non-nuclear materials in the past, environmental data are lacking in that area. Following the passage of the Resource Conservation and Recovery Act (RCRA), NFS apparently began record keeping for those chemicals regulated under RCRA. They now supply quarterly reports to both the USEPA and the Tennessee Department of Environmental Conservation (TDEC). These reports were reviewed and summarized in the public health assessment.
I am suggesting a participatory process be established in reference to health and environmental surveys/studies. The community, local elected officials, ETSU, State Dept. of Health as well as other agencies could work together and design a plan or model. This approach insures that the community has ownership in the process which means they would be willing to be more open about their health or their knowledge of the plant and the community. A project such as this could include academic disciplines and departments such as: Environmental Health, Appalachian Studies, Geography, Medical and Nursing Interns /Students. A participatory research project is far reaching and encourages partnerships with Universities through professors and students who can obtain a wealth of information and experience by working out in the field. The local medical community has an opportunity to gain knowledge as well. Participants can gather, share and exchange information. The fence line community gains knowledge, becomes more informed, which gives them the opportunity to make better life choices. We must also keep in mind that plant workers are also the community and have pertinent knowledge and information. Workers exposure in the plant as well as in the community should be included in this	During the public meetings in August 2006 ATSDR proposed this suggestion to faculty members of the East Tennessee State University (ETSU) Department of Environmental Health in Johnson City. We believe that this would be both a learning experience for senior level and graduate students and a benefit for the community-at-large. ATSDR and ETSU have discussed joint efforts that could be undertaken to assist the Erwin community. As a result of this meeting, ATSDR is evaluating the establishment of either an internship or Public Health Service co-op (COSTEP) for a student at the university. The project would work to develop a needs assessment and public health education program for the community. The identification of a cancer cluster and other health effects, however, are difficult because the population of Unicoi County is small. In the case of cancer in a town the size of Erwin, one would expect a cancer rate of 20 to 30% according to the American Cancer Society as well as government health agencies. Identifying clusters of the various types of cancer may not be possible, especially since the statistical rate of cancer is about 500 to 800 residents per year.

process. The agency needs to identify cancer clusters, birth defects, miscarriages, still born births and other symptoms and diseases that could be identified as related to exposure. Indicators of future illnesses once identified could prompt preventive measures and early detection in some diseases such as cancer.	
It is an insult to the intelligence of mountain folks to imply that there is "no problem". We all know that the facility has been in Erwin since the late 50"s and we know that their practices have not been friendly to the environment or the public. Having said that, I respectfully thank you for accepting my comments.	Our conclusion was not meant to insult the area's residents. The conclusion ATSDR derived in its public health assessment only pertained to the contamination in the groundwater. During the public meetings held by ATSDR, releases of nuclear material comprised the majority of the health and environmental issues associated with Nuclear Fuel Services and ATSDR was prohibited by law from evaluating these releases.
The agency should reverse its process from that described in the Foreword to a precautionary approach. If carcinogenic or other harmful contaminants are known to be released, the likelihood of their impacting water sources and human health should be assumed and detection vigorously investigated. The agency should not delay investigations of possible exposures. People who know "a hundred people who have died with cancer" in a small communities, should not have to live long with unresolved causes or sources for anxiety that might or might not be realistic. The Agency should act sooner rather than later and should, through direct and definitive assessment, assure that an exposure source the citizens' fear can indeed be ruled out.	The precautionary principle is not universally accepted among scientists. Typically using the precautionary principle means taking action when scientific uncertainty rules out sufficient information. The Institute of Science in Society (http://www.i-sis.org.uk) states "The precautionary principle is actually part and parcel of sound science. Science is an active knowledge system in which new discoveries are made almost every day. Scientific evidence is always incomplete and uncertain. The responsible use of scientific evidence, therefore, is to set precaution." In many cases assessors have sufficient information on environmental processes to determine the health threat. In reality, risk assessors and health assessors apply conservative (protective) variables to determine the likelihood of adverse health impacts.
It is extremely disappointing to note in the report that "the state has limited reliable health data or data of not sufficient quality."	ATSDR agrees with the comment. The state of Tennessee is working to improve its current data collection system and data base.

I find it troubling, likewise, that the agency appears not to have performed direct testing/sampling for the VOC contaminants of concern. The public springs and wells which supply residents' drinking water are a short distance (less than 5-6 miles) from the facility and all (excepting the upgradient RR well) could be "a plausible pathway for human exposure." The report does not indicate, though, if all wells were tested and if dye- or other procedures were used to exclude spread of the contamination plume in the groundwater, to the areas, near the public-water intakes. As first action by your agency in determining possible exposure to waterborne contaminants, as citizens fear, one would expect that groundwater at the well sites, and "finished" water at the utility water-treatment plants, would be tested and the test results be make part of the public information.	ATSDR does not perform environmental sampling at hazardous waste sites. The agency relies on environmental agencies and organizations to perform sampling that can pass a rigorous quality assurance and quality control protocol. With respect to the public water sources, no public water supply sources are between the facility and the river (downgradient). The upgradient water sources are regulated by both the state and the US EPA who require testing the water quality on a regular basis.
Do not citizens have reason for consternation at lack of public-source water testing by your agency when you repeatedly state the need that private well owners perform this very testing "of chemical contamination" to insure health of their water?	The testing of public water supplies is a federally mandated requirement. The Safe Drinking Water Act states that "All **public water systems** must have at least 15 service connections or serve at least 25 people per day for 60 days of the year." Private wells are not required to be tested; therefore, ATSDR recommends these well owners test their wells.
Given the absence of direct, current testing, the conclusion that "there are no completed exposure pathways," and therefore, "no apparent public health hazard," seems unjustified in my opinion.	The finding is based on the fact that there are no current or future exposures as the groundwater downgradient from NFS is not now nor will it be in the future, used for a drinking water source.
The Schreiber report should be acknowledged by ATSDR. Should the Schreiber report not meet quality-assurance criteria for the testing and analysis performed, this should be so documented. If its procedures meet the standards that regulatory agencies normally expect, it is in the public's interest to have its data	ATSDR reviewed the Schreiber report prior to completing the public health assessment. When we called the company to discuss the report, we were told that they did not want to discuss the report with us nor did they want to be informed of our findings. Therefore, we did not include its results in the document.

considered, made public, and acted upon.	
I am puzzled by a number of statements in the report to the effect that groundwater is not being used as a source of drinking water," as all the Erwin utility water comes from groundwater wells and springs. Likewise, in the demographics breakdown of the people exposed to that water, on page 6, why several groups, e.g. children older than 6, adults 45-64, excluded. Please provide clarification on these matters, as well, in your expanded, later report on the Public Health Assessment.	The current source of public water for the Erwin Utility system is upgradient from NFS and their supplies have not been impacted by the NFS releases of volatile organic compounds into the groundwater. The demographic breakdown is derived from US Census data sources. The data tables on page 6 do not exclude any age group. Of the total population, those under the age of 6 number 185 individuals; those over 65 number 618 and; females of child-bearing age number 472 individuals. The remaining 1363 individuals comprise the remaining population within the one mile radius of the site.
Review and analyze all existing data where appropriate. Also - where is the air pathway analysis?	In the past as in the present, NFS was not and is not required to monitor for chemical releases into the atmosphere. ATSDR has seen statements that the Tennessee Department of Environment and Conservation does not have any air monitoring stations in Unicoi County. NFS is required, however, to report releases for the EPA Toxic Release Inventory. The lack of air data is considered a data gap (missing data). However, as the contamination is limited to the groundwater, the air pathway would not and is not a viable pathway of exposure.
We later learned that Dr. Charp did not have full security clearance to view the entire NFS facility and were told by the press that he actually viewed it from the parking lot....We demand a full and credible site investigation.	Security clearances are never discussed with individuals who do not have security clearance nor are security issues discussed in a non-secure area such as hotel lobbies or public meetings. Therefore, we cannot confirm nor deny your comment. Nonetheless, the purpose of a security clearance is irrelevant for this document. Portions of the site can be toured without a security clearance. The nuclear operation for which a security

	clearance is required is exempt from ATSDR activities. Dr. Charp did tour the facility related to nonradiological releases. The information supplied by the press relates to the remediation activities that can be best observed from the parking areas.
Dr. Charp admitted, in both of his presentations to the public, that the Tennessee Cancer Registry is in no way held up as a "gold standard." Sadly, it's quite the contrary.	The Tennessee Cancer Registry does not meet the requirements of the North American Association of Central Cancer Registries, Inc. and is not certified by that organization. The CDC maintains a list of those states that are certified and that list can be found at the CDC web site discussing cancer registries: http://www.cdc.gov/cancer/npcr/index.htm. One can view a map of states that meet the requirements at http://www.cdc.gov/cancer/npcr/naaccr.htm (last accessed on February 16, 2007). The most recent data is for 2002 and the Tennessee registry did not achieve certification at that time.
Extensive review reveals the effectiveness of this EABRP process is still questioned in the scientific community. We note that EABRP is patented by Arcadis Garrighty and Miller. Our personal water consultant's simplistic dye test beat a Garrighty and Miller expensive, weighty, theoretical model in a TN court of law. Further, extensive review of Wiley InterScience Journals and Remediation Journal(s), reveal this process EABRP process is still in test phases. The GAO reports a major test facility is at Dover Air force base where all the tests are in a test building with tightly controlled conditions.	We would appreciate receiving a copy of your consultant's study as well as the court documentation. ATSDR is aware of other studies in which dyes have been used in attempts to evaluate flow in karst formations such as those underlying NFS and other parts of East Tennessee. The General Accountability Office (GAO) report GAO-05-666 discusses the Dover Air Force Base system as you state. In general, the Department of Defense has either implemented or field tested the 15 generally accepted methodologies for groundwater remediation. The Dover site is where the Air Force tests new processes prior to use in the field. However, the report also states that the Air Force, as well as other branches within the Department of Defense utilize the enhanced anaerobic bioremediation and reductive precipitation (EABRP) process. For

	example, molasses has been field-tested at Vandenberg and Hanscom Air Force bases during bioremediation to treat chlorinated solvents. Furthermore, molasses is used at many dry cleaning sites contaminated with PCE to bio-remediate those sites.
Why are monitoring wells drilled into the shallow aquifer only? Oddly, we know that the deeper you go, the higher the concentration of contamination will be, after all, we are dealing with DNAPLES. Why are there not test wells drilled into the bedrock aquifer, which clearly would give a better understanding of the contamination in the water?	The environmental indicator documents that that during attempts to drill well wells, the boreholes collapsed. As the DNAPLE migrate from the source, their density decreases; that is, the concentration is highest at the source. The geology of the shale underlying the facility is thought to direct the contamination down the fractures until the groundwater is stabilized upon reaching solid bedrock. However, with karst geology, the groundwater flow can vary seasonally.
ATSDR did not properly notify the citizens of Erwin of their visit to the area, and instead claimed that the Erwin Record discarded their email notices as spam.	For meetings in Erwin in February and August, the CDC Office of Communications sent out notices to the local news outlets both in Erwin and the surrounding communities. We later learned from the Erwin Record that their spam filters did indeed route our email to their trash. We were told that the best way to notify the newspaper was to call then send a fax notice.
We have been informed by our local Federally based officials, that any illegal discharge of a radioactive substance is an automatic and undeniable violation of CERCLA. We also find that another area with a facility of similar type: Babcock and Wilcox, is now a Federal Superfund Site. Per the EPA, said sites have a 50 year life expectancy with possible 20 year extensions sometimes granted. Nuclear fuels was founded in 1959.	Illegal discharges are subject to federal laws. In the case of radiological materials, releases are regulated by the NRC. With regard to Babcock and Wilcox (B&W), the company has several Superfund sites. The site in Apollo, Pennsylvania was an abandoned site but never listed on Superfund as it was also licensed by the NRC. There are no other B&W sites listed on the EPA Superfund web site. There are, however, several B&W sites

	listed as decommissioning sites on state levels but again, these are not Superfund sites.
One commenter questioned the ATSDR statement that NFS stopped using volatile organic compounds in their processes. They supplied a list of chemicals from a state of Tennessee correspondence dated August 2, 1990. The list included both organic and inorganic compounds	Volatile organic compounds are defined as organic materials that at room temperatures can produce vapors readily. They can include gasoline and solvents such as toluene, xylene, and tetrachloroethylene. The EPA, however, defines this class of compounds as any organic compound that participates in atmospheric photochemical reactions except those designated by EPA as having negligible photochemical reactivity. The Code of Federal Regulations defines the list of EPA compounds with negligible photochemical reactivity at 40 CFR 51.100. Of the compounds supplied by the commenter, only acetone is considered a VOC. The permit granted to NFS lists those compounds they can legally discharge; however, actual discharges do not have to include all listed compounds.
What is the efficiency of NFS's WWTF in removing VOCs and other chemicals from the waste streams prior to discharges into surface water? What is the efficiency of the EPOTW in removing VOCs and other chemicals from the waste streams prior to discharges into surface water? What is done with the sludge from NFS's WWTF and from EPOTW?	At the Waste Water Treatment Facility (WWTF), liquid effluents are batch treated, sampled, and discharged to the Nolichucky River in accordance with the regulatory requirements of a National Pollution Discharge Elimination System (NPDES) permit. The processing occurs in batches with the efficiency varying. In the treatment process, the non-volatile organics are reduced to carbon dioxide, water, and ammonia. Ammonia is removed from the liquid stream by "air stripping" in accordance with a state air pollution control permit. Sludge is packaged and sent out-of-state for burial at a licensed radiological waste disposal facility in another State. The efficiency of the Erwin Utilities waste treatment facility meets the requirements of their NPDES permit. As stated above, the sludge from NFS is sent out-of-state for

	disposal in a licensed low level radioactive waste facility. The sludge from Erwin Utilities is centrifuged to dry the sludge which is sent to the Iris Glen landfill in Johnson City.
Can ATSDR get a copy of the 12/18/87 TDHE letter to NFS? Can ATSDR determine if the "new process activity planned to begin in 1988" actually came to fruition at NFS? If TCE was, in fact, used again by NFS in 1988, can ATSDR provide the public with information on the annual amounts of TCE consumed, processed in NFS's WWTF, and discharged into surface water since the installation of NFS's WWTF? If TCE was, in fact, used again by NFS in 1988, can ATSDR provide the public with information on the annual amounts of TCE consumed, "processed" in NFS's settling ponds, and discharged into surface water or allowed to seep into ground-water? Who was ATSDR's source for ATSDR's statement that "NFS stopped the use of VOCs"? If ATSDR does find that disinformation was provided to it, are there any consequences to the source or sources? Can ATSDR inquire if TDHE ever pursued the curiosity of TAW and discovered anything (possibly that NFS discharged TCE without authorization through NPDES TN 0002038), and cited NFS with any violation? If NFS were contacting TDHE in early 1987 about discharging 50-75 ppb of TCE, yet the 12/18/87 Fulkerson letter had not yet been written setting regulated limits, and NFS had not yet applied for an amendment to NPDES TN 0002038 through its 01/08/88 letter, were NFS's discharges of TCE in 1987 (and prior) actually	The letter dated December 18, 1987, to which you are referring is from the Tennessee Department of Environment and Conservation to Mr. Dale Gergely of NFS. The letter established technology-based limits for the discharge of TCE and 1,1,1-TCE. The state would apply these limits to the steam stripping unit at NFS. Discharges from existing treatment at NFS would have to be adjusted. The limits established for both compounds were 0.5 mg/L as a monthly average and a daily maximum release of 1 mg/L. ATSDR has learned that the details of the process are classified in accordance with the Atomic Energy Act , the "new process" refers to the start-up of a Research and Development (R&D) process in November of 1988 which was operated for a relatively short time. During the R&D process, TCE was used with trace amounts being carried over into the process' waste water. The water then was sampled to meet NPDES permit requirements prior to transferring to NFS WWTF for further treatment. At the completion of the project, approximately 30 gallons of Trichloroethylene (TCE) remained in the process. The 30 gallons of TCE were not disposed through the WWTF but instead were put into a drum and properly disposed of at an off-site licensed disposal facility. None of the TCE used during the R&D process initiated in November 1988 was discharged to the settling ponds or allowed to seep into the groundwater. ATSDR was informed by both the facility and the EPA that TCE

within regulatory limits?	was no longer used. ATSDR was informed by both the facility and the EPA that PCE was no longer used as a degreasing agent ATSDR is not a regulatory agency and therefore cannot assess any penalties for the misinformation if it supplied to the agency. ATSDR will attempt to work out the discrepancies and if this is not possible, we report the information in the public health assessment. NFS was not discharging TCE in its wastewater in 1987. Planning for the short-term R&D project, including contacting TDHE about what was needed to potentially discharge TCE, was initiated long before the start of operations in November 1988. TCE was not discharged until the NPDES Permit Modification was issued.
ATSDR, p.7, P.4: "The closest well, the Railroad Well … does not draw from beneath the NFS (sic) nor from areas downgradient of the facility." A map of the zone of influence or of the area of "draw" for the Railroad Well would be very useful to include in the final report. Can ATSDR provide the public with independent studies (i.e., not paid for by NFS or conducted by EcoTek, an NFS company) that prove that the Railroad Well "does not draw" from beneath NFS? Is it possible that the "draw" of the Railroad Well reaches to the Indian Creek Fault which is about 2000 feet from the Railroad Well?	In 1996, a modeled capture zone analysis indicated that the draw down from the Railroad Well does not intersect the NFS property even if Erwin Utilities pumps upto 1000 gallons per minutes. The USGS is in the process of reviewing this report. ATSDR has included this map in the public health assessment. ATSDR and the USGS are not aware of any independent study of the capture zone or draw-down investigation related to the railroad well.
ATSDR, p.7, P.4: "NFS reports that there are no private wells between their operation and the river". While it may be true that no private wells exist between NFS and	Fault lines can be a conduit for contaminant transport. Although ATSDR does not have the capability to test wells or springs, we relayed your concerns to the US Geological Survey regional

the Nolichucky, the "Geologic Map of East Tennessee" (previously supplied) indicates that Wells #17 & 19 and Springs #16 & 18 are directly on the Indian Creek Fault which is about one-half mile from NFS. Will ATSDR have those wells and springs tested for contaminants if it concludes that fault lines can and do serve as conduits for contaminant migration?	office in Nashville. According to the USGS, the reports you to which you refer, are based on well and spring inventories conducted in the 1930's and 1940's. The two wells, #17 and #19 were both shallow wells and probably hand-dug water supplies. Well #17 is reported as 30 ft deep and 36 inches in diameter and well #19 is reported as 14 feet deep. The "probable water-bearing beds" listed for both wells is "Residual dolomite". The residual dolomite is the clay and chert left after the dolomite has weathered and formed the deep soil and material over the bedrock. Even if these two wells were still available, neither well would be deep enough to sufficiently test flow through any fracture zones. The two springs, #16 (Erwin Water Dept.) and #18 (Birchfield Spring) probably do occur along the fault because of fractures occurring along the fault and the connection with upgradient fractures and conduits. Faults zones in East Tennessee can act to channel ground-water flow fractures associated with the faults. The faults can also restrict ground-water flow if the faulting has closed or plugged some of the existing fractures. The other significant components to ground-water flow along faults are the occurrence of recharge and discharge areas and water-level gradients from high elevations to lower elevations. If any ground-water flow does occur along fractures associated with the faults, the flow would most likely be towards the Nolichucky River. The reported land-surface elevations for the springs are 1760 feet at #16 and 1,650 feet at #18. Both elevations are higher than the land surface elevation at NSF (about 1,640 feet based on the topographic map) and indicate that flow would not occur from NSF toward the two springs.

ATSDR, p.7, P.5: Citing a 2004 NFS report, ATSDR states that the "groundwater typically flows toward the north-northeast". Comment 5-1: One of Erwin's public drinking water wells -- the Railroad Well -- is about one-half mile northeast of NFS. Since the Railroad well is northeast of NFS and only about a half mile away from the settling ponds on NFS's site, even if ATSDR is correct and the Railroad Well does not draw from as far away as NFS, couldn't contaminants from 20 years of dumping in unlined settling ponds and seepage of extraordinarily heavy metals (such as uranium) have migrated along the north-northeast groundwater flow? If groundwater flow is toward the north-northeast, wouldn't that be toward Erwin's population center where wells and springs have been used for domestic water uses and where wells and springs might still serve some homes? In its final PHA, it would be helpful if ATSDR have an extensive discussion of groundwater flows in the alluvial, shallow bedrock and deep bedrock regions.	ATSDR rechecked the cited reference and corrected the mistake in the assessment. The proper direction for groundwater flow is toward the north-northwest. The flow from the site does not impact the draw-down from the Railroad Well. The dumping at the site impacted both groundwater and surface water; however, the contaminants would reach the river, not the well. As the groundwater flow is toward the north-northwest, the wells located north of the Railroad Well would not be impacted as the water flow under those wells would prevent flow from the NFS area mingling with those wells. ATSDR geologists and groundwater modelers have supplied additional information and that has been added to the final public health assessment.
<u>ATSDR, p.7 on Natural Resource Use omits information on Banner Spring</u> A discussion of Banner Spring and its history relative to the establishment of the Banner Hill neighborhood and the other south Erwin neighborhoods, if included in the section on Natural Resource Use, would help inform the reader on another environmental exposure medium. The 05/03/01 <u>Environmental Assessment</u> (EA) prepared in support of NFS's application for an amendment to its SNM-124 license to approve the North Site Decommissioning Plan states on	The Banner Spring creek lies entirely within the site boundary of NFS and flows into Martin Creek. Prior to the establishment of NFS, part of the Banner Spring flowed into a marshy area. It was this marshy area where NFS established holding ponds and some disposal areas. The waste in these areas has impacted the groundwater associated with the Banner Spring. This information has been included in the public health assessment.

p.6 that the "source of Banner Spring is probably FRACTURE CONTROLLED GROUNDWATER from the mountains southeast of the site. Banner Spring has a continuous flow rate of about 300 gallons/minute." (Emphasis added.) NFS's August 2001 RCRA Facility Investigation Workplan states that "some upward component of flow is evident within the deeper bedrock (50+ feet) which is probably the result of higher elevation recharge THROUGH FRACTURE SYSTEMS in the mountains to the southeast". (Emphasis added.)	
Even if it were only a folkloric tale that Banner Spring was a mountain-fed spring, its flow rate and proximity to a well-travelled road would have made it an attractive water source. Did the public have access to Banner Spring after NFS began operations in 1957? Were homes on Banner Hill supplied domestic water from Banner Spring? In what year was public access to Banner Spring terminated?	Holston Land Company, a part of the Clinchfield Railroad (now CSX) family, owned the spring from prior to 1957 to 1982. NFS believes that neither NFS nor the public had any access to the spring during that period. The Town of Erwin (Erwin Utilities) purchased Banner Spring from Holston Land Company on October 15, 1982. The spring was evaluated by Erwin Utilities as a potential potable water supply in the event a significant drought or other system stressor occurred but the spring was never placed into service as a potable water supply. The property was sold to NFS on July 31, 1989. During ownership by Erwin Utilities and NFS, there was fencing designed to prevent public access. Further details of the land use should be directed to the previous owners. Prior to 1957, a county road separated NFS property and private property on the east side where Banner Spring originates. Aerial photographs taken during the late 1950's to early 1960's indicate the presence of a fence surrounding the spring.
A diagram included by NFS in Responses to NRC Questions Related to NFS Erwin Environmental Information Report dated May 31, 1977 shows Banner Spring & Pump House behind a	Because the nature of fractured flow and karst topography, ATSDR cannot determine what water sources such as springs and wells intersect fractures. The US Geological Survey (USGS) is

barbed wire fence. When was the pump house at Banner Spring fenced off from the public? What other wells and springs in Unicoi County supplied water for household uses (including drinking water) that could have intersected the same fractures? Since NFS used unlined settling ponds to "treat" waste for approximately 20 years since beginning operations in 1957, could a groundwater contamination plume have formed and intersected bedrock fractures and fractures between beds such as the one that is the source of Banner Spring's substantial flow? If there is a system of fractures (as the RCRA Workplan report indicates), could the contaminant plume possibly be intersected by more than the one fracture feeding Banner Spring? Could the same system of fractures also feed the Railroad Well?	the appropriate agency to determine the characteristics of the groundwater flow. As previously stated in these responses, the USGS has evaluated the karst topography in the Upper East Tennessee area with inconclusive results. The source of Banner Spring is both upland and upgradient of the NFS site. The water source is produced by downward flow of surface water in the mountains, recharging the upgradient groundwater. Therefore, the Banner Spring water source would not be impacted by contamination in the groundwater near the site. In a 1989 groundwater characterization study, the Banner Spring water is described as rarely having storm related turbidity, thus signifying relatively deep groundwater circulation. The settling ponds are in the unconsolidated deposits and intersect the shallow unconfined unconsolidated or water table aquifer. Additionally, the hydrogeologic characterization study demonstrated that Banner Spring is upgradient from the ponds area and the source of water for Banner Springs is derived from downward flow from the surrounding mountains. Therefore, the pond sludges are not a potential source for contaminating Banner Spring Branch. As stated in the public health assessment, the closest well to NFS is the Railroad Well about 3,500 feet northeast of the plant. A capture zone analysis was performed for this well in 1996 by Geraghty and Miller, Inc. indicated that the Railroad Well's area of capture does not include the NFS Site.
ATSDR, p. 7 on Natural Resource Use omits information on karst terrain. No mention of Erwin's karst terrain is mentioned in the section of	An ATSDR geologist has supplied information karst formations and this has been added to the public health assessment.

ATSDR's draft report, nor are the major fault lines mentioned. A discussion of karst features and of the geology of Erwin would be useful in the final report. Is it possible that contaminants emanating from NFS have reached the Indian Creek Fault which is also about 2000 feet from NFS? Could contaminants run along a fault line or fracture in the bedrock? If yes, how far can contaminants travel along fault lines according to studies of comparable karst locations?	Contaminant migration could move through the fractures in the area. Comparable studies have indicated that contaminants will move along the fractures or other openings in karst locations until other geological features stop the migration. According to the USGS, it is not possible to compare movement in karst systems.
Comment 7-2: The possibility that vertical fractures exist in the bedrock was raised by Geraghty & Miller on page 2-5 of its Revised Groundwater Flow and Solute-Transport Modeling Report (February 1999): "Fractures BETWEEN the beds of the NEARLY VERTICALLY DIPPING DOLOMITE probably provide the easiest pathways for water to flow. Flow through FRACTURES ACROSS THE BEDS may be more restrictive relative to flow through fractures along the bedding planes."	The US Geological Survey has reported that fractures or karst formations are abundant in the limestone formations under much of East Tennessee. These fractures serve as a "path of least resistance" so groundwater flow is most likely through these karst areas as indicated in the referenced model. Additional information is supplied in the next comment.
Comment 7-3: The karst Valley and Ridge physiographic province is described by the US Geological Survey (USGS) in Circular 1205 (Water Quality in the Upper Tennessee River Basin, 2000) as being "underlain by folded and extensively faulted limestone, dolomite, shale, and sandstones that occur in long subparallel belts trending southwest to northeast. The principal water bearing units are the carbonate-based dolomites" – the rock which Geraghty & Miller describe as "nearly vertically dipping" and existing beneath NFS. Comment 7-4: USGS Circular 1205 further states on page 8 that "ground-water systems such as the carbonate systems of the	The USGS did indeed state that the area is susceptible to contamination and the discussion on page 8 of Circular 1205 regarding bacterial contamination is very important. However, on page 18 of the same report, the USGS reported that volatile organic compounds detected did not exceed the drinking water standards. The entire report can be found at http://pubs.usgs.gov/circ/circ1205/pdf/circular1205.pdf (last accessed on February 21, 2007).

Upper Tennessee River Basin are particularly susceptible to contamination from surface sources" and "the common presence of bedrock outcrops, areas of thin overburden, and karst features such as sinkholes provide direct avenues for aquifer contamination."	
Comment 7-5: Dye traces performed in Missouri's karst regions have demonstrated that dyes injected into the ground can emerge from (1) one or more spring, (2) springs in other watersheds, (3) springs 20 or more miles away from the dye injection point. Living on Karst (published Dec. 2003 by the Nature Conservancy) also reveals that the recharge areas of springs in karst terrain vary from less than two-tenths of a square mile to over 500 square miles. Can ATSDR conduct dye traces in Unicoi and adjacent karst counties to determine the actual recharge areas of all of Erwin's public drinking water wells and springs, with special attention to the Railroad Well? Can ATSDR conduct dye traces at various depths to determine alluvial and bedrock groundwater flows and their influence on all of Erwin's public drinking water wells and springs?	ATSDR cannot perform the dye tests you requested. The best agency to perform these types of tests would be the US Geological Survey (USGS). ATSDR hydrogeologists have reviewed USGS databases to see if there are any recent dye studies in this area. The results of these reviews were added to the public health assessment. The USGS has performed several studies on karst formations in Tennessee. 1997 report indicated that no dye studies were available for Unicoi County (see reference 8 in the public health assessment). This study also stated that following a 200,000 gallon release of TCE over 7 years, no DNAPL were found. The USGS also reviewed the data we have on file and reviewed the dye-trace data base maintained by the Tennessee Division of Environment and Conservation (TDEC). Neither the USGS nor TDEC had information on dye-trace studies conducted at Erwin. Dye-trace tests in a karst setting can identify direct connections though the fracture and conduit (cave) systems that transmit ground-water. However, in a setting such as Erwin, with alluvium and weathered regolith occurring on top of the karst bedrock, dye-trace tests can be difficult to complete. Ground-water flow through the alluvium and regolith could take a much longer time than the dye-monitoring program. The best "tracer" tests for Erwin's water supply wells and springs is the continued monitoring for the contaminants of concern and the contaminant break-down products.

	The USGS has collected water-quality samples from surface water, wells, and springs in Unicoi County. During the 1990's, samples from 5 wells or springs were collected and analyzed. The data are available at the Tennessee USGS site http://nwis.waterdata.usgs.gov/tn/nwis/qwdata (last accessed on April 17, 2007). Three of the 5 sites, including O'Brien Spring, include analyses for VOC's.
Comment 7-6: Finally, with respect to groundwater contaminants and their subsurface movements, researchers at Oak Ridge National Laboratories (ORNL) reported in the November 11, 1998 internet edition of Environmental Science & Technology that "radioactive contaminants can migrate over long distances faster than originally thought." ORNL scientist and lead author, John McCarthy, PhD., noted that "'The tracers moved at almost the same speed as the groundwater'" and were observed 10 to 80 meters from the injection site within a week or less. "'This information opposed the results of laboratory tests that suggested contaminants strongly bind to the soil and move only centimeters a year'." Environmental Science & Technology is a journal of the American Chemical Society. Can ATSDR consult with or contract with the scientists at ORNL to do dye or tracer studies of the groundwater contaminant flows beneath Erwin?	The Oak Ridge National Laboratory (ORNL) has performed dye tests in its karst geology below the laboratory in an attempt to understand the difficult task of modeling the karst issues. The McCarthy report is a study of the transport of radioactive material by natural organic matter. The metals involved in this study were carried by the organic material and its movement was influenced by rain events and the movement through a shallow flow path was intermittent. ATSDR does not have the funding to contract with ORNL to perform the types of studies you request. The USGS would be the agency to perform these test; however, their experience in karst topography indicates the results would be inconclusive.
Comment 8-1: If atmospheric releases – accidental or routine -- of radiological or chemical contaminants occurred during daylight hours and the prevailing winds were blowing at all, then the fallout would be over Erwin's population center, according to the information on prevailing winds contained on p.7 of ATSDR's draft PHA.	That, in general, is correct for those materials that remain in a gaseous state. Those materials released into the atmosphere that are particulate in nature or after cooling, become particulate, would be deposited closer to the release point. The distances traveled are dependent on numerous factors other than wind direction such as their initial temperature at the point of release,

Comment 8-2: A discussion of NFS's numerous planned and accidental releases, and the constituents emitted into the atmosphere, needs to be included in the discussion of local meteorological conditions as well as in the "Off-Site Contamination" sections of the final PHA.	their chemical properties, the wind speed, time of day, air temperature, atmospheric conditions such as upper atmosphere wind direction and speed, inversions, etc. Because of limitations placed on ATSDR by the CERCLA legislation, ATSDR was not able to find any atmospheric release data that was not related to the Nuclear Regulatory Commission license.
Comment 10-2: The radioactivity measured in Nolichucky River sediment downstream of NFS (10.84 picocuries/gram in the year 2000) was more than 54 times the radioactivity measured ten years prior (0.20 picocuries/gram in the year 1990), according to NFS's June 2002 Environmental Assessment, p.D-1. If "most" radium concentrates in fish bones, does the rest accumulate in fish tissue? If yes, would eating fish caught in the Nolichucky result in ingestion of contaminants? Do any of the chemicals listed in pages 1 & 2 of these comments concentrate in fish tissue?	The concentration units you supplied to ATSDR typically represent the radiation associated with soils and sediments. The Nolichucky River is typically highly sedimented and contains much agricultural run-off. These sediments and agricultural products typically contain naturally occurring radioactive materials. The values you cite are not indicative of man-made contamination but of contamination from a naturally occurring process. Radium, upon intake into the body, behaves very similar to calcium. Therefore it concentrates in the bone. What is not deposited into the bones does not stay in the body. Unless one would eat the fish bones, then the intake of radium is minimal, perhaps less than the radium normally taken in by humans in daily activities. The NPDES permit lists those chemicals that can be released, not necessarily released. Of the contaminants you supplied in the comments,
12. ATSDR, p.19, P2: "The type and severity of health effects that a person can experience depend on the dose ... and the multiplicy of exposure (combination of contaminants). Erwin water customers, and those still taking their domestic water	ATSDR reviewed the issues of uranium in foods during the evaluation of the Oak Ridge Reservation Y-12 facility that released about 50,000 kilograms of uranium into the air alone. The nearest community where foods were raised was sampled by

needs from private wells and springs, seem to be consuming a chemical cocktail when they drink the water out of their taps. If they live or work downwind of NFS, they could also be inhaling contaminants emitted by the company during accidents or routine releases. If they garden or eat locally-grown fruits and vegetables, they might be ingesting crops that concentrated atmospheric fluoride (emitted by NFS as uranium hexafluoride gas) or consumed beef that grazed on forage crops with high fluoride concentrations. If they fish too, their skin could have come into contact with contaminants in the Nolichucky or Martin Creek, or in their sediments. If the water in which they bathe or shower is contaminated, they could be breathing in contaminated water vapor. Could a multiplicity of exposures to numerous contaminants cause a "Combined MCL" (for example, PCE + TCE + Chloroform + Gross Alpha + Fluoride) to be exceeded? Even if "Combined MCLs" are not yet codified in the Safe Drinking Water Act, wouldn't prudence dictate that children at least be protected from a multiplicity of exposures even if each individual contaminant is well below its MCL?	Florida A&M. The analysis of those foods indicated that uranium would not be a public health hazard as uranium is not easily absorbed into the plants. Since cattle consume the vegetation, their uranium concentrations would be low as well. Yes that is possible. Since the MCL is for public drinking water supplies and not monitoring well water, care must be taken in applying the MCL to situations where no contamination has been detected in public water supplies. The Safe Drinking Water Act actually allows for combining contaminants using the "sum of the ratios" method. In this procedure, one determines each contaminant percentage of its associated MCL. If the sum total of these percentages exceed 100%, then the combined MCL is exceeded.
Proofreading and Editorial Comments are noted by page (abbreviated as p.) and paragraph (abbreviated as P.1). Even when a paragraph at the top of a page is incomplete, it is counted as Paragraph 1. p.1, P.3: Insert apostrophe in "petitioners" to indicate possessive nature of concerns. p.2, P.4: Change "all" applicable federal and state regulations to "other or "some" so as not to give the impression that NFS has never violated RCRA, Hazardous Waste or Special	

Nuclear Material license or permit requirements. p.2, P.4: Insert after NRC, "EPA and TDEC". p.3, P.2: Insert after "Per applicable laws and permits in effect at the time" the phrase "and, in some cases, in violation of federal and state licenses and permits". p.3, P.3: Insert after "the on-site ponds" the phrase "and into the Nolichucky River." p.7, P.3: Insert an "h" in "Nolicucky".	

When did the city first start supplying water to the residents in Erwin?	Erwin Utilities began serving the county in 1945 supplying electricity. The following year, 1946, the existing water utility was purchased by Erwin Utilities.
In 1973 there were four houses (on NFS property today) that had a well in the backyard. They are not used but covered up.	Thank you for the information.
Concerns that there is no air monitoring. Orange smoke is coming out of the stack at night (nitric acid?)	Air monitoring by NFS for materials other than radioactive materials was not required by either state or federal regulators. NFS, however, reports releases of materials to the Toxic Release Inventory maintained by the EPA. That information was reviewed by ATSDR.
Hydrologist study done by a NFS contractor. Did EPA and ATSDR review – what were the results?	The reports were reviewed by both agencies. At ATSDR, the NFS study was reviewed by both a hydrogeologist with karst hydrogeology experience and by a groundwater modeler. Their review comments

	were discussed and added to the public health assessment.
Was the Exposure Pathway of hunting and fishing looked at? There is a concern for downstream residents.	All pathways were evaluated following the procedures outlined in the ATSDR Public Health Assessment Guidance Manual. A completed exposure pathway consists of 5 elements: 1) a release; 2) movement through the environment; 3) an exposure point; 4) an exposure route to humans; and 5) exposed populations. The exposures need to be above screening levels that are derived from levels associated with adverse human health effects.
Who gave ATSDR the data to complete the PHA? How far back does the data go?	ATSDR received data from the US EPA as well as the State of Tennessee. The data received much of the 1990s through 2005.
Can ATSDR assist with the water quality testing?	ATSDR can only recommend to the appropriate agency to retest the water and notify the public of those findings. Currently, all data are reviewed by the state as required by law.
Did ATSDR review the Schreiber Report? What are the limits to that report?	ATSDR did receive a copy of the report. We reviewed the report and included some its data on the organic compounds in the public health assessment. Their reporting of the radioactivity did not meet the quality requirements used by ATSDR; therefore, that portion of the report was not evaluated further.
In 2003 there was a drought where the water level was below the plants.	The closest public well or public supply well is the

Where are public wells in relation to the NFS plant?	Railroad Well located about ½ mile upgradient from the plant.
If there is a known VOC in private wells, can ATSDR do testing on public wells? Residents would like to see quality data (not from NFS) on other sources.	The public well testing is performed by the state of Tennessee, not NFS. The results of the water quality testing can be obtained from the state by calling the Tennessee Department of Environmental Conservation, Water Quality Division at (615) 532-0191
Why are there no more off-site monitoring wells?	Based on the groundwater data, more wells were not required as the concentration of the contaminant in the distant wells reached the federally enforceable limit, the Maximum Contaminant Level.
Facility was done for bio-remediation, what more information can you tell residents?	In discussions with the EPA, ATSDR was told that this process is also used to remediate many dry cleaning sites contaminated with perchlorethylene. At NFS, the full-scale operations of the bioremediation are progressing.
Mercury off-site, where is it going?	Based on your comment, we believe you are referring to mercury mixed with radioactive waste. This is considered mixed waste. NFS closed the operation in 2005 and presented a closure plan to the state of Tennessee who will oversee the disposal. The site was working on a process to separate the mercury from the radiological contaminants. Their report can be found at http://apps.em.doe.gov/ost/pubs/itsrs/itsr2407.pdf (last accessed on 02/16/2007).

Concerns for rafting on the Nolichucky. VOC's –how is it for fishing? Are there monitors?	There are no monitors on the Nolichucky River for monitoring VOCs; they are only monitored at the water supply points. The concentrations of VOCs in the river are not at levels known to cause adverse health effects so both rafting and fishing are not hazardous.
Would like to see a graph of how the water concentration travels from NFS to the River. How will the VOCs affect the future of the River? Is this good for the river plants and people (not yet detected)	The impact of VOCs on the river is expected to minimal as the site is currently using bio-remediation to reduce the contaminant concentrations. As the concentrations continue to drop, the amounts potentially entering the river should drop as well.
Are there any radioactive materials in the River?	The solubility of uranium varies with the water quality and the geology of the water system. Also some of its decay products may be in the water as well. Radioactive materials will also enter the river from fallout and naturally produced radioactivity in the atmosphere.
Potential concerns for workers when discussing Radiation concern. This is private information.	ATSDR agrees; except for documents related to medical issues and petition requests, all ATSDR documents are public.
Data plotted on plume maps from original research. Did this include wells? Was there a projection on models? Did this come from an NFS contractor?	The model was prepared by a contractor for the site and reviewed by the EPA. ATSDR received a copy of the report and it was reviewed by on-staff professional geologists with extensive hydrology experience. Their comments have been incorporated into the public health assessment.

29% of wells contained VOCs? Can US Geology Survey test the area?	The USGS does not have the funding to sample wells in the area. In discussions with Erwin Utilities, ATSDR was told they were only aware of one private well in the area served by the utilities and that well was upgradient and uphill from the Nuclear Fuel Services facility.
How can "no exposure" conclusion be drawn when no wells were tested?	The "no exposure" conclusion was derived from the following observations: 1) groundwater flows under the site toward the river; 2) there are no private wells between the facility and the river; and 3) the wells within the industrial park are capped (sealed) apparently as a result of the settlement between the site and Impact Plastic, Inc. (the actual findings are sealed under court order).
Page 7 of the report talks about the flow direction of groundwater in paragraph 3: Rail Road is ½ miles North of NFS, NFS is down gradient from RR and the water flows N-NE?	Thank you for finding this error. The correct distance for groundwater flow is toward the northwest as based on groundwater contours. The Railroad Well is north of the facility; however, the groundwater contours, as they migrate toward the river, do not intersect the flow contours of the railroad well.
NFS former owner was WRGrace? Not a good neighbor.	The W.R. Grace Company did operate NFS as the Davison Chemical Division. The company does have locations listed on the National Priority List (Superfund) in Montana and Massachusetts.
Who do people call for help with worker health and radiation issues?	The National Institute for Occupational Safety and Health is the organization responsible for worker issues. An employee can request an Health Hazard Evaluation

	(HHE) if he or she is currently an employee at the workplace of concern and has the signatures of two other employees. Also, an officer of a labor union that represents employees for collective bargaining can request an HHE. The NIOSH HHE group can be reached at 1-800-356-4674.
What happened in the 1970s spill? What VOC were released?	ATSDR learned that during maintenance operations, workers would dispose of degreasing agents, VOCs, by pouring the wastes onto the ground outside the maintenance facility. The most commonly used VOC during this time was perchloroethylene.
40 ft deep "worker stuff" buried on site because of this spill.	The spill did not result in the burial of any spill-related materials as the liquid soaked into the ground. Worker materials from the nuclear operations at the facility were placed in on-site burial grounds. Some of this material did contain volatile organic compounds as discussed in NFS documents. Groundwater associated with Pond 4 contained chemical contaminants and this information has been added to the public health assessment.
Regarding the 1970s spill were there any immediate remediation efforts prior to 2003?	There does not appear to be any efforts to remediate the spill of volatile organic compounds prior to the initiation of the bioremediation project. The bioremediation pilot study began in 2001.
ATSDR should take a tour of the NFS shooting range. Shots are fired directions into Indian Creek. There are traces of lead and powder in the	ATSDR toured the outside area of the NFS shooting range. Its proximity to the sawmill and residential areas

creek.	is a concern. ATSDR is looking into the safety issues with the state as well as any federal firearms regulations.
Have concerns for NFS hiring un-skilled workers to complete work while others on strike?	The issue of unskilled workers performing skilled jobs within the plant has been transmitted to the appropriate agency; in this case, the Nuclear Regulatory Commission.
NRC not looking out for public. How can residents trust them?	Trust can be obtained through an open dialog with all the parties associated with this site. This would include the Nuclear Regulatory Commission, the state of Tennessee, and Nuclear Fuel Services.
NFS documents: who monitors the NRC?	NRC oversight is through its commissioners as well as other federal groups such as the Government Accountability Office and public watchdog groups.
Admiral of Navy pulls NFS chain for the weapons plutonium (U-235) classified information.	Thank you for your comment. ATSDR has relayed this to the Nuclear Regulatory Commission.
MS and cancer links for Erwin?	A review of the medical literature housed at National Library of Medicine did not uncover any connection between the two diseases. There is information, however, that some forms of multiple sclerosis respond in a positive manner when treated with some anti-cancer drugs.
Since 1957 (prior to NFS operations) are there any cancer death concerns in Unicoi Co? Prior to the plant opening versus now? A health study should be	Current cancer information for Unicoi County is very poor and the information for 1957 is perhaps non-

done.	existent. The information required for the health study would not be available so the study design would be very difficult if not impossible.
Health problems from exposure –you need to know what you are exposed to. It is hard to classify a health problem with out it.	We agree with this comment. A public health assessment serves many purposes. The selection of contaminants of concern and pathway analyses are very important in determining if exposures have occurred. If there is no completed exposure pathways or if the completed exposure pathway results in exposures below which have been shown to cause adverse health effects, then the community needs to be aware of this fact.
Seems to be a gap in information across agencies and with the public.	The exchange of information between ATSDR and the EPA operates smoothly through the work of the ATSDR regional representatives who are headquartered in the EPA offices. The sharing of information among other federal or state agencies; however, does not occur as smoothly.
There needs to be an Alert System for Evaluation Plans. NFS needs to be honest with the public	We agree the honesty is an important factor that will help the local residents with their concerns. The site does have an emergency plan on file with the county.
Concerns there are unskilled workers at NFS since the strike.	As stated above, ATSDR has transmitted these concerns to the Nuclear Regulatory Commission.
Honesty from NFS –who would you believe? How can Erwin residents be educated about NFS actions?	ATSDR believes that NFS, the state and the Nuclear Regulatory Commission should hold regularly scheduled informational and educational meetings with

	the community to discuss plant mission, safety issues, and other concerns that the community may have.
Safety Department, Radiation Experts, and Union reps have all been contracted out.	As ATSDR understands the process, all contracting employees are to have the appropriate qualifications to meet the requirements of the Nuclear Regulatory Commission. The on-site inspection teams of the NRC should be aware of the contractor qualifications, training, and abilities.
Are there safety monitors for Radiation workers? Is NFS a high exposure facility?	All radiation monitoring is under the auspices of the state of Tennessee and the Nuclear Regulatory Commission. As discussed in the public health assessment, ATSDR cannot comment on the radiation issues unless the site is placed on the National Priority List (Superfund).
Residents request a meeting with NRC/EPA and ATSDR to meet with the public on safety issues.	The author of this public health assessment passed this request up the chain of command. A letter was written to the Erwin mayor stating that the agency is continuing to pursue the public meeting request.
NFS has their own on-site Fire Dept. Erwin Fire Dept handles controls now due to NRC rule.	Thank you for your comment. ATSDR was informed that the Erwin Fire Department and Unicoi units serve as a backup to the NFS fire units.
Public Monitoring System? Beyond NRC and NFS, where can they do their own surveys?	There are several private organizations and universities that may assist the community in the surveys for which you are requesting.

NRC is only responsible for NFS worker safety, we need to look inside the fence.	Issues associated with worker health and safety are handled by the National Institute for Occupational Safety and Health (NIOSH). ATSDR will pass these concerns to them for review.
City water testing. Can we test for different elements and compare to a different city to see if there is a difference in elements?	The state of Tennessee has listings for public water supplies and the sampling results. That information should be available. Please contact the local state office in Johnson City.
Concerns for cancer rates of people living near NFS and workers.	ATSDR will see if we can facilitate discussions with ETSU.
Concern for rare blood disorders in Erwin residents and workers. 1968 Spill led to 5 cancers with 4 now dead.	ATSDR will direct your comment to the Tennessee Department of Health for review.
Is there an increase of MS in Unicoi County and are they linked to cancer?	A review of the medical literature in the National Library of Medicine does not indicate a relationship between cancer and multiple sclerosis (MS). However, there are several drugs used to treat cancer that are being evaluated or used for the treatment of MS
Erwin Mayor would like to see a resolution that no unskilled workers be allowed to work at NFS. NRC sets the guidelines.	This issue was discussed at the public meeting in Erwin and the mayor indicated that he would look into drafting the resolution.
In 1985-86 NRC was not honest about safety issues at the plant (with workers or residents)	ATSDR met with representatives of the NRC Regional Office in Atlanta. These issues were relayed to them.

Right next door to NFS they are working on their license and we can't regulate or evaluate their rad data.	Issues associated with the neighboring facility should be expressed by the community to both the State of Tennessee and the Nuclear Regulatory Commission
Where is the raw data on Railroad Well? Air Strippers	By "raw data" we believe you refer to the laboratory data collected during the evaluation of the water quality. Those data should be held by the Erwin Utilities. They are required to report the results to the Tennessee Department of Environment and Conservation, Division of Water Supply in Nashville as well as the customer served by the utilities company. ATSDR met with the state and received copies of the the most recent Railroad Well sampling events as reported by the facility to the state. These results were added to the public health assessment.
Is there a link with NFS and Impact Plastics settlement agreement? IF there is groundwater contamination at that site, then others are exposed as well.	The legal agreement with NFS and Impact Plastics is not available to the public because of a court order. With regards to exposures, the groundwater evaluations reviewed by ATSDR indicate that contamination under the Impact Plastics site does not impact or influence any public or private drinking water wells other than the wells no longer used inside the industrial park.
Can residents go with TN when they sample water in Erwin, RR and Jonesboro? Do they sample at the tap and in the Nolichucky River?	The request to accompany the state during sampling of the drinking water supply should be made to the state or the local water utility. The river is probably not sampled as the river water is not used directly as potable water. It undergoes treatment prior to distribution. The federal drinking water regulations do not necessarily require

	sampling at the tap, not necessarily at the source. Tennessee state regulations, however, do require water systems to "prepare and annually update a contaminant source inventory of significant potential contaminant sources which may have any adverse effect on the health of persons and potential contaminant sources within the source water protection area"(Rule 1200-05-01-.34).
Possible exposure of the Aquifer	The aquifer beneath the facility, the Rome aquifer, is mostly recharged by subsurface movement of water migrating downhill from the surrounding mountains. Rainfall directly enters this aquifer, by filtering through the surface soils. The rain on the surrounding mountains and hills also enters those aquifers and migrates downgradient in the subsurface through extensive fracture and solution zones. The higher elevations where this water recharges the aquifers lead to the creation of the hydraulic pressure or head that creates the artesian wells and springs in the valley. Where the height of the hydraulic pressure exceeds the height of the bedrock, water is discharged to the surface. This discharge occurs throughout the NFS facility as well as other water bodies such as Banner Spring. This information was derived from Ecotek, Inc. (1989) Hydro geologic Characterization Study NFS Facility, Erwin, Tennessee Volume 1 Technical Overview.

DOE/EIS-0240-SA1

SUPPLEMENT ANALYSIS

DISPOSITION OF SURPLUS HIGHLY ENRICHED URANIUM

October 2007

U.S. Department of Energy
National Nuclear Security Administration
Office of Fissile Materials Disposition
Washington, D.C.

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Acronyms

BWXT	BWXT Nuclear Operations Division
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
DOE/NNSA	U.S. Department of Energy/National Nuclear Security Administration
DOT	U.S. Department of Transportation
EIS	environmental impact statement
FRR SNF EIS	*Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel*
HEU	highly enriched uranium
HEU EIS	*Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*
INL	Idaho National Laboratory
ISO	International Organization for Standardization
LCF	latent cancer fatalities
LEU	low-enriched uranium
LLW	low-level radioactive waste
MEI	maximally exposed individual
MEOI	maximally exposed offsite individual
NEPA	National Environmental Policy Act
NFS	Nuclear Fuel Services, Inc.
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ROD	Record of Decision
SA	supplement analysis
SRS	Savannah River Site
SST	DOE safe, secure transport
SST/SGT	SST/SafeGuards Transport
TRAGIS	Transportation Routing Analysis Geographic Information System
UF_6	uranium hexafluoride
UN	uranyl nitrate
UO_3	uranium trioxide
U_3O_8	triuranic octaoxide
UNH	uranyl nitrate hexahydrate
U-235	uranium-235
WSRC	Westinghouse Savannah River Company/Washington Savannah River Company
Y–12	Y–12 National Security Complex

SUPPLEMENT ANALYSIS

DISPOSITION OF SURPLUS HIGHLY ENRICHED URANIUM

1.0 INTRODUCTION AND PURPOSE

The U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) maintains an ongoing program for disposition of surplus U.S.-origin highly enriched uranium (HEU). The purposes of this program are to support U.S. nuclear weapons nonproliferation policy by reducing global stockpiles of excess weapons-usable fissile materials and to recover the economic value of the materials to the extent feasible. Activities supporting disposition of this HEU have been underway for more than a decade in accordance with the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (*HEU EIS*) (DOE 1996a) and the associated Record of Decision (ROD) (61 FR 40619; August 5, 1996).

This supplement analysis (SA) summarizes the status of HEU disposition activities conducted to date and evaluates the potential impacts of continued program implementation. In addition, this SA considers the potential environmental impacts of proposed new DOE/NNSA initiatives to support the surplus HEU disposition program. Specifically, DOE/NNSA is proposing new end-users for existing program material, new disposal pathways for existing program HEU discard material, and down-blending additional quantities of HEU.

Council on Environmental Quality (CEQ) regulations under Title 40, Section 1502.9(c) of the *Code of Federal Regulations* (CFR) (40 CFR 1502.9(c)) require Federal agencies to prepare a supplement to an environmental impact statement (EIS) when an agency makes substantial changes to a proposed action that are relevant to environmental concerns, or when there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. CEQ also recommends careful re-examination of EISs that are more than 5 years old and concern ongoing programs to determine whether a supplement to the EIS is required. DOE regulations under 10 CFR 1021.314(c) further direct that, when it is unclear whether a supplement to an EIS is required, an SA should be prepared to assist in that determination.

This SA evaluates the potential environmental impacts of both the current ongoing program and proposed new initiatives in accordance with these requirements to determine whether the existing *HEU EIS* should be supplemented, a new EIS should be prepared, or no further National Environmental Policy Act (NEPA) analysis is necessary.

2.0 BACKGROUND

Surplus U.S.-origin HEU is primarily stored at the Y–12 National Security Complex (Y–12) on the Oak Ridge Reservation (ORR) in Tennessee in accordance with the RODs for the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (DOE 1996b; ROD: 62 FR 3014; January, 21, 1997) and the *Final Site-Wide Environmental Impact Statement for the Y–12 National Security Complex* (DOE 2001; ROD: 67 FR 11296; March 13, 2002). Disposition of this material is conducted in accordance with the *HEU EIS* ROD, which specifically analyzes down-blending and subsequent management of a nominal 200 metric tons of surplus HEU.

Uranium enriched in the isotope uranium-235 (U-235) to 20 percent or above is considered highly enriched and is suitable for use in nuclear weapons. Down-blending HEU involves diluting this material to lower enrichment levels by blending it with other uranium materials (blendstock) to produce low-enriched uranium (LEU), which is considered unsuitable for use in weapons. Blendstock materials used in this process may include LEU, natural uranium, or depleted uranium.

2.1 Scope of the *HEU EIS*

The *HEU EIS* evaluates down-blending HEU to LEU at U-235 enrichment levels that would be suitable for either fabrication into commercial nuclear fuel (typically 3 to 5 percent U-235 enrichment) or disposal as low-level radioactive waste (LLW) (0.9 percent U-235 enrichment) using one or more of three blending technologies: uranyl nitrate (UN); molten metal; and uranium hexafluoride (UF_6).[1] In addition, the *HEU EIS* evaluates conducting this down-blending at up to four existing U.S. facilities: Y–12; the Savannah River Site (SRS) in South Carolina; Babcock and Wilcox (now BWXT Nuclear Operations Division [BWXT]) in Lynchburg, Virginia; and Nuclear Fuel Services, Inc., (NFS) in Erwin, Tennessee. These sites were considered because they have technically viable HEU conversion and blending capabilities and could blend surplus HEU to LEU for use as commercial fuel or disposal as waste. BWXT and NFS are the only commercial enterprises in the United States licensed by the U.S. Nuclear Regulatory Commission (NRC) to process HEU.

Because of the many possible permutations of end products, blending technologies, and blending sites, DOE analyzed several options that encompassed the range of reasonable alternatives. In the associated ROD, DOE announced selection of its preferred alternative: to blend down up to 85 percent (approximately 170 metric tons) of the surplus HEU to LEU for use in fabricating commercial fuel for nuclear power plants; and to blend down the remaining 15 percent (approximately 30 metric tons) for disposal as waste. In addition, DOE announced a programmatic decision to distribute down-blending services among the four facilities considered in the *HEU EIS* over a period of 15 to 20 years.

2.2 Status of Surplus HEU Disposition Activities

The *HEU EIS* explained that approximately 175 of the nominal 200 metric tons of HEU analyzed had already been declared surplus. DOE/NNSA subsequently defined disposition pathways for specific batches of the material. As of March 2007, approximately 100 of the 175 metric tons initially declared surplus has been down-blended using a combination of the four blending sites considered in the *HEU EIS*. Disposition of another approximately 10 metric tons of the material is in progress under ongoing campaigns.

DOE/NNSA has identified the characteristics of the balance of the 200 metric tons of HEU analyzed in the *HEU EIS*. Disposition of these batches of HEU is proposed or anticipated to occur as part of future down-blending campaigns or other initiatives:

- Approximately 17.4 metric tons of HEU were recently proposed for down-blending to support the Reliable Fuel Supply Initiative (described in **Section 3.1** of this SA).

- Approximately 28 metric tons of HEU are presently unallocated material that DOE/NNSA expects to dispose of in future down-blending campaigns similar to those completed or in progress (anticipated between 2008 and 2030).

[1] In the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*, the uranyl nitrate and uranium hexafluoride blending technologies are evaluated for down-blending surplus highly enriched uranium to 4 percent uranium-235 enrichment for commercial use; the uranyl nitrate and molten metal technologies are evaluated for down-blending to 0.9 percent uranium-235 enrichment for disposal as waste.

- Approximately 18 metric tons of HEU are currently considered unsuitable for beneficial reuse and are expected to be disposed of as waste in either a geologic repository for spent nuclear fuel or a LLW facility. Most of this material is in the form of spent nuclear fuel. No timeframe for this activity has been established.

- Approximately 25 metric tons of HEU would come from future declarations of surplus material that would be disposed of consistent with the *HEU EIS* ROD.

Some aspects of the proposed action to complete future disposition of specific quantities of HEU differ from or extend beyond the activities considered in the *HEU EIS*. These aspects are the subject of this SA.

3.0 PROPOSED ACTION

Since the mid-1990s, DOE/NNSA has maintained an ongoing program for disposition of surplus U.S.-origin HEU. In addition to continuing these activities, DOE/NNSA proposes to implement new initiatives and modify certain elements of the existing surplus HEU disposition program, including:

- Supplying potential new end-users with LEU from surplus HEU (approximately 17.4 metric tons) in support of the Reliable Fuel Supply Initiative;

- Establishing new disposition pathways for HEU discard material (approximately 18 metric tons);

- Down-blending additional quantities of HEU (approximately 20 metric tons).

3.1 New End-Users of Existing Program Material

The Reliable Fuel Supply Initiative is a series of mechanisms to be instituted by the United States to ensure that foreign countries with good nonproliferation credentials that refrain from developing and deploying uranium enrichment and reprocessing technologies continue to have access to the nuclear fuel market and the benefits of nuclear power. As one component of this initiative, DOE plans to down-blend and hold a supply of LEU to serve as backup in case other market mechanisms fail. Specifically, DOE/NNSA has procured commercial services to down-blend 17.4 metric tons of surplus U.S.-origin HEU to LEU, and maintain this supply of LEU until needed. The primary components of this proposed action consist of:

- Processing and packaging the material for offsite shipment at Y–12 in Tennessee.

- Shipping 17.4 metric tons of HEU from Y–12 to a commercial blending site.

- Down-blending the HEU to LEU using the liquid UN process.

- Transporting the resulting LEU (approximately 290 metric tons) as uranyl nitrate hexahydrate (UNH) or oxide from the blending site to a U.S. commercial fuel fabrication facility. The fabricator would be required to maintain 40 metric tons of LEU in storage, and would be able to use the majority of the remaining LEU for working inventory, subject to contractual conditions for providing LEU when requested by DOE/NNSA. LEU storage would be accommodated within the facility's existing capacity and operating license, and would not require additional construction.

- Shipping quantities of LEU, in the form of UF_6, to participating foreign countries as directed by DOE/NNSA and in accordance with procedures and requirements governing the sale of this material.

DOE/NNSA awarded a contract for this down-blending work on June 29, 2007.[2] Shipments of HEU to the blending contractor began in August 2007, and down-blending is scheduled to be completed in approximately 4 years. Most of the activities necessary to support disposition of the 17.4 metric tons of surplus HEU allocated to the Reliable Fuel Supply have already been evaluated in the *HEU EIS*, including transport of the HEU from storage at Y–12 to the blending site; down-blending the HEU to LEU; and transporting the LEU from the blending site to a domestic commercial fuel fabricator. As such, potential impacts associated with these activities are not revisited in this SA. However, the proposed action in this SA also includes transporting LEU fuel to participating foreign countries, which would constitute potential new end-users of HEU disposition program material. Because transport of this material to these new end-users is not within the scope of the *HEU EIS*, this SA evaluates the potential impacts of its transportation from the commercial fuel fabricator to a U.S. ocean port and across the global commons. Overland and ocean shipments under this initiative are expected to be similar to routine commercial transport of LEU.

No decisions have been made regarding the potential sale and transport of Reliable Fuel Supply LEU to specific foreign countries. If DOE/NNSA ultimately decides not to implement the international component of this proposed action, the HEU could still be down-blended for commercial use within the United States consistent with the ongoing surplus HEU disposition program.

3.2 New Disposition Pathways for HEU Discard Material

This SA also evaluates the proposed direct disposition of HEU discards in the form of spent nuclear fuel and low equity materials.[3] The *HEU EIS* analyzed the potential down-blending of surplus HEU that could be separated from spent nuclear fuel—pursuant to health and safety, stabilization, or other nondefense activities—to LEU. The *HEU EIS* also evaluated down-blending a minimum of 30 metric tons of HEU to an enrichment level of 0.9 percent U-235 for disposition as waste, and assumes this waste would then be disposed of at a LLW facility. This disposition approach is analyzed in the *HEU EIS* partly to address "off-specification materials," which at the time had no economically viable pathway for fabrication to commercial reactor fuel.[4] Subsequent changes in HEU market conditions and establishment of the Tennessee Valley Authority Off-Specification Fuel Program in 2001 have provided an economical means of using such material as fuel. However, approximately 18 of the 175 metric tons of HEU initially declared surplus are still considered unsuitable for use in fuel. DOE/NNSA is no longer considering down-blending this material for disposition as waste, but intends to directly dispose of it in either a geologic repository or a LLW facility:

- Approximately 15 metric tons of HEU discard material in the form of spent nuclear fuel stored at Idaho National Laboratory (INL) are proposed for direct disposal in a geologic repository.
- Approximately 3 metric tons of HEU (not in the form of spent nuclear fuel) considered low-equity materials are proposed for direct disposal in a LLW facility.

The impacts of transporting this spent nuclear fuel from INL for disposal at the proposed Yucca Mountain geologic repository are addressed in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002a). The impacts of transporting HEU material suitable for disposal as low-level waste at the Nevada Test Site (NTS) are addressed in the *HEU EIS*.

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[2] DOE/NNSA awarded the Reliable Fuel Supply contract to a team consisting of Wesdyne International (a subsidiary of Westinghouse Electric Company) and NFS. Under the terms of the contract, NFS will down-blend the 17.4 metric tons of surplus HEU to LEU at its facility in Erwin, Tennessee, and Wesdyne International will store the LEU at the Westinghouse fuel fabrication facility in Columbia, South Carolina (DOE 2007).

[3] Low-equity items include materials with varying enrichments no longer needed for programmatic needs, have no further defined use, and are commonly considered uneconomical for recovery due to low concentration of HEU or impurities.

[4] "Off-specification" highly enriched uranium refers to material possessing characteristics undesirable for use in commercial nuclear fuel.

Because the *HEU EIS* analyses already account for the potential impacts that would have been associated with down-blending surplus HEU for disposal as waste, the proposed direct disposal of this material would add approximately 18 metric tons to the blending margin available under the existing *HEU EIS* analyses, as described further in Section 3.3.

3.3 Down-Blending of Additional HEU

Lastly, this SA addresses the proposed future down-blending of additional quantities of HEU that were not associated with the surplus HEU disposition program at the time the *HEU EIS* was prepared. These additional quantities primarily derive from two sources: new material recently declared excess to weapons needs, and HEU returned to DOE from domestic and foreign research reactor programs. DOE/NNSA proposes to down-blend these additional quantities of HEU to LEU for use in fabricating commercial fuel for nuclear power plants.

HEU recently declared excess. In the fall of 2005, an additional 200 metric tons of HEU were declared excess to weapons needs. The U.S. Naval Reactors Program will use much of this material as fuel. However, DOE/NNSA anticipates that approximately 30 metric tons of this HEU will be unsuitable for use as naval reactor fuel and proposes to down-blend it to LEU. Another 20 metric tons of this material are already designated for down-blending. Disposition of these combined 50 metric tons of HEU is proposed to begin in 2008 and be incorporated into down-blending campaigns over the next several decades.

Domestic and foreign research reactor returns. DOE/NNSA is also considering down-blending approximately 10 metric tons of HEU from domestic and foreign research reactor returns.[5] The vast majority of these 10 metric tons of HEU would be processed and down-blended at SRS. The impacts of transporting spent nuclear fuel to SRS are evaluated in the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995) and the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel (FRR SNF EIS)* (DOE 1996c). In 2004, DOE/NNSA extended the schedule for receipt of foreign research reactor spent nuclear fuel through 2019 (69 FR 69901; December 1, 2004).

Associated recovery operations are evaluated in the *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement (SRS SNF EIS)* (DOE 2000). DOE/NNSA may recover some or all of this spent nuclear fuel in H-Canyon consistent with the RODs for the *FRR SNF EIS* (61 FR 25092; May 17, 1996) and *SRS SNF EIS* (65 FR 48224; August 7, 2000). In addition, DOE is currently preparing the *Highly Enriched Uranium and Spent Nuclear Fuel Management SA* to address management activities for spent nuclear fuel stored at INL and SRS, including the use of H-Canyon for separation and recovery of HEU embedded in research reactor returns and certain other spent nuclear fuel.

While there are no current or anticipated DOE/NNSA plans to process spent nuclear fuel solely for the purposes of extracting HEU, activities associated with the fuel for the purposes of stabilization, facility cleanup, treatment, waste management, safe disposal, or other environment, safety, and health reasons could result in the separation of HEU in weapons-usable form that could pose a proliferation threat. Therefore, if HEU is recovered from spent HEU fuel, it would be available for down-blending consistent with the ROD for the *HEU EIS* and addressed within the scope of this SA.

This SA assumes the surplus HEU proposed for disposition would be located at either Y–12 or SRS. The blending sites, processes, and annual throughputs associated with disposition of these additional

[5] These approximately 10 metric tons may include other miscellaneous HEU materials, and are not a subset of the 200 metric tons of highly enriched uranium declared excess in the fall of 2005.

quantities of HEU (approximately 60 metric tons) are expected to be identical or similar to those evaluated in the *HEU EIS*. Because down-blending of approximately 25 metric tons of HEU presently remains available within the scope of analysis originally considered in the *HEU EIS* and the proposed direct disposal of HEU discard material (addressed in **Section 3.2** of this SA) would also increase the available blending margin another 18 metric tons, disposition of all but approximately 20 metric tons of these additional quantities of HEU would occur within the scope of the *HEU EIS*. However, because the total additional quantity of HEU involved and the timing of the actions would still exceed those evaluated in the *HEU EIS*, these aspects are addressed in this SA.

4.0 IMPACTS

This section evaluates the potential environmental impacts of continuing surplus HEU disposition activities at each of the blending sites evaluated in the *HEU EIS* (Y–12, BWXT, NFS, and SRS) and identifies where current key data or assumptions differ from those considered in the *HEU EIS* analyses. It also evaluates the potential environmental impacts of proposed disposition program initiatives for DOE/NNSA surplus HEU: specifically, new end-users for existing program material, new disposal pathways for existing HEU discard materials, and down-blending additional quantities of HEU. A discussion of potential impacts resulting from intentional destructive acts (i.e., acts of sabotage or terrorism) is also presented.

4.1 Overview of Impacts Analysis

The following discussions provide an overview of the analyses and results originally presented in the *HEU EIS*, address key parameters or assumptions that have since changed, and describe the DOE/NNSA approach to determining impacts associated with the SA proposed action.

4.1.1 Key Assumptions and Impacts Presented in the *HEU EIS*

A number of key assumptions form the basis for the analyses presented in the *HEU EIS*:

- The analyses evaluated disposition of a nominal 200 metric tons of surplus HEU, resulting in two possible end products: (1) LEU that can be used as commercial nuclear reactor fuel feed (at a U-235 enrichment level of approximately 4 percent) and (2) LEU that can be disposed of as LLW (at a U-235 enrichment level of approximately 0.9 percent).

- To assess potential environmental impacts, the down-blending analyses assume that surplus HEU is enriched to 50 percent U-235 based on a weighted average of the surplus HEU in inventory at that time.

- Impacts are based on an annual HEU throughput of 10 metric tons at each of the sites when down-blending for use as commercial fuel and an annual HEU throughput of 2.1 to 3.1 metric tons when down-blending to waste. Construction of new facilities would not be required.

- For transportation analyses purposes, most of the surplus HEU would originate from Y–12. The transportation analyses also conservatively assume that the longest route (Hanford to all potential blending sites) would be representative for shipping the blendstock material necessary to support down-blending activities. The NTS is used as a representative site to evaluate the impacts of transportation from the blending sites to an LLW disposal site.

As discussed in **Section 2.1**, DOE developed and analyzed several alternatives to represent reasonable choices within the range of possible end products, blending technologies, and blending sites. In the *HEU EIS*, the results of Alternative 2, No Commercial Use, and Alternative 5, Maximum Commercial Use (the preferred alternative), generally envelope the range of potential impacts associated

with the proposed action. Alternative 2, No Commercial Use, assumes that all 200 metric tons of surplus HEU would be down-blended to LLW using a combination of all four blending sites (Y–12, BWXT, NFS, and SRS). Conversely, Alternative 5 assumes gradually down-blending up to 170 metric tons of surplus HEU using a combination of the four sites, selling the resulting commercially usable LEU for use as reactor fuel, and down-blending the remaining surplus HEU that has no commercial value (up to 30 metric tons) to LEU for disposition as LLW. The other two action alternatives presented in the *HEU EIS* (Alternative 3, Limited Commercial Use, and Alternative 4, Substantial Commercial Use) represent additional fuel/waste blending ratios and points of reference along the continuum bounded by *HEU EIS* Alternatives 2 and 5.

Because no new construction would be required and the down-blending activities conducted to support the proposed action would be either identical or very similar to operations that have occurred at the analyzed facilities in the past, DOE concluded that the potential incremental impacts from the *HEU EIS* proposed action at the blending sites would be low. However, DOE acknowledged that impacts could change over the life of the campaign if the exact fuel/waste ratio or division among sites were different than evaluated. Accordingly, the *HEU EIS* analyzes the impacts of site variations for the preferred alternative that would involve down-blending 0, 25, 50, and 100 percent of the surplus HEU at each of the sites. Based on these analyses, DOE concluded that the expected impacts would be low for many parameters (including radiological impacts) during normal operations and would be within the regulatory limits for each site even if that site were to down-blend 100 percent of the inventory. Therefore, the impacts at any site from any possible distribution of the down-blending work among the facilities would similarly be low and would be bounded by the analyses in the *HEU EIS*.

4.1.2 Key Changes in the Past 10 Years

In preparing this SA, DOE/NNSA has compared the assumptions and down-blending operations evaluated in the *HEU EIS* against actual operational experience over the past 10 years and determined that the following core assumptions have not changed:

- Surplus HEU blending sites and processes are the same as those evaluated in the *HEU EIS*.
- Annual down-blending throughputs vary, but are within the parameters considered in the *HEU EIS*.
- Surplus HEU material forms are consistent with those evaluated in the *HEU EIS*.
- Average nonradiological emissions would be the same as those presented in the *HEU EIS*.
- No new accident scenarios or source terms associated with surplus HEU disposition activities have been identified.

However, changes in the following parameters have occurred since the *HEU EIS* impact analyses were conducted:

- The SA analyses assume that the remaining HEU feedstock is enriched to 80 percent U-235 to better reflect the actual weighted average of the HEU materials now proposed for down-blending. The *HEU EIS* assumed an average U-235 enrichment of 50 percent.
- The chemical form of the uranium oxide blendstock considered for down-blending as UN now includes the potential use of either triuranic octaoxide (U_3O_8) (as addressed in the *HEU EIS*) or uranium trioxide (UO_3).
- Total site worker populations have changed at the blending sites.

- The 80-kilometer (50-mile) radius population dose evaluated in the *HEU EIS* for each of the blending sites was based on 1990 census data extrapolated to 2010; updated population values are now available based on the 2000 census data extrapolated to 2020.

- The standard dose-to-latent-cancer-fatalities-risk (dose-to-LCF-risk) conversion factors used by DOE/NNSA to estimate radiological risk to workers and offsite populations have been revised.

4.1.3 Approach to *HEU SA* Analyses

Because surplus HEU disposition activities have generally continued as analyzed in the *HEU EIS*, the analysis presented in this SA employs a sliding-scale approach that focuses on those areas most likely to be affected by implementation of new surplus HEU disposition program initiatives, as well as by key parameters and assumptions known to have changed since preparation of the *HEU EIS*.

DOE/NNSA conducted an initial screening of all resource areas addressed in the *HEU EIS* to determine which would potentially be affected by the proposed actions, or by known changes to related site activities or environmental conditions. Each blending site's operational experience was reviewed to identify potential concerns relative to facility resource requirements, throughputs, and emissions. Based on this screening, DOE/NNSA determined the following resource areas would not likely be affected by the proposed action:

- Land resources (no new construction or land requirements)

- Site infrastructure (same annual facility water, electrical, and fuel requirements)

- Air quality and noise (same down-blending processes and annual non-radiological emissions)

- Water resources (same down-blending processes and annual discharges)

- Geology and soils (no new construction or land disturbance)

- Biotic resources (no new construction or land disturbance)

- Cultural resources (no new construction or land disturbance)

- Socioeconomics (same number of workers supporting down-blending operations)

Therefore, the impact analyses presented in the *HEU EIS* for these resources are still considered applicable and are not evaluated further in this SA. The resource areas likely to be impacted, and therefore evaluated in greater detail in this SA, include human health risk, facility accidents, transportation risk, and waste management. In addition, this SA addresses environmental justice concerns and potential impacts occurring as a result of sabotage or terrorism.

Because of the uncertainty as to when some materials would be received and made available to the disposition program over the next several decades, this SA does not identify an end date for implementation of the proposed action. Rather, impact estimates presented in this SA are annualized or tied to specific events (e.g., postulated accidents) based on an assumed down-blending throughput of approximately 10 metric tons per year. This material throughput is conservatively high, and would allow for disposition of all surplus HEU addressed under the proposed action by 2020. Should disposition activities extend beyond 2020 as anticipated, total campaign impacts would essentially remain the same. However, because these total impacts would be projected over a longer timeframe, associated annual impacts would be similar but proportionately lower. An exception to this correlation is the impact resulting from use of the H-Canyon at SRS, which is not expected to continue operating after completing

the planned processing of the inventory of currently identified materials, including certain HEU materials. DOE projects completion of this processing by 2019.

4.2 Human Health and Facility Accidents

The analysis of human health and facility accidents includes evaluation of public and worker health data and assessment of changes that would affect the consequences and risks of accidents associated with the proposed action. Public health, worker health, and facility accidents are described for the four sites in the following sections, and relevant data are presented to update information developed since the *HEU EIS* was issued. **Table 4.2–1** compares the key radiological impact parameters cited in the *HEU EIS* with those used in this SA. Of particular note is the use of updated dose-to-risk conversion factors in the SA analyses. The *HEU EIS* used a factor of 0.0004 LCF per rem for workers and 0.0005 LCF per rem for the public, but current DOE guidance stipulates the use of 0.0006 LCF per rem for both workers and the public. This change results in a 50-percent increase in risk to workers and a 20-percent increase in risk to the public from the same radiological exposures reported in the *HEU EIS*.

4.2.1 Human Health

Normal Operations. A comparison of radiological consequences and risks evaluated in the *HEU EIS* and this SA from normal operations at each of the four blending sites is presented in **Table 4.2–2**. The *HEU EIS* normal operations analyses present doses resulting from potential offsite exposure to U-235 and U-238. These values have been adjusted to account for additional radionuclides (U-232, U-234, and U-236) consistent with the facility accident and transportation analyses presented in the *HEU EIS*, and provide a more comparable basis for assessing potential impacts associated with the proposed action.

Annual doses to the involved workforce at each site are expected to remain unchanged because the number of involved workers and their average exposure levels have not changed. Involved workers are not expected to be affected by the higher U-235 enrichment of the HEU feedstock because their exposure is limited by facility design features, operational procedures, and health physics monitoring programs. These factors enable the blending sites to adjust levels of shielding, the distances of involved workers from radioactive source terms, and the duration of their exposures. In contrast, increases in the maximally exposed offsite individual (MEOI) dose would occur due to the higher assumed U-235 enrichment of the HEU feedstock. Increases in the offsite population dose would also occur due to the higher assumed U-235 enrichment as well as the updated population values presented in Table 4.2–1. All risks resulting from normal operations would also increase because of the larger dose-to-LCF-risk factor used in this SA for both workers and the public. However, all annual radiation doses would remain a small fraction of applicable regulatory limits (detailed below) and normal background radiation exposure (0.36 rem per year).

The measured annual dose to the MEOI from all radiological emissions at each of the blending sites from 2002 to 2005 is presented in **Table 4.2–3**. All annual doses are less than 0.001 rem, or less than 1 percent of the DOE annual public dose limit of 0.1 rem (DOE 1993), and represent an increase in lifetime fatal cancer risk of less than 1 in 2 million. These MEOI doses are due to radiological emissions from all activities at each site; the actual MEOI dose (and LCF risk) attributable solely to surplus HEU disposition activities would therefore be lower than the values presented.

Table 4.2–1. Comparison of Key Blending Site Radiological Impact Parameters

Parameter	*HEU EIS*[a]	Supplement Analysis[b]
Y–12		
Stack height	10 meters (33 feet)	20 meters (66 feet)[e]
MEOI distance	619 meters (2,031 feet)	Same
Noninvolved worker distance	644 meters (2,113 feet)	Same
Total onsite workforce	17,000 at ORR; 6,400 at Y–12	17,000 at ORR; 5,000 at Y–12
80-kilometer (50-mile) population	1,040,000[c]	1,523,573[d]
BWXT		
Stack height	11 meters (36 feet)	24 meters (79 feet)[e]
MEOI distance	540 meters (1,772 feet)	Same
Noninvolved worker distance	230 meters (755 feet)	Same
Total onsite workforce	2,200	2,300
80-kilometer (50-mile) population	730,000[c]	789,917[d]
NFS		
Stack height	33 meters (108 feet)	Same
MEOI distance	250 meters (820 feet)	Same
Noninvolved worker distance	250 meters (820 feet)	Same
Total onsite workforce	325	850
80-kilometer (50-mile) population	1,260,000[c]	1,287,973[d]
SRS		
Stack height	10 meters (33 feet)	Same
MEOI distance	11,750 meters (38,550 feet)	Same
Noninvolved worker distance	644 meters (2,113 feet)	Same
Total onsite workforce	12,000	8,900
80-kilometer (50-mile) population	710,000[c]	889,341[d]
All Sites		
Involved workforce	125	Same
Average HEU feedstock U-235 enrichment	50 weight percent	80 weight percent
Worker dose-to-LCF-risk factor	0.0004 per rem	0.0006 per rem
Public dose-to-LCF-risk factor	0.0005 per rem	0.0006 per rem

[a] DOE 1996a.
[b] BWXT 2007a, 2007b; NFS 2007a; NRC 2003a; WSRC 2007.
[c] Projected 2010 population extrapolated from 1990 census data.
[d] Projected 2020 population extrapolated from 2000 census data.
[e] The larger stack height would result in lower radiation doses; therefore this parameter is bounded by the lower stack height evaluated in the *HEU EIS*.

Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*; LCF=latent cancer fatalities; MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc.; ORR=Oak Ridge Reservation; and SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.

Table 4.2–2. Comparison of *HEU EIS* and Supplement Analysis Normal Operations Radiological Doses and Risks

Impact Parameter	Involved Workforce		MEOI		Offsite Population	
	HEU EIS	SA	*HEU EIS*[a]	SA	*HEU EIS*[a]	SA
Y–12						
Annual Dose (person-rem)	11.3	11.3	7.0×10^{-4} (rem)[b]	7.8×10^{-4} (rem)[b]	2.9	4.7
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	3.5×10^{-7}	4.7×10^{-7}	1.5×10^{-3}	2.9×10^{-3} [c]
BWXT						
Annual Dose (person-rem)	11.3	11.3	3.4×10^{-5} (rem)[b]	3.8×10^{-5} (rem)[b]	0.30	0.37
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	1.7×10^{-8}	2.3×10^{-8}	1.5×10^{-4}	2.3×10^{-4} [c]
NFS						
Annual Dose (person-rem)	11.3	11.3	2.5×10^{-3} (rem)[b]	2.8×10^{-3} (rem)[b]	21	25
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	1.3×10^{-6}	1.7×10^{-6}	1.1×10^{-2}	1.5×10^{-2} [c]
SRS						
Annual Dose (person-rem)	11.3	11.3	4.5×10^{-5} (rem)[b]	5.0×10^{-5} (rem)[b]	2.9	4.0
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	2.3×10^{-8}	3.0×10^{-8}	1.5×10^{-3}	2.4×10^{-3} [c]

[a] Adjusted to include uranium-232, uranium-234, and uranium-236.
[b] Unit for MEOI dose is rem because the receptor is a single individual.
[c] This SA's calculated offsite population risk is equivalent to the following increased annual risk of an LCF occurring in the total offsite population: 1 chance in 357 for Y-12; 1 chance in 4,545 for BWXT; 1 chance in 71 for NFS; and 1 chance in 416 for SRS.

Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*; LCF=latent cancer fatalities; MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: Derived from DOE 1996a.

Table 4.2–3. Public Maximally Exposed Offsite Individual Radiation Doses (rem) from Annual Radionuclide Releases from All Site Activities

Site	2002	2003	2004	2005
Y–12	3.0×10^{-4}	2.0×10^{-4}	4.0×10^{-4}	8.0×10^{-4}
BWXT	3.7×10^{-4}	5.1×10^{-4}	3.9×10^{-4}	1.4×10^{-4}
NFS	5.0×10^{-5}	3.0×10^{-5}	2.0×10^{-5}	2.0×10^{-5}
SRS	1.8×10^{-4}	1.9×10^{-4}	1.5×10^{-4}	1.3×10^{-4}

Key: BWXT=BWXT Nuclear Operations Division; NFS=Nuclear Fuel Services, Inc.; ORNL=Oak Ridge National Laboratory; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: BWXT 2007c; NFS 2007b; ORNL 2003–2006; WSRC 2003–2006.

Whereas Table 4.2–2 presents analytically derived conservative estimates of MEOI dose due to down-blending activities, Table 4.2–3 presents recent measured dose information for the MEOI at each blending site. The conservative assumptions inherent in the calculated values in Table 4.2–2 include a high atmospheric release of radioisotopes and low air filter particle removal efficiency, as compared to actual measured releases and filter efficiencies that have occurred at each site. The largest calculated MEOI dose from down-blending activities would be 2.8×10^{-3} and would occur at NFS primarily due to the much closer proximity of the MEOI. In contrast, actual measured MEOI doses at all four sites from

all activities during these years are much lower and range between 2.0×10^{-5} and 8.0×10^{-4} rem. Because actual MEOI doses attributable solely to down-blending operations are not measured, a direct correlation cannot be made between the data presented in Tables 4.2–2 and 4.2–3. However, both estimated project and measured total site MEOI doses are presented in this SA to illustrate that they are all well below the DOE public annual dose limit of 0.1 rem.

The proposed use of higher U-235-enriched HEU feedstock or UO_3 as alternate blendstock material would not measurably affect non-radiological facility emissions. As such, annual quantities of chemicals that would be released at each of the blending sites during normal operations under the proposed action are expected to be approximately the same as those presented in the *HEU EIS*. In addition, no new chemicals other than those presented in the *HEU EIS* are expected to be used for the proposed action (BWXT 2007a, 2007b; NFS 2007a; WSRC 2007). Therefore, environmental impacts to the public from chemical releases during normal operations would be unchanged from those presented in the *HEU EIS*.

Worker Health. Reported total site worker radiation doses for the years 2002 through 2005 are presented in **Table 4.2–4**. Year-to-year variations in the number of workers with a measurable dose and the total workforce dose at each site are a function of specific radiological activities conducted at the site for that year. All average worker doses continue to be a small fraction of both the DOE occupational annual dose limit of 5 rem (DOE 1993) and normal annual background radiation exposure.

Table 4.2–4. Historical Total Site Worker Radiation Doses from 2002 to 2005 from All Site Activities[a]

Parameter	2002	2003	2004	2005
Y–12[b]				
Workers with measurable dose	2,304	2,389	2,132	1,988
Total worker dose (person-rem)	107.8	116.0	115.5	101.4
Average worker dose (rem)	0.047	0.049	0.054	0.051
BWXT[c]				
Workers with measurable dose	238	246	252	277
Total worker dose (person-rem)	32	29.2	24.6	26.9
Average worker dose (rem)	0.14	0.12	0.10	0.10
NFS				
Workers with measurable dose	783	763	725	617
Total worker dose (person-rem)	96.8	56.3	13.2	11.2
Average worker dose (rem)	0.12	0.07	0.018	0.018
SRS				
Workers with measurable dose	3,217	3,446	2,996	2,360
Total worker dose (person-rem)	199.1	258.6	201.2	121.3
Average worker dose (rem)	0.062	0.075	0.067	0.051

[a] All reported site worker doses are based on both external dose measurements and calculations of estimated internal dose from facility air radioisotope concentrations.
[b] Values represent contributions from all Oak Ridge Reservation facilities, including Y–12.
[c] BWXT reported average worker doses are higher than Y–12, NFS, and SRS because BWXT uses a more conservative method to estimate internal dose to workers.

Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; NFS=Nuclear Fuel Services Inc; NRC=U.S. Nuclear Regulatory Commission; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.

Source: DOE 2004a, 2005; NRC 2003b, 2004–2006.

Whereas Table 4.2–2 presents analytically derived estimates of doses from workers involved only in down-blending activities, Table 4.2–4 presents available measured dose information for the total workforce at each site. The involved workforce doses presented in Table 4.2–2 are the same as those

presented in the *HEU EIS*, and were calculated with the conservative analytical assumptions that 125 workers would be involved in HEU down-blending operations and that each involved worker would receive an annual dose of 0.09 rem, resulting in a total annual involved workforce dose of 11.3 person rem. Each blending site has confirmed the continued validity of these worker dose estimates with respect to the proposed actions considered in this SA (BWXT 2007a, 2007b; NFS 2007a; WSRC 2007). The actual measured average worker doses presented in Table 4.2–4 range between 0.018 and 0.14 rem, and account for all workers exposed to radiation at each site. Because each site is involved in numerous other radiological activities, the total number of workers with a measurable dose is larger than the 125 assumed for down-blending operations. Because actual worker doses attributable solely to down-blending operations are not available, a direct correlation cannot be made between the data presented in Tables 4.2–2 and 4.2–4. However, both estimated project and measured total site worker doses are presented in this SA to illustrate that they are all well below the DOE occupational annual dose limit of 5 rem.

4.2.2 Facility Accidents

Potential impacts to workers and the public from facility accidents are evaluated in this SA by identifying applicable *HEU EIS* accident scenarios and calculating revised consequences and risks based on the updated key parameters presented in Table 4.2–1.

Unlike the *HEU EIS*, the proposed action in this SA involves only down-blending HEU to LEU in the chemical form of UN (4 percent U-235 UN). Whereas four accident scenarios are analyzed for down-blending as UN in the *HEU EIS* at all four sites, only three of these accident scenarios are analyzed in this SA because DOE/NNSA is no longer proposing down-blending to 0.9 percent U-235 UN. **Tables 4.2–5** and **4.2–6** compare the doses and risks to the public and workers expected from the SA proposed action under the applicable accident scenarios analyzed in the *HEU EIS*.

Accident consequences and risks have increased due to the changes in five radiological impact parameters in Table 4.2–1: total onsite workforce, offsite population, worker and public dose-to-LCF-risk factors, and average HEU feedstock U-235 enrichment. Noninvolved worker and offsite population consequences have changed in direct proportion to their respective updated site-specific numerical values. Because the higher average HEU U-235 enrichment results in larger uranium source terms for the filter fire and earthquake accidents (the criticality accident releases fission products and not uranium isotopes), the consequences of these two accidents also increase for all three dose receptors: the noninvolved worker, MEOI, and offsite population. Finally, risks for all three accident scenarios and all three dose receptors increase due to the larger dose-to-LCF-risk factors used in this SA for workers and the public.

Approximately 125 involved workers directly support down-blending operations at each of the sites. In the event of an accident, nearby involved workers could receive relatively higher doses and be at risk of serious injury or death. Potential impacts to these workers are addressed qualitatively for each accident scenario because no adequate method exists for calculating meaningful consequences at or near the location where the accident could occur:

- *Filter Fire Accident*—Involved workers could inhale some radioactive particles before evacuating the area, but the relative location of filters and the short exposure time is not expected to result in fatalities from radiological consequences.

- *Criticality Accident*—Involved workers could receive substantial or potentially fatal doses from the initial pulse of neutron and gamma radiation. After this initial pulse, workers would evacuate the area on the initiation of criticality monitoring alarms.

- *Earthquake*—Involved workers could receive lethal injuries from structural damage associated with an earthquake, but no fatalities are expected from radiological consequences.

Table 4.2–5. Comparison of *HEU EIS* and Supplement Analysis of Radiological Accident Doses

Evaluation Basis Accident Scenario	Noninvolved Worker Dose (person-rem)		MEOI Dose (rem)		Population Dose (person-rem)	
	HEU EIS	SA	*HEU EIS*	SA	*HEU EIS*	SA
Y–12						
Filter fire accident	11	22	0.01	0.02	1.5	4.4
Criticality accident	38	38	0.051	0.051	3	4.4
Earthquake	320	576	0.31	0.56	44	64
BWXT						
Filter fire accident	24	50.4	0.012	0.024	0.9	1.94
Criticality accident	80	84	0.056	0.056	1.9	2.1
Earthquake	760	1,436	0.36	0.65	26	50
NFS						
Filter fire accident	1.6	8.4	0.002	0.004	1.3	2.6
Criticality accident	8.7	22.8	0.014	0.014	2.2	2.2
Earthquake	67	317	0.078	0.140	38	709
SRS						
Filter fire accident	2.3	3.4	6.6×10^{-5}	1.3×10^{-4}	0.37	0.92
Criticality accident	8.5	6.3	3.0×10^{-4}	3.0×10^{-4}	0.33	0.41
Earthquake	70	94	0.0019	0.0034	11	25

Key: BWXT=BWXT Nuclear Operations Division; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement;* MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc.; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: Derived from DOE 1996a.

As discussed in **Section 4.2.1**, the quantities of chemicals that would be used for the proposed action and the processes involving these chemicals would be essentially identical to those evaluated in the *HEU EIS* accident analyses. As such, postulated chemical accidents and associated impacts are expected to be the same as those analyzed in the *HEU EIS*.

4.3 Transportation

Two types of transportation activities are addressed in this SA: (1) transport activities similar to those evaluated in the *HEU EIS*, and (2) transport of LEU to foreign countries as part of the Reliable Fuel Supply Initiative. The methods and data used to evaluate transportation impacts in the *HEU EIS* were analyzed and used as the basis for estimating impacts of similar transportation activities in this SA. This analysis is summarized in **Section 4.3.1**. Transport of LEU to a fuel fabricator in a foreign country was not considered in the *HEU EIS*; therefore, a more detailed analysis of this activity is provided in **Section 4.3.2**.

Table 4.2–6. Comparison of *HEU EIS* and Supplement Analysis of Radiological Accident Risks (LCF per year)

Evaluation Basis Accident Scenario	Noninvolved Worker Risk		MEOI Risk		Population Risk	
	HEU EIS	SA	*HEU EIS*	SA	*HEU EIS*	SA
Y–12						
Filter fire accident	4.4×10^{-6}	1.3×10^{-5}	5.0×10^{-9}	1.2×10^{-8}	7.5×10^{-7}	2.6×10^{-6}
Criticality accident	1.5×10^{-6}	2.3×10^{-6}	2.6×10^{-9}	3.1×10^{-9}	1.5×10^{-7}	2.6×10^{-7}
Earthquake	1.3×10^{-5}	3.6×10^{-5}	1.6×10^{-8}	3.4×10^{-8}	2.2×10^{-6}	6.8×10^{-6}
BWXT						
Filter fire accident	9.6×10^{-6}	3.0×10^{-5}	6.0×10^{-9}	1.4×10^{-8}	1.9×10^{-7}	5.6×10^{-7}
Criticality accident	3.2×10^{-6}	5.0×10^{-6}	2.8×10^{-9}	3.4×10^{-9}	9.5×10^{-8}	1.3×10^{-7}
Earthquake	3.0×10^{-5}	8.6×10^{-5}	1.8×10^{-8}	4.0×10^{-8}	1.3×10^{-6}	3.1×10^{-7}
NFS						
Filter fire accident	6.4×10^{-7}	5.0×10^{-6}	1.0×10^{-9}	2.4×10^{-9}	6.5×10^{-7}	1.6×10^{-6}
Criticality accident	3.5×10^{-7}	1.4×10^{-6}	7.0×10^{-10}	8.4×10^{-10}	1.1×10^{-7}	1.3×10^{-7}
Earthquake	2.7×10^{-6}	2.0×10^{-5}	3.9×10^{-9}	8.5×10^{-9}	1.9×10^{-6}	4.1×10^{-6}
SRS						
Filter fire accident	9.2×10^{-7}	2.0×10^{-6}	3.3×10^{-11}	8.0×10^{-11}	1.9×10^{-7}	5.6×10^{-7}
Criticality accident	3.4×10^{-7}	3.8×10^{-7}	1.5×10^{-11}	1.8×10^{-11}	1.7×10^{-8}	2.5×10^{-7}
Earthquake	2.8×10^{-6}	5.6×10^{-6}	9.5×10^{-11}	2.0×10^{-10}	5.5×10^{-7}	1.5×10^{-6}

Note: *HEU EIS* risks are based on the dose-to-LCF-risk factor of 0.0004 per rem for workers (i.e., noninvolved workers) and 0.0005 per rem for public (i.e., MEOI and population); SA risks are based on the dose-to-LCF-risk factor of 0.0006 per rem for both workers and public. Filter fire accident annual frequency=0.001 per year. All other accident annual frequencies=0.0001 per year. All accident annual frequencies are from the *HEU EIS* and are identical for this SA.
Key: BWXT=BWXT Nuclear Operations Division; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*; LCF=latent cancer fatalities; MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc.; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: Derived from DOE 1996a.

4.3.1 Transport Activities Similar to those Evaluated in the *HEU EIS*

Transport activities similar to those evaluated in the *HEU EIS* include transport of surplus HEU and blendstock to blending sites, transport of LEU to fuel fabricators, and transport of associated wastes. The various materials are and would continue to be transported in DOE-, NRC- and U.S. Department of Transportation (DOT)-certified packaging, as appropriate.

The *HEU EIS* analyses assume that DOE safe, secure transports (SSTs) would be used to ship HEU to the blending sites, and commercial trucks would be used for all other overland transport activities. Transportation impacts in the *HEU EIS* are conservatively estimated using the RADTRAN 4 computer program and default RADTRAN input parameters (Neuhauser and Kanipe 1992). For example, the *HEU EIS* assumes that there would be frequent stops (1 hour every 91 kilometers of travel) and that these stops could occur anywhere along the route in either rural, suburban, or urban areas. The analyses also assume constant population densities of 6; 719; and 3,861 people per square kilometer, respectively, for rural, suburban, and urban areas irrespective of the routes and locations. At the time the *HEU EIS* was prepared, these estimates were considered conservative and appropriate when analyzing aggregate route characteristics, which only consider the total distance between the origin and destination for each transport and the fractions of travel in the rural, suburban, and urban areas.

Current population density estimates are based on route-specific characteristics using the Transportation Routing Analysis Geographic Information System (TRAGIS) computer code (DOE 2003b), which generates population densities using 2000 census statistics. Comparisons of population data for transport

between locations similar to those used in the *HEU EIS* indicate that today, population densities for highway routes in rural areas are higher, and population densities in the suburban and urban areas are much lower. DOE has also developed additional transportation risk assessment guidelines since the *HEU EIS* was prepared (DOE 2002b).

To determine the degree to which the updated analytical methods and data would affect the results, one transportation segment (transporting a shipment of HEU from Y–12 to a representative blending site [BWXT]) was analyzed using the new methodology, and the results were compared to the *HEU EIS* analysis. Comparison of the doses and risks indicates that the dose estimates in the *HEU EIS* remain valid and would envelope the impacts from similar activities under this SA (SAIC 2007). However, independent of the transportation analyses, application of revised dose-to-LCF-risk conversion factors (discussed in **Section 4.2**) increases the risk to exposed workers by 50 percent and to the exposed population by 20 percent over those presented in the *HEU EIS*. Updating the *HEU EIS* analyses with these revised conversion factors, the combined annual impacts of transporting surplus HEU and blendstock to each of the blending sites, and then transporting the resulting LEU to a fuel fabrication facility, are summarized in **Table 4.3–1** and discussed in the paragraphs that follow. These results indicate that the proposed activities would be similar to those analyzed in the *HEU EIS*, and the associated transportation impacts would continue to be low. Consistent with the impacts presented in the *HEU EIS*, the largest contributor to overall transportation risks would be nonradiological impacts from traffic accidents.

Table 4.3–1. Annual Transportation Risks from Surplus Highly Enriched Uranium Disposition Activities[a]

	Incident-free Risks[b]		Accident Population Risks[c]	
Blending Sites	**Crew[c]**	**Population**	**Radiological**	**Traffic**
Y–12	9.3×10^{-3}	1.3×10^{-2}	4.8×10^{-4}	3.4×10^{-2}
BWXT	1.0×10^{-2}	1.4×10^{-2}	5.7×10^{-4}	3.7×10^{-2}
NFS	1.0×10^{-2}	1.4×10^{-2}	5.1×10^{-4}	3.6×10^{-2}
SRS	1.0×10^{-2}	1.4×10^{-2}	5.5×10^{-4}	3.7×10^{-2}

[a] Total annual health effects from transport of surplus HEU from Y–12 to blending sites, transport of blendstock materials from Hanford to blending sites, and transport of resulting LEU to fuel fabricator site.
[b] Incident-free risks are in terms of LCF.
[c] Radiological risks are in terms of LCF. Traffic risks are in terms of nonoccupational traffic fatalities.
Note: The values in this table include adjustments for the worker and population risk factors to 0.0006 LCF per person-rem of exposure.
Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; LCF=latent cancer fatalities; NFS=Nuclear Fuel Services, Inc.; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: Derived from DOE 1996a.

Transport of Surplus HEU to Blending Sites. Surplus HEU materials are assumed to originate at Y–12 and to be shipped to the blending sites as either metal, oxides, or alloys. Annually, about 10 metric tons of HEU would be transported from Y–12 to the blending sites. Transport characteristics and packaging are expected to be similar to those evaluated in the *HEU EIS*.

Accident risks for radiological accidents are identified in terms of increased LCFs in the exposed population, while traffic risks are in terms of potential nonoccupational (public) fatalities resulting from traffic accidents. The values presented assume the accident rates used in the *HEU EIS* are still valid. Because the HEU materials are transported in SSTs, the expected accident rates for these transports are much smaller than those associated with commercial trucks.

Transport of Blendstock Materials to Blending Sites. The *HEU EIS* evaluates the impacts of transporting various blendstocks to each of the blending sites. For analysis purposes in this SA, the

blendstock is assumed to be natural uranium in the form of U_3O_8 or UO_3. This material could be provided from several Government or commercial sources and transported directly to the blending site. Consistent with the *HEU EIS*, this SA analyzes the DOE Hanford Site as a representative source for the blendstock material because its location is farthest from the blending sites. Because of the distance and material form, this assumption would envelope the impacts of transporting other blendstock materials from other locations. The required amount of blendstock is a function of initial enrichment (U-235) in the HEU feed and the desired final enrichment of the resulting LEU. This SA assumes the same final product enrichment as in the *HEU EIS*. However, this SA assumes a higher initial HEU feedstock enrichment (80 percent) to better reflect the actual average assay of HEU now proposed for down-blending, which corresponds to an annual blendstock requirement of about 280 metric tons of natural uranium (as UO_3). Assuming packaging and shipping characteristics similar to those used in the *HEU EIS*, this would result in about 26 shipments annually, or approximately 11 more per year than originally estimated in the *HEU EIS*.

Transport of LEU to Fuel Fabricators. Following down-blending, the resulting LEU would be transported in certified packaging to a domestic fuel fabricator. The *HEU EIS* evaluates such transport to a number of fuel fabrication sites, with distances ranging from 0 kilometers (where the fuel fabricator is at the blending site) to more than 4,400 kilometers (a fuel fabrication site in Richland, Washington). For this SA, the LEU feed stock is assumed to be UNH and the fuel fabricator is assumed to be in Washington State. These assumptions lead to higher transportation risk estimates, a larger number of shipments (about 70 shipments per year), and longer travel distances than are expected based on DOE/NNSA having selected a fuel fabricator in South Carolina.

Transport of LLW. As described in **Section 3.2**, the amount of surplus HEU that would be suitable for disposal as LLW at NTS has been reduced to approximately 3 metric tons, or approximately 10 percent of the amount analyzed in the *HEU EIS*. The method of transportation and nature of impacts are expected to be the same. Therefore, the risks evaluated in the *HEU EIS* for transporting HEU down-blended to LLW are higher than the potential impacts associated with the current proposed action.

4.3.2 Transport of LEU to Support the Reliable Fuel Supply Initiative

This SA evaluates the potential impacts of transporting about 220 metric tons of LEU UF_6 feedstock from a domestic fuel fabricator to a foreign country in support of the Reliable Fuel Supply Initiative. These materials would be transported in packaging that is specially designed and certified for fissile material transports. The DOT-certified packaging currently used consists of four 30-B UF_6 cylinders configured on a specially designed structure for transport within a standard 6.1-meter International Organization for Standardization (ISO) container. Each cylinder would contain 2,277 kilograms of UF_6, so each ISO container would transport about 9.1 metric tons of LEU UF_6 feedstock. This quantity of UF_6 is consistent with the amount assumed in the *HEU EIS* for transport of similar materials within the United States.

For analysis purposes in this SA, it is conservatively assumed that the LEU feedstock would be transported across the United States from a fuel fabricator on the West Coast to a port on the East Coast, and placed on a commercial vessel for marine transport to a fuel fabricator in a foreign country.[6] Each potential shipment is assumed to comprise approximately 40 metric tons of LEU, the quantity sufficient for one standard refueling cycle of a pressurized water nuclear reactor. Therefore, approximately six or seven shipments would be required to transport all 220 metric tons of LEU UF_6. In addition, each LEU shipment is assumed to require four ISO containers that would be transported as a convoy of commercial truck trailers, consistent with current practices in civilian commerce.

[6] Under the Reliable Fuel Supply contract, the Westinghouse fuel fabrication facility in Columbia, South Carolina, will serve as the actual LEU storage location and point of origin for subsequent transport to a marine terminal. Any decision to select a specific West or East Coast port would be predicated upon the geographic location of the participating foreign country. Therefore, the transportation analysis presented in this SA conservatively assumes maximum shipping distances (a West Coast fuel fabricator and an East Coast marine terminal) in order to bound all potential domestic LEU transportation impacts (including the possible use of an East Coast fuel fabricator and a West Coast marine terminal).

A number of East Coast ports regularly transport fissile materials between the United States and foreign countries. DOE/NNSA evaluated the impacts of transporting spent nuclear fuel and mixed oxide fuel through multiple U.S. East Coast ports in the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE 1996c); the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement,* (DOE 1996b); and the *Supplement Analysis for the Fabrication of Mixed Oxide Fuel Lead Assemblies in Europe* (DOE 2003a). Previous NEPA analyses have demonstrated that ocean transport is safe and would involve minimal environmental impacts. These NEPA analyses considered commercial ports such as Newport News, Norfolk International, and Portsmouth Marine Terminals in Virginia, as well as military ports such as the Military Ocean Terminal at Sunny Point, North Carolina; Charleston Naval Weapons Station in South Carolina; and Yorktown Naval Weapons Station in Virginia. Norfolk International is the assumed port of departure used in this SA to evaluate the distance traveled and the impacts from port activities during container loading. The following activities are evaluated in association with transporting Reliable Fuel Supply Initiative LEU:

- Overland transport of UF_6 from a fuel fabricator to Norfolk International Terminal, in Norfolk, Virginia.
- Port transfer of the UF_6 ISO containers from trucks to an ocean container ship.
- Ocean transport of UF_6 across the global commons.

Overland Transport of UF_6. **Table 4.3–2** summarizes the impacts from transporting LEU UF_6 feed materials, assuming transport characteristics and packaging similar to those used in the *HEU EIS.* It is conservatively assumed that the materials would be transported from a West Coast fuel fabricator (in Richland, Washington), to the Norfolk International Terminal. The one-way distance between these two locations is 4,530 kilometers, with fractions of travel in rural, suburban, and urban areas essentially unchanged from those evaluated in the *HEU EIS.*

Table 4.3–2. Impacts of Overland Transport of Uranium Hexafluoride Low-Enriched Uranium (per shipment)

Transport	Incident-free Risks[a]		Accident Population Risks[b]	
	Crew	Population	Radiological	Traffic
UF_6 to the port	4.0×10^{-4}	6.1×10^{-4}	2.7×10^{-5}	1.6×10^{-3}

[a] The risks are in terms of LCF.
[b] Radiological risks are in terms of LCF. Traffic risks are in terms of nonoccupational traffic fatalities.
Note: The values in this table include adjustments for the workers and population risk factors to 0.0006 LCF per person-rem of exposure.
Key: DOE=U.S. Department of Energy; LCF=latent cancer fatalities; UF_6=uranium hexafluoride.
Source: Derived from DOE 1996a.

Port Activities. These activities include loading of the ISO containers onto a commercial vessel, container-handling activities while on board, and subsequent movement of the vessel from the port out to the open sea. Assuming incident-free transfer of the ISO containers to the vessel, the only radiation exposures anticipated would be those to persons directly involved in the transfer (inspectors, port handlers, guards, etc.). Members of the public would be too distant to receive measurable radiation exposures. The dose to an exposed worker would be a function of the exposure time and the distance from the ISO container. Port activity impacts were evaluated in Appendix D of the *FRR SNF EIS.* Assuming for this analysis that the activities involved in loading the ISO containers at ports would be similar to those analyzed in the *FRR SNF EIS* and the external dose rate of the containers would be similar to those considered in the *HEU EIS*, the potential impacts to port workers from loading four containers of UF_6 are provided in **Table 4.3–3**.

Table 4.3–3. Human Health Effects from Incident-Free Port Operations (per shipment)

Exposed Personnel	MEI Dose (rem)	MEI Risk (LCF)	Collective Dose[a] (person-rem)	Collective Risk[a] (LCF)
Longshoremen	1.8×10^{-4}	1.1×10^{-7}	6.1×10^{-4}	3.6×10^{-7}
Crane Operators	3.4×10^{-5}	2.0×10^{-8}	4.5×10^{-5}	2.7×10^{-8}
Inspectors	5.2×10^{-4}	3.1×10^{-7}	2.2×10^{-3}	1.3×10^{-6}
Observers	3.2×10^{-5}	1.9×10^{-8}	1.6×10^{-3}	9.6×10^{-7}

[a] Collective dose and risk represent the total dose and risk to all potentially exposed personnel in each category (i.e., longshoremen, crane operators, inspectors, and observers).
Key: DOE=U.S. Department of Energy; LCF=latent cancer fatalities; and MEI=maximally exposed individual.
Source: Derived from DOE 1996c.

A handling accident at the port would not be expected to result in cask failure leading to any release of radioactive material. Only an accident involving a ship collision and ensuing fire has a potential to damage the cask. The *FRR SNF EIS* evaluated such a scenario; the analysis was very site-specific in terms of population distributions, land use, meteorology, and other factors. Given security provisions, port proximity, and awareness of the shipment, the potential severity of a ship collision is limited, and the consequences of accidents are enveloped by those in Appendix D of the *FRR SNF EIS.* The consequences of similar accidents at the port would be much lower than those described in the *FRR SNF EIS* due to the substantially lower total radioactivity content.

Global Commons. Transporting the Reliable Fuel Supply Initiative LEU reserves to participating foreign countries by ship is expected to add up to seven ocean trips to the thousands of commercial and military vessel trips crossing the oceans of the world each year. Therefore, a few ships transporting this LEU over the course of the program would not have a noticeable impact on the global commons.[7]

Impacts of an accident during transport of enriched uranium over the global commons would be similar to those discussed in the *Environmental Assessment for the Proposed Interim Storage at the Y-12 Plant Oak Ridge, Tennessee of Highly Enriched Uranium Acquired from Kazakhstan by the United States* (DOE/EA 1006) (DOE 1994) and the *Environmental Assessment for the Transportation of Highly Enriched Uranium from the Russian Federation to the Y-12 National Security Complex and Finding of No Significant Impact* (DOE/EA-1271) (DOE 2004b). These analyses conclude that in the case of an accident there could be some loss of marine life to organisms directly exposed to the uranium. However, as a result of the large volumes of water, the mixing mechanisms within it, the existing background uranium concentrations, and the radiation-resistance of aquatic organisms, the radiological impact of an accident would be localized and of minor impact.

It is also possible that a ship containing LEU could pass through an area known to be routinely inhabited by the right whale, an endangered species. There are two identified habitats for this species: one located mainly off the coast of Massachusetts and one off the coasts of Florida and Georgia (66 FR 58066; November 20, 2001). Before a ship enters such an area, it is required to contact the Mandatory Ship Reporting System operated by the U.S. Coast Guard and endorsed by the International Maritime Organization to report its name, call sign, location, course, speed, destination, and route. This system reduces the likelihood of a ship striking a right whale by providing ships in the area with contact information for data on the most recent whale sightings and avoidance procedures that could prevent a collision (DOE 2006).

[7] The actual number of annual commercial LEU shipments is considered sensitive information. However, the seven additional LEU shipments that could result under the proposed action would represent only a small fraction of the total LEU commercially transported overseas each year.

4.4 Waste Management

Down-blending surplus HEU to LEU generates LLW, mixed LLW, hazardous waste, and nonhazardous waste. The *HEU EIS* analyses identified that generation of such wastes would not greatly impact the waste management infrastructure at any of the blending sites. Similarly, the proposed use of higher U-235-enriched HEU feedstock or UO_3 as alternate blendstock would not measurably affect waste generation. Because the overall down-blending processes have not changed and the down-blending rates remain within the parameters evaluated in the *HEU EIS*, the amounts of wastes generated annually at each of the blending sites as a result of the SA proposed action would be similar to those previously analyzed. Accordingly, the offsite transportation of down-blending process wastes are also expected to be similar to those analyzed in the *HEU EIS*.

The *HEU EIS* proposed action considers down-blending at least 30 metric tons of surplus HEU to 0.9 percent-enrichment LEU for disposal as LLW. Establishing a new disposal pathway for surplus HEU discard material through direct disposal would reduce the volume of waste to be disposed of, compared to first down-blending the surplus HEU to 0.9 percent-enrichment LEU and then disposing of it as LLW as evaluated in the *HEU EIS*. It would also reduce the total campaign impacts presented in the *HEU EIS* that are associated with transporting substantial quantities of resulting LLW to a DOE or commercial LLW management facility. On a per unit basis, down-blending HEU to LEU for commercial use would reduce LLW and nonhazardous waste, although the total quantities of mixed LLW and hazardous waste would increase due to the addition of a purification process required to meet fuel specifications.

Considering the additional down-blending increment afforded under the *HEU EIS* analyses by not down-blending surplus HEU discard materials to waste, the proposed disposition of new quantities of HEU would exceed the envelope analyzed in the *HEU EIS* by approximately only 20 metric tons, corresponding to an approximate 10 percent increase in waste management impacts. However, the timeframe for disposition of all the additional HEU would likely extend for several decades. Because the incremental impacts associated with disposition of this additional material would be incurred over this extended timeframe, no discernable increase in annual impacts is expected.

4.5 Environmental Justice

As described in **Sections 4.2** and **4.3**, potential health impacts to surrounding populations resulting from associated normal operations, facility accidents, and transportation activities would continue to be low. Therefore, it is unlikely that disproportionate adverse impacts to minority and low-income populations would result from the proposed action considered in this SA.

4.6 Sabotage or Terrorist Attack

In the aftermath of September 11, 2001, DOE/NNSA and NRC have implemented measures to minimize the risk and consequences of potential terrorist attacks on DOE and NRC-licensed facilities. The safeguards applied to protecting Y–12, BWXT, NFS, and SRS involve a dynamic process of enhancement to meet threats; these safeguards will evolve over time. It is not possible to predict whether intentional attacks would occur at the sites addressed in this SA, or the nature or types of such attacks. Nevertheless, DOE/NNSA and NRC, as appropriate, have re-evaluated security scenarios involving malevolent, terrorist, or intentionally destructive acts at Y–12, BWXT, NFS, and SRS to assess potential vulnerabilities and identify improvements to security procedures and response measures (Brooks 2004; NRC 2002, 2003c). Security at these facilities is a critical priority for both DOE/NNSA and NRC, which continue to identify and implement measures to defend and deter attacks against them. DOE/NNSA and NRC maintain a system of regulations, orders, programs, guidance, and training that form the basis for maintaining, updating, and testing site security to preclude and mitigate any postulated terrorist actions (Brooks 2004; NRC 2007a–c). The conservative assumptions inherent in the accidents analyzed in **Section 4.2.2** for Y–12, BWXT, NFS, and SRS assume initiation by natural events, equipment failure, or inadvertent worker actions. These same events could be caused by intentional malevolent acts by one or more saboteurs or terrorists. For example, a criticality could be purposefully created, or high explosives

could be used to damage buildings in the same way as an earthquake. However, the resulting radiological release and consequences to workers and the public would be similar, regardless of the nature of the initiating event.

The site physical security protection strategy is based on a graded and layered approach supported by an armed guard force that is trained to detect, deter, and neutralize adversary activities and is backed up by local, state, and Federal law enforcement agencies. The sites use both staffed and automated access-control systems to limit entry into areas and/or facilities to authorized individuals. Automated access-control systems use controlled booths, turnstiles, doors, and gates. Escorting requirements provide access controls for visitors. Barriers, electronic surveillance systems, and intrusion detection systems form a comprehensive site-wide network of monitored alarms. Various types of barriers would delay, channel personnel, or deny access to classified matter, HEU, LEU, and vital areas. Barriers direct the flow of vehicles and deter and/or prevent penetration by motorized vehicles where they could significantly increase the likelihood of a successful malevolent act. Some barriers are passive and would require the use of special tools and high explosives to penetrate them. Other barriers have an active component designed to dispense an obscuration agent, viscous barrier, or sensory irritant. Tamper-protected surveillance, intrusion detection, and alarm systems designed to detect an adversary action or anomalous behavior inside and outside the facilities are paired with assessment systems that evaluate the nature of the adversary action. Random patrols and visual observation are also used to deter and detect intrusions. Penetration-resistant, alarmed vaults and vault-type rooms are used to protect classified materials.

There is also a potential for attempted sabotage or terrorist attacks during transport. As such, transportation activities would incorporate existing physical safeguards aimed at protecting the public from harm, including SST/SafeGuards Transport (SST/SGT) for inter-site transport of HEU and enhanced monitoring and coordination of commercial transport of LEU to minimize the possibility of sabotage and facilitate recovery of shipments that could come under control of unauthorized persons. The safety features of the transportation casks that provide containment, shielding, and thermal protection also protect against sabotage. Although it is not possible to predict the occurrence of sabotage or terrorism or the exact nature of such events if they were to occur, DOE/NNSA has previously examined several transportation accident scenarios that would have the types of consequences that could result from such acts in the *FRR SNF EIS* (DOE 1996c). However, because the materials being considered for transport under this SA would have substantially less total radioactivity than those analyzed in the *FRR SNF EIS*, the corresponding impacts resulting from such events would be much lower.

5.0 CONCLUSION

In accordance with CEQ regulations 40 CFR 1502.9(c) and DOE regulations 10 CFR 1021.314(c), this SA evaluates ongoing and proposed surplus HEU disposition program activities to determine whether the *HEU EIS* should be supplemented, a new EIS should be prepared, or no further NEPA documentation is necessary.

Based on the analyses in this SA, continued implementation of ongoing disposition activities and the addition of new disposition initiatives described herein would not substantially change the environmental impacts from those described in the *HEU EIS*. Although some relatively large percentage increases to certain impacts presented in the *HEU EIS* have been identified, they represent only small changes to these impacts in absolute terms. Therefore, the activities evaluated in this SA do not represent substantial changes in any proposed actions or result in any new circumstances relevant to environmental concerns.

Proposed down-blending processes and rates would remain within the parameters evaluated in the *HEU EIS*; therefore, similar annual non-radiological emissions, waste generation, and transportation activities associated with ongoing surplus HEU disposition activities are expected. Projected radiological risks from normal operations and facility accidents to both workers and the public would increase from

those presented in the *HEU EIS* as a result of incorporating the higher average U-235 enrichment of the HEU now proposed for down-blending, updated population statistics, and larger dose-to-LCF-risk factors. However, operation of surplus HEU disposition facilities continues to pose no more than a small risk to human health, and no new or different bounding accident scenarios have been identified. Transportation activities supporting the Reliable Fuel Supply Initiative would add small additional impacts associated with transfer activities at the port of departure, and impacts of associated additional overseas shipments on the global commons would be negligible. Although proposed down-blending of additional HEU would increase total campaign impacts by approximately 10 percent, these additional impacts would be distributed over an expanded timeframe and continue to be well within applicable DOE limits and each site's capacity to manage.

6.0 DETERMINATION

The analyses in this SA indicate that the activities and potential environmental impacts associated with ongoing activities and proposed new initiatives supporting the DOE/NNSA disposition program for surplus HEU do not constitute substantial changes in the proposed action that are relevant to environmental concerns. Similarly, no significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts have been identified. Therefore, pursuant to 10 CFR 1021.314(c), no additional NEPA analyses are required.

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all ages, male, cancer site: breast 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	1.4	1.2	1.6	176
TN: Carter County (47019)	0.6	0	3.6	1
TN: Greene County (47059)	1.2	0.1	4.7	2
TN: Sullivan County (47163)	1.3	0.5	3.1	6
TN: Unicoi County (47171)	1.7	0	11.5	1
TN: Washington County (47179)	2.5	0.9	5.5	6

Rates are per 100,000 and age-adjusted to the 2000 US

Cell surpression rule is not applied.

all ages, cancer site: soft tissue including heart 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	2.8	2.6	3	832
TN: Carter County (47019)	2.3	1	4.7	8
TN: Greene County (47059)	2.6	1.2	4.8	10
TN: Sullivan County (47163)	2.7	1.8	4.1	26
TN: Unicoi County (47171)	2.4	0.5	7.9	3
TN: Washington County (47179)	3.8	2.3	5.7	22

Rates are per 100,000 and age-adjusted to the 2000 US

Cell surpression rule is not applied.

all ages, cancer site: myeloma 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	5.3	5	5.5	1,610
TN: Carter County (47019)	3.9	2	6.7	13
TN: Greene County (47059)	5.5	3.4	8.4	22
TN: Sullivan County (47163)	6.2	4.8	8	62
TN: Unicoi County (47171)	4.7	1.7	11	6
TN: Washington County (47179)	5.2	3.5	7.3	32

Rates are per 100,000 and age-adjusted to the 2000 US

Cell surpression rule is not applied.

Children age <=19, Leukemia 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	40.4	36.1	45	322
TN: Carter County (47019)	76.7	24.8	179.1	5
TN: Greene County (47059)	24.6	3	90.6	2
TN: Sullivan County (47163)	33.7	12.3	73.4	6
TN: Unicoi County (47171)	54.2	1.4	294.3	1
TN: Washington County (47179)	22.7	4.7	66.3	3

Rates are per 1,000,000 and age-adjusted to the 2000
- User standard; Confidence intervals (Tiwari mod) are 9

Cell surpression rule is not applied.

Children age <=19 Brain tumor 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	27.2	23.7	31.1	216
TN: Carter County (47019)	12.8	0.3	78.4	1
TN: Greene County (47059)	25.2	3	92	2
TN: Sullivan County (47163)	50.8	23.2	96.5	9
TN: Unicoi County (47171)	0	0	19	0
TN: Washington County (47179)	21.7	4.5	64	3

Rates are per 1,000,000 and age-adjusted to the 2000 - User standard; Confidence intervals (Tiwari mod) are 9

Cell surpression rule is not applied.

all ages, male, cancer site: breast 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	1.4	1.2	1.6	176
TN: Carter County (47019)	*	*	*	*
TN: Greene County (47059)	*	*	*	*
TN: Sullivan County (47163)	*	*	*	*
TN: Unicoi County (47171)	*	*	*	*
TN: Washington County (47179)	*	*	*	*

Rates are per 100,000 and age-adjusted to the 2000 US

Cell surpression rule is not applied.

all ages, cancer site: soft tissue including heart 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	2.8	2.6	3	832
TN: Carter County (47019)	*	*	*	*
TN: Greene County (47059)	2.6	1.2	4.8	10
TN: Sullivan County (47163)	2.7	1.8	4.1	26
TN: Unicoi County (47171)	*	*	*	*
TN: Washington County (47179)	3.8	2.3	5.7	22

Rates are per 100,000 and age-adjusted to the 2000 US

Cell surpression rule is not applied.

all ages, cancer site: myeloma 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	5.3	5	5.5	1,610
TN: Carter County (47019)	3.9	2	6.7	13
TN: Greene County (47059)	5.5	3.4	8.4	22
TN: Sullivan County (47163)	6.2	4.8	8	62
TN: Unicoi County (47171)	*	*	*	*
TN: Washington County (47179)	5.2	3.5	7.3	32

Rates are per 100,000 and age-adjusted to the 2000 US

Cell surpression rule is not applied.

Children age <=19, Leukemia 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	40.4	36.1	45	322
TN: Carter County (47019)	*	*	*	*
TN: Greene County (47059)	*	*	*	*
TN: Sullivan County (47163)	*	*	*	*
TN: Unicoi County (47171)	*	*	*	*
TN: Washington County (47179)	*	*	*	*

Rates are per 1,000,000 and age-adjusted to the 2000
- User standard; Confidence intervals (Tiwari mod) are 9

Cell surpression rule is not applied.

Children age <=19 Brain tumor 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	27.2	23.7	31.1	216
TN: Carter County (47019)	*	*	*	*
TN: Greene County (47059)	*	*	*	*
TN: Sullivan County (47163)	*	*	*	*
TN: Unicoi County (47171)	*	*	*	*
TN: Washington County (47179)	*	*	*	*

Rates are per 1,000,000 and age-adjusted to the 2000 - User standard; Confidence intervals (Tiwari mod) are 9

Cell surpression rule is not applied.

all ages Bone cancer 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	0.9	0.8	1	272
TN: Carter County (47019)	^	^	^	^
TN: Greene County (47059)	^	^	^	^
TN: Sullivan County (47163)	^	^	^	^
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	^	^	^	^

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

^ Statistic not displayed due to fewer than 10 cases.

Age>=20 Bone cancer 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	1	0.8	1.1	206
TN: Carter County (47019)	^	^	^	^
TN: Greene County (47059)	0	0	1.5	0
TN: Sullivan County (47163)	^	^	^	^
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	^	^	^	^

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

^ Statistic not displayed due to fewer than 10 cases.

all ages Brain 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	6.6	6.3	6.9	1998
TN: Carter County (47019)	6.6	4.1	10.1	22
TN: Greene County (47059)	6.8	4.3	10.1	25
TN: Sullivan County (47163)	7.3	5.5	9.4	61
TN: Unicoi County (47171)	11.4	6	20.1	13
TN: Washington County (47179)	6.8	4.8	9.2	40

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

Age>=20 Brain 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	8.1	7.7	8.5	1778
TN: Carter County (47019)	8.8	5.4	13.5	21
TN: Greene County (47059)	8.5	5.3	12.9	23
TN: Sullivan County (47163)	8.2	6.1	10.8	52
TN: Unicoi County (47171)	16	8.4	27.8	13
TN: Washington County (47179)	8.6	6	11.9	37

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

All ages Stomach 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	5.6	5.3	5.8	1694
TN: Carter County (47019)	3.9	2	6.7	13
TN: Greene County (47059)	5.3	3.2	8.2	21
TN: Sullivan County (47163)	5.5	4.2	7.2	57
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	5	3.4	7.1	32

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

^ Statistic not displayed due to fewer than 10 cases.

age>=20 Stomach 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	7.8	7.4	8.2	1693
TN: Carter County (47019)	5.4	2.9	9.3	13
TN: Greene County (47059)	7.4	4.6	11.4	21
TN: Sullivan County (47163)	7.8	5.9	10.1	57
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	7	4.8	9.9	32

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

^ Statistic not displayed due to fewer than 10 cases.

all ages thyroid 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	8.9	8.6	9.3	2708
TN: Carter County (47019)	6.5	3.9	10	20
TN: Greene County (47059)	5.6	3.4	8.7	20
TN: Sullivan County (47163)	9.1	7.1	11.5	73
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	8.9	6.6	11.7	51

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

^ Statistic not displayed due to fewer than 10 cases.

Adult age>=20 thyroid 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	12.3	11.8	12.8	2,665
TN: Carter County (47019)	9.1	5.5	14	20
TN: Greene County (47059)	7.8	4.7	12.1	20
TN: Sullivan County (47163)	12.6	9.8	15.9	72
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	12.2	9	16.1	50

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

^ Statistic not displayed due to fewer than 10 cases.

all ages Non-Hodgkins Lymphoma 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	17.6	17.1	18	5367
TN: Carter County (47019)	13.5	9.9	18.1	47
TN: Greene County (47059)	18.7	14.6	23.7	73
TN: Sullivan County (47163)	19.9	17.1	22.9	193
TN: Unicoi County (47171)	19	12	29.1	23

TN: Washington County (47179)	18.7	15.5	22.4	120

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

age>=20 Non-Hodgkins Lymphoma 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	24.3	23.6	24.9	5,292
TN: Carter County (47019)	19	13.9	25.3	47
TN: Greene County (47059)	25.8	20.1	32.6	72
TN: Sullivan County (47163)	27.6	23.8	31.9	192
TN: Unicoi County (47171)	26.6	16.8	40.5	23
TN: Washington County (47179)	26.3	21.8	31.5	120

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -
- User standard; Confidence intervals (Tiwari mod) are 95% for rates.

all ages colorectal cancer 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	49.4	48.6	50.2	15,105
TN: Carter County (47019)	39.4	33.1	46.8	136
TN: Greene County (47059)	44.2	37.8	51.4	173
TN: Sullivan County (47163)	44.7	40.6	49.2	437
TN: Unicoi County (47171)	41.6	31	55.1	52
TN: Washington County (47179)	46.4	41.3	52.1	295

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

Adult age>=20 colorectal cancer 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	69.2	68.1	70.3	15,097
TN: Carter County (47019)	55.3	46.3	65.5	136
TN: Greene County (47059)	61.9	53	72	173
TN: Sullivan County (47163)	62.7	56.9	69	437
TN: Unicoi County (47171)	58.3	43.5	77	52
TN: Washington County (47179)	65.1	57.8	73	295

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

all ages female breast cancer 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	116.8	114.9	118.2	19,644
TN: Carter County (47019)	80.4	67.8	94.8	148
TN: Greene County (47059)	117.1	102.7	133	248
TN: Sullivan County (47163)	116.6	107.3	126.6	605
TN: Unicoi County (47171)	133.2	104.4	168	79
TN: Washington County (47179)	121.6	110	134.2	409

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

Adult age>=20 female breast cancer 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	163.4	161.1	165.7	19,638
TN: Carter County (47019)	112.7	95	132.8	148
TN: Greene County (47059)	164.1	144.1	186.3	248
TN: Sullivan County (47163)	163.6	150.5	177.5	605
TN: Unicoi County (47171)	186.8	146.5	235	79
TN: Washington County (47179)	170.5	154.2	188.1	409

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -
- User standard; Confidence intervals (Tiwari mod) are 95% for rates.

all ages Leukemia 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	10.4	10	10.7	3,113
TN: Carter County (47019)	11.6	8.1	16.1	37
TN: Greene County (47059)	10.4	7.3	14.3	38
TN: Sullivan County (47163)	9.1	7.3	11.3	87
TN: Unicoi County (47171)	12.4	6.6	21.6	14
TN: Washington County (47179)	13.1	10.3	16.3	81

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

Adult age >=20 Leukemia 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	12.9	12.4	13.4	2,791
TN: Carter County (47019)	13.1	9	18.6	32
TN: Greene County (47059)	13.6	9.5	18.9	36
TN: Sullivan County (47163)	11.4	9.1	14.3	81
TN: Unicoi County (47171)	15.3	8	26.7	13
TN: Washington County (47179)	17.4	13.7	21.7	78

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -
- User standard; Confidence intervals (Tiwari mod) are 95% for rates.

all ages all cancer sites 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	440.7	438.4	443.1	135,838
TN: Carter County (47019)	328.2	309.1	348.1	1,131
TN: Greene County (47059)	428.8	408.3	450.1	1,675
TN: Sullivan County (47163)	458	444.5	471.8	4,461
TN: Unicoi County (47171)	398	362.3	436.4	472
TN: Washington County (47179)	434.2	418	450.9	2,730

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

age>=20 all cancer sites 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	611.8	608.5	615.1	134,599
TN: Carter County (47019)	454.7	428.2	482.3	1,122
TN: Greene County (47059)	596.3	567.7	626	1,665
TN: Sullivan County (47163)	635.5	616.7	654.7	4,431
TN: Unicoi County (47171)	551.9	502.4	605.1	469
TN: Washington County (47179)	602.6	580	625.9	2,709

Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups -

age<=19 all cancer sites 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	155.2	146.7	164.1	1,239
TN: Carter County (47019)	^	^	^	^
TN: Greene County (47059)	124.4	59.6	229.7	10
TN: Sullivan County (47163)	166.8	112.5	238.3	30
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	156.5	96.8	239.4	21

Rates are per 1,000,000 and age-adjusted to the 2000 US Std Population (19 age groups

Children age <=19 Leukemia 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	40.4	36.1	45	322
TN: Carter County (47019)	^	^	^	^
TN: Greene County (47059)	^	^	^	^
TN: Sullivan County (47163)	^	^	^	^
TN: Unicoi County (47171)	^	^	^	^
TN: Washington County (47179)	^	^	^	^

Rates are per 1,000,000 and age-adjusted to the 2000 US Std Population (19 age groups - User standard; Confidence intervals (Tiwari mod) are 95% for rates.

^ Statistic not displayed due to fewer than 10 cases.

Children age <=19 Brain tumor 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	27.2	23.7	31.1	216
TN: Carter County (47019)	^	^	^	^
TN: Greene County (47059)	^	^	^	^
TN: Sullivan County (47163)	^	^	^	^

TN: Unicoi County (47171)	0	0	19	0
TN: Washington County (47179)	^	^	^	^

Rates are per 1,000,000 and age-adjusted to the 2000 US Std Population (19 age groups - User standard; Confidence intervals (Tiwari mod) are 95% for rates.

^ Statistic not displayed due to fewer than 10 cases.

Children age <=19 Bone tumor 2002-2006

	Rate	Lower CI	Upper CI	Count
Tennessee	8.3	6.4	10.6	66
TN: Carter County (47019)	0	0	5.6	0
TN: Greene County (47059)	^	^	^	^
TN: Sullivan County (47163)	0	0	2.1	0
TN: Unicoi County (47171)	0	0	19	0
TN: Washington County (47179)	0	0	2.8	0

Rates are per 1,000,000 and age-adjusted to the 2000 US Std Population (19 age groups - User standard; Confidence intervals (Tiwari mod) are 95% for rates.

^ Statistic not displayed due to fewer than 10 cases.

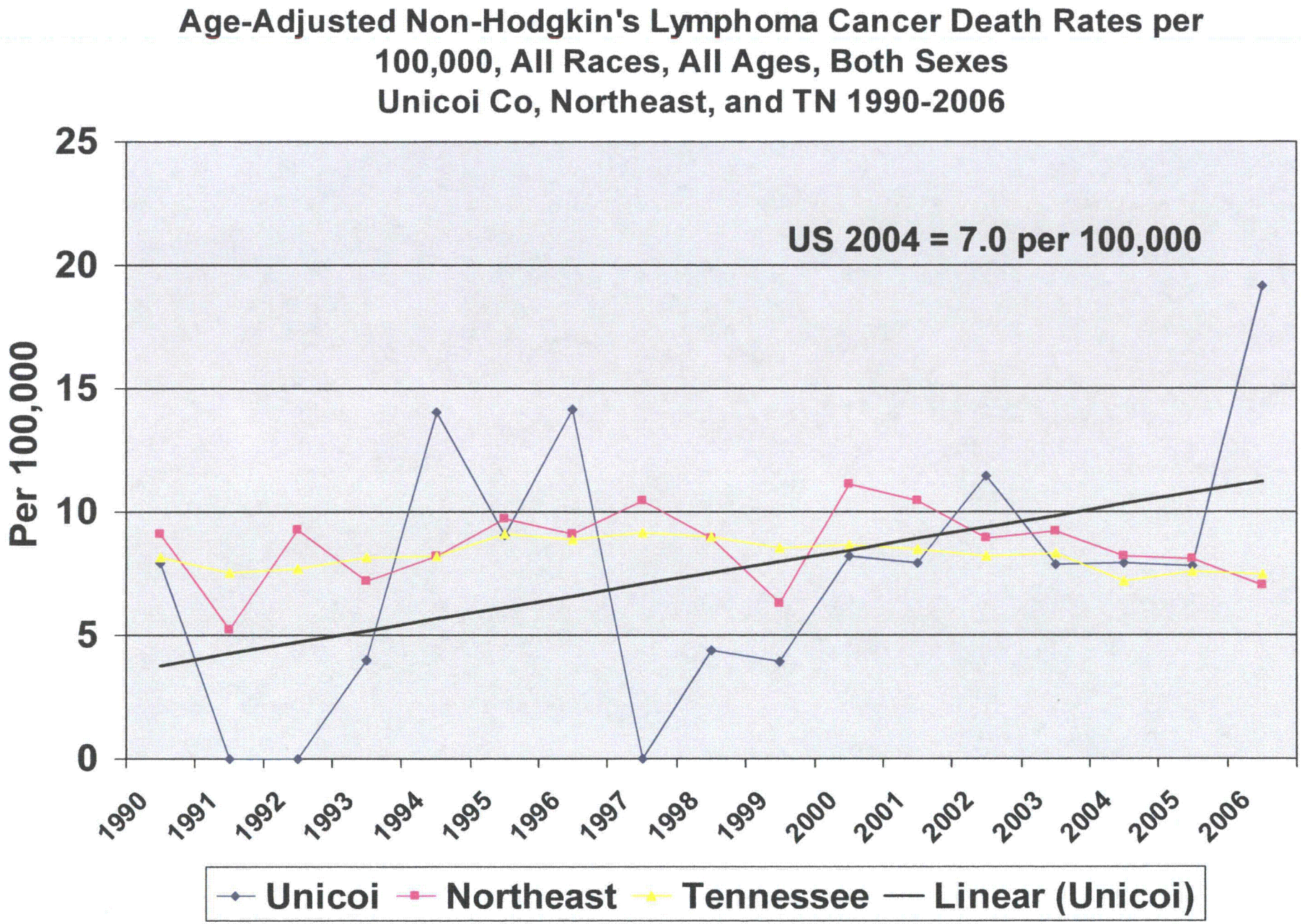
Unicoi County Cancer Information

Incidence and Mortality Data 1990-2006 (where available)

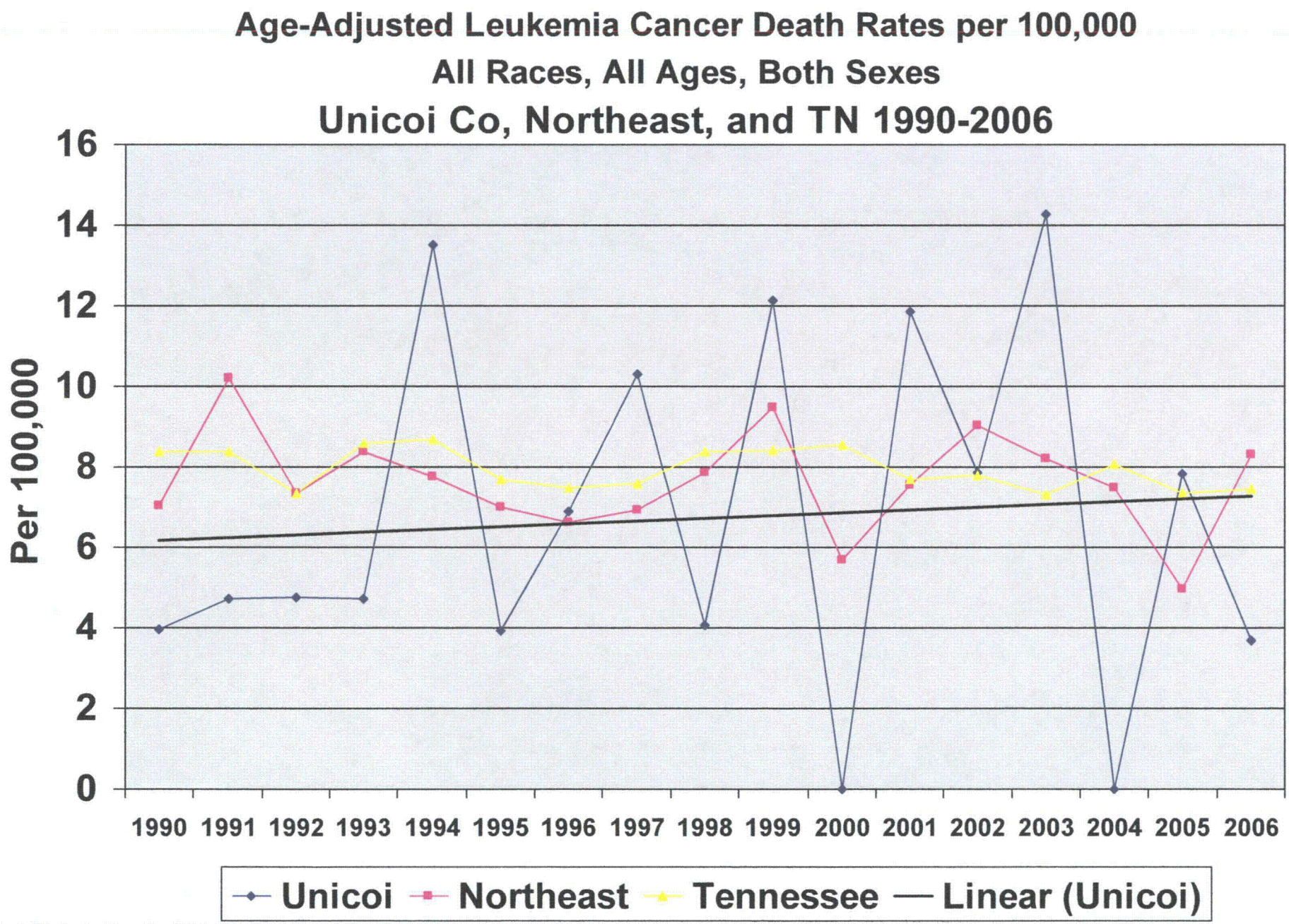
La'Shan D. Taylor MS, MPH

Environmental Epidemiologist

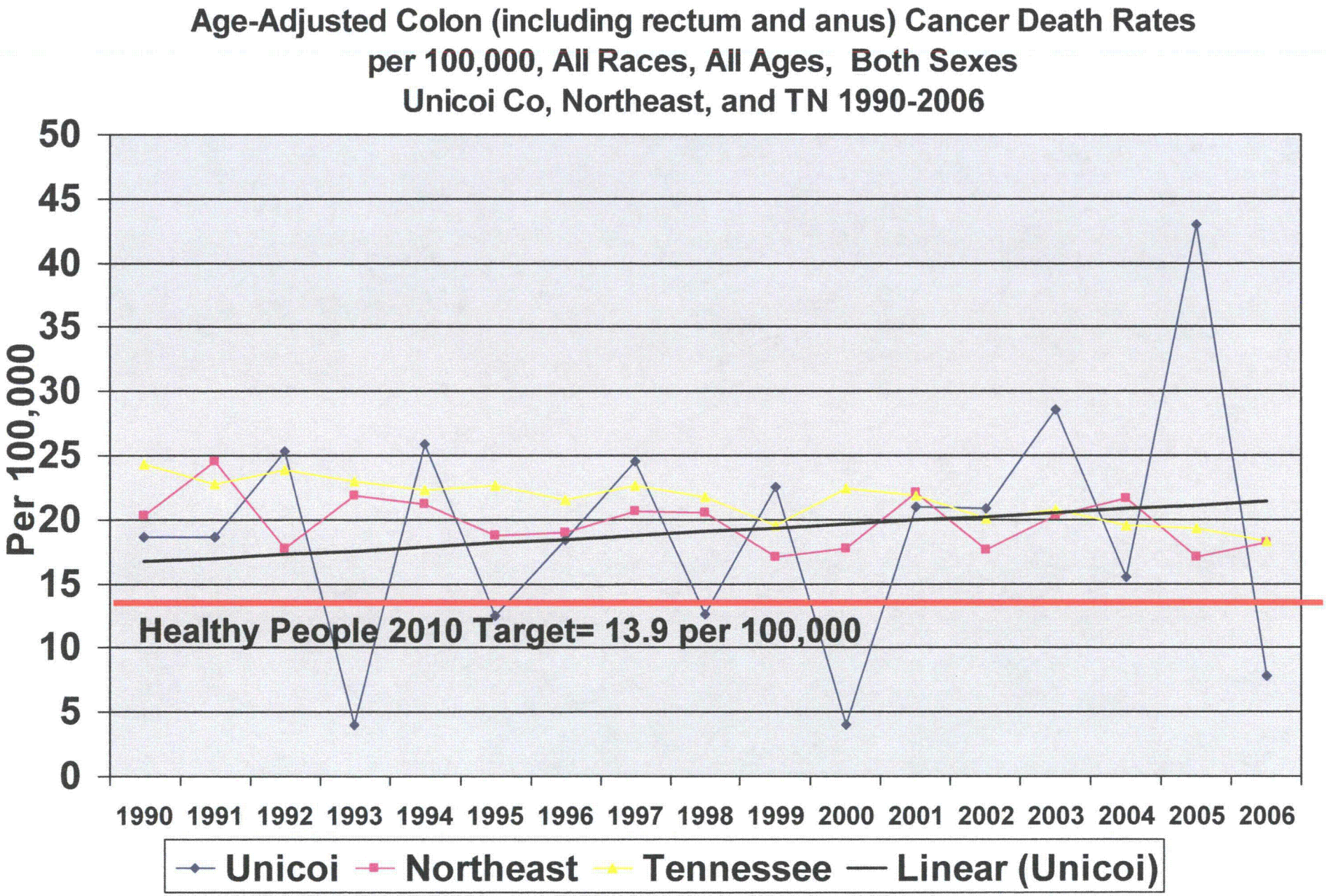
Northeast Tennessee Regional Health Office



Age Adjusted using the 2000 Standard Population (2003 Estimation Method)
Source: Death Certificate Data (Tennessee Resident Data) Tennessee Department of Health

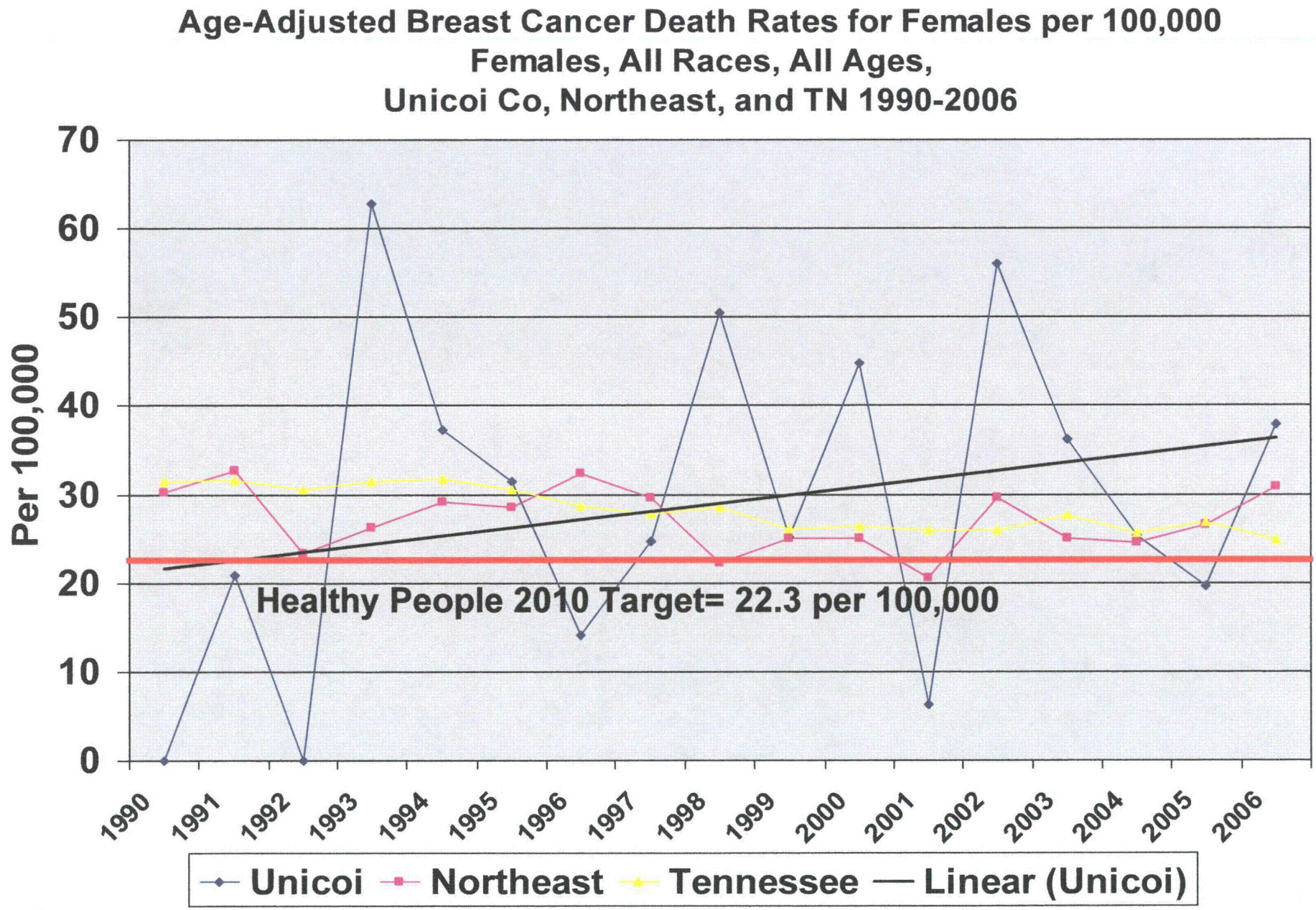


Age Adjusted using the 2000 Standard Population (2003 Estimation Method)
Source: Death Certificate Data (Tennessee Resident Data) Tennessee Department of Health



Age Adjusted using the 2000 Standard Population (2003 Estimation Method)

Source: Death Certificate Data (Tennessee Resident Data) Tennessee Department of Health



Age Adjusted using the 2000 Standard Population (2003 Estimation Method)
Source: Death Certificate Data (Tennessee Resident Data) Tennessee Department of Health

Wilson Family
(4 deaths)
Esophageal - Wilson, Sr.
Colon - Mrs. B E Wilson
Stomach - B E Wilson, Jr.
Skin - Paul Wilson

Griffith
Lung - Mary Griffith
(non-smoker)

Powers Family
Leukemia - Glavis
Colon - Chloe

Willa Early's Sister
Non-Hodkins Lymphoma - sister

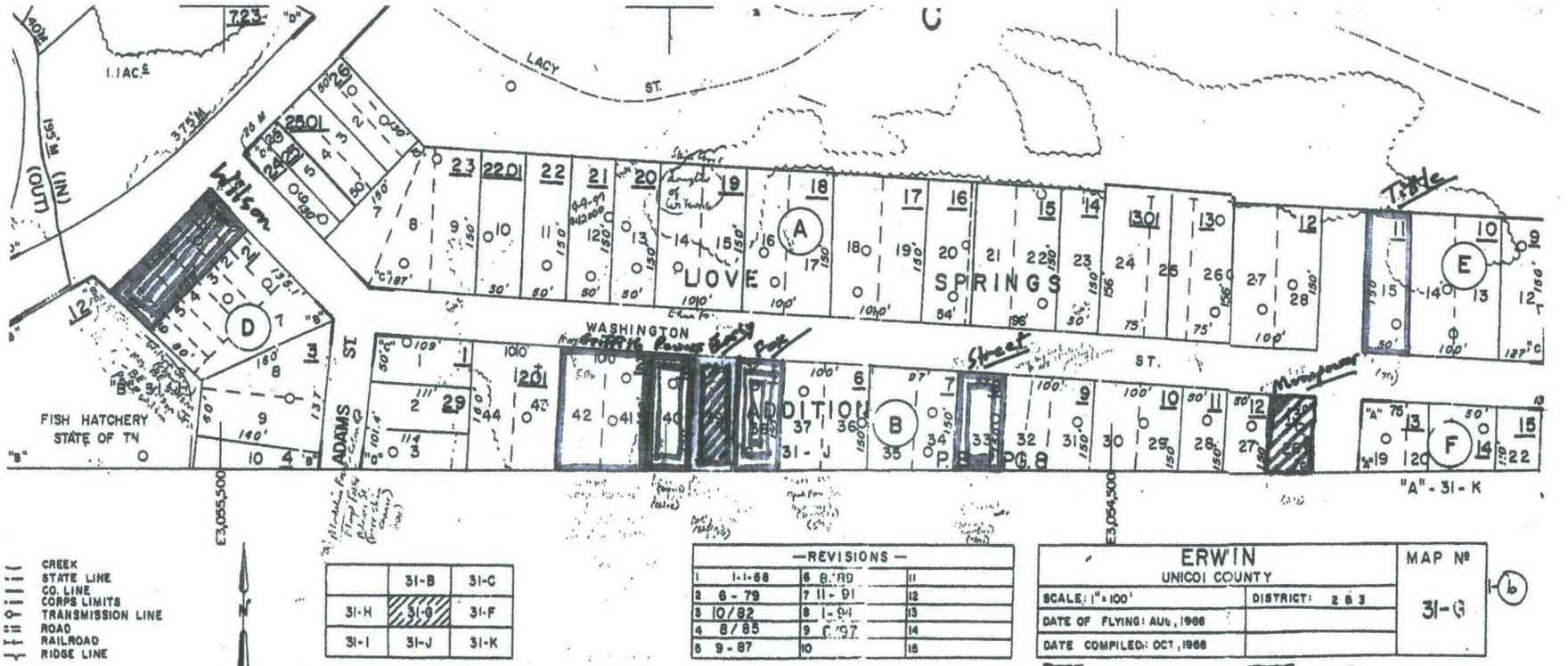
Willa Early
(survivor)
Colon - Willa

Fox Family
(3 deaths)
Lung
Stomach
Breast

Street Family
Head + Neck
Throat Cancer (?)

Tittle
Stomach cancer

Mumpower
(survivor)
Stomach



Preparers: Modica + Wallack
Date: 2006
Revised: 01 July 2009

Washington St. Cancers

= Cancer Death

= Cancer Survivor

Figure 13A.3

Quarterly Offsite Dose - External

Value/Goal Supported

H,S & Env. Compliance
Enhance Image with NRC

Metric Formula

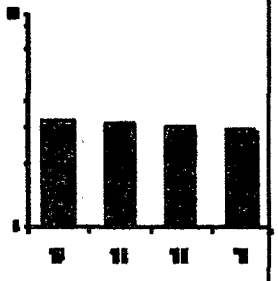
Maximum net external dose (deep-dose equivalent in units of mrem) based on the highest dosimeter measurement at or beyond NFS' property boundaries. These values have been adjusted to account for occupancy, per the specifications of procedure NFS-HS-A-82.

Notes

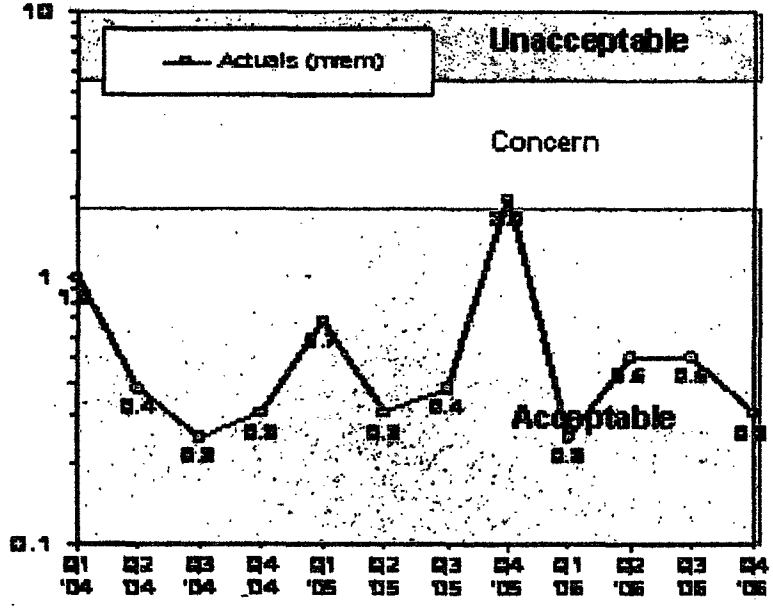
Based on methods described in procedure NFS-HS-A-82.

Historical Annual Total (mrem)

Annual Statistical Data (mrem)



Current Performance



Enhancement Plans

Additional dosimeters placed 03/06 as diagnostic tools around locations of interest

Benchmarks

None identified at this time

Company Confidential

(ML082660148)

Figure 13A.3

Metric Title

Quarterly Offsite Dose - External

Value/Goal Supported

H,S & Env. Compliance
Enhance Image with NRC

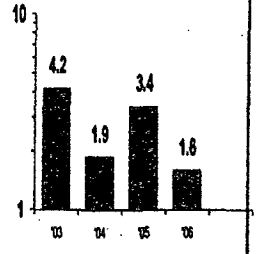
Metric Formula

Maximum net external dose (deep-dose equivalent in units of mrem) based on the highest dosimeter measurement at or beyond NFS' property boundaries. These values have been adjusted to account for occupancy, per the specifications of procedure NFS-HS-A-82.

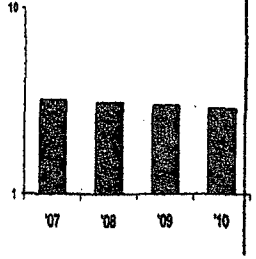
Notes

Based on methods described in procedure NFS-HS-A-82.

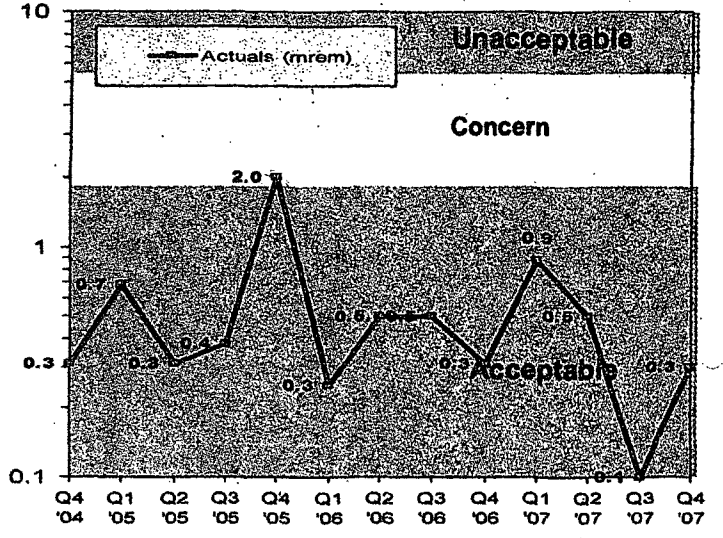
Historical Annual Total (mrem)



Annual Stretch Goals (mrem)



Current Performance



Company Confidential

Enhancement Plans

None identified at this time

Benchmarks

None identified at this time

Figure 13A.4

NFS, Changes to Part II of SNM-124 Reflecting Changes Made During Calendar Year 2008, January 27, 2009, Appendix A, Page 39. (ML091060514)

Figure 13A.4

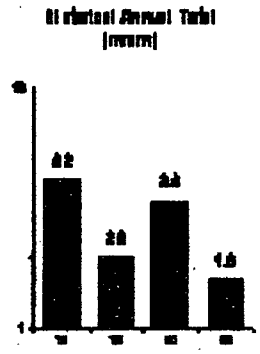
Offsite Total Effective Dose Equivalent (TEDE)

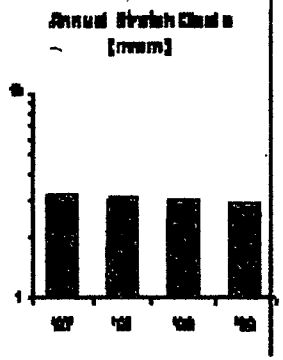
Value/Goal Supported

H,S & Env. Compliance
Enhance Image with NRC

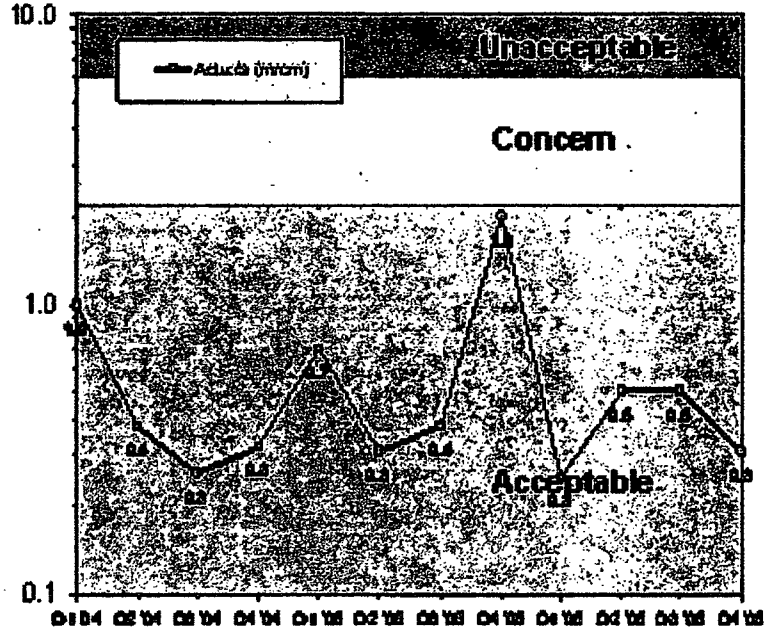
Metric Formula

The TEDE to the maximally exposed individual (MEI) from all effluent pathways (i.e. gaseous, liquid and ambient radiation) regardless of location. This calculated dose is very conservative because the MEI locations for each of these effluent pathways are normally very different from each other, such that a single individual would never receive the entire estimated dose.





Current Performance



Enhancement Plans

None identified at this time

Benchmarks

None identified at this time

Company Confidential

(ML082660148)

Metric Title

Offsite Total Effective Dose Equivalent (TEDE)

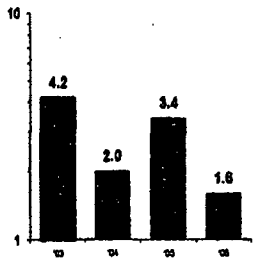
Value/Goal Supported

H,S & Env. Compliance
Enhance Image with NRC

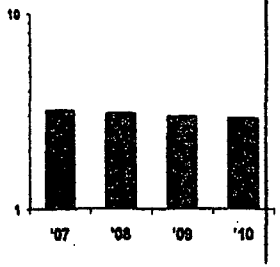
Metric Formula

The TEDE to the maximally exposed individual (MEI) from all effluent pathways (i.e. gaseous, liquid and ambient radiation) regardless of location. This calculated dose is very conservative because the MEI locations for each of these effluent pathways are normally very different from each other, such that a single individual would never receive the entire estimated dose.

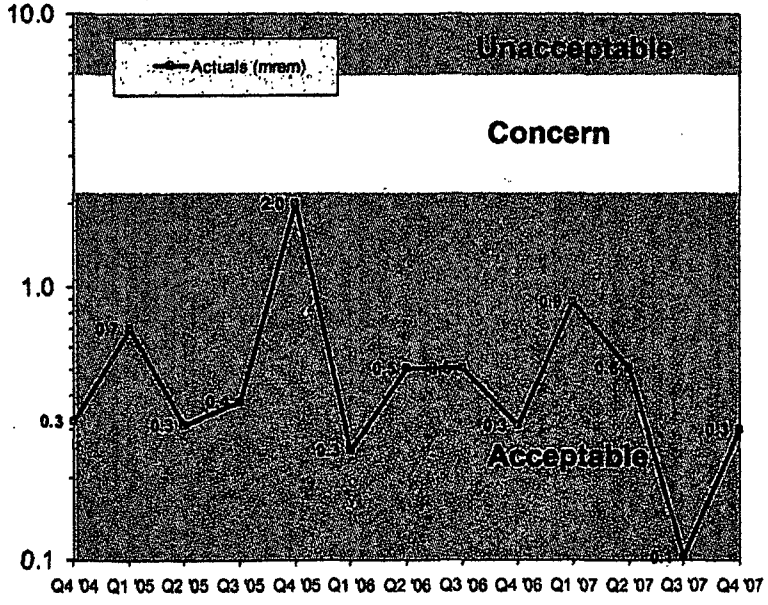
Historical Annual Total (mrem)



Annual Stretch Goals (mrem)



Current Performance



Company Confidential

Enhancement Plans

None identified at this time

Benchmarks

None identified at this time

NFS – Erwin Site

2007 Independent Safety Culture Assessment

RESULTS REPORT—February 16, 2008

EXCERPTS

Decision Making: The site does not consistently meet regulatory expectations with respect to conservatism in decision making. In this regard the SCUBA Team has concluded that:

- Examples exist where the process was hurried or shortcuts were taken—particularly when continued production was at stake.
- NFS does not have a systematic, rigorous and formalized system for making operational decisions when risk-significant or safety-significant issues arise.
- Decisions are not consistently developed with the requisite degree of conservatism, particularly when a potential for personal injury is involved.
- **Communication of the bases for key decisions affecting safety is in many instances untimely, insufficient or lacking**. (p.24)
- **NFS lacks an appropriate focus on conservatism when making decisions. Too frequently, operations focus has come to be interpreted as production focus. The basic premise for going forward with any safety-significant or risk- significant activity should be that it has been shown it is safe to proceed as planned, rather than it is acceptable to proceed unless it can be proven it is unsafe to do so.** (p. 25) Reasons for significant decisions related to nuclear safety and safe facility operations are not effectively communicated to the workforce by management.

Personnel Interviews, Behavioral Observations, and Documentation Reviews: Some examples include—

- The site lacks a procedure that defines the operational decision-making process when risk-significant or safety-significant issues arise.
- **There are occasions when non-conservative decisions are made in the field in order to allow continued production.**
- **A recent decision, made on the part of a fuel area supervisor, was to continue a production run although he knew there was uncertainty as to whether there was a violation of**

operating procedures. The motivation was to avoid jeopardizing the production run and the resultant loss of production.

- Information obtained from employee interviews indicates that employees rarely understand the basis for decisions involving risk-significant or safety-significant situations. This is due to the lack of a communication tool for informing employees about key decisions. Information flows down the chain of authority with varying degrees of effectiveness.

- **Effectiveness reviews of safety-related decisions to verify validity of underlying assumptions, identify unintended consequences, and improve future decisions are not typically performed**. (p. 26)

Resources: This Safety Culture Component does not meet regulatory expectations. **The NFS organization has become accustomed to tolerating recurring equipment problems, operational burdens & workarounds, degraded equipment conditions and degraded infrastructure issues.** There are a number of situations that represent challenges to industrial/personnel safety. Organizational tolerance of such degraded conditions and the corresponding message that is sent with respect to management values and standards represents a deficiency with respect to industry standards and norms and the potential for adverse carryover effects on the organization's nuclear safety culture. **The SCUBA Team concluded that an embedded tolerance of degraded conditions raised significant concerns regarding the current general safety culture and the potential for carryover effects on nuclear safety.** Weaknesses or fragilities exists in the effectiveness of key supporting functions, programs and processes, the most notable of which are the shortage of project and process engineering expertise, and the inadequate support personnel for the Corrective Action, Quality Assurance/Self Assessment and Configuration Management Programs. (p. 28) In some cases, this additional staffing is needed to ensure that regulatory commitments and/or regulatory expectations are met. In the past, insufficient financial resources have been applied to meet NFS's facility infrastructure needs. **The current physical condition of the facility is considered to be deficient when compared to industry standards and norms**.

While it appears NFS has sufficient engineering resources to support safe operations of its nuclear facilities, these resources are frequently diverted to support new business opportunities. This has contributed to significant engineering work backlogs, tolerance of degraded equipment conditions, delays in resolving recurring equipment problems and delays in addressing facility infrastructure improvement needs. (p. 29)

Personnel Interviews, Behavioral Observations and Documentation Reviews: "The SCUBA Team has observed that NFS has historically provided sufficient resources to assure safe operations of its primary production facilities, particularly with respect to nuclear criticality considerations, but that such assurance has generally been at the "meet minimum regulatory requirements" level. Over the past few years, **rather than consistently focusing resources on pursuing improvements in its safety culture and its safety-related performance, NFS has been in a position of diverting its relatively scarce resources to address immediate situational challenges** (e.g., the workforce strike and the operational problems at the

BPF facility) **and/or to pursuing and responding to new business opportunities. Among other things, this has fostered a culture that tolerated degraded conditions.** Some examples are as follows:"

- ✓ A significant number of operator burdens/workarounds (some of which involve the use of administrative controls in lieu of engineering controls) as a response to degraded equipment conditions.

  A specific example is the venture scrubber in the fuel area that requires operators to make manual caustic additions for pH control because the automated system is not functional. This situation has existed so long the operating procedure has been modified to make the manual addition process the standard mode of operation. The original operating procedure only allowed manual additions for "off-normal" conditions." **This is clearly a case where industrial safety margin has been sacrificed in that operators must manually handle hazardous chemicals, and administrative controls have replaced engineered controls.**

- ✓ **The SCUBA Team has observed degraded conditions, some of which create industrial/personnel safety risk and some of which create risk to continued productions. An example of the former is the catastrophic failure of the waste water filter press, while an example of the latter is the HVAC fan system that services the MAA. In all cases, tolerance of these degraded conditions reinforce slower than desired management standards and contributes to a poor value system that has the potential to carry over into the nuclear safety culture.** The SCUBA Team has observed:

  - Recurring equipment problems that have not been corrected in a timely manner, such as the false alarms that have plagued the criticality alarm system.
  - Equipment problems that have become accepted on the basis of a **"run to failure" philosophy**, such as the frequent calciner high pressure interlock shutdowns in the fuel recycle area (approximately one week.)
  - Numerous plant infrastructure needs include roof replacements, HVAC system component replacements, selective process equipment replacements, paving, etc. (p.32)

NFS developed an infrastructure Improvement Plan in August 2007 to aid in the development of capital budgets. The plan identified a long list of problems that need to be fixed. A key issue is prioritizing this list so that degraded conditions including security, nuclear safety, personnel safety, and production capability are addressed in a timely manner commensurate with risk. It will also be necessary to ensure that engineering resources are available to execute this plan. This will require a planned approach that will likely include:

- Increasing the project engineering and processing staffs

- Freeing up process engineers to focus on operations-related activities
- Establishing relationships with larger contractors and constructors to facilitate execution of major projects

Based on the integration of all sources of assessment input, the SCUBA Team concluded that several other key NFS program, processes and functions needed to support a strong safety culture are not sufficiently staffed for success or to meet regulatory expectations. Additional resources will be needed to effectively implement several new programs, processes or functions designed to improve both safety culture and safety performance. **NFS has a reactive approach to preventive maintenance and tends to operate equipment until it fails.** (p. 33)

Work Control: The SCUBA Team has concluded that: **NFS does not have a comprehensive work management process/system to identify, prioritize, plan, schedule, manage risks and execute work.** The preventive maintenance program needs to be expanded. It is more reactive than proactive. **There is little or no equipment performance monitoring or equipment life-cycle management; and reliability-centered maintenance is not a focal point for the organization.** Industrial Safety oversight of site activities needs to be improved for the specific purpose of providing enhanced reinforcement of safety requirements. This is particularly important for contractor activities performed outside the Material Access Area (MAA). (p. 36) Industrial Safety oversight of maintenance, project, and contractor activities needs to be increased. **There is little or no Industrial Safety presence in these areas; thus, there is little reinforcement of safety requirements.** (p. 37)

Personnel Interviews, Behavioral Observations and Documentation Reviews: Reviews of the Work Order systems revealed there is typically a two to three week backlog of maintenance work orders, most of which are reactive and corrective action focused. This backlog does not include equipment issues where a Work Order has not yet been generated. Examples include work requests that are in queue for engineering support, and equipment that is in a degraded condition, but for which no corrective action request has been documented (that is, no Work Order, engineering work request, or PIRCS corrective action system entry has been generated.) It is not clear how many systems or how much equipment requires corrective action that has not been documented, but **there are multiple examples where degraded conditions have become a way of life and operations personnel have learned to live with and accommodate these degraded conditions**. Items Relied on For Safety (IROFS) and Safety Related Equipment (SRE) are identified along with any functional testing requirements. There is no systematic effort to identify other critical plant components, manage critical spare parts, or perform contingency planning. There is little or no effort expended in the area of equipment performance monitoring, equipment reliability improvement, or equipment life-cycle management. The overall system and equipment maintenance effort is much more reactive than proactive. The preventive maintenance program for SRE and IROFS is also reactive in that **functional testing failure determines when SRE and IROFS receive maintenance attention.** (p. 38-39)

Work Practices: The SCUBA Team has concluded that: **Organizational standards are principally focused on getting tasks completed to support production**. There is a strong supervisory presence in

place in the field, but its primary focus is to respond to production and quality issues. Observations and interviews indicate very little supervisory time is spent on establishing, coaching and reinforcing safety performance standards, including procedural compliance. There is generally little management reinforcement of safety performance standards in the field, including procedural compliance. Human error prevention methods are currently being used sparingly, inconsistently and ineffectively. When faced with uncertainty, employee decisions in the field are not always conservative. A recurring theme of procedural non-compliance problems has been identified and is supported by interviews, behavioral observations and documentation reviews. Contributing factors appear to include:

- A lack of awareness of desired standards and expectations.
- A value system that encourages putting production ahead of procedural compliance.
- Failure to reinforce desired behaviors.
- Occasional peer and/or supervisor pressure to operate outside of procedures.
- Failure to establish individual accountability and ownership for procedural compliance. (p.41)

Procedural compliance is a significant problem at NFS-Erwin. The site has a history of NRC violations associated with procedural adherence deficiencies, and procedural non-compliance continues to be an area for improvement. An immediate intervention with a proactive approach is necessary to address and correct this continuing problem. (p. 42)

Personnel Interviews, Behavioral Observation and Documentation Reviews: Supervisory oversight is focused on production, resolving technical issues, and ensuring product quality. **Safety (nuclear and industrial) is not emphasized in work practices or in work orders.** Material issues and procedural violations were observed without supervisory intervention or corrective action. Interviews indicated employees are skeptical that supervisors and management take industrial and personal safety seriously. This perception is reinforced by a sense of compartmentalization. When production is discussed, only production is discussed. When safety is discussed, only safety is discussed. The independence of these discussions creates a perception of production being more important, since the primary briefing focus is production. (p. 44)

The SCUBA Team observed that workarounds are often implemented and sometimes become permanent solutions. **The workforce often describes the environment as a production-oriented environment where workarounds are rewarded if they can "save a run."** Workarounds undermine conservative approaches to uncertainty, procedure compliance and the seriousness of industrial and personal safety. (p.45)

The Lock-Out/Tag-Out process requires attention. **The practice of utilizing common keyed locks for system isolations is not consistent with industry standard.** It has the potential to compromise the integrity of an isolated system. The practice of an "Arm's Reach Rule" (locks not required if in an arm's reach during work) for system isolation is not in agreement with industry norms for lock-out/tag-out

programs and is a precursor for an accident or event (human error "trap".) A work practice to manage the custody (and control) of keys for isolation devises is not deployed at NFS-Erwin.

- Specific Examples from Field Observations:

  - **Operators have occasionally been instructed to operate outside of procedure scope by supervisors.** At least two situations were identified to SCUBA Team members
  - Weekly plant shutdown and restart procedures are not followed precisely. Additional steps are frequently involved as well as altered sequencing The omission of other requirements also occurs. None of these procedural challenges are the subject of a revision request (p.45)
  - Known procedural deficiencies and equipment problems (e.g., instrument plugging) are common knowledge to operators and supervision. Action is taken to deal with the situation without requesting a procedural change
  - Supervisors are often present when procedural violations occur yet violations go unreported or undetected
  - During maintenance of a scrubber assembly, several procedural violations, procedural omissions, and lapses in safety behavior were observed involving radiological safety and industrial safety
  - After a scrubber chemical addition system failed, the chemicals were added manually via an open panel in the scrubber as a long term alternative to correcting the deficiencies of the addition system. These types of workarounds undermine procedural compliance. (46)

Based on the information presented above, it is the SCUBA Team's conclusion that organizational standards are principally focused on getting tasks completed to support production. There is inconsistent ownership and accountability for and reinforcement of procedural compliance in comparison to the focus on production. These behaviors reinforce the organizational perception that the current procedural compliance performance level is acceptable. Interim compensatory measures are needed to effect an immediate change in organizational focus and performance related to procedural adherence. **Sufficient and appropriate resources, with adequate time and focus, will be required to change the existing culture**. (p. 46)

Corrective Action Program: The Corrective Action Program (CAP) execution lacks rigor and insufficient management oversight and control. The effectiveness and timeliness of CAP investigations, corrective actions, and common cause analyses is lacking.

Problem Identification Reporting and Correction System (PIRCS) is not utilized as the only method and central repository for issue identification and resolution, a practice which is inconsistent with most nuclear industry corrective action programs. NFS needs to clearly define the types of issues that are required to be

processed through the CAP using PIRCS. PIRCS is not currently being used to record every issue or problem that is identified at the NFS-Erwin site. (p. 49)

NFS needs to fully convert the commitment tracking process to the PIRCS system as intended. There are currently multiple processes, and unclear ownership for effectiveness of corrective actions. This diffusion of responsibility provides the opportunity for administrative error and could lead to an inadvertent lapse in regulatory compliance. The current commitment approval process does not systematically evaluate the effectiveness of corrective actions taken and allows commitments to be closed when work is merely scheduled, not completed. (p. 51)

Personnel Interviews, Behavioral Observations and Documentation Reviews: PIRCS Quality and Timeliness Issues: The Vice-President of Safety and Regulatory is responsible for assigning all Investigation Team Leaders, and Vice-Presidents must approve non-QA root cause analyses in their area of responsibility, per NFS-GH-922. **Root cause analysis training has not been systematically administered in the past ten years; and there are no annual or bi-annual re-qualification requirements for analysts or reviewers. No formal training is offered relative to the conduct of apparent cause evaluations.** The lack of periodic training on root cause analysis techniques limits effectiveness of this management oversight.

The CAP has not been effective in applying the corrective action needed to reverse adverse trends associated with safety-related issues. There are recurring issues associated with production-related components, involving business risk and the potential for personal injury.

- ✓ The failure to fix the automated caustic addition system on the MAA venture scrubber requires operators to manually handle hazardous materials on a regular basis – a practice that a number of members of management consider unnecessarily hazardous.

- ✓ A second example is the decision to cancel installation of a new wastewater filter press because an alternative solidification process supposedly made component replacement unnecessary. **The old press was run to catastrophic failure, and could have resulted in a serious, if not fatal, injury**. Again, there were members of management who considered the operation hazardous enough to warn operations personnel to stay away from the press when in operation.

- ✓ The site lacks a comprehensive self assessment tool, and the CAP has not received a self-assessment that would meet industry standards.

- ✓ Two commitments made to the NRC were overdue for completion until the due dates were successfully re-negotiated. The centrifuge U-Al bowl wash procedure and the U-Metal process were scheduled as pilots for full incorporation into the Configuration Management (CM) Program in the second and third quarters of 2007, respectively. The CM Specialist is actively working on both, but the site has taken the position that scheduled dates for these written commitments were only targets. Neither is yet complete although the NRC has subsequently agreed to extend the due dates into 2008.

- ✓ There are occasions when PIRCS commitments are closed to other commitments, with neither resulting in definitive action . (Problem Reports 3246, 4716, and 4865) This practice is considered to be unacceptable and is inconsistent with industry practice.

- ✓ Some PIRCS items that should be quality records (e.g., those pertaining to corrective actions following the BPF spill) were resolved by using informal memoranda or recorded in e-mail traffic. (Problem Reports 3237, 3292 and 3293.) (p.55-56)

Issue Trending: Trend data is available in paper form, but is not correlated in any systematic fashion to allow for intervention prior to a system fault. Procedure NFS-GH-56 refers. **Stated another way, Safety Related Equipment (SRE) and Items Relied on for Safety (IROFS) are run to failure. (p. 57)**

Operating Experience: The SCUBA Team has concluded that NFS does not meet regulatory expectations related to this Safety Component. NFS has no formal written internal or external Operating Experience (OE) program. With respect to use of internal operating experience, there have been ad hoc responses to significant or recurring events, but these tend to be narrowly focused. Examples include repetitive Radiation Work Permit (RWP) violations in 2005, a design problem relating to Nuclear Criticality Safety (NCS) in 2005, the March 6, 2006 spill, and the filter press event in 2007. NFS currently does not have a systematic, thorough and formal program/process in place for obtaining, evaluating and acting upon external operating experience. (p. 58)

Personnel Interviews, Behavioral Observations and Documentation Reviews: SCUBA interviews and procedure reviews indicate there is no formal written Operating Experience program at NFS, which at least partially explains why this Safety Component is not well understood throughout the organization. Some of the following information provides additional insights into NFS-Erwin processes related to OE:

- There is no systematic review of NRC inspection reports to identify trends other than numbers of violations.

- NFS uses the PIRCS system to collect internal operating experience from incidents and events. This process is neither systematic nor consistently used; events tend to be documented in isolation. "Similar Events" shown in PIRCS are rarely related. Until recently, looking for root causes did not consistently receive a high priority. Common cause investigations are inconsistent and not available yet in PIRCS options (p. 60)

- **Pre-job briefings are often cursory and provide little opportunity to communicate operating experience. By virtue of the recent initiation of human performance skills training, it is reasonable to presume this practice does not currently exist at NFS.**

- There has been no apparent attempt to incorporate Operating Experience (OE) into pre-job briefings, as is the standard in commercial nuclear power.

- **There is an underlying concern that some of the pitfalls encountered during the design and installation of the BLEU Processing Facility are still in existence as the Reliable Fuel Supply and Commercial Development Line projects near the same point in their design lives**. There

has not been an effectiveness review conducted or a significant effort made to advertise lessons learned and conservatism applied from previous projects. The discussion at some planning sessions infers this doubt exists among senior managers. (p. 61)

Environment for Raising Concerns: In this regard, the SCUBA Team has concluded that: **The SCUBA assessment identified significant gaps between current NFS standards and practices and those in the nuclear power industry.** The trend seemed to rest on an absence of negative trend information instead of the presence of positive indicators. (p. 74)

Personnel Interviews, Behavioral Observation and Documentation Reviews:

- Offers of the opportunity for truly open and honest debate are viewed with skepticism by some employees.
- **In particular, reporting issues that pose a threat to continued operations or production are viewed as probable triggers for a negative management response. Some employees report signs of management anger or irritation when production is jeopardized. They cited examples of raising issues that affect production and a negative consequence (e.g., assignment of unpleasant work, lack of opportunity or promotion, etc.) for the individual viewed as "stopping production" and view this as an example of management saying one thing (safety over production), but signaling through their behaviors the real priority is different.**
- Alternate reporting processes are available at NFS. However, an **employee seeking confidentiality must contact the company's General Counsel. Interviewees said they would be willing to use that avenue if it was important enough, but expressed reluctance to go that high with a minor problem; they would just let it go. There have been only two instances of employees using that venue in the last two years. That is a statistical anomaly, compared to the number of confidential concerns received by the average Employee Concerns Program (ECP) in the nuclear power industry.**
- The lack of a truly independent reporting process (like the industry standard ECP model) may be a barrier to reporting certain kinds of relationship-based concerns, because the current reporting methods and alternatives are perceived as too public, too slow, or not sufficiently independent.
- Interviews with NRC Residents indicate the regulator has a high level of confidence in employee willingness to bring issues and concerns to their attention and attribute the low numbers of NRC allegations to the fact that NFS management responds well to informal discussion on employee concerns relayed by the Resident Inspectors. Resident Inspectors report no signs of reluctance or need for confidentiality on the part of NFS employees when it comes to speaking with the NRC. It is their view that employees clearly understand their rights and protections under the Whistleblower Act and employee interviews confirm this. (72-74)

Preventing, Detecting and Mitigating Perceptions of Retaliation: The SCUBA Team concluded this Safety Culture Components meets minimum regulatory expectations. NFS does not have sufficient policy guidance or demonstrate a proactive approach to preventing, detecting, and mitigating perceptions of retaliation. Employees receive some training on company expectations and available reporting processes. Discrimination claims are investigated, primarily by Human Resources (HR).) Union leadership participates in discipline decisions (above a certain level) affecting bargaining unit employees. Management administrative actions (adverse performance evaluations, demotions, transfers, promotions) are not routinely reviewed for potential chilling effects. The company does not have processes in place to evaluate and mitigate other actions and decisions (work assignments, changes to work or holiday routine, contractor decisions, etc) that have the potential to create the perception of retaliation. (p. 75)

Personnel Interviews, Behavioral Observations and Documentation Reviews: The SCUBA Team gained significant insights during interviews, observations, and documentation reviews: Responsibility for retaliation claims resides in HR. Some employees view this as a potential conflict of interest. Employees who lack confidence in HR's investigative performance may use the site General Counsel instead. This option is not widely understood, nor is it used with any frequency. Investigations do not always take place in a timely manner; there is no target time frame for investigations to be completed, as is the industry norm. Investigator training requirements are not established and investigative report quality is inconsistent. Guidance on specific investigation requirements (e.g., investigation plan, expert assistance, interview outlines) is non-existent. Feedback to employees is inconsistent and there is no process for tracking corrective actions or verifying their effectiveness. (p. 77) Interviews indicate a low level of management self-awareness when it comes to behaviors that could have a potentially chilling effect. Interviews also indicate employees have very low recognition/recall of attempts by management to mitigate chilling events. Some employees perceive that negative management reactions (and, in some instances, retaliation) have occurred when issues or concerns that had the potential to interrupt production were raised. (p. 77-78)

Accountability: Performance is considered to be deficient with respect to commercial nuclear power plant industry best practices. It does not meet regulatory expectations in that accountability has not been systematically and consistently reinforced at the workforce, supervisor, or management levels. This conclusion is based on a number of significant deficiencies noted in NFS's accountability-related management practices. Historically, NFS management has not consistently demonstrated and promoted a questioning attitude. As a result, there is an embedded reluctance to raise issues or concerns that could potentially impact production or key organizational objectives that must be overcome and reversed. *A key factor seems to be the continuing perception that the burden of proof rests with the individual raising a concern or issue.* **Management ownership and accountability for regulatory commitments is deficient.** Follow-through to assure effectiveness of corrective actions occurs infrequently. Management does not consistently model high-accountability behaviors. Assignment of single point ownership and accountability is not an institutionalized organizational practice. (p. 79) This cultural attribute received one of the five lowest NFS-Erwin Site Composite numerical survey ratings. (p. 81)

Personnel Interviews, Behavioral Observations and Documentation: There are several specific concerns regarding (1) roles and responsibilities, and (2) management's reinforcement of safety standards and safety-related behaviors as an overriding priority. Management does not consistently exhibit or reinforce a questioning attitude. Most employees indicated they would always raise a concern if they felt they were dealing with an issue that presented an "imminent danger" to an individual or the organization. **Many employees, including members of management, expressed reluctance to raise a concern when confronted with an issue that presented the "potential for a safety problem."** This reluctance arose from the concern they might not be able to defend their position. **This perspective is reinforced by the observation that management will frequently proceed with a course of action unless it can be proven to be unsafe, as opposed to proceeding only if it can be proven that it is safe**. Management ownership and accountability for regulatory commitments is deficient. **There is minimal management oversight and control to assure corrective actions are completed in a high quality and timely manner, and effectiveness reviews are not systematically performed.** First line supervision and the training organization have a significant presence on the shop floor-particularly in the HEU areas. Their presence provides some reinforcement for the message that safety is an important priority. **However, most supervisors are much more production focused than safety focused. This leads to the perception held by some employees that production is more important than safety and undermines individual safety focus and accountability for same. (p. 82)**

Examples can be found where supervisors and/or managers proceed without understanding procedural requirements in response to perceived production pressures. There are also examples where management does not consistently follow administrative procedures. **The organization is extremely tolerant of degraded equipment/conditions and frequently develops workarounds to deal with them.** Many of these workarounds become formalized (via changes in operating procedures) in order to avoid procedural non-compliance. The inconsistency between these practices and management statements that safety is the organization's overriding priority is not lost on the work force. **The message is that management does not hold itself accountable for fixing equipment problems. Vertical communication within the organization is poor. There is a tendency to communicate an issue once or twice and assume that communication will cascade throughout the organization without any loss of content or impact. As a result, many employees do not understand where the organization is headed from a safety perspective or why, thus undermining individual employee ownership and accountability**. NFS does not have an active formal performance management system for salaried or hourly employees. Performance objectives and reviews, and the associated rewards and sanctions, are not utilized to reinforce safety objectives or requirements. (p. 83) Accountability has not been systematically and consistently reinforced at the workforce, supervisor, or management levels. (p. 84)

Continuous Learning Environment: The Site does not meet regulatory expectations in that the organization is insular and has a poor frame of reference with regard to industry standards and best practices. NFS management does not sufficiently value opinions and suggestions from the workforce (particularly from shop-floor workers) to resolve problems and improve performance. There is variability between the work practice taught in the classroom and those observed at the work site

once the technicians are qualified and comfortable with their job. On the job experience is allowed to replace procedural reference and this practice goes uncorrected by supervisors. The site administers an adequate "just in time" training program. There is essentially no professional development program for soft skills and leadership training. (p. 85) **NFS has developed a frame of reference that is based primarily upon its own experience as opposed to one based upon current nuclear industry standards and best practices**. This is largely due to organizational insularity, which appears to have developed as a result of the organizations sense of the uniqueness of its operations. (p. 86) Leadership skills at NFS have been suborned to technical competence and there is no current training program to address this gap. (p. 87)

Personnel Interviews, Behavioral Observations and Documentation Reviews: The SCUBA Team intended to monitor management meetings held to review progress against established standards and performance indicators. Such meetings are not held and performance indicators, though available within each functional area, are not used strategically to improve long-term performance against industry standards or close gaps to excellence as defined by NFS. The available tools are used to track production progress instead. Survey results and personnel interviews reveal a sense of frustration, particularly among the craftsmen, that opinions and suggestions to resolve problems have been neither solicited nor entertained by NFS-Erwin leadership. (p. 89)

Organizational Change Management: The SCUBA Team has concluded that Organizational Change Management does not meet regulatory expectations. NFS does not have a formal process to pre-identify and manage the safety impact of major change in organizational structures, organizational functions, leadership, policies, programs, and resources. No documents, standards/expectations, tools, or training are available with respect to Organizational Change Management; thus, there is no guidance as to what changes should be evaluated, or how these evaluations should be performed. Failure to manage the safety-related impacts associated with organizational change can pose a risk to regulatory compliance, several examples of which were observed by the SCUBA Team. NFS does not have a formal organizational change management program. **Changes are not formally reviewed for potential safety or resource implications**. Major changes are not consistently or effectively communicated throughout the organization. **This safety culture component does not meet regulatory expectations, and is considered to be deficient when compared to industry standards. (p. 91)**

Safety Policies: *Personnel Interviews, Behavioral Observations and Documentation Reviews*: As discussed in other Safety Culture Component Sections of this Report, the SCUBA Team determined that:

The NFS organization has a number of weaknesses in its safety culture that, unless effectively addressed, serve to undercut the values, standards and expectations set forth in "Safety Strong." Findings related to acceptance of a "meet minimal regulatory requirements" approach, tolerance of degraded conditions, weaknesses in procedural compliance, lack of thoroughness of Corrective Action Program evaluations and insufficient focus on self-assessment and the continuous improvement of organizational culture and performance are particularly important in this regard, as the underlying cultural weaknesses do not reflect or reinforce desired organizational values, standards and expectations. Effective implementation of

programs, processes and functions that support the "Safety Strong" concept are adversely affected by, lack of sufficient accountability and ownership (both individual and organizational), lack of effective management oversight and lack of effective organizational change management. The key programs, processes and functions in need of particular attention are:

- Corrective Action Program
- Nuclear Oversight
- Safety Conscious Work Environment (Alternate Reporting Channels)
- Industrial/Personnel Safety. (p. 97-98)

ASSESSMENT RESULTS—ADDITIONAL SCOPE: Notices of Violation (NRC Confirmatory Order-2/21/2007) SCUBA Team Conclusion--Area for Improvement (AFI) NFS provided minimally adequate responses to the specifics identified in the NRC violations, but did not adequately address the underlying causes and associated cultural issues. This represents a deficiency when compared to commercial nuclear power plant industry best practices. This also is indicative of an organization that is satisfied with minimum regulatory compliance. (p. 99)

NFS COMMITMENTS OF 9/18/2006: (NRC Confirmatory Order-2/21/2007) At a management meeting with the NRC on Sept., 18, 2006, NFS committed to completing 14 action items designed to improve the Corrective Action Program (CAP). Most have been met. A few have not. The SCUBA Team concluded that NFS standards and practices for regulatory commitment closure do not meet industry best practices or regulatory expectations. In this regard: (a) Commitments should not be closed unless the action has actually been completed (that is, it is not appropriate to close a regulatory commitment to a work request.) (b) Oversight requirements are not sufficiently formalized. (c) A formal or systematic approach for reviewing the effectiveness of corrective actions taken to meet commitments does not currently exist. (d) Accountability and ownership for the regulatory commitment control process is unclear; there is evidence of multiple procedures, some of which are inactive. (p. 100)

CONFIGURATION MANAGEMENT: (NRC Confirmatory Order-2/21/2007) The SCUBA Team has concluded the CM Program improvement initiatives are not adequately resourced to ensure that regulatory commitments will be met. This situation represents an Area for Improvement. There is sufficient document evidence to confirm the programmatic elements necessary to comply with the stated objectives of the CM program are planned and that some are in place in final form. Draft guidance document (NFS-GH-901, Configuration Management), if appropriately augmented by supporting procedures that have been concurrently developed, should support effective implementation. The governing document must be finally reviewed, approved and tested. Significant milestone events still need to be completed in an expeditious manner in order to comply with the Confirmatory Order (and attendant commitments.) The timetable for some of these commitments, specifically those associated with data entry for selected components and systems, has been eased by obtaining the NRC's concurrence to extend deadlines from 2007 to 2008. It is imperative to train and dedicate the additional personnel needed to complete the work on time. The BPF

Project is scheduled for full implementation in 2008, HEU in 2009 and the entire site in 2010; **the CM Manager estimates the workload at 26 man years.**

The SCUBA Team reviewed the status of existing documentation designed to ensure it would support development of the *new Reliable Fuel Supply (RFS) facility,* pending full software automation, *it became apparent that program implementation is currently facing schedule challenges and requires corrective action.* (p. 101)

NFS-ERWIN SELF-ASSESSMENT OF SAFETY CULTURE (June/July 2007) The overall accuracy of the NFS SCSA was affected by the lack of an adequate frame of reference for excellence in the nuclear industry. This fact became more evident during the SCUBA Team's review of individual Safety Culture Components. It is noteworthy that the NFS SCSA was considered as not being sufficiently self-critical for the three safety components that constitute Problem Identification and Resolution (Corrective Action Program, Operating Experience, and Self and Independent Assessments.) (p. 102)

OUTLIER ORGANIZATIONS BASED ON WORKFORCE SURVEY NUMERICAL RATINGS: Based on the workforce survey results, seven individual NFS Functional Organizations were identified by SYNERGY as Priority Level 1 or 2 "organizational outliers" due to having provided low numerical ratings for key cultural metrics (i.e., Overall NSC and Overall SCWE ratings.) These organizations are:

- BLEU Complex Operations (NFS Only) – Priority Level 1
- Analytical Services – Priority Level 1
- Health Physics (including Radiation Monitoring & Nuclear Measurements) – Priority Level 1
- Transportation & Waste Management – Priority Level 1
- HEU Fuel Fuel Production – Priority Level 1
- BPF Operations – Priority Level 2
- Other Operations Support – Priority Level 2

SYNERGY indicated Priority Level 1 and 2 designations correlate to the following recommended action levels:

- ✓ Priority 1= There is a potential need to take remedial action in the immediate future.
- ✓ Priority 2= There is a potential need to take remedial action in the near – term.

The SCUBA Team conducted confidential interviews with personnel from the Priority Level 1 and 2 "outlier organizations" to determine the underlying reasons for the lower ratings provided by those organizations. These interviews revealed the following:

- ➢ Survey results and interview results were in alignment.

- There are on-going communication problems between management and employees in several of the organizations.
- There are legacy issues, e. g. the strike, that continue to influence the relationship between management and some employees.
- Excessive overtime is a concern to some employees. (NFS has implemented interim compensatory measures to address overtime issues.)
- No NSC or SCWE problems or concerns were identified as a result of the focused interviews.

Based on the above results, the SCUBA Team has concluded that no independent corrective action is required for three of the outlier organizations. The SCUBA Team recommends management take remedial action with four of these organizations to proactively surface and resolve the issues identified through the workforce survey and the personnel interviews conducted by SCUBA. (p. 103)

SCUBA TEAM FINDINGS AND RECOMMENDATIONS: The workforce survey identified a number of organizations which were outliers from either a Nuclear Safety Culture (NSC) or Safety Conscious Working Environment (SCWE) perspective, indicating a potential need for management to take action in either the near-term or immediate future. These prompted the need for the SCUBA Team to conduct personnel interviews to identify the underlying issues which led to the low survey ratings. In this regard, the SCUBA Team recommends the following.

- BLEU Complex Operations (NFS Only): **NFS and AREVA Management should meet and develop solutions to the communication problems that currently exist between AREVA management and the NFS employees at the BLEU Complex.** Details are provided in the Confidential BLEU Complex Outlier Organization Report.
- Analytical Services: Near term management intervention is required to resolve work-related and strike-related environmental issues in the Analytical Services organization. Details are provided in the Confidential Analytical Services Outlier Organizational Report.
- Health Physics Monitoring & Nuclear Measurements: **The current radiation protection program, and the associated ALARA principles, needs to be explained to the senior Radiation Technicians (RT); the RTs should explain the program to the balance of the workforce.** RTs should also take part in work planning and pre-job briefs. Details are provided in the Confidential Health Physics Monitoring & Nuclear Measurements Outlier Organization Report.
- Transportation & Waste Management: An overtime policy needs to be developed that ensures worker hours are reasonable. **The material condition of the Waste Water facility needs to be improved and workarounds corrected.** Details are provided in the Confidential Transportation & Waste Management Outlier Organization Report.

Management should ensure that the specific concerns of the remaining outlier organizations, as identified in the workforce survey, are successfully addressed as NFS progresses in implementing its Safety Culture improvement program. (p. 104)

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(Note: This is a product of the Erwin Citizens Awareness Network, P. O. Box 1151, Erwin, TN 37650)

TABLE 3
SUMMARY TABLE OF SCUBA TEAM CONCLUSIONS RELATED TO MEETING NRC REGULATORY EXPECTATIONS FOR EACH OF THE NRC RIS 2006-13 SAFETY CULTURE COMPONENTS

SAFETY CUTURE COMPONENT	SCUBA TEAM CONCLUSION
Human Performance	**Does not meet regulatory expectations**
> Decision Making	Does not meet regulatory expectations
> Resources	Does not meet regulatory expectations
> Work Control	Does not meet regulatory expectations
> Work Practices	Does not meet regulatory expectations
Problem Identification & Resolution	**Does not meet regulatory expectations**
> Corrective Action Program (PIRCS)	Partially meets regulatory expectations
> Operating Experience	Does not meet regulatory expectations
> Self/Independent Assessment	Does not meet regulatory expectations
Safety Conscious Work Environment	**Meets minimum regulatory expectations**
> Environment for Raising Concerns	Meets minimum regulatory expectations
> Prevent, Detect and Mitigate Perceptions of Retaliation	Meets minimum regulatory expectations
Other Safety Culture Components	**Does not meet regulatory expectations**
> Accountability	Does not meet regulatory expectations
> Continuous Learning Environment	Does not meet regulatory expectations
> Organizational Change Management	Does not meet regulatory expectations
> Safety Policies	Meets minimum regulatory expectations

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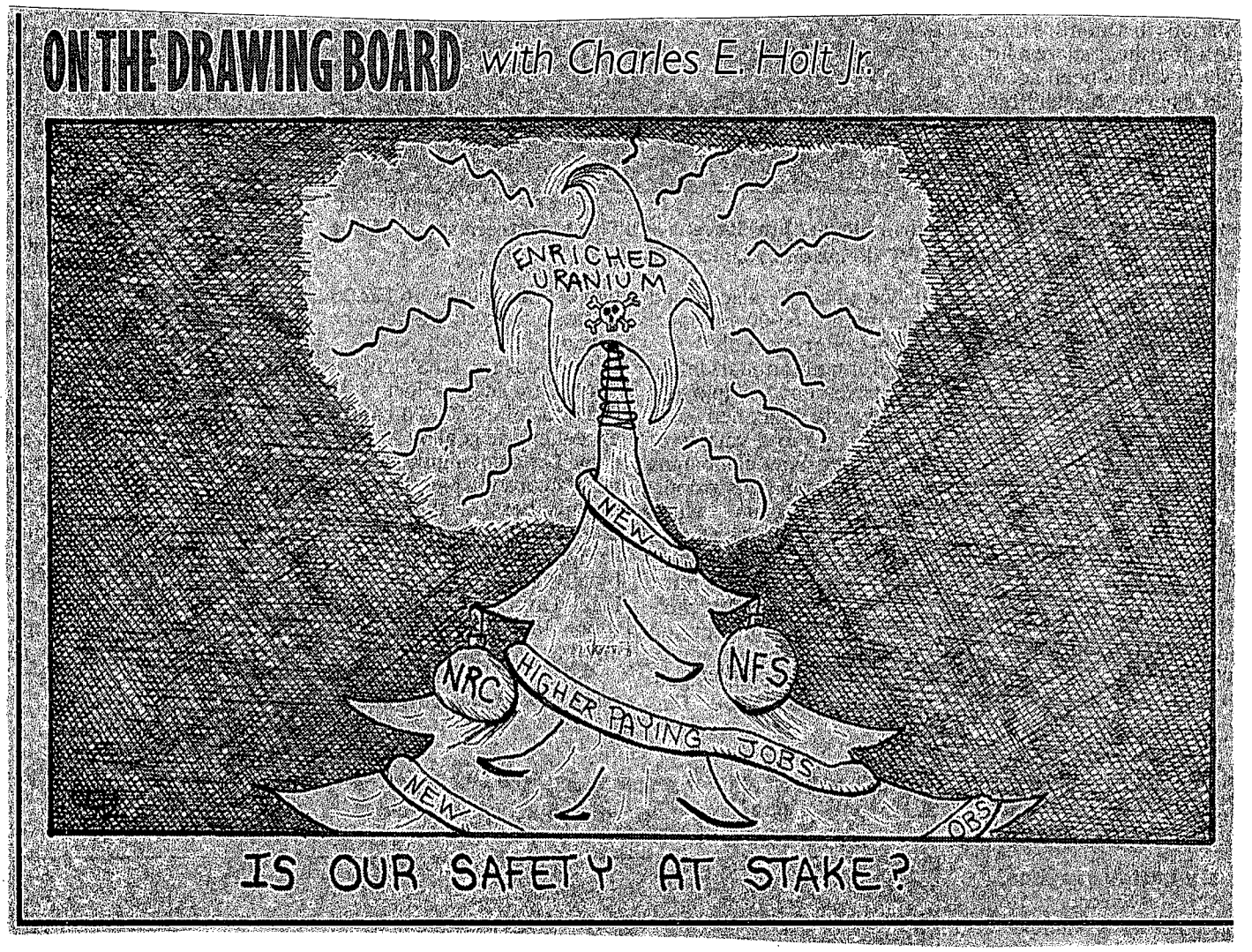

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Forked-tongued speaking

To the editor,

Regarding the article in last week's edition of *The Erwin Record*, "Commission deems NFS operation 'overall safely'," -- a conclusion that Eugene Cobey, a Nuclear Regulatory Commission staff member, says the NRC "formulated" about Nuclear Fuel Services. I would simply say, they must be suffering from severe amnesia.

Wasn't it just a little over a year ago when the Safety Culture Board of Advisors' independent safety evaluation report of NFS showed that the company did not meet safety expectations in nine of 13 categories and only partially or minimally met the expectations in the other four areas? It also stated that NFS runs its equipment to failure, including safety-related equipment and items relied on for safety, and a whole host of other safety-related issues.

Are all of these things fixed now? I don't think so. Perhaps this safety survey, which no doubt cost a great deal of money to perform, was just a sham.

Wasn't it just about eight months ago when NFS had a problem with the potential for an accident involving 23 gloveboxes and had to take all of the uranium out and shut them down? The NRC sent in a special inspection team to investigate.

And, just about three weeks ago, on Oct. 13, didn't NFS have another accident involving high-enriched uranium, which, according to news reports, warped the ventilation system, and caused a shut down of the BLEU facility? The event report, which was not provided to the NRC until Oct. 19, stated that items relied on for safety were insufficient. This time, the NRC determined that another special inspection team was warranted, but after a further evaluation elevated it to an augmented inspection team.

At the Oct. 29 meeting, I believe the public was exposed to a lot of forked-tongue speaking by the NRC staff members – a skill they seem to have mastered. And, the fact that the NRC staff appeared to have much different details from its own commission chairman and published documents, surely makes one highly suspicious of the NRC's "formulated" conclusion of "overall safely."

Barbara O'Neal,
Erwin

ON THE DRAWING BOARD *with Charles E. Holt Jr.*