

# 12 Subject-Specific Timelines

for the

## **Safety Evaluation Report**

regarding the

NFS 40-yr License Renewal Request

Submitted by

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October 26, 2010

12 (of 60) Subject-specific Timelines  
submitted for the  
Safety Evaluation Report (SER)  
Draft EA/Draft FONSI, NFS 40-year license renewal request  
October 26, 2010

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(Submitted by Barbara O'Neal on behalf of the Erwin Citizens Awareness Network, Inc.)

**MATERIAL CONTROL & ACCOUNTABILITY (MC&A) & RELATED ISSUES**

*(Missing, Lost, Misplaced, Theft, Unaccounted For, Mishandling, Storage, Inventory, Security, and Failure to Properly Control SNM & SSNM)*

(Note: (R) Means Word or Text Has Been Redacted. IR Means Inspection Report)

- 01/68 *Latest Nuclear Fuel Loss 'Within Limits'. The Nuclear Fuel Services plant lost **246** pounds of highly enriched uranium (Hereafter HEU) from January 1968 through December 1978, the NRC said. Government records say that is enough to make six atomic bombs. Johnson City Press Chronicle, April 26, 1981*
- 06/71 *NRC Releases Report On Missing Uranium At Nuclear Fuel Plant. For the period of June through October in 1971, the net inventory difference of **11.66** pounds was reported, based on pro-rated distribution of inventory adjustments. Johnson City Press Chronicle, 10/29/80*
- 10/04/74 *Order to Show Cause why activities in MBA 6 should not be suspended pending resolution of the large quantity of material unaccounted for (MUF.) Hearing Before the Subcommittee on Energy Conservation and Power, p.72, 9/18/86*
- 1979 ***11.26** lbs. of highly enriched uranium (HEU) unaccounted for. "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 (48.4 pounds) by estimating how much of it had vaporized to the air, was absorbed into flooring, remained as residue or had been disposed of. Associated Press, 10/31/80, "Report Supports Theory of No Security Breach in Uranium Loss"; ATSDR Report, p. 51*
- 1979 *NFS was unable to account for a reported **48** pounds of highly enriched uranium. Hearing Before the Subcommittee on Energy Conservation and Power, p.17, 9/18/86*
- 1979 *A loss of **24½** pounds was indicated in 1979 because the scrubber which serves the ventilation system was operated improperly. Also, inadequacies were identified in both the design and operation of the waste measurement system. Missing Uranium Explained By NRC, Johnson City Press-Chronicle, 10/29/80*
- 02/05/79 *Enforcement Conference to discuss the **theft of 60 Kg.** of low enriched uranium (Hereafter LEU.) Hearing Before the Subcommittee on Energy Conservation and Power, p.73, 9/18/86*
- 06/15/79 **No Accounting Error Found Yet At NFS. Inventory covering June 15-August 14, 1979, revealed an amount of uranium above the permitted loss of nine kilograms, or **19.8** pounds of 96% fissionable uranium is unaccounted for. Kenneth M. Clark, a public information officer for NRC continued**

to emphasize the uranium is classified as "unaccounted for," not missing. He said that a discharge from the plant containing uranium was highly unlikely. Plant to be shut down until Nov 1. A re-inventory is scheduled to begin Oct. 1 due to the amount of uranium in liquid form that must be converted into a physical form for measurement. It will take 30 days to gather the thousands of calculations making up the inventory. The NRC will not disclose how much uranium cannot be accounted for. Johnson City Press Chronicle, 9/21/79

(Note: "Determining whether an inventory difference is due to statistical noise in the measurement process or to theft or diversion is a difficult. As William J. Dircks, head of the NRC's Office of Nuclear Material Safety and Security, told the journal *Science*: 'We're not counting discreet items; we're really estimating the amount of uranium atoms that may be within the system at any one time. It's more like putting a net in a tank where you think you have a certain number of fish, and taking a statistical sample to see if you have the number of fish per meter that you think you should have. If the fish are all at the bottom feeding, or stuck somewhere (then you have a problem). Erwin is checking through all its miles of piping to see where the fish are hiding.'

"Under present NRC practices, the Material Unaccounted For (MUF) game is played as follows: When the MUF exceeds (the alarm level) the facility is shut down. A big review is launched. Several possible loss mechanisms are "*discovered*" or "*postulated*," and then, casting all logic aside in one mystical leap, the NRC staff concludes the MUF is due to one or more of these loss mechanisms and there is "*no evidence* of diversion." Through this mechanism the MUF is "*explained*," i.e., reduced to less than (the alarm level) and the facility is allowed to reopen."

"In the case of the Erwin plant, however, the investigators were unable to develop a *plausible technical explanation* for the inventory difference; *satisfactory loss mechanisms* were not *identified*. Dircks, who had been unable to determine where the fish were hiding, recommended that the NRC revoke the Erwin plant's license. But in January 1980, in a closed meeting, the commission voted to allow Erwin to reopen, easing the plant's *accountability requirements* by *raising the alarm threshold to a level the plant could meet*. Paula DePerna, "Nuclear Debit," *The Nation*, vol. 230, no. 13, 5 April 1980, p. 389 Since the plant could not meet the conditions of its license, the NRC simply relaxed the rules to make them "more realistic." The DOE had sent the NRC commissioners a classified letter saying that the continued operation of the Erwin plant was essential to national security, apparently convincing the NRC to amend Erwin's license. *New York Times*, January 17, 1980, p.B6. "*In October 1980, after the plant had reopened with its new relaxed license, the NRC staff discovered new loss mechanisms, reducing the amount of MUF by more than half.*" Material Losses at Erwin Less Than Half of Original Estimate, *Nucleonics Week*, 23 October 1980, p.7

"In February 1980, the Natural Resources Defense Council (NRDC), requested that a hearing be held on Erwin's license, and in July 1980, *the NRC voted 3 to 2 to change its rules for holding adjudicatory hearings so that it would not have to comply with NRDCs petition*. The majority doubted whether the "public interest" would be served by holding a hearing since the case involved "*sensitive issues*" and "basic regulatory policy questions regarding the conduct of military functions." U. S. Nuclear Regulatory Commission, "Amendment to Provide Exception From Procedural Rules

for Adjudications Involving Conduct of Military or Foreign Affairs Functions,” Rules and Regulations, 10 CFR, part 2, Federal Register, vol. 45, no. 130, 3 July 1980, p. 45254 (One of the dissenting commissioners called the decision “dishonorable and disgraceful,” charging that “the only thing being protected against here is the potential embarrassment to this agency (the NRC) or to the Department of Energy that might flow from effective probing of particular facts in this case.” Ibid., p. 45255, No Evidence, Nukespeak, p.170, 171, 260, 261

- 09/79 *Plant Repeatedly Cited For Nuclear Safety Failures.* Nuclear Fuel Services was shut down for four months because of a security matter after the NRC discovered in September 1979 that **22,085 grams of highly enriched uranium**—enough to make two atomic bombs, was missing from the plant’s June to August inventory. Atlanta Journal Constitution, 12/02/81
- 09/19/79 *NRC Closes Erwin Plant; Uranium Lost.* Johnson City Press Chronicle, 9/19/79
- 11/17/79 *Search Continues For Uranium At Nuclear Fuels Plant.* Johnson City Press Chronicle, 11/17/79
- 11/27/79 *No NRC Report On Lost Uranium.* Johnson City Press Chronicle, 11/27/79
- 01/80 *NRC: Too Much Erwin Plant Radioactivity.* Before any of the uranium had been accounted for, in January 1980, the NRC changed its standards—allowing more uranium to remain unaccounted for in order to reopen the plant. The Tennessean, 01/26/81
- 01/80 *NRC Releases Report On Missing Uranium At Nuclear Fuel Plant.* **1½ pounds Uranium** in waste which was buried understated. Johnson City Press Chronicle, 10/29/80
- 01/30/80 *NRC Official Says No Announcement At Hand.* Johnson City Press Chronicle 1/30/80
- 02/25/80 *Enforcement conference to discuss the inadvertent shipment of cylinders containing UF<sub>6</sub>.* Hearing Before the Subcommittee on Energy Conservation and Power, p. 73, 9/18/96
- 03/18/80 *Amount Of Lost Uranium Kept Secret.* Johnson City Press Chronicle, 3/18/80
- 04/05/80 *Nuclear Debit Over Past 10 Years, Approximately 246 lbs. of Material Unaccounted For.* Last September the NRC received a report from NFS that at least about twenty pounds (**9 kilograms**) of highly enriched weapons-grade uranium (HEU) was missing. Nine kilograms will operate a bomb. (Sixty kilograms were packed into the bomb exploded over Hiroshima). The plant was shut down. On January 18, 1980 the NRC authorized NFS to return on-line, six months after the loss of uranium was discovered. An undisclosed amount over the nine-kilogram minimum is still missing. The statute limit was amended with an all-new, just-for-Erwin exception making the cutoff level 1% of “throughput,” which may be higher or lower than nine kilograms. The NRC will not say. *Dr. Frank Ingram, an NRC spokesman, said the new limit is “more realistic in terms of the plant’s ability to control its records.” It appears the NRC has changed the rules because Erwin couldn’t play the*

*game. If NFS Erwin is old or too sloppy to meet original standards, why is it up and running again"? The Nation, 4/05/80*

- 04/26/80 *Latest Nuclear Fuel Loss 'Within Limits'. Johnson City Press Chronicle, 4/26/80*
- 06/27/80 *NRC Denies Environmental Group Public Hearing On NFS: The group, Natural Resource Defense Council, asked for a hearing following NRC's decision to allow NFS to re-open in January after being closed following the loss of an undisclosed amount of uranium. Joseph Fouchard, NRC director of the Office of Public Affairs, said the commission had given the environmental group until Sept. 1 to file written reports. The group has advocated the closing of the plant and its relocation on a federal reservation. Tom Cochran, head of the environmental group's Washington office, said they were dissatisfied with the NRC ruling and planned an appeal. Cochran said there were members of his organization that lived in a 25-30 mile radius of NFS' plant but he would not identify them. Johnson City Press Chronicle, 6/27/80*
- 09/17/80 *NRC Official Says No Announcement At Hand. The commissioners are considering the loss of an undisclosed amount of uranium which was reported September 17. Johnson City Press Chronicle, 01/03/81*
- 12/11/80 *NRC: Too Much Erwin Plant Radioactivity. NFS accidentally vented uranium through its stacks due to malfunctioning equipment. Small amounts, totaling no more than 36 grams, were released when the hydraulic column overflow line malfunctioned. About one-fourth of the 48.4 pounds--or **11.4 pounds remains unaccounted for from the 1979 inventory discrepancy.** The Tennessean, 01/26/81*
- 01/03/81 *NRC Officials Says No Announcement At Hand. Commissioners considering the loss of undisclosed amount of uranium (*reported last September 17, 1980*). Ken Clark, public information officer for the NRC said the commissioners had several options to consider and that the revoking of the company's license and the operation of the plant being placed under the supervision of the DOE was only one of the options. Johnson City Press Chronicle, 1/03/81*
- 03/18/81 *Amount of Lost Uranium Kept Secret. NRC says due to new policy of DOE, amount of uranium reported missing last September by NFS would not be released. The amount of uranium missing exceeded **19.8** pounds, the amount allotted as "production loss" at the plant. Johnson City Press Chronicle, 3/18/81*
- 04/81 *A Big Job For A Little Town. The people of Erwin may be giving more than their share for 'national security'. Off and on for the past decade, and almost continuously since 1979, Erwin has been gripped by strife and controversy, and NFS has stood in the center of the storm. Its business, for "reasons of national security," has been shrouded in secrecy, and its officials have maintained a posture of public silence. The roster of critics has included local and national anti-nuclear groups, commissioners and staff members of the NRC, several physicians in Erwin and Johnson City and both local and national representatives of the union itself. Local officials, including the mayor, who*

is also the NFS company doctor, have steadfastly supported the company, and newspapers in the area have tended, in the main, to ignore the controversy altogether.

On three or more occasions in the past, the NFS plant has accidentally released into the atmosphere a cumulative total of *more than 40 pounds (about 18,144 grams) of radioactive uranium hexafluoride*. On numerous occasions since 1968, NFS has been shut down by the NRC *after routine inventories showed that excessive quantities of highly enriched uranium could not be accounted for*. After the inventory discrepancy was reported in September, a five-member regulatory commission ordered a shutdown of the plant while FBI agents conducted an intensive search for the missing uranium. *Four months later, with the investigation still incomplete, the Navy's Admiral Hyman Rickover told the NRC that fuel processing at the Erwin plant was vital and indispensable to national defense, and the commission promptly voted 4 to 1, with member Victor Gilinsky dissenting, to reopen the facility. Safety and security regulations were tightened, but accounting standards were actually relaxed, permitting NFS to have uranium shortages of more than twenty pounds in each two month inventory period; exactly how much more, NRC officials would not say. The exact amount of uranium lost in the two month period was not made public, but individuals in a position to know placed the total at forty-eight pounds. Total loses have never been disclosed by the NRC, but published figures have ranged to 400 pounds and more.*

At a public meeting in Erwin last December, and again in a closed session with local physicians the following month, NRC officials stoutly maintained that in spite of all the alarms about accidents and missing uranium, NFS has never come close to exceeding the Government's health and safety standards, and the company's twenty-four year presence in Erwin had done no measurable damage to workers, residents, or the environment. *But just as insistently, one speaker after another rose to question the performance, the motives, and even the veracity of both the company and the NRC.* Maximum allowable exposure of workers at the Erwin plant is thirty rems a year in the lungs.

The answers provided by NRC and plant officials to hard questions have been detailed and exceedingly complex, filled with scientific data and the mystifying terminology of nuclear science. Stripped to their essence, the answers seem to say this: "There is nothing to fear. The uranium materials handled by NFS are not fissionable, not by themselves explosive, not even highly radioactive. We have elaborate safeguards to minimize their danger, and NFS has never exceeded the critical boundaries of safety. Workers in the plant have not been seriously contaminated by radiation, nor have residents of the community. This is not a dangerous place to work or to live. The Progressive, April/1981, p.45, 46,47,48

09/03/81

*Plant Repeatedly Cited For Nuclear Safety Failures.* The most recent charge was made in an NRC letter to W. C. Manser, general manager of the NFS plant. Addendums to the letter outlined security breakdowns discovered during an inspection in August that appeared to violate strict NRC regulations for safeguarding nuclear materials. NFS was shut down for four months because of a security matter after the NRC discovered in September 1979 that 22,085 grams of HEU (enough to make at least two atomic bombs) was missing from the plant's June to August inventory. *As a result of the investigation, NRC officials concluded that some of the uranium may have been*

*discharged into a nearby river or released up a smokestack as radioactive waste. But the NRC conceded the inventory discrepancy "was not reduced to a level that some NRC staff would have expected solely as a result of measurement uncertainty." The records also indicate the plant has a history of inadequate accounting and inventory procedures which have resulted in "inventory differences" over the last 12 years. These reports were of sufficient concern to the NRC that the plant was ordered to shut down on several other occasions.*

Despite chronic problems at the facility over the years, which also include waste discharges as well as inventory discrepancies, most security breakdowns, including the latest, have been treated as routine occurrences, NRC officials say. Critics of the Erwin facility, *including some past and present NRC staff members, say the NRC is sometimes reluctant or hesitant about enforcing strict regulations against the facility because it is essential in the Navy's Nuclear Propulsion Program. "What you're talking about is a matter of national security," said one staff member. That puts us sort of between a rock and a hard place. We've got a 24 year old facility that's had some problems, without it our nuclear fleet wouldn't have any fuel. "That's what you have to consider," said one former high-ranking NRC official, who described the aging facility as "a crock of a plant."* The Atlanta Journal and Constitution, 12/02/81 (Note: On June 30, 2009, NFS applied for a license renewal for 40 years from the NRC . ML091900063)

- 12/02/81 *Plant Repeatedly Cited For Nuclear Safety Failures.* During the two years since the unexplained disappearance of some **50** pounds of weapons grade uranium from an Erwin, Tn., nuclear fuel plant, the facility has been cited numerous times for failing to adequately protect its present inventory of nuclear material. *Despite the plants inability to account for its uranium, the NRC described the occurrences as "minor and insignificant".* "The violations include the failure to inspect packages adequately that are entering and leaving nuclear material access areas and failure to provide security guards "with continuous communication capability." *The records also indicate the plant has a history of inadequate accounting and inventory procedures which have resulted in inventory differences over the last 12 years.* Atlanta Journal Constitution, 12/02/81
- 05/82 *Workers Reprimanded For Uranium Error.* NFS mistakenly shipped more than **1,000** lbs. of uranium scrap out of the plant in eight barrels they thought were empty, along with a truckload of empty barrels. *The Erwin plant receives uranium in a gaseous form called uranium hexafluoride (UF<sup>6</sup>), and chemically converts it into uranium oxide or some other solid uranium compound that can be used in fuel rods for nuclear reactors.* Treating low enriched uranium scrap for commercial customers is a sideline. Atlanta Journal and Constitution, 8/07/82
- 06/17/82 Enforcement Conference to discuss inadvertent shipment of low enriched uranium (Hereafter LEU) to another licensee. Hearing Before the Subcommittee on Energy Conservation and Power, p.72, 9/18/86
- 11/23/83 *Erwin NFS Plant Illustrates Loss problem.* When it comes to monitoring radioactive materials or waste, the federal government is nothing if not inconsistent. A nuclear fuel fabrication plant run by Nuclear Fuel Services, Inc., (NFS), a Getty Oil Co. subsidiary, is periodically closed as regulators,

and on occasion, FBI agents, attempt to discover the whereabouts of missing uranium. NFS was also the operator of the fuel-rod reprocessing plant at West Valley, N.Y., an economic and technological failure that closed in 1972. *An internal NRC report, dated December 11, 1979, and originally classified "confidential," offers a grim assessment of uranium bookkeeping at NFS. "During a four year period, NFS "has failed to establish an heavily enriched uranium accounting system which can consistently and confidently demonstrate accountability for this sensitive material within acceptable limits of measurement error. Because of equipment failure, an undetermined number of pounds went up the plant's smoke stack. Radioactive particles rained over the surrounding area. A random survey discovered that 55 gallon barrels of radioactive waste the company shipped to burial grounds contained **20** percent more uranium than NFS had said. On other occasions, the company shipped out barrels it labeled as empty when in fact they contained uranium, according to NRC records. Accounting procedures were so haphazard that, following a joint FBI-NRC investigation in 1979, an NRC staff member concluded in a report "Both the staff and FBI have completed their investigations without being able to state conclusively whether or not a theft has occurred at NFS. Kingsport Times News, 11/23/83*

- 05/09/84 NRC fined NFS \$18,750 for multiple violations of nuclear criticality safety control measures during the handling of special nuclear material (Hereafter SNM). Hearing Before the Subcommittee on Energy and Power, p.17 & p.72, 9/18/86
- 07/27/84 Failure to establish an adequate physical protection system in allowing degraded Material Access Area barriers. Severity Level II--\$100,000 proposed, later mitigated to \$50,000. Hearing Before the Subcommittee on Energy and Power, p.73, 9/18/86
- 1985 Licensee failed to maintain current knowledge of the identity, quantity and location of SNM contained in discrete items and containers. The amount was **473** grams of U-235. Hearing Before the Subcommittee on Energy and Power, p.49, 9/18/86
- 01/21/86 Enforcement Conference to discuss failure of security guard to detect weapon in truck which entered the plant. Hearing Before the Subcommittee on Energy and Power, p.73, 9/18/86
- 06/17/86 Failure to notify NRC of the introduction of an unauthorized firearm in the prescribed manner; failure to prepare procedures which were sufficiently detailed to implement the required level of search; and failure to fully implement self-imposed corrective actions. Hearing Before the Subcommittee on Energy and Power, p.73, 9/18/86
- 11/90 Mishandling of more than **4** kilograms Uranium. Kingsport Times News, 01/26/91
- 02/24/92 Shipping Error – Exceeded A2 Limits. Licensee reported a shipping error that caused 250 shipments to **(R)** exceed A2 limits. Containers used were not approved for the quantities shipped. Due to failure of the computer software, *not all (R) was accounted for*. The total amount shipped was **(R)** not **(R)** as planned. Source/Material—Fuel Fabrication Material (PU-241). FC920181

- 1999 A Severity Level III violation was identified involving the *improper movement of Special Nuclear Material (SNM)* at the 200 Complex. 2001 NFS ER, p. 6-1, ML050130093
- 08/24/99 *NRC Bulletin 91-01—24 Hour Report.* Operator was loading trays in ENCLOS-0602. There were two 2-liter bottles each in ENCLOS-0601 and -0602, which is the limit for each enclosure. After emptying one of the bottles in ENCLOS-0602, the operator needed to switch the remaining full bottle with one in ENCLOS-0601. He did this by putting the full bottle from ENCLOS-0602 on the ledge between the enclosures, moving to ENCLOS-0601, brought the bottle into ENCLOS-0601 and set it on the floor. The limit for two 2-liter bottles in ENCLOS-0601 was violated. Next, the operator took the bottle he wanted from ENCLOS-0601 out of its rack position, and moved it to the ledge between enclosures. In doing so he violated the limit that states only one bottle can be out of its rack at a time. He then moved back to ENCLOS-0602 and brought the bottle in. Licensee informed the NRC Resident Inspector. Event #36071, FC990587
- 10/19/99 Unauthorized removal of seven grams of Uranium 235 contained in HEU from the building vault to a building storage area which involved the *unauthorized storage of a 55-gallon drum containing the SNM in a location not approved for SNM storage, and the failure to assure the movement of this material out of the vault was properly documented by the material control and accounting system at the facility.* NUREG-0940, Part 3, 6/30/00, ML003729792 A Severity Level III Violation. 2001 NFS ER, p.6-1, ML050130093
- 04/03/00 *License Amendment #3—Authorization to Delay Conducting Physical Inventory Pursuant to 10 CFR 70.34.* License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.5, 8/31/07
- 06/02/00 *License Amendment #7—Authorization to Delay Conducting Physical Inventory Pursuant to 10 CFR 70.34.* License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.5, 8/31/07
- 07/20/00 *NFS issued violation by the NRC for failure of the licensee to meet the performance requirements of a July, 2000, Confirmatory Order Modifying License (COML) involving its safeguards contingency plan.* Reply to Notice of Violation No. 70-143/2007-402-02-(U), B. Marie Moore, Vice President, Safety and Regulatory, NFS, 5/16/08, to NRC, Document Control Desk, Washington, DC., 20555, ML081680114, and NRC" Escalated Enforcement Actions Issued to Materials Licensees-N, EA-06-129; 133; 141; 160; 179; 182; <http://www.nrc.gov/reading-rm/doc-collections/enforcement/actions/ma...>, 1/01/2010 (See 5/16/08)
- 09/26/00 The Regional Administrator and the Director, Division of Nuclear Materials Safety were at NFS to lead a meeting with licensee management. The purpose of this meeting was to discuss the licensee's performance from Nov. 14, 1999 to June 30, 2000, and the results or outcomes achieved thus far *in improving both the safety culture and regulatory compliance at the fuel facility.* NFS discussed several program initiatives to improve their performance which included an event tracking system, *safety-related management programs, a safety compliance enhancement plan, a commitment tracking system, and a quality assurance audit program.* NRC, Region II, Items of Interest, Week Ending September 29, 2000

- 10/19/00 NFS shipped Class C waste to Envirocare labeled as Class A waste. NFS' assay counting system contained a plutonium-241 source (decays to Am-241). Significant Am-241 in-growth occurred in the calibration system resulting in decline of the efficiency of the system. The State of Utah will allow the waste to remain buried. Enforcement Action Tracking System, p.80, License History Report, NFS ML020420107
- 01/15/01 *License Amendment #15—Approval of Request for Time Extension to Conduct a Physical Inventory.* License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.5, 8/31/07
- 01/23/01 *From January 23, 2001 until March 9, 2001, NFS stored up to 20 kilograms of HEU-235 in storage locations and a monitoring system (i.e., a criticality alarm system) meeting the requirements of 10 CFR 70.24 was not maintained in the area. Specifically, the HEU was shielded such that an accidental criticality in the SNM producing an absorbed dose in soft tissue of 20 rads of combined neutron and gamma radiation *could not have been detected at an unshielded distance of 2 meters from the reacting material within one minute.* This is a Severity Level III violation. Notice of Violation to NFS, EA 01-098 from Martin J. Virgilio, Director, Office of Nuclear Material Safety & Safeguards (NMSS), NRC, 9/24/01*
- 03/05/01 Safety Equipment Failure/Criticality Alarm May Not Cover Area Used For Storage. Event 37811
- 03/22/01 *NFS Licensee Performance Review (LPR). Period beginning Nov. 14, 1999 and ending Jan. 13, 2001.*  
 → Safeguards—Challenges to Performance: *Plan processing so that (1) SNM inventory can be completed in the time required and (2) scrap can be processed to a more accurately measurable form.* Continue adequate security during decommissioning of facilities and also during the security upgrade of structures. LPR of Licensed Activities for NFS, from NRC, Inspection dates 11/14/99-1/13/01, March 22, 2001
- 03/26/01 *License Amendment #21—Approval of Request for Time Extension to Submit the Physical Inventory Summary Report.* License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.6, 8/31/07
- 05/31/01 *Safety Equipment Failure—Inadvertent Loss of Power To The Criticality Accident Alarm System. Event # 38044* “During testing of a portion of the system that has not been used for many years, a short circuit in the system occurred that resulted in system failure and loss of power to certain safety and safeguards equipment.” NFS—Uninterruptable Power Supply Update, Region II, Items of Interest, Week Ending June 1, 2001, FC010506
- 06/22/01 After several NRC inspections and investigations, *the agency determined that NFS could not account for a substantial amount of nuclear material for a period of about six weeks in June 2001.* “While there were no actual consequences, the event’s potential consequences were significant,” said NRC administrator Luis Reyes. NFS was cited for “more minor” violations in 2001 and 1999

concerning failure to maintain criticality alarm system for storage of about 20 kilograms of HEU and for failure to follow procedures to control and account for nuclear materials. Violation nets NFS \$60,000 fine, The Erwin Record, 10/25/03 (In April 2002, this material discrepancy came to the NRC's attention. *The licensee failed to meet several regulatory requirements for accounting for SSNM.* The NRC determined in July 2002 there had been an actual event, and it was potentially significant enough to warrant special inspection. Several apparent violations of regulatory requirements were identified and the NRC issued a Confirmatory Action Letter (CAL) to NFS on October 15, 2002, to document specific commitments to corrective actions discussed by NFS in the Oct. 3, 2002 meeting.) Report to Congress on Abnormal Occurrences, Fiscal Year 2002, Date Published: April 2003, Office of Nuclear Regulatory Research, NRC, p.30, 31, NUREG-0090, Vol. 25 (Note: *Formula quantities—It is defined as "strategic special nuclear material" (SSNM). The uranium-235 content of low enriched uranium can be enriched to make highly enriched uranium, the primary ingredient of an atomic bomb, according to the NRC. NFS now is in the process of amending its Special Nuclear Material (SNM) license so that it can convert 33 metric tons of highly enriched uranium into fuel for TVA commercial nuclear reactors. The Office of Enforcement said that based on multiple failures in the NFS case, the incidents could have led to the undetected diversion of SSNM "and there would have been no record providing evidence that it was missing."* NFS Faces \$60,000 fine for Nuclear Material Violations, Elizabethton Star, 10/19/03 (Note: The NRC was notified almost a year later of this event)

- 09/12/01 *Discovery of Missing Shipments (30-day Report).* License reported the *loss and recovery of two packages provided to Airborne Express for delivery.* One package contained 40 MBq (1.1 mCi) of natural thorium (R) solid metal rod, and the other contained 3.4 MBq (91 uCi) of *highly enriched U-235 (R) solid UO<sub>2</sub>.* The package containing natural thorium was licensed by the State of Tenn., (License #TN-S-86007) and the package containing the U-235 was licensed by the NRC (License #SNM-124). The material was subsequently found intact at the Wilmington Airborne Express facility on 11/30/2001. The licensee notified the FBI that the material was found. *Reported date—10/19/01. Event 38406, FC010960*
- 09/23/01 *One Hour Security Report.* Safeguards system degradation related to power supply functions. Event #38306
- 05/16/02 The NRC inspector observed weighing of materials received by NFS (HEU uranium containers having more than 60 grams) and the use and control of tamper safety seals. The material was placed in a temporary storage area. *The inspector noted the material was neither locked nor personally attended and the potential for diversion of nuclear material was increased due to construction activities in the immediate area. NFS agreed the regulation was not being followed and was slow to initiate correction action.* NFS Issued Violations By NRC—Nuclear Material, Criticality Issues Cited, Elizabethton Star, 7/07/02
- 07/19/02 *License Amendment #35—Time Extension to Submit the Physical Inventory Summary Report.* License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.6, 8/31/07

- 11/08/02 Licensee stored multiple SNM-bearing containers in a location within Bldg. 306 West NDS Scanning Facility which was neither designated for storage nor approved by a posted station limit card. Severity Level IV Violation from Inspection September 1-October 12, 2002.
- 01/18/03 *A routine inspection of NFS by the NRC found some minor violations. The inspection was done Oct. 13 and Nov. 23<sup>rd</sup>. According to a letter from the NRC to NFS, dated Jan. 7, the plant was cited for one violation, while no citations were issued for three other violations. Both the NRC and spokesman for NFS, Tony Treadway said *the cited violation was classified and no further information would be released to the public.* Two other non-cited violations included failure to assure reliability of safety-related equipment through testing *and the location of an excessive number of nuclear material storage containers in one place. The third non-cited violation was also classified.* Inspectors said that in the non-cited violation, *several storage containers were located where only one should have been.* Johnson City Press, 1/18/03 (Note: NFS cited and non cited violations are classified information?)*
- 03/25/03 The NRC announced Friday it will hold a public meeting with NFS officials on April 9 to discuss the annual License Performance Review (LPR). The LPR covered a period from Feb. 17, 2002 through Jan. 18, 2003. Five major areas were evaluated. "Based upon the results of the review, procedural compliance continues to present a challenge to the facility and warrants increased NRC oversight," NRC officials said. "Company efforts for improving the system used by managers and supervisors *to ensure procedural compliance for safety and security activities have not been completely effective.*" The NRC said it will use the review as a basis for establishing a NRC oversight program for the plant during the next 12 months. *In addition to problems in the NFS procedural compliance for safety and security activities, it has also identified improvement is needed in the plant's material control and accounting program.* Johnson City Press, 3/25/03
- 04/22/03 *Agency Action Review Meeting (AARM)* reviewed the operation safety performance of Nuclear Fuel Services, Inc. "Only those plants with significant performance problems are discussed at AARM. The plants discussed are those whose performance had resulted in them being placed in either the multiple/repetitive degraded cornerstone or unacceptable performance columns of the NRC reactor oversight program (ROP) action matrix."
- Martin Virgillio, Director of the NRC Office of Nuclear Materials Safety and Safeguards (NMSS) stated that NMSS worked with the Regional Administrators to perform a screening review and concluded that one facility, Nuclear Fuel Services, (NFS) in Erwin, TN., needed to be discussed at the AARM. Luis Reyes led a discussion of NFS. The LPR identified areas needing improvement: *ensuring procedural compliance (identified in each of the last (3) years; implementation of material control and accounting (MC&A) program, and completeness of license amendment applications.* Mr. Reyes discussed the uniqueness and importance of the facility, MC&A inspection findings which resulted in a *Confirmatory Action Letter and an Office of Investigation (OI)*, unresolved items and upcoming Licensee and NRC actions. As a result of these discussions, senior managers concluded the performance of NFS did not meet the criteria in SECY-02-0216 for discussion at the Commission briefing on the AARM. Results of the NRC Agency Action Review Meeting, (AARM),

April 22-23/2003, 5/2/03, ML031250269 (Note: *The objectives of the AARM discussions are to review the appropriateness of Agency actions that have been taken for those plants with significant performance problems and those that have moved into the multiple repetitive degraded cornerstone. And also to review the appropriateness of Agency actions that have been taken for those nuclear materials licensees, including fuel facilities with significant safety or security issues. p.6, NRC Briefing on the Results of the Agency Action Review Meeting (AARM), 5/14/09, ML091390764*)

- 07/21/03 A closed, predecisional, enforcement conference was conducted in the NRC's headquarters office with NFS and members of NFS staff to discuss the apparent violations, their significance, root causes, and NFS' corrective actions associated with the physical protection and MC&A programs at NFS's Erwin facility. Ten (10) violations of NRC requirements occurred concerning a substantial amount of Category 1A Strategic Special Nuclear Material (SSNM) that went unaccounted for at the Erwin facility for a period of approximately 6 weeks beginning in June of 2001. *The NRC considers the violations a significant breakdown in NFS's implementation of its MC&A system. Letter to Dwight Ferguson, President, NFS, from Luis A. Reyes, Regional Administrator, NRC, Subject—Notice of Violation and Proposed Imposition of Civil Penalty, 10/17/03, Inspection Report Nos. 70-143/2002-10 and 70-143/2003-201, EA-03-124*
- 08/29/03 *License Amendment # 41—Approve Time Extension to Perform Receipt Measurements. License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.6, 8/31/07*
- 09/15/03 *License Amendment # 42—Approve Time Extension to Perform Receipt Measurements. License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.6, 8/31/07*
- 10/17/03 *24 Hour Bulletin 91-01 Report From NFS. It was suspected that NFS storage area H/X limits were potentially exceeded for materials received from an off-site facility. A subsequent review of stored materials identified the H/X values for two containers exceeded the H/X limits for a storage area. Event #40257, FC030834 Containers of (R) exceeded the (R) H/X ratio established by NCS for a (R) area because no method of verifying the actual H/X ratio of the material prior to placing the material (R) had been established. Licensee Performance Review (LPR) of Licensed Activities for NFS, 3/12/04, ML081440081*
- 10/24/03 *License Amendment #44—Approve Time Extension to Perform Independent Assessment of MC&A Program. License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.6, 8/31/07*
- 10/25/03 *NFS Levied Fine by NRC for Violations of NRC Requirements Related to the Control and Accountability of Nuclear Material. Letter to NFS from NRC Region II Office in Atlanta said that after several NRC inspections and investigations, the agency determined that NFS could not account for a substantial amount of nuclear material for a period of about 6 weeks in June 2001. The NRC considers the violations related to this event a significant breakdown in the NFS system to control Licensed nuclear material and that the events potential consequences were significant. The NRC also concluded the initial NFS review of the event was less than adequate. NFS was cited for "more minor" violations in 2001 and 1999 concerning failure to maintain a criticality alarm*

*system for storage of about 20 kilograms of HEU and for failure to follow procedures to control and account for nuclear materials. The Erwin Record, 10/25/03 (Note: Almost 2½ years later!)*

11/26/03

*NFS Inspection Report: Two recent Nuclear Criticality Safety (NCS) operating limit violation events were reviewed along with the associated licensee investigation including walk downs of fissile storage areas where the events occurred. NCS Event 88015: Inspectors reviewed licensee's investigation and corrective actions for two Nuclear Criticality Safety (NCS) events occurring recently in fissile material storage areas and reviewed NFS' investigations of the two events to ensure NFS had performed thorough reviews of the events.*

*NFS determined that two cans of fissile material stored in a designated storage area were stored in contravention of the mass limit of kilograms for material authorized to be stored in that area. The event was discussed in detail in Inspection Report 70-143/2003-007 and characterized as Unresolved Item (URI) 70-143/2003-007-01 because the NFS investigation was incomplete. *NFS' investigation revealed the event was caused when materials was moved from one designated storage area to another by operators who had not been trained on NCS requirements for the new storage area. The operators were qualified for one storage area and thought they were qualified to move material from that area to another area.* NFS acknowledged the systemic weakness revealed by the event, which would be remedied by periodic review of the data base by NFS management. Inspectors determined the event violated the station limit card at the storage location. *This non-repetitive, licensee-identified and corrected violation is being treated as a Non Cited Violation (NCV). Failure to effectively assure fissile material stored in designated storage areas met NCS requirements for storage.* (NCV) 70-143/2003-205-01)*

*H/X Limit Event: NFS determined that two cans of fissile material stored in a different designated storage area did not comply with the Nuclear Criticality Safety (NCS) required hydrogen to fissile nuclide (H/S) ratio less than 1. The investigation revealed this event occurred due to poor communication of receipt requirements to the shipper resulting in two containers with communication of receipt requirements to the shipper resulting in two containers with less than 150 grams each of U-metal which did not meet the H/X limit due to extra packing material. NFS found that BLEU project U-metal did not have H/X information provided for each individual container. The H/X ratio was calculated for each shipping drum in order to meet Department of Transportation (DOT) requirements, NFS lacked the required information to verify the H/X limit was met on individual cans. *Inspectors determined NFS understood the material content of the storage containers but had not established a minimum mass limit for the storage area based on the belief the H/X limit would be met by the mass of fissile materials to be shipped.* IR 70-143/ 2003-205, Inspection dates 11/3-7/03*

12/31/03

*License Amendment # 46—Approve Time Extension to Perform Receipt Measurements. License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.7, 8/31/07*

01/26/04

*NFS Inspection Report: Licensee stored multiple Special Nuclear Material (SNM) **(R)** containers in a location **(R)** which was neither designated for storage nor approved by posted station limit card.*

*The inspector observed the storage of multiple 55-gallon drums containing NDS standards in a location, which was not posted with a storage station limit card. "The guide lines and Expectations for the Implementation of Nuclear Criticality Safety Evaluations" had not been established prior to licensee conducting the implementation of nuclear criticality safety evaluation. (One Violation, with three examples was identified with implementing licensee's nuclear criticality safety program.) The inspector also verified if the required nuclear criticality safety inspections for every shift in the fuel manufacturing area were being performed and noted a few were missing over the last 2 months. IR 70-143/2003-010, Inspection dates 12/15/03-12/18/03, ML081440508*

- 04/21/04 *Nuclear Regulators Tell NFS to Increase Safety Education. The Greeneville Sun, 4/21/04 Note: "The purpose of this meeting was to discuss the licensee's performance from 11/14/99 to 6/30/00, and the results or outcomes achieved thus far in improving both the safety culture and regulatory compliance at the fuel facility. NFS discussed several program initiatives to improve their performance. These included an event tracking system, a safety related management programs, a safety compliance enhancement action plan, a commitment tracking system, and a quality assurance audit program. Licensee Performance Review, NFS, and NFS MidCycle Performance, 9/26/00*
- 10/15/04 *License Amendment #53—Request for Time Extension to Perform Receipt measurements of a material shipment for potential business opportunities. Approve Time Extension to Perform Receipt Measurements. License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.7, 8/31/07, ML072630248*
- 11/05/04 *License Amendment #55—Request for Modification of Material Inventory Measures with regard to a quantity of material partially removed from the facilities dissolution process prior to the conduct of a semiannual inventory. Request needed because of upcoming Nov. 2004 HEU physical inventory. Approve Modification of Certain Material Inventory Measurements. License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.7, 8/31/07*
- 12/13/04 *Uncontrolled geometry bags. IR 70-143/2004-10, ML081440453*
- 12/14/04 *Licensee failed to comply with the unfavorable geometry bag handling requirements of NFS-HS-CL-27. Specifically, licensee did not close, modify, or remove the unfavorable geometry bag from the area upon completion of the activity which required the use of the bag. IR 07000143-2004207, 2/10/05, ML081440507*
- 01/10/05 *License Amendment #57—Request for Time Extension to complete receipt measurements from letter dated Sept. 30, 2004. With temporary safeguard conditions SG-4.34 reissued, effective immediately for SSNM. Larger shipments of material received. More time needed to perform required receiving activities with larger shipment quantities. Approve Time Extension to Perform Receipt Measurements. License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.7, 8/31/07, ML072630207*

- 02/11/05 Failure to comply with the unfavorable geometry bag handling requirements. Failure to get NCS approval prior to storing **(R)** containers. IR 70-143/2004-207, ML081440511 and ML081440512
- 03/04/05 *NFS cited for failing to "Secure or Properly Attend" Special Nuclear Material (SNM). Johnson City Press 3/04/05 and Federal Register, Vol. 72, No. 145, p.41529*
- 03/24/05 *Loss or Degraded Safety Items—Equipment Piece for Storage Rack Not in Place for Safe Storage of Special Nuclear Material (SNM.) NFS Event Report 41523, FC070005*
- 05/09/05 *Licensee identified a container stored in a unauthorized location **(R)** designed with several different types of shelves, and as noted on the NCS posting, different containers were allowed to be stored on each type of shelf. The similarity between shelves led to confusion on the part of the operators and supervisors and an incorrect decision resulted in a container being stored in an unauthorized location. Failure to store SNM in its authorized location due to confusion over identical storage racks (Non-Cited Violation (NCV). IR 70-143/2005-03, Report date 6/27/05, ML081440517*
- 06/01/05 *Watchdog Group Urges Nuclear Materials' Storage Be Consolidated At 7 Sites. In a report issued on May 19, the Project on Government Oversight (POGO) recommended that NFS in Erwin be among seven sites in the U.S. at which highly enriched uranium and plutonium would continue to be stored. Currently, according to a POGO press release, 13 sites around the country house "hundreds of metric tons of plutonium and HEU in quantities large enough to make nuclear bombs." Among those sites is Nuclear Fuel Services in Erwin. The facility is one of only two commercially run facilities in the nation that store such materials. *Security experts greatest concern is that a suicidal terrorist group would reach its target at one of the facilities and, in an extremely short time, create an improvised nuclear bomb on site, the report says. "It is only now becoming known outside DOE how easily this could be accomplished: using a critical mass (about 100 pounds) of HEU, a terrorist could trigger a detonation of a magnitude close to that which devastated Hiroshima, referring to the Japanese city destroyed by a U.S. atomic bomb in 1945 near the end of World War II.**

*"The possibility of this scenario was a primary motivation for the DOE's decision to significantly increase security requirements at nuclear weapons facilities last year." The other commercial facility at which special nuclear materials (SNM) are stored and used, according to the POGO report, is the Nuclear Products Division of BWXT Corp., in Lynchburgh, Va. Both NFS and BWXT contain weapons grade nuclear materials (but) have not been required to meet the security standards set for similar facilities by the DOE, according to the report. NFS and BWXT are overseen by the NRC, which has less stringent security standards than does the U.S. DOE, according to the POGO report. In addition, the report says, security has not been tested at NFS since 1998. "Although problems with security were identified at that time (1998), the Office of Naval Reactors reportedly fixed them quickly." In Oct. 2004, the NRC announced that this site had started down blending 33 metric tons of HEU from the DOE's Savannah River Site to produce fuel for a TVA nuclear power plant, the POGO report notes. Two other Tennessee sites where SNM*

are stored and used now are the Oak Ridge National Laboratory and the Y-12 National Security Complex in Oak Ridge.

*In 2004, the DOE, which oversees most U.S. facilities where "bomb-grade" nuclear materials are stored (but not the NFS plant) announced enhanced security requirements for facilities where enriched uranium and plutonium are stored. The report recommends holding NFS to the same "upgraded Design Basis Threat (standards) that apply to U.S. Department of Energy (DOE) sites and shifting responsibility for testing security from the NRC to the DOE's Office of Safety and Security Performance Assurance. The report estimates the cost of tripling the size of the security force at NFS to bring the facility up to DOE's standards to be "at least 180 million" over 3 years".*

Peter Stockton, a POGO senior investigator, said during a telephone interview, that his organization's aim is to see a reduction of the amount of HEU being stored and to improve security for the special nuclear material (SNM) that remains in storage. "Any high school student knows what you can do with HEU," he said. The Greeneville Sun, 06/01/05

- 06/30/05 NFS cited for failing to "secure or properly attend" Special Nuclear Material (SNM). Johnson City Press and Federal Register, Vol. 72, No. 145, p. 41529
- 11/09/05 NFS Cited for "Failure to Secure or Properly Attend" Special Nuclear Material. Johnson City Press and Federal Register, Vol. 72, No. 145, p. 41529
- 11/17/05 A (R) was left open and unattended (R). Failure to close an unattended container was a violation of NRC requirements, NCV 70-143/2005-011-03. IR dated 1/23/06, 70-143/2005-011, ML081480308
- 12/07/05 Lost/Stolen LNM>10X (Thorium). NFS Event Report 42191, Because the shipment was found within 30 days of licensee's determination that it was lost, licensee retracted this event. Licensee identified the (R) shipment exceeded the allowed (R) weight limit for the general license documented on the shipping papers. Since the shipment was ultimately bound for Holland, licensee claimed an oversight in that the shipping papers should have cited the (R) limit. The shipping personnel were in a hurry and interchanged the appropriate regulating reference, the correlating weight, and the proper weight units. Cause: Management deficiency. FC060001
- 12/11/05 Failure to comply with the unfavorable geometry bag handling requirements. Failure to get NCS approval prior to storing (R) containers. IR 70-143/2004-207, Inspection dates 12/13-12/17/04, ML081440512 and ML081440511
- 12/16/05 NFS procedure HS-CL-13-07 limits net container mass of containers in storage in the (R) area for criticality safety purposes. On 12/16/05 a container was stored in an area which exceeded the posted mass limit. Standard Operating Procedure (SOP) 409, Section 22, required two operators verify the container meets the posted limits prior to storage. *Failure to comply with storage area mass limits was a violation of NRC requirements, NCV 70-143/2006-001-01. Licensee determined*

the excessive mass in the container was bounded by the area safety analysis and implemented adequate corrective actions, *which consisted of review of storage of other containers and re-training operators on container storage.* IR 70-143/2006-001, Inspection dates 12/25/05-02/04/06, ML081490104

- 03/08/06 NFS failed to meet the performance requirements of Section IV of a July 2000 Confirmatory Order Modifying License and NFS Safeguards Contingency Response Plan, Revision 0 dated October 26, 2004, Section 3.3, Module 3, subparagraph 3.3.1 during a force-on-force exercise (EA-06-133). Federal Register, Vol. 72, No. 145, 7/30/07, p.41529
- 03/28/06 Failure to comply with criticality safety postings which restricted the number of drums stored in the QC vault. Failure to close an open container when it was left unattended. *Six examples (6) of failure to properly control SSNM.* Licensee Performance Review (LPR) of Licensed Activities for NFS, Report date 3/28/06, Inspection dates 1/23/05-2/04/06, ML072490009
- 05/13/06 NFS fails to "Secure or Properly Attend" Special Nuclear Material (SNM). Federal Register, Vol. 72, No. 145, p. 41529
- 05/23/06 Open unattended container found in building. IR 70-143/2006-003, ML073060269
- 06/06/06 *License Amendment #71—One-time Exemption from Physical Inventory Deadline.* Letter dated 4/13/06, inventory exemption request for the BLEU Preparation Facility, one-time exemption from physical inventory deadline (TAC L31947). BLEU facility in shutdown mode per Confirmatory Action Letter No. 02-06-003 dated 3/18/06. Inadvertent material transfer event. Safeguards license condition SG 4.35 of Material License SNM-124 added to incorporate one-time exemption. *Approve One-Time Exemption from Physical Inventory Deadline.* License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.7, 8/31/07, ML072630040
- 06/09/06 Special Inspection Team (SIT) inspection conducted to review causes and circumstances of *3/06/06 spill event into enclosure not approved for operation.* Significant safety concerns raised due to solution leaks in BPF are a credible abnormal condition. IR 70-143/2006-06, CAL #02-06-003, Events #42393 & #42411, ML072630328 (Note: Reported to Congress 13 months later).
- 07/07/06 *Synopsis of NRC's (OI) report regarding NFS personnel willfully recorded incomplete and inaccurate information of transfer of containers of SNM.* IR 70-143/2006-004, OI Case # 2-2005-028, ML073060562
- 08/08/06 *License Amendment #74: Authorize Use of Shipper's Quantities to Resolve Shipper-Receiver Difference.* Application dated 5/24/06, pursuant to Parts 70 and 74 to Title 10, Code of Federal Regulations, Material License SNM-124 *is amended to approve one-time use of shipper's quantity to resolve shipper-receiver differences on three occasions.* License History, Table 9.1, SNM-124, Chapter 9, Part II, Section A, p.8, 8/31/07, ML072630257

- 12/01/06 *Areas needing improvement are control of SSNM. LPR for NFS, 12/01/06, ML071930522*
- 12/21/06 *Failure to properly secure material prior to leaving it unattended. IR 70-143/2006-14, ML073050171*
- 05/30/07 *Nuclear Regulatory Commission Meeting at Rockville, Maryland: NFS management and NRC Region II Officials met with NRC Commissioners. William Travers, Regional Administrator, Region II, stated the issues that have been occurring at NFS are in procedural adherence and operations, procedural adherence in material control and accounting, utilization of problem identification and correction, the corrective action program, engineering design, configuration management and Nuclear Criticality safety analyses have been at issue at this facility. "About June of 2004, when the BLEU facility began operations, we've noted an increase in these types of issues arising from the BLEU facility in this relatively new process that they have been doing at the BLEU facility (p. 8)." The most significant event occurred in March of 2006. (35 liters of high enriched uranyl nitrate spilled into a glovebox, then onto the floor within a few feet of an elevator pit they (NFS) were not aware of. This was significant and two severity level 2 Aparent Violations because the configuration management controls that were not in place could have resulted in an inadvertent criticality in either the glove box or elevator pit (p.9) and ranked #2 on the INES Scale (p.10).*
- "An additional resident inspector was added to the site in 2005 (normally a Category 1 facility has one senior resident inspector.) (p.11). A number of enforcement actions occurred over the last year or so. Eight severity level 3 issues were identified. (p.12) Several of these involved willful violations of NRC requirements (p. 12). Alternative dispute resolution (ADR) was offered to NFS. They accepted. "We believe we've leveraged their willingness to agree that safety culture, configuration management, and areas of concern, including performance, procedural adherence, and corrective actions really were the issues that need to be resolved through a great deal of management attention." (p. 13) "There is a requirement for NFS to do a safety culture survey within two years, but after that not for the life of the facility." (p. 23)*
- Tim Lindstrom, Executive Vice President of HEU Operations stated "We at NFS have found our performance as described by the staff as being unacceptable in the past. (p. 25) Additionally, we found that we were not putting safety first." (p. 27) Commissioner McGaffigan: "NFS is as safe as it's ever going to be." (p.47) Closed session between NFS, NRC Region II and the Nuclear Regulatory Commission, 5/30/07, ML071930389*
- 07/18/07 *NFS Confirmatory Order reissued to Nuclear Fuel Services, Inc., for numerous issues, including a failure of NFS to meet the performance requirements of a July, 2000 Confirmatory Order Modifying License involving its safeguards contingency plan and the inadvertent transfer of HEU nitrate into an enclosure that was not approved for operation, published in Federal Register, Vol. 72, No. 145, Monday, 07/30/07 and Office of Enforcement Notification of Significant Enforcement Action, 07/11/07; ML071910431*

- 05/16/08 Failure to Implement Measures in the NRC Confirmatory Order (CO) Modifying License dated July 20, 2000. NFS' response to the violation dated May 16, 2008 contains Confidential National Security Information and is not subject to release to unauthorized personnel. Reply to Notice of Violation 70-143/2007-402-02 (U) to NRC from NFS, 5/16/08, ML081680114 (Note: NFS has not complied with a CO in eight years?) See 07/20/00, 03/08/06 & 07/18/07
- 08/15/08 *Incident Report on Unresolved Material Discrepancy Alarm.* Event Report 44417
- 08/21/08 *Materials Control & Accountability Alarm Procedure Initiated.* Event Report 44435
- 07/06/09 PIRCS 12815 was initiated after *a container of material was discovered in a storage rack not approved for that type of material.* Licensee determined root causes of the event to be failure of configuration control of the storage system and a failure to train personnel to be knowledgeable of the storage requirements. IR 70-143/2009-010, ML091880007
- 07/01/10 Material Control and Accountability (MC&A) Alarm Actuation Event Report 46064
- 07/08/10 Material Control and Accountability (MC&A) Alarm Actuation Event Report 46086

end

(Product of the Erwin Citizens Awareness Network, Inc., P. O. Box 1151, Erwin, TN 37650)

## CRITICALITY SAFETY AND CRITICALITY SAFETY RELATED ISSUES AT NFS

*"Nuclear Criticality Safety analyses have been at issue at this facility. —and I'm really talking about the period beginning about June of '04, when the facility, the blue facility, began operations—we've noted an increase in these types of issues arising from the blue facility."*  
William Travers, Regional Administrator, Region II, May 30 2007 NRC Commission Report, p.8, ML071930389

(Note: (R) Means Word Or Text Has Been Redacted. IR Means Inspection Report.)

- 12/04/80 NFS has had three significant (greater than 100 grams) releases of uranium hexafluoride since 1957. *The NRC has determined that accidents at NFS could involve: **criticality**, release of material (i.e., uranium hexafluoride fire). NFS has had small localized **fires**, (some involving less than 10 grams of uranium) have occurred. NRC Report, Public meeting in Erwin, TN, 12/04/80, p.4, p.5, & p.22*
- 05/09/84 NFS fined \$18,750 for multiple violations of **nuclear criticality safety** (NCS) control measures during the handling of special nuclear material (SNM). Severity Level III. Hearing Before the Subcommittee on Energy Conservation and Power, p.17 & 72, 9/18/86 "This action was based on a violation involving the accumulation of uranium-bearing solids in process equipment above specified limits, where the licensee failed to make appropriate investigations and take appropriate corrective action". Office of Inspection and Enforcement, Notification of Significant Enforcement Action, EN-85-014A, 11/27/85
- 10/29/84 Enforcement Conference to discuss NRC concerns regarding a buildup of uranium-235 in the ventilation systems and licensee's remedial action program. Hearing Before the Subcommittee on Energy and Power, p.73, 9/18/86 "In October 1984 it was determined that during the period of July-September 1984, accumulation of uranium bearing solids greater than action limits were found in the HEU Scrap Recovery Building ventilation system tanks. Consequently, materials accumulated in the ventilation system which exceeded the **criticality safety action limits**. Hearing Before the Subcommittee on Energy and Power, p.32, 9/18/86
- 09/19/86 *Nuclear Plant Said To Ooze Radiation. A nuclear plant in Tennessee is oozing radioactive contamination and the NRC is doing a poor job of overseeing its operations says Rep. Edward J. Markey. The report calls it quite simply the **most dangerous** uranium fuel production plant that the NRC licenses and says the commission has failed to crack down on the plant operated by Nuclear Fuel Services, Inc. *The study says the operator is lax on safety issues and lacks an adequate warning system to notify the neighboring community in event of an accident. It also cites groundwater contamination from radioactive ponds. The commission's chairman Lando Zech, said his agency's inspections in the last three years had identified significant deficiencies in the areas of **nuclear criticality control**, nuclear materials safeguard and radiological controls. St. Louis Post, 9/19/86**
- 03/90 *Resident Inspector To Be Posted At NFS. The NRC will be placing a full-time resident inspector at NFS due to NRC concerns about **criticality safety**. Kingsport Times News, 1/26/91 Note: "Among the accidents that have occurred in processing uranium are criticality accidents, fires, and releases of UF<sub>6</sub>. There have been no less than 37 occasions when the power level of fissile systems rose unexpectedly because of unplanned or unexpected changes in system reactivity. Of these 37 cases, **six cases caused eight deaths**. Of these **37 criticalities**, **eight occurred in fuel cycle facilities** (7 in the U.S. and one abroad). p.42 "In evaluating the need for offsite emergency preparedness at NFS, the staff concluded that the UF<sub>6</sub> accident to be considered was release from a 15 kg cylinder containing high enriched uranium (Hereafter HEU). This is the largest cylinder used at the site for HEU UF<sub>6</sub>. An accident in 1962 breached one cylinder.*

*Of the 15 kg contents, 6 kg was recovered but 9 kg was not recovered and presumably much of the material escaped from the plant". p. 49, A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees, Final Report, U.S. NRC, Office of Nuclear Regulatory Research, S.A. McGuire, 1/01/88, ML0620207910*

- 03/29/90 *Uranium Concentration Greater than Limit/Loss of **Criticality** Safety Controls.* Uranium concentration in a solution was greater than the (R) limit; reported on 07/11/1990. FC900218
- 11/28/90 *Proposed Civil Penalty of \$10,000: Failure to provide a siphon break or other means of preventing the transfer of HEU solution to an unsafe geometry tank and exceeding the station procedural concentration limits for uranium in two tanks on 11/28/90. The violation was aggregated as a Severity Level II problem because sufficient material was available and there was an existing pathway which, in combination, could have resulted in a **criticality**. "Because of poor past performance in the general area of criticality control, the civil penalty was escalated by 50%. The State of TN will be notified". Office of Enforcement, Notification of Significant Enforcement Action, EN 91-019, EAs 90-124 and 94-004, March 15, 1991*
- 11/30/90 *Resident Inspector To Be Placed At NFS.* The NRC will be placing a full-time resident inspector at NFS *due to NRC concerns about criticality safety*. Steward D. Ebnetter, Region II Administrator of the NRC in Atlanta briefed the commission on NFS. "He told them it was an old, unique facility with many modifications. *He said there were numerous deficiencies and concerns on the part of the NRC staff about **criticality safety**.*" Kingsport Times News, 01/26/91
- 11/30/90 ***Criticality** Control Limit Violated.* Criticality control limit was violated when a solution of Uranium with a concentration over the administrative limit was transferred to a waste tank. Highly concentrated uranium solutions in an adjoining part of the process were available in quantities that were more than sufficient to *have caused a criticality accident* in the unfavorable geometry tank. Operators had no knowledge of the potential for crossover of highly concentrated uranium solutions into unfavorable tanks as a result of open valves or other anomalies in the piping systems. FC900707
- 1991 *Between November 1991 and December 2000, NFS reported **10 Criticality Safety Events**. Criticality Safety Event Reporting Experience at NRC Regulated Fuel Cycle Facilities, 3/29/01, p.3, ML010880027*
- 11/07/91 *Raffinate Released to Unsafe Geometry/Loss of **Criticality** Safety Controls.* Raffinate columns were released to unsafe geometry tanks by mistake. U/I content was (R) and (R). Normal Release Limit (R). Reported on 11/14/91. FC911248
- 10/13/92 *NFS Incidents Spur Commission To Hold Enforcement Meeting.* A transfer of a uranium solution to a large tank in the NFS uranium recovery facility happened after an operator accidentally released untested waste liquid. There were 23 grams of uranium in the batch. If concentrations of uranium within the solution had been higher when the material was transferred to the "improper container," *it could have caused an "inadvertent criticality" and radiation could have been released*, said Frank Ingram, NRC spokesman. Johnson City Press, 12/10/92 (Note: "Uranium solution was drained from the wrong set of favorable geometry tanks into an unfavorable geometry tank without verifying the concentration was safe. This violation has been categorized at Severity Level III because it defeated a **criticality** control. A 12,500 Civil penalty was assessed". The Civil penalty was mitigated for licensee identification and corrective action, but escalated for poor licensee performance in this area". The State of TN will be notified. Office of Enforcement, Notification of Significant Enforcement Action, EN93-003, EA 92-231, 1/13/93)

- 05/20/93 ***Criticality Safety Limits Exceeded.*** Criticality safety limits exceeded for the quantity of (R) in a (R) tank analysis of the recovered waste revealed the total content of the tank had been between (R) of highly enriched (97%) uranium in the form of (R). FC940841
- 07/02/94 Failure of ***Criticality Alarm System.*** Commercial (R) were lost to the criticality alarm system for approximately (R). FC940619
- 09/27/94 ***Criticality Monitoring System Alarm Disabled.*** The audible alarm for the criticality monitoring system was found to be turned off (disabled). FC941881
- 1996 Between 1996 and 2000, Fifty Three (53) violations were identified at NFS by the NRC. Most of these violations occurred in the nuclear criticality safety and occupational radiation protection programs. NFS 2001 ER, p.6-1
- 03/22/96 ***Criticality Alarm System Alarm Locked.*** FC960199
- 08/07/96 ***Failure of Criticality/Fire Alarm System.*** FC960472
- 02/25/98 ***Criticality Control Parameter Exceeded.*** Licensee reported that plant personnel discovered that portions of the diked area around two waste water storage tanks in (R) was between (R) deep. This condition exceeds the Criticality Control Parameter (geometry) of (R) maximum dike depth and a level floor within the diked area specified in Plant Criticality Safety Analysis #54T-97-014. Plant personnel plan to fill in the portions of the dike that are greater than (R) and then resurface the dike area. FC980288
- 09/29/98 ***Criticality Monitoring Instruments Inoperable.*** Licensee reported that the inverter component of the (R) had failed during a test causing (R) criticality monitoring system failures. Due to (R) concerns, no additional details are provided. Procedure error was viewed as the primary cause of this event as the Plant Superintendent did not issue or authorize a work request for repair of the (R) System. FC981021
- 02/26/99 ***Criticality Alarm System Inoperable.*** Event # 35414, FC990133
- 02/28/99 ***Criticality Alarm System Was Out Of Service.*** Event# 35425
- 05/06/99 Failed Criticality Alarm Detector. Event #35691, FC990293
- 01/23/01-03/09/01 From January 23, 2001 until March 9, 2001, NFS stored up to 20 kilograms of HEU-235 in storage locations and a monitoring system (i.e., a criticality alarm system) meeting the requirements of 10 CFR 70.24 was not maintained in the area. Specifically, the HEU was shielded such that an accidental **criticality** in the SNM producing an absorbed dose in soft tissue of 20 rads of combined neutron and gamma radiation could not have been detected at an unshielded distance of 2 meters from the reacting material within one minute. This is a Severity Level III violation. Notice of Violation to NFS, EA 01-098 from Martin J. Virgilio, Director, Office of Nuclear Material Safety & Safeguards (NMSS), NRC, 9/24/01
- 03/05/01 ***Safety Equipment Failure—Insufficient Coverage of Criticality Alarm System Used for Storage.*** Event # 37811, FC010212
- 04/01/01 ***Safety Equipment Failure—Loss of Power To Criticality Alarm System.*** Event # 37881, FC010314
- 04/19/01 ***NFS Improves In Some Areas; Other Lacking, Says NRC.*** NFS received the best performance review in its history Wednesday from the NRC, however, the NRC also identified areas that still need improvement. The NRC found that improvements need to be made in safety operations and safety licensing, and also identified problems in procedural compliance, **criticality safety analyses** and self-assessment. Challenges were

identified in four areas. An "event" is an any occurrence in which there is injury, equipment or property damage, equipment failure, or a significant interruption in processes. *Since Aug. 30, 2000, 396 Events have been recorded. Elizabethton Star, 4/19/01 (Note: 396 Events in 8 months is NFS's best report in NFS history?)*

- 05/31/01 *.Safety Equipment Failure—Inadvertent Loss of Power To The Criticality Accident Alarm System. Event # 38044 "During testing of a portion of the system that has not been used for many years, a short circuit in the system occurred that resulted in system failure and loss of power to certain safety and safeguards equipment." NFS—Uninterruptable Power Supply Update, Region II, Items of Interest, Week Ending June 1, 2001, FC010506*
- 06/05/01 *Temporary Loss Of Criticality Accident Alarm System Due To Power Failure. Event # 38054, FC010522*
- 06/22/01 *After several NRC inspections and investigations, the agency determined that NFS could not account for a substantial amount of nuclear material for a period of about six weeks in June 2001. "While there were no actual consequences, the event's potential consequences were significant," said NRC administrator Luis Reyes. NFS was cited for "more minor" violations in 2001 and 1999 concerning **failure to maintain criticality alarm system for storage** of about 20 kilograms of HEU and for failure to follow procedures to control and account for nuclear materials. Violation nets NFS \$60,000 fine, The Erwin Record, 10/25/03 (In April 2002, this material discrepancy came to the NRC's attention. The licensee failed to meet several regulatory requirements for accounting for SSNM. The NRC determined in July 2002 there had been an actual event, and it was potentially significant enough to warrant special inspection. Several apparent violations of regulatory requirements were identified and the NRC issued a Confirmatory Action Letter (CAL) to NFS on October 15, 2002, to document specific commitments to corrective actions discussed by NFS in the Oct. 3, 2002 meeting.) Report to Congress on Abnormal Occurrences, Fiscal Year 2002, Date Published: April 2003, Office of Nuclear Regulatory Research , NRC, p.30, 31, NUREG-0090, Vol. 25 (The NRC was notified almost a year later?)*
- 07/20/01 *A predecisional enforcement conference was conducted at NRC Headquarters in Rockville, Maryland, with members of NFS and their staff to discuss an apparent NRC violation pertaining to the storage of up to 20 kilograms of highly enriched uranium (HEU) in the Building 306E bins for approximately 46 days without **adequate criticality alarm system (CAS) coverage**. Based on the results of NRC calculations, we have determined the NFS CAS would not have detected and annunciated an accidental criticality in Building 306E. *Failure to have adequate CAS coverage is of significant concern to the NRC because criticality alarm systems are designed to mitigate radiation exposure to workers and the public resulting from accidental criticality.* A severity Level III violation was issued on 9/24/01 (EA-01-098). Letter to Dwight Ferguson, President, NFS, Subject: Notice of Violation (NRC Inspection Report 70-143/2001-203), from /RA/ Martin J. Virgilio, Director, Office of Nuclear Material Safety and Safeguards (NMSS), EA-01-098, 9/24/01*
- 03/02 *The required monthly test of NFS's **criticality alarm system** was not performed in March 2002. At least one individual unit was not checked, as is to be done monthly on a rotational basis. NFS identified the deficiency at the end of April and performed the missing test in May following an NRC inspection. The inspector noted that failure to perform the required test was not recorded in EventTrac, NFS's system for problem identification, corrective actions and resolutions, at the time it was identified. Failure to record the deficiency was significant because the probability of establishing effective corrective action and preventing a recurrence was reduced, the NRC said. NFS Issued Violations By NRC—Nuclear Material, Criticality Issues Cited, Elizabethton Star, July 7, 2002*
- 05/13/02 *NFS Issued Violations by NRC—Nuclear Material, Criticality Issues Cited. A small fire occurred in the area used for uranium recovery. The fire started when one of the heater mounts' insulation ignited. The*

NRC inspector observed weighing of materials received by NFS (HEU uranium containers having more than 60 grams) and the use and control of tamper safety seals. The material was placed in a temporary storage area. The inspector noted the material was neither locked nor personally attended and the potential for diversion of nuclear material was **increased** due to construction activities in the immediate area. NFS agreed the regulation was not being followed and was slow to initiate correction action. Elizabethton Star, 7/07/02

- 01/12/03 Transfer of LEU material by an employee who failed to follow procedure and failed to notify the **nuclear criticality engineer** the sample results were **above the limits**. This is a Severity Level III Violation. Letter to NFS employee, Notice of Violation, Office of Investigations, Report No. 2-2003-024 and IR 70-143/2002-11, Report dated 3/29/04, ML081500239
- 04/20/03 *NFS Cite 7 Years of O.K.'d Assessments on BLEU Project. At the NRC's public hearing of NFS's annual Licensee Performance Review (LPR) on April 9, the agency reported that the company's license amendment applications did not include nuclear criticality safety analyses, fire hazards analysis and adequate commitments to management measures, according to the review. Elizabethton Star, 4/20/03*
- 11/26/03 NFS Inspection Report: **Two recent Nuclear Criticality Safety (NCS) operating limit violation events were reviewed** along with the associated licensee investigation including walk downs of fissile storage areas where the events occurred. NCS Event 88015: NFS determined that two cans of fissile material stored in a designated storage area were stored in contravention of the mass limit of kilograms for material authorized to be stored in that area. The event was discussed in detail in Inspection Report 70-143/2003-007 and characterized as Unresolved Item (URI) 70-143/2003-007-01 because the NFS investigation was incomplete. *NFS' investigation revealed the event was caused when materials was moved from one designated storage area to another by operators who had not been trained on NCS requirements for the new storage area. Failure to effectively assure fissile material stored in designated storage areas met NCS requirements for storage. (NCV 70-143/2003-2005-01) IR 70-143/2003-205, Inspection dates 11/3-7/03*
- 01/26/04 NFS Inspection Report: Licensee stored multiple Special Nuclear Material (SNM) **(R)** containers in a location **(R)** which was neither designated for storage nor approved by posted station limit card. "The guide lines and Expectations for the Implementation of Nuclear Criticality Safety Evaluations" had not been established prior to licensee conducting the implementation of nuclear criticality safety evaluation. (One Violation, with **three examples** was identified with implementing licensee's nuclear criticality safety program.) The inspector also verified if the required nuclear criticality safety inspections for every shift in the fuel manufacturing area were being performed and noted a few were missing over the last 2 months. IR 70-143/2003-010, Inspection dates 12/15/03-12/18/03, ML081440508
- 03/09/04 Scenario 4.1.7 failed to ensure the introduction of the more reactive materials **(R)** would not result in a k-effective **exceeding 0.95**. IR 07000143-2004-207, Report date 2/10/05, ML081440507 Scenario 4.1.7 of Nuclear Criticality Safety Analysis for Areas (R) Facility, Revision 0, failed to evaluate the parameters for failed control (i.e. introduction of more reactive materials) at both the most reactive system location (R) and with the parameter for the functional control (reflection) assumed at the most reactive value within its controlled range (R). The parameter for the failed control was not evaluated at the most reactive system location. IR 70-143-04-207, 6/10/05, Inspection dates 12/13-17/04, ML081440456
- 03/11/04 NFS Inspection Report. **Criticality alarm system has had 27 trouble alarms since November 2003.** IR 70-143/2004-201, Inspection dates 2/23/04-2/27/04, 3/11/04, ML081440450 (Note: Marie Moore, vice president of Safety and Regulatory Management for NFS, said NFS rarely has false criticality alarms but when it does happen, "everybody is trained to evacuate, no matter what." NFS is looking at replacing its criticality alarm

system with an upgraded, state-of-the-art system, she said. Now, the way the criticality system works, "just a power surge can set it off.") NRC Identifies Strengths, Shortcomings at NFS, Elizabethton Star, 5/01/02

04/21/04

Officials from NRC's Region II office met with NFS administration to discuss the Licensee Performance Review (LPR) to monitor activities at NFS from Jan. 20, 2003-Jan. 23, 2004. Among those areas the review reported a detailed ***criticality safety analysis was not performed when changes to existing equipment and procedure changes were made in order to process licensed material.*** Loren Plisco, NRC deputy regional administrator for Region II, said Region II had included the creation of a *second resident inspector's* position at NFS. NRC officials acknowledged in February that NFS's growing operations (particularly the BLEU Project) were an impetus to add the second inspector and added ***the programs' success lay in meeting NRC compliance.*** Elizabethton Star, 4/21/04

04/28/04

The blended LEU (BLEU) (R) ***ventilation system (R)*** so that *double contingency was not established* for scenario 4.1.3. Scenario 4.1.3 of NCSE, 54T-04-022, Revision 2, dated April 27, 2004, takes credit for (R) to prevent solution from back flowing into the ventilation system. *Section 4.1.1 of the license application requires that all process equipment and systems be designed to incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality is possible.* Notice of Violation, Inspection dates 5/02-04/2004, IR Report dated 6/02/04, ML081440203

05/14/04

***Loss of Criticality Safety Controls.*** NFS Event Report 40750 (May 14, 2004, licensee reported a previously unidentified failure mode for a piece of safety related equipment (SRE) had been identified during review of an integrated safety analysis (ISA). The SRE item was a conductivity probe and was designed to detect and prevent the transfer of moderating materials (R). The operation was in a shutdown state when the problem was identified—the condition had existed since system operation commenced in 1999). IR 70-143/2004-04, 6/28/04, Inspection dates 4/18-5/29/04, ML081440457. ***(From system startup in 1999 until May 14, 2004, an engineered control was unable to detect an undesired situation, was unable to implement corrective action without requiring human intervention, and was not capable of performing the criticality safety purpose for which it was specified).*** Pre-decisional Enforcement Conference Agenda, NFS, 9/24/04, ML081500428 & ML081430457 (Six Years!)

05/17/04

From September 9, 2002 through January 12, 2003, operations which involved more than a safe mass of licensed material, where double batching was possible, were performed without a detailed ***criticality*** safety analysis. IR 70-143/2004-003, Inspection dates 3/07-4/17/04, ML081440458 The NCS controls in place to prevent double batching to produce more than a safe mass were not sufficient to adequately prevent credible changes in process conditions that could lead to a ***criticality accident.*** *The main concern for criticality safety for this operation was preventing more than a safe mass from getting in (R). Solutions pumped (R) had a concentration limit that was not to be exceeded but administrative controls on concentration of solutions did not work and solutions above the limit was (R) on at least one occasion. Response to Disputed Notice of Violation, IR 70-143/2004-03, ML081360341 (Five Months!)*

06/04

From process startup in June 2004 to January 7, 2005 the safety related equipment process logic controller (SRE PLC) for the (R) process was ***not capable of performing the criticality safety purpose*** for which it was specified. IR 70-143/2005-01, Inspection dates 1/23-3/03/05, 04/04/05, EA-05-032, ML081440195 (Eight Months!)

12/13/04

***NFS Inspection Report. Failure to follow criticality safety requirements for discard of waste containing (R) material. Failure to meet nuclear criticality safety limits for a transfer of liquid process waste.*** IR 70-143/2004-10, Inspection dates 10/3/04-11/13/04, ML081440453

- 12/17/04 *Criticality Control Event. Materials were transferred to a storage area without being transferred through a particular device as required by Standard Operating Procedure (SOP) which prevents a more reactive/incorrect material type from being transferred. NFS Event Report 41274*
- 02/11/05 *Failure to get NCS approval prior to **storing (R)** containers. Double contingency (R) of the NCSE for the Oxide Conversion Building Scrap Dissolver was not adequately established. Tracking of licensee's actions to adequately justify the acceptability of replacing an engineered control with an administrative control. IR 70-143/2004-207, Inspection dates 12/13-12/17/04, ML081440512 & ML081440511*
- 04/07/05 *Misaligned valves in the BLEU process area resulted in a spill of uranium contaminated caustic solution. Corrective action was to be completed by April 29, 2005, *which meant that more than 3 weeks had been assigned to accomplish the corrective action even though an accumulation in a HEPA filter housing would violate NCS controls.* (R) of caustic solution to the floor in the BLEU Process Facility. Licensee indicated this event occurred during an attempt to return caustic discharge solution to (R) with an incorrect valve line-up and while level transmitters were giving incorrect level readings (R). As a result, caustic solution was pumped into the (R) dilution system through the process off-gas lines. IR 70-143/2005-203 dated 6/02/05, Inspection dates 5/02-04/05, ML081480315 On April 7, 2005, licensee attempted to rework (R) waste solution (R). The operation required manipulation of several manual valves, and the lineup was performed in error such that the waste solution was pumped to the off-service (R) column. The operation eventually filled the column, which **overflowed** into the (R), filled the process off-gas piping, and overflowed **into the (R) dilution ventilation system on the roof.** The operation was finally shut down when solution was discovered that had drained from the ventilation system onto the operating spaces floor. The event was **reported to the NRC on April 29, (Event No. 41651).** There was apparently no validation of expected system response to the operation in progress. Although a **significant** volume of liquid was moved, there was inadequate validation that the operation was proceeding as expected. *When the full extent of the issue was realized on April 28, the (R) system was shut down for review and revision of the safety basis, and also design and completion of physical modifications to the system.* IR 70-143/2005-03 dated June 27, 2005, Inspection dates 04/17-05/28/05, ML081440517*
- 06/02/05 *NFS Inspection Report. **Criticality Safety Inspection** to review Event 41651 that occurred on April 7, 2005 involving the discovery of *uranium contaminated caustic solution of the (R) dilution system HEPA filter housing.* On April 28, 2005, the BLEU (R) dilution ventilation system had only one drain and no (R) so that double contingency for the backflow of solution into the (R) dilution process ventilation system is violation 70-143/2005-203-01. The inspectors noted more than three weeks had been assigned to accomplish the corrective action even though *an accumulation in a HEPA filter housing would violate Nuclear **Criticality System (NCS) controls.*** IR 70-143/2005-203, Inspection dates 5/2/05-5/4/05, ML081480315 (cover letter) and ML081480316 (report).*
- 06/10/05 *NFS Inspection Report. On March 9, Scenario 4.1.7 of 54X-04-001, "Nuclear **Criticality Safety Analysis for Areas (R) Facility**" Revision 0, failed to evaluate the parameter for failed control (i.e. introduction of more reactive materials) at both the most reactive system location (R) and with the parameter for the functional control (reflection) assumed at the most reactive value within its controlled range (R). The parameter for the failed control was not evaluated at the most reactive system location, but rather it was evaluated at the top (R) water reflection. IR 70-143-04-207, EA 05-115, Inspection dates 12/13-12/17/04, ML081440456*
- 10/08/05 *Criticality Alarm System Inoperable in the NDA/Loading Dock area due to Detector Failure (Safety Equipment Failure). NFS Event Report 42047*

- 12/11/05 Less than a safe mass of enriched uranium was involved in the **transfer** from the caustic Discard (R) without the demonstration the U235 concentration was less than (R). Failure to comply with the unfavorable geometry bag handling requirements. Failure to get NCS approval prior to storing (R) containers. IR 70-143/2004-207, Inspection dates 12/13-12/17/04, ML081440512 and ML081440511
- 12/16/05 **Inadequate** design basis of process enclosure drains to a common cause failure. A poorly controlled modification of a process enclosure drain, such that the drain may not have functioned due to lack of control of the elevation of the drain, since the IROFS mentioned were the only IROFS in an accident sequence leading to a criticality, and since those IROFS were subject to common cause failure, the *potential consequences of this issue are severe*. IR 70-143/2005-10, Inspection dates 10/02-11/12/05, ML081480307
- 12/22/05 **Safety Equipment Failure**. NFS Event Report 42226. Cause: Design, Manufacturing, or installation error. FC06002 Failed electronic component of the **criticality accident alarm** system. The event occurred at the NFS BLEU Complex site. The potential hazard for this event would involve radiation exposure to facility occupants in the highly unlikely situation of an accidental nuclear criticality, with no provision to announce a prompt evacuation alarm. The cause of the alarm failure was determined to be a failed relay switch in the alarm circuitry and allowed the unit to go into alarm but prevented the signaling of the site audible evacuation alarm. 30-day Written Notification of Event No. 42226, from B. Marie Moore, NFS to NRC, 1/20/06, ML06020387
- 01/05/06 **Monitor Setpoint Improperly Set (Loss of or Degraded Safety Items)** Failure to adjust the set-point of the in-line monitor for the (R) discard system to the required value stated in the nuclear criticality safety evaluation configuration control. 10 CFR 61 performance criteria could not be met. NFS Event Report 42244 (It was determined the set-point for the Building (R) condensate Tank in-line uranium concentration monitor was set at a non-conservative value. Upon discovery of the situation, transfer operations to the condensate tank were suspended. WWTF sample results were reviewed which confirmed low uranium concentrations). IR 70-143/2006-001, 3/06/06, Inspection dates 12/25/05-2/04/06, ML081490104
- 1/23/06 Licensee identified a **criticality safety issue**, in that a source of potential over-pressure in the product (R) *were not analyzed to ensure that no backflow into unfavorable geometry utilities could take place*. Although the (R) were vented, a source of nitrogen was piped to the (R) *and the effect of this pressure source was not previously considered*. An analysis was initiated to determine the potential safety issues (tracked as IFI 70-143/2005-011-05. Letter to Kerry Schutt, President/General Manager, Nuclear Fuel Services, Inc., from /RA/ David A. Ayres, Chief, Fuel Facility Inspection Branch 1, Division of Fuel Facility Inspection, NRC, IR 70-143/2005-011, 1/23/06, Inspection dates 11/13-12/24/05, Events 42131 & 42191, ML081480308
- 02/03/06 **NFS Inspection Report**. As of December 16, 2005, licensee relied on a safety limit of (R) a calculated single parameter limit from Table 1 of the consensus standard ANSI/ANS-8.1, for the concentration of (R) material in a non-uniform aqueous solution stored in unsafe geometry WWTF tanks without discussing or justifying the limit in criticality analysis for the tanks to demonstrate sub-criticality for normal and credible abnormal conditions. IR 70-143/2005-208, Inspection dates 12/12/05-12/16/05, ML081490103.
- 03/06/06 Accidental spill of 35 liters (event report 42393 states 37 liters) of highly enriched uranium in the BLEU Processing Facility could have caused a **criticality** and nuclear chain reaction. Reported to Congress 13 months later. Letter, dated 7/3/07 from Congressmen John D. Dingell and Bart Stupak, U.S. House of Representatives, to the NRC, and NRC IR 70-143/2006-006, June 9, 2006, ML072630328 (Not reported to NRC until 3/07/06)
- 03/07/06 **Unanalyzed Condition of Criticality Controls**. NFS Event Report 42393

- 03/10/06 *NFS Inspection Report. (Special Inspection Team (SIT) Report. Event Response: NFS management failed to recognize the significance of the March 6 HEU spill event, specifically that the facility was operating in an unanalyzed condition without any approved controls to prevent a nuclear criticality accident. NRC notification was **not** made in accordance with the timeliness requirements of 10 CFR70, Appendix A (APV 70-143/2006-006-01). The NRC Senior Resident Inspector's involvement was necessary to ensure event reporting and to protect the "as-found" condition of the enclosure and piping for further inspection and evaluation. Criticality Safety: During the BPF HEU spill event, sufficient fissile solution was transferred that could have resulted in criticality in either of two available collection points, and no NCS controls were available to prevent accumulation of a critical system at either collection point. The following apparent violations were identified: Failure to assume in NCS analysis for the tray dissolver system that fissile solution could be misdirected from the solvent extraction feed transfer line (APV 70-143/2006-006-05) IR 70-143/2006-006, Inspection dates March 13-17, 2006, ML072630328*
- 03/28/06 *NFS License Performance Review (LPR). Potential NCS control failures resulting in fissile solution accumulation in the BLEU U-AI dissolution process off-gas system. LPR for NFS, Inspection dates 1/23/05-2/04/06, ML072490009*
- 04/21/06 *Notice of Violation and Proposed Imposition of Civil Penalty. Failure to provide adequate assurance that items relied on for safety (IROFS) would be reliable and available to meet **nuclear criticality safety** performance criteria. Violation A involves the failure to develop and implement a design for the (R) enclosure overflow system which provides adequate assurance that IROFS would be reliable and available to perform their function when needed. The NRC has concluded that criticality is **NOT** highly unlikely under the expected and bounding process conditions that existed in the (R) enclosure, due to the failure to install the enclosure drains at the correct height. The **NRC considers the potential consequences of this event to be significant**. The NRC further notes these enclosures are present throughout the NFS facility and their drains are the only protection against the accumulation in them (R). Notice of Violation and Proposed Imposition of Civil Penalty, IR 70-143/2005-010, EA-06-018, Inspection dates 10/02/05-11/12/05, NFS Event Report 42133, Severity Level III Violation, ML081500190*
- 05/31/06 *Criticality Evacuation Alarm Failure (Safety Equipment Failure). NFS Event Report 42612*
- 07/21/06 *NFS Inspection Report. May 31 through June 23, 2006 a **criticality** accident alarm system for the WWTF only had one detector in service after electrical storm and could not be reset. Inoperable detector had been in an alarm state since May 31, 2006. (24 days) The inspectors noted that no compensatory measures were taken during the time period in which there was only one function alarm in the area. The audible alarm system for BLEU complex CAAS was also disabled during the same storm. *This CAAS failure was not noted for several days because the lightning strike had disabled both the alarm and the diagnostic panel that should have indicated alarm failure. BLEU has lightning protection but the protection failed to protect the CAAS equipment.* IR 70-143/2006-205, Inspection dates 6/19-6/23/06, ML081490352 (Note: November 7, 2006 letter to NFS states CAAS for WWTF had only one operable detector in service from May 31, 2006 to July 15, 2006—almost two months) ML081490354*
- 05/30/07 *NRC Meeting at Rockville, Maryland—NFS management and NRC Region II Officials met with NRC Commissioners. William Travers, Regional Administrator, Region II, stated the issues occurring at NFS started in June of 2004 when the BLEU facility began operations. (p.8) The most significant event occurred in March 2006, (35 liters of high enriched uranyl nitrate spilled into a glove box, then onto the floor within a few feet of an elevator pit NFS was not aware of). This was significant and two Severity Level II Apparent*

Violations because the configuration management controls that were not in place could have resulted in an inadvertent **criticality** in either the glove box or elevator pit (p.9) and ranked No. 2 on the INES Scale. (p.10)

A number of enforcement actions occurred over the last year or so. Eight severity level III issues were identified. (p.12) The Executive Vice President of HEU Operations stated "We at NFS have found our performance as described by the staff as being unacceptable in the past. (p.25) "Additionally, we found that **we were not putting safety first**". (p.27) Closed session between NFS, NRC Region II and the Nuclear Regulatory Commission, 5/30/07, ML071930389

12/29/07

*Safety Equipment Failure of the Criticality Alarm System.* NFS Event Report 43883, FC080001

01/05/08

*Safety Equipment Failure of the Criticality Alarm System.* Two of 18 detector pairs did not generate an alarm signal in all modes. In the event of a criticality, 2 detector pairs may not have generated an alarm signal. NFS Event Report 43883

05/05/08

*NFS Inspection Report.* Follow-up on Previously Identified Issues—The inspectors also reviewed licensee corrective actions for apparent violations (AVs) identified in Inspection Report 70-143/2006-006 related to the BLEU spill event. *These APVs were discussed in the February 27, 2007, Alternative Dispute Resolution (ADR) Confirmatory Order (CO) which exercised discretion not to proceed with enforcement action but required a written response to the proposed violations. The licensee written response was provided on April 20, 2007, and included corrective actions associated with the apparent violations. The licensee corrective actions were reviewed and accepted by the NRC in the transmittal letter for Inspection Report (IR) 70-143/2007-007.* The inspectors reviewed corrective action completion and adequacy through document reviews and interviews with licensee staff and management.

#### Apparent Violations Status Summary:

AV 70-143/2006-006-01: Failure to notify the NRC within one hour of discovery of an event consisting of a spill of HEU material into an unapproved and unfavorable geometry enclosure when no safety controls or IROFS were available and reliable to prevent a nuclear criticality accident. The inspectors identified three licensee corrective actions related to this violation and determined the corrective actions were complete. This item is closed.

AV 70-143/2006-006-03: Failure to establish management measures for the solvent extraction tray dissolver filter enclosure drain system as required by 19 CFR 70.62(d), which resulted in the failure to ensure the filter enclosure met performance requirements of 10 CFR 70.61(d) for limiting the risk of a **nuclear criticality accident** under credible abnormal conditions. The inspectors identified 9 licensee corrective actions related to this violation and determined the corrective actions were complete. This item is closed.

AV 70-143/2006-006-04: Failure to meet the requirements of 10 CFR 70.61(d), in that the solvent extraction room did not meet performance requirements for **criticality safety** with respect to the credible abnormal condition of fissile solution accumulation on the solvent extraction room floor when there were no controls available to prevent a spill of fissile solution from accumulating into an unsafe geometry elevator pit (EA-06-179). The inspectors identified 5 licensee corrective actions related to this violation and determined the corrective actions were complete. This item is closed.

AV 70-143/2006-006-05: Failure to assume, as required by the license and license application Section 4.1.1, in the tray dissolver system **Nuclear Criticality Safety (NCS)** analysis, the occurrence of a credible

abnormal condition. Specifically, NFS failed to assume that fissile solution could be misdirected from the solvent extraction feed transfer line to the tray dissolver filter enclosure. The inspectors identified one NFS corrective action related to this violation and determined the corrective action was complete. This item is closed.

IR 70-143/2008-001, Inspection dates 01/01-04/05/08, EA-06-179, Events #43883, 43937, 44104, NMED #080012, 080056 and 080185, 5/5/08, ML081270020 (Note: The NRC received NFS's replies to Notices of Violation 70-143/2007-008-01, 02, 03 and 2007-009-02, 03 (letters, dated January 25, 2008 and February 27, 2008). The replies met the requirements of 10 CFR 2.201 and NFS's corrective actions were reviewed during this inspection or will be reviewed during a future inspection.) p. 2

- 01/30/08 *NFS License Performance Review (LPR).*  
The NRC noted an upward trend in the number of procedural violations identified during this review period including eight violations in a five month period. At least one of these procedure violations involve failure to adhere to procedures implemented as a corrective action following the March 2006 incident involving the spill of HEU solution. Failure to follow procedure due to storage and use of flexible pipe sections without formal approval from the nuclear criticality safety group. Failure to implement **criticality alarm response procedures** following a false alarm. (LPR), Inspection dates 7/29-12/31/07, ML080300451
- 09/08/08 *NFS Licensee Performance Review (LPR).* Failure to implement surveillance procedures according to procedure for **criticality safety controls**. Specifically, licensee did not adequately verify the presence of process pipe sleeves (an item relied on for safety (IROFS) for fire wall penetrations. Several of the pipe sleeves were concealed in a fire retardant material and could not be verified to be present. (VIO 70-143/2008-001-02, NRC Event #43937. Failure to adequately demonstrate subcritical margin for routine and expected abnormal conditions associated with the centrifuge bowl cleaning station. Specifically, transfer of bowls from the centrifuge station to the bowl cleaning station was not adequately controlled to assure subcritical margin as described in the nuclear criticality evaluation. (VIO 70-143/2008-202-01) Licensee Performance Review (LPR) for Nuclear Fuel Services, (NFS) Inc., Inspection dates 01/01-07/05/08
- 09/26/08 Failure to demonstrate the adequacy of subcritical margin under all normal conditions associated with BPF centrifuge bowl cleaning. The inspectors determined the licensee was required to demonstrate the adequacy of subcritical margin for bowl cleaning by showing that  $k_{eff}$  for centrifuge bowl transfer operations was less than 0.90 under a reasonably defined normal condition. Licensee committed to review other Nuclear **Criticality** Safety Evaluations (NCSEs) for similar failures to define normal conditions. *Licensee documented 20 issues for correction during future NCSE revisions.* Licensee also committed to submit a license amendment to clarify requirements for analyzing reflection conditions by December 31, 2008. IR 70-143/2008-206, Inspection dates 9/8-11/08, ML082620240
- 11/05/08 The inspector reviewed the licensee Nuclear Criticality Safety Evaluation (**NCSE**) for the OCB Process Ventilation System. The overflow drains that were associated with the scrubber and dissolution system are used to prevent accumulation of material in unfavorable geometry ductwork of the system. The inspector determined the analysis had an inadequate description. The description in the analysis used a generic description and it did not indicate the actual location of each drain and made it difficult to identify the overflow drains in the facility. IR 70-143/2008-207, Inspection dates 10/20-24/08, ML083040131
- 12/09/08 An open management meeting was conducted with NFS in Rockville, MD. The purpose of the meeting was to discuss significant unresolved issues in the NFS application to operate the new Commercial Development (CD) line. Criticality Safety—In May 2008, the NRC requested an additional item relied on for safety (IROFS) for accident sequences involving a criticality accident caused by too much uranium in a glove box. NFS identified an IROFS as being a trained operator that complied with a regulated limit of uranium in the

container (glove box). The control was failed twice. *The NRC concluded that failing the same control twice is not sufficiently independent to demonstrate compliance with **criticality** safety requirements.* Memorandum to Peter J. Habighorst, Chief, Fuel Manufacturing Branch, Office of NMSS from Kevin M. Ramsey, Project Manager, Fuel Manufacturing Branch, Office of NMSS, Subject: Summary of 12/09/08 Management Meeting with NFS, Inc., Regarding Application to Operate New Commercial Development (CD) Line, ML090150597, 12/09/08

06/30/09

*Safety Equipment Failure Of The Criticality Alarm system.* NFS Event 45179

03/19/10

Augmented Inspection Team (AIT). The purpose of the Augmented Inspection Team was to inspect and assess the facts and circumstances surrounding the Oct. 13, 2009 process upset at the NFS facility that resulted in unexpected levels of heat and nitrogen compound gas (NOx) due to a chemical reaction during the dissolution of scrap material containing low levels of uranium in the BLEU Preparation Facility (BPF) uranium aluminum (U-Al) process area.

The team observed a NRC criticality inspection exit meeting and noted the inspectors identified a minor issue that had been documented in PIRCS P7914 on May 19, 2006, where a noncompliance with regulations, *specifically license conditions, had been identified in that no basis documents existed for glass columns to address fixed neutron absorber requirements.* The issue *had not been addressed or corrected* as of December 10, 2009, and another corrective action report (C3455) was written to address the problem with a due date of October 1, 2010. Management did not identify or correct this problem over a substantial period of time which indicates a lack of oversight in maintaining the safety basis. NRC Augmented Inspection Team (AIT) Report No. 70-143/2009-011, Event # 45446, ML100780127, 3/19/10

## NFS CRITICALITY SAFETY ALARM & CONTROL FAILURE ISSUES

(Note: (R) means word or text has been redacted. IR means Inspection Report)

- 03/29/90 *Uranium Concentration Greater than Limit/Loss of Criticality Safety Controls. Uranium concentration in a solution was greater than the (R) limit; reported on 07/11/1990. FC900218*
- 11/07/91 *Raffinate Released to Unsafe Geometry/Loss of Criticality Safety Controls. FC911248*
- 10/13/92 *"Uranium solution was drained from the wrong set of favorable geometry tanks into an unfavorable geometry tank without verifying the concentration was safe. This violation has been categorized at Severity Level III because it defeated a criticality control. Office of Enforcement, Notification of Significant Enforcement Action, EN93-003, EA 92-231, 1/13/93)*
- 05/20/93 *Criticality Safety Limits Exceeded. FC940841*
- 07/02/94 *Failure of Criticality Alarm System. FC940619*
- 09/27/94 *Criticality Monitoring System Alarm Disabled. FC941881*
- 03/22/96 *Criticality Alarm System Alarm Locked. FC960199*
- 08/07/96 *Failure of Criticality/Fire Alarm System. FC960472*
- 02/25/98 *Criticality Control Parameter Exceeded. FC980288*
- 09/29/98 *Criticality Monitoring Instruments Inoperable. FC981021*
- 02/26/99 *Criticality Alarm System Inoperable. Event # 35414, FC990133*
- 02/28/99 *Criticality Alarm System Was Out Of Service. Event# 35425*
- 05/06/99 *Failed Criticality Alarm Detector. Event #35691, FC990293*
- 03/05/01 *Safety Equipment Failure—Insufficient Coverage of Criticality Alarm System Used for Storage. Event # 37811, FC010212*
- 04/01/01 *Safety Equipment Failure—Loss of Power To Criticality Alarm System. Event # 37881, FC010314*
- 05/31/01 *Safety Equipment Failure—Inadvertent Loss of Power To The Criticality Accident Alarm System. Event # 38044*

- 06/05/01 *Temporary Loss Of Criticality Accident Alarm System Due To Power Failure. Event # 38054, FC010522*
- 07/20/01 A pre-decisional enforcement conference was conducted at NRC Headquarters in Rockville, Maryland, with members of NFS and their staff to discuss an apparent NRC violation pertaining to the storage of up to 20 kilograms of highly enriched uranium (HEU) in the Building 306E bins for approximately 46 days **without adequate criticality alarm system (CAS) coverage**. Letter to Dwight Ferguson, President, NFS, Subject: Notice of Violation (NRC Inspection Report 70-143/2001-203), from /RA/ Martin J. Virgilio, Director, Office of Nuclear Material Safety and Safeguards (NMSS), EA-01-098, 9/24/01
- 03/02 The required monthly test of NFS's **criticality alarm system was not performed** in March 2002. At least one individual unit was not checked, as is to be done monthly on a rotational basis. NFS identified the deficiency at the end of April and performed the missing test in May following an NRC inspection. NFS Issued Violations By NRC—Nuclear Material, Criticality Issues Cited, Elizabethton Star, July 7, 2002
- 04/20/03 *NFS Cite 7 Years of O.K.'d Assessments on BLEU Project. At the NRC's public hearing of NFS's annual Licensee Performance Review (LPR) on April 9, the agency reported that the company's license amendment applications **did not include nuclear criticality safety analyses, fire hazards analysis and adequate commitments to management measures, according to the review.** Elizabethton Star, 4/20/03*
- 03/11/04 *NFS Inspection Report. **Criticality alarm system has had 27 trouble alarms since November 2003.** IR.70-143/2004-201, Inspection dates 2/23/04-2/27/04, 3/11/04, ML081440450*
- 05/14/04 *Loss of Criticality Safety Controls. NFS Event Report 40750 (May 14, 2004, licensee reported a previously unidentified failure mode for a piece of safety related equipment (SRE) had been identified during review of an integrated safety analysis (ISA). The SRE item was a conductivity probe and was designed to detect and prevent the transfer of moderating materials (R). The operation was in a shutdown state when the problem was identified—the condition had existed since system operation commenced in 1999). IR 70-143/2004-04, 6/28/04, Inspection dates 4/18-5/29/04, ML081440457. (From system startup in 1999 until May 14, 2004, an engineered control was unable to detect an undesired situation, was unable to implement corrective action without requiring human intervention, and was not capable of performing the criticality safety purpose for which it was specified). Pre-decisional Enforcement Conference Agenda, NFS, 9/24/04, ML081500428 & ML081430457 (Six Years!)*
- 10/08/05 *Criticality Alarm System Inoperable in the NDA/Loading Dock area due to Detector Failure (Safety Equipment Failure). NFS Event Report 42047*
- 03/07/06 *Unanalyzed Condition of Criticality Controls. NFS Event Report 42393*
- 05/31/06 *Criticality Evacuation Alarm Failure (Safety Equipment Failure). NFS Event Report 42612*

*Licensee reported the criticality accident alarm system (CAAS) in the (R) Complex was not capable of providing a site-wide evacuation alarm in the event of a criticality. Discovery date—5/31/06, Event date—5/20/06, Report Date—6/10/06. FC070007*

- 07/21/06 *NFS Inspection Report. May 31 through June 23, 2006 a **criticality accident alarm system** for the WWTF only had one detector in service after electrical storm and could not be reset. Inoperable detector had been in an alarm state since May 31, 2006. (24 days) The inspectors noted that no compensatory measures were taken during the time period in which there was only one function alarm in the area. The audible alarm system for BLEU complex **CAAS was also disabled** during the same storm. *This CAAS failure was not noted for several days because the lightning strike had disabled both the alarm and the diagnostic panel that should have indicated alarm failure. BLEU has lightning protection but the protection failed to protect the CAAS equipment. IR 70-143/2006-205, Inspection dates 6/19-6/23/06, ML081490352 (Note: November 7, 2006 letter to NFS states CAAS for WWTF had only one operable detector in service from May 31, 2006 to July 15, 2006—almost two months) ML081490354**
- 12/29/07 *Safety Equipment Failure of the Criticality Alarm System. NFS Event Report 43883, FC080001*
- 01/05/08 *Safety Equipment Failure of the Criticality Alarm System. Two of 18 detector pairs did not generate an alarm signal in all modes. In the event of a criticality, 2 detector pairs may not have generated an alarm signal. NFS Event Report 43883*
- 01/30/08 *NFS License Performance Review (LPR). Failure to implement criticality alarm response procedures following a false alarm. (LPR), Inspection dates 7/29-12/31/07, ML080300451*
- 05/05/08 *NFS Inspection Report. Follow-up on Previously Identified Issues—VIO 70-143/2007-008-002: A worker who was inadequately trained, opened a breaker that de-energized four criticality detectors which **caused a criticality alarm and site evacuation**, the operations supervisor failed to immediately evacuate the process area in order to shut down equipment, and plant personnel were authorized to re-enter the protected area (PA) without completion of the security related actions. NFS labeled the detector breaker panel indicating it is a criticality accident alarm system (CAAS) system, and breaker locks have been added on all circuit breakers feeding the CAAS system to prevent inadvertent switching to the off position. The operations supervisor was re-instructed on the objectives and requirements of proper evacuation and response actions to a CAAS alarm. Security was given a tabletop criticality evacuation scenario to evaluate their search into the PA prior to allowing re-entry. Closed. IR 70-143/2008-001, Inspection dates 01/01-04/05/08, EA-06-179, Events #43883, 43937, 44104, NMED #080012, 080056 and 080185, 5/5/08, ML081270020*
- 06/30/09 *Safety Equipment Failure Of The Criticality Alarm system. NFS Event 45179*

## CONFIGURATION MANAGEMENT ISSUES

(Note: (R) Means Word or Text Has Been Deleted. IR Means Inspection Report)

04/02/96

*Fire at NFS Subject of NRC review:* The fire began in a piece of process equipment inside a building at the plant which processes radioactive material and spread into a section of ventilation exhaust ductwork for the incinerator at the facility. Waste, contaminated with uranium, was being burned in the incinerator at the time of the fire according to NRC officials. The Erwin Record, 4/10/96 (NFS team at work on incident assessment, future safe guards. NFS team at work on fire incident assessment, future safeguards pertaining to fire on April 2, 1996 that began in an incinerator and spread to ventilation ducts outside the building. Also stated corrective actions ordered by NRC following a similar fire in 1983 were either not done or had not been maintained over the years. The Erwin Record, 4/17/96) Declaration of a site area emergency due to a fire exceeding 15 minutes, a breach of containment and the potential for a radioactive release. The fire was detected in the #302 incinerator room. It spread to the ducting on the roof and breached the ducting. The incinerator was burning radioactive material at the time so the potential existed for a radiological release. Licensee determined there was a maximum of **800** grams of HEU available for release. The fire damaged approximately 150 feet of ventilation ducting on the roof. Latest measurements indicate the amount of material involved was approximately **8** grams in the ventilation system and approximately **45** grams in the actual burn. U.S. Nuclear Regulatory Commission Operations Center Event Report, Event #30220, Facility—NFS, 04/02/96, ML051640507

Violation A involved your failure to implement and maintain a configuration control and management system for the Building 302 incinerator which was used to handle uranium. Violations B.1 and B.2 involved failure to institute adequate procedures for the safe operations of the incinerator and multiple examples in which your staff failed to follow procedures. Of particular concern was your failure to verify the operability of the quench tank spray nozzles prior to operation of the incinerator because such verification contributes to assuring the effectiveness of the incinerator exhaust cooling. Violation C involved failure to identify the incinerator as safety related which resulted in failure to implement a preventative maintenance and surveillance program for components essential to safety. Violation D involved failure to implement an adequate training program for personnel operating the incinerator equipment. The root cause of the violations appears to be a lack of attention in ensuring that safety systems and controls remain in place and that changes which might affect them are controlled and reviewed. Collectively, the violations represent a significant regulatory concern because they are indicative of a significant lack of attention toward licensed responsibilities. Specifically, multiple processes and barriers to preventing unsafe operations of the Building 302 incinerator failed including equipment, procedures, and personnel which culminated in the April 2, 1996 fire. A further example of your lack of attention is the fact that corrective actions in response to a similar fire in 1983 were not effective in preventing the April 1996 fire and were not fully implemented. The consequences of the fire, both potential and actual, would have been mitigated had you effectively implemented corrective actions following the 1983 fire. Adequate controls for the licensed activities you were conducting should have been implemented and in effect, and they were not. Letter from Luis A. Reyes, NRC, Region II Administrator, Subject: Notice of Violation and Proposed Imposition of Civil Penalty, (NRC Inspection Report #70-143/96-05), to Dwight Ferguson, President, NFS, 8/21/96

- 08/21/96 A Notice of Violation and Proposed Imposition of Civil Penalty in the amount of \$12,500 was issued for numerous failures involving inadequate configuration control, inadequate procedures, and failure to follow procedures. Office of Enforcement Annual Report, Fiscal Year 1996, U.S. NRC, ML091390385, 5/21/09
- 07/21/03 *NFS Inspection Report: NFS commitments: The availability of Items Relied on For Safety (IROFS) and to establish a document control system for new facilities to create, control and track documents within the configuration management function associated with IROFS, procedures that included IROFS, and procedures related to training, quality assurance, maintenance, audits and assessments, emergency operations, and emergency response. This documentation included design requirements, engineering drawings and/or sketches, specifications for IROFS, and the ISA Summary. IR 70-143/2003-04, Inspection dates 06/02-6/06/03*
- 03/12/04 Failure to maintain a control in the (R) process area according to configuration management led to a fire. LPR of Licensed Activities for NFS, Inspection dates 1/20/03-1/24/04, LPR, ML081440081
- 12/13/04 Failure to maintain configuration control of temporary equipment. IR 70-143/2004-10, Inspection dates 10/03-11/13/04, ML081440453
- 03/22/05 *NFS License Performance Review (LPR). Your prior corrective actions have not been effective. Our current review concluded improvements were needed in the development and documentation of nuclear criticality safety bases and the oversight of your (R) program. Items Relied On for Safety (IROFS):*
  - A fire resulted when the work request procedure was not adequately performed for the installation (R) due to a weakness in the licensee's procedure for implementing configuration control in Internally Authorized changes.
  - *Licensee compromised an IROFS when they failed to demonstrate the concentration of the material in the (R) BLEU Preparation Facility was less (R) prior to discharge*
  - *Licensee compromised an IROFS when they failed to control (R) unfavorable geometry bags that were open and unattended (R)*
  - *Licensee compromised an IROFS when they failed to remove an unfavorable geometry bag from the oxide conversion building (OCB) process area after use*
  - *Licensee compromised an IROFS when they failed to remove an unfavorable geometry bag from (R)*
  - *Licensee failed to verify the availability of a fire safety IROFS for the (R) system, Non Cited Violation (NCV)*
  - *Failure to follow fire safety procedures that involved new areas/modifications*
  - *Improper implementation of Letter of Authorization (R) for the (R) was not properly implemented and led to a fire (R)*
  - *The NCS evaluation (R) failed to adequately demonstrate a k-effective below 0.95*
  - *An engineered control was not capable of performing the nuclear criticality safety (NCS) purpose for which it was specified (Enforcement Discretion, (IR) 2004-04-02*

- The NCS evaluation for the **(R)** operation had been modified to replace an active engineered control with an administrative control.
- The **(R)** NCS evaluation lacked justification for replacing the engineered **(R)** control with an administrative sampling control in a human performance challenged operating environment
- The NCS Department failed to evaluate the use of a new **(R)** container **(R)** prior to use (NCV)
- A safety related equipment (SRE) process logic controller **(R)** was identified as being degraded. LPR, Inspection dates 1/25/04-1/22/05, ML081370278

- 10/31/05 *NFS Inspection Report:* September 8, 2005 licensee failed to document transmittal of design information and failed to maintain BLEU preparation facility design changes. An upset condition/ overflow from the **(R)** system which identified a violation of NFS design procedures associated with the documentation for **(R)** system modifications performed by subcontractors; Failure to maintain configuration control of facility design modifications. IR 70/143/2005-08, NFS Inspection dates 8/21/05-10/1/05, Events 41197 & 41839, ML081480305
- 01/05/06 *Monitor Setpoint Improperly Set (Loss of or Degraded Safety Items)* Failure to adjust the set-point of the in-line monitor for the **(R)** discard system to the required value stated in the nuclear criticality safety evaluation configuration control. 10 CFR 61 performance criteria could not be met. NFS Event Report 42244 (It was determined the set-point for the Building **(R)** condensate Tank in-line uranium concentration monitor was set at a non-conservative value. Upon discovery of the situation, transfer operations to the condensate tank were suspended. WWTF sample results were reviewed which confirmed low uranium concentrations. IR 70-143/2006-001, 3/06/06, Inspection dates 12/25/05-2/04/06, ML081490104; FC060003
- 02/01/06 Request for changes to certain administrative programs closed without prejudice (TAC L31904). NFS' application dated Dec. 3, 2004 and supplemental letter dated 06/22/05 proposed the following changes, in part, to administrative programs under Material License SNM-124:
- (1.) Deletion of requirements for Safety-Related Equipment (SRE) and Configuration Controlled Equipment (CCE), and
  - (2.) Frequency of procedure reviews by the Safety Review Committee.
- On August 24, 2005, Amendment 64 was issued to approve *other* program changes, but these two changes remained open. On Sep. 27, 2005, the NRC concluded that *this information was inadequate* to approve the changes and identified the additional information needed. No additional information was received. NRC closed the action without prejudice to resubmission with additional information. Letter to B. Marie Moore, Vice President, Safety and Rules, NFS, (TAC L31904) from /RA/ Kevin M. Ramsey, Fuel Cycle Facilities Branch, Office of Nuclear Material Safety and Safeguards, 2/01/06, ML081430428
- 03/06/06 *NFS Inspection Report.* License Application Section 2.12 requires management measures to ensure items relied on for safety (IROFS) are available and reliable to perform their function when needed. Event 42244 identified on January 6, 2006, involved the failure to adjust the set-point of the in-line monitor for the **(R)** discard system to the required value stated in the nuclear criticality

safety evaluation (NCSE). This was a management measures failure in the area of configuration control. Failure to implement and maintain an IROFS as necessary was a violation of NRC requirements, Non Cited Violation (NCV) 70-143/2006-01-02. Licensee implemented adequate corrective actions through the use of a modified NCSE verification checklist. IR 70-143/2006-001, Inspection dates 12/25/05-02/04/06, Events 42226 & 42244, ML081490104

03/10/06

*NFS Inspection Report: (The spill of 37 liters HEU on March 6, 2006) The Special Inspection Team (SIT) determined the events immediate safety consequences were *very significant* in that operators were unaware that their actions could result in transfer of high enriched uranium (HEU) to the filter enclosure. In addition, identification after the event of an unsafe accumulation point (elevator pit) in the BLEU Preparation Facility (BPF) floor raised significant safety concerns because *solution leaks are a credible abnormal condition in the BPF, and the BPF floor is identified as an item relied on safety (IROFS) to maintain solution leaks in a safe slab configuration. There were no controls in place to prevent a solution leak from entering the elevator pit. The SIT specifically noted the problem identification and resolution, configuration management, and change control programs failed to prevent the event. These issues are indicative of inadequate internal processes and ineffective management oversight.**

Event Description: On March 6, 2006, approximately **35** liters of high enriched uranyl nitrate (HEUN) solution was inadvertently transferred to a filter enclosure *not currently approved for operation in the BLEU preparation facility (BPF)*. The filter enclosure was equipped with two independent safety-related drains whose intended function was to maintain a safe slab configuration within the enclosure by diverting solution to the building floor. *The equipment, which was not approved for use, was connected to an in-service solution transfer line.* This allowed an unintended transfer of solution to a process enclosure and led to the determination *the existing safety analysis was not completed for the operation of this enclosure.*

Event Response: NFS management failed to recognize the significance of the March 6 HEU spill event, *specifically that the facility was operating in an unanalyzed condition without any approved controls to prevent a nuclear criticality accident.* NRC notification was not made in accordance with the timeliness requirements of 10 CFR70, Appendix A (APV 70-143/2006-006-01). The NRC Senior Resident Inspector's involvement was necessary to ensure event reporting and to protect the "as-found" condition of the enclosure and piping for further inspection and evaluation.

Criticality Safety: During the BPF HEU spill event, sufficient fissile solution was transferred that could have resulted in criticality in either of two available collection points, and no NCS controls were available to prevent accumulation of a critical system at either collection point.

Root Causes and Contributing Factors: The root causes of the March 6 spill of uranyl nitrate solution included inadequate configuration control, and change analysis and design requirements. *More specifically, the configuration control program lacked requirements to ensure that unapproved systems were isolated from operational systems, and that configuration changes, such as not implementing the operational requirements (e.g., procedures, IROFS) of a system, received a safety review (APV 70-143/2006-006-06).* Design requirements also lacked criteria to prevent misdirected flow. The inspectors concluded that correction of any of these deficiencies would have prevented the March 6<sup>th</sup> misdirected flow event. Contributing causes included inadequate proced-

ures for operation of the enclosure components (APV70-143/2006-006-07) and failure to capture unusual conditions associated with yellow solution in the enclosure in the corrective action program (APV 70-143/2006-006-08).

Root Cause 1- Configuration Control Program Less Than Adequate

*Root Cause 2- Change Analysis Less Than Adequate:* The licensee's program for configuration control lacked a provision to evaluate the change associated with not finalizing the installation and operational safety verification of a processing system. Sometime after the BPF Tray Dissolver system was constructed and placed into configuration control in March 2004, licensee management decided not to complete final installation and operational safety testing. Through discussions with the ISA specialist, *the inspectors determined that no procedure existed to evaluate potential safety consequences of the unfinished system located in the SNM-bearing processing area. The ISA had been completed based on the assumption that the BPF Tray Dissolver system would be completed and operationally tested to ensure IROFS were maintained and available.* Failure to re-evaluate the unfinished system meant the consequences of a misdirected flow event were not considered, and the BPF Tray dissolver system was left vulnerable to the activities preceding the March 6 spill.

*Root Cause 3- Design Development Less Than Adequate:* Licensee's design development guidance lacked any specific requirements to ensure that misdirected flow of SNM-bearing solution was prevented. The BPF Tray Dissolver system discharged in the solvent extraction system transfer header *without any misdirected flow isolation or prevention device required nor installed. Implementation of a misdirected flow prevention design requirement could have prevented the event.* IR 70-143/2006-006, Inspection dates March 13-17, 2006, ML072630328 (Note: *The NRC issued a 92 page report supporting the latest licensing amendment as meeting federal safety standards. "NFS has constructed hazard analysis that identified and evaluated and established safety controls to provide reasonable assurance of a safe facility operations," the agency said. Nuclear Fuel Services In Erwin Begins 'Down blending' Uranium, The Greeneville Sun, 10/14/04*)

03/28/06

*NFS Licensee Performance Review (LPR):* A large number of deficiencies are in the BLEU processing operations, where your efforts to improve safety have either not been implemented or were not effective. BLEU operations continued to experience problems after the LPR period ended, such that a Confirmatory Action Letter was issued on March 18, 2006. Based on the performance information reviewed, *the NRC found areas needing improvement in four of the five performance areas, including problems identified in the previous LPR period associated with implementing the criticality safety analytical process, implementing the safeguards program, management oversight of operations, consistency in the implementation of the radiological protection program, the quality assurance of transportation packages, the use of the corrective action program, facility configuration control, the reliability of the criticality alarm system, and control of strategic special nuclear material. The number and repetitive nature of elements of this LPR are indicators that further action to improve your safety culture is warranted. Failure to maintain configuration control due to lack of use of engineering change notices. Only out of date configuration drawings were available in the BPF. Licensee Performance Review (LPR) of Licensed Activities for Nuclear Fuel Services, Inc., Inspection dates 01/23/05-02/04/06, ML072490009*

- 04/17/06 *NFS Inspection Report. On January 3, 2006, licensee failed to comply with change control process during modifications to the **(R)** detector system in that failure to ensure that changes to the as-built condition did not impact the safety of the systems, structures and components (SSC), in that a failsafe feature of the system was defeated by a change in system components. Failure to comply with configuration control program. IR 70-143/2006-002, Inspection dates 2/5/06-3/18/06, ML081490105 & ML081490350 (Corrected Copy)*
- 05/01/06 *NFS Inspection Report. Weaknesses were identified in configuration management program. Although licensee procedure NFS-GH-901 describes placing systems under configuration management, no guidance was provided in the procedure regarding boundaries. The inspectors observed the licensee relies to a great degree on process knowledge of the participating staff. This weakness led to a spill event in BPF when licensee staff failed to recognize that out-of-service equipment was, in fact, connected to an HEU solution line. IR 70-143/2006-203, Inspection dates 04/03/04-07/06, ML081490351*
- 05/04/06 *NFS Inspection Report: AECs not placed under configuration control. Independent verifications or auditing configurations not performed. Letter to Dwight Ferguson, President/CEO, Nuclear Fuel Services, Inc., IR 70-143/2006-07, Inspection dates 04/03-04/07/06, ML073060347*
- 06/30/06 *NFS response dated March 24, 2006 to Confirmatory Action Letter (CAL) 02-06-003 and additional information NFS provided at the meeting at NRC Headquarters on March 27, 2006, that discuss details of NRC's response. NRC continues to have concerns about the information NFS provided to demonstrate the safe operation of the HEU fuel manufacturing processes. NFS's response mentioned differences between the BPF and **(R)** and stated that processes in **(R)** had been at a steady state for over five years. NFS also stated that **(R)** has been expanded over the past several years, primarily with duplications of well understood processes. The BPF has had numerous design problems associated with new types of process equipment during its relatively short operational life, many of the problems that have occurred were associated with relatively simple, well-understood processes. The event that occurred on March 6, 2006 was basically a well understood process of pumping a uranium **(R)** solution from one **(R)** to another for use as feed material for the solvent extraction system. The lack of complexity as a design change should not be a key element in determining whether a change would impact safety.*

The second significant difference NFS mentioned was that **(R)** has a more experienced staff, and to strengthen the experience in BPF, personnel reassignments were made in 2005 to augment the BPF operation. The NRC noted there have been relatively limited reassignments of more experienced staff to BPF and will continue to review the effects of such reassignments on the safety performance in **(R)**. Another remaining issue is the amount of design guidance provided to the engineering staff for specific types of equipment with safety implications. The results of the inspections showed that specific design guidance was lacking for engineering staff and design reviewers for many basic systems, (piping, ventilation, electrical) as well as key safety-related issues such as backflow prevention.

NRC continues to have several concerns with the NFS configuration management program. Since the configuration management program is used throughout the facility, problems that surface during the BPF event could also affect **(R)**. The NRC inspection of the BPF event and the subseq-

uent inspection of **(R)** showed problems in a proper review, approval, documentation of the design, the as-built conditions, and the changes made to the facility. The fact that most electrical drawings are not included in the existing configuration management program is a significant concern since many safety controls are electrically actuated. The response to the CAL did not fully address the concerns with the site-wide configuration management program. The inspection found the independent review of P&IDs and the “vertical slice” of key operational areas in **(R)** consisted mainly of looking at six of the oldest P&IDs to see if they were accurate, assuming that these drawing would have the highest likelihood of inaccuracies because of their age. The inspection found this was not an adequate review of the configuration management program to make broad conclusions regarding the program at NFS because the drawings reviewed were for areas that had minimal changes over the years and three of them were of utility systems that had no associated safety controls. NFS’s statement implying the “vertical slice” also included a reassessment of the **(R)** safety controls was inaccurate. After discussion with safety management, the NRC and NFS determined this reassessment was for the BPF facility, not (R) as implied by NFS’ response.

NFS discussed the various items and programs in place to identify and address abnormal conditions in the facility. *Specifically:*

- The use of station limit cards (or no SNM allowed signs)
- The use of PIRCS and the oversight provided by the NFS’s quality Control organization are examples provided for this assurance. *The NRC had concerns about this response because—*
- A station limit card was originally posted on the glove box in which the BPF event occurred, even though the station was not yet authorized for SNM.
- After discovery of some type of solution in the glove box in 2003/2004, the station limit card was replaced with a “no SNM allowed” sign, but subsequent discoveries of solution in the glove box were not noted as a problem.
- The PIRCS was not used to identify and correct the discovery of these events, and other concerns with the inconsistent use of the PIRCS program identified in previous routine inspections and the LPR.
- The oversight provided by the NFS Quality Control organization mainly deals with fuel quality issues, not quality of safety systems.
- The SIT inspection identified the NFS procedure for implementing the Integrated Safety Analysis (ISA) process allowed the posting of the station limit card *prior* to final release of the system.

*The NRC continues to be concerned with the use of generic procedures in some areas to cover activities such as draining of systems that contain SNM. Since the ISA that was submitted in response to the Oct. 2004 due date, NFS has discovered occasional unanalyzed, credible accident sequences in both BPF and (R). This, combined with the number of ongoing changes within BPF and **(R)** can lead to further unanalyzed conditions and unidentified credible accident sequences. NFS has not yet fully implemented management measures to assure that IROFS will be available and reliable. The inspection of the **(R)** conducted the week of April 3, 2006, revealed at least two problems associated with management measures in **(R)** stemming from apparent lack of program oversight. **(R)** The functional tests associated with this isolation valve were consolidated into one set of instructions and one of the key safety systems affected by the isolation valve*

was left out of the functional test instructions. Another instance involved the repeated plugging of a vent line that caused frequent actuation of the safety controls to shut down the affected operation. *This repeated frequent challenge to a safety system was not addressed for several months and was not reviewed for its effect on the management measures associated with the control. NFS must be diligent against the problems that occurred in BPF from happening in (R).* The NRC requests that NFS provide a supplemental response to CAL 02-06-003 within 30 days of receipt of this letter addressing NRC's request for additional information noted above. Request For Supplemental Response to Confirmatory Action letter, to Dwight B. Ferguson, President/Chief Executive Officer, Nuclear, Fuel Services, Inc., from /RA/ Douglas M. Collins, Director, Division of Fuel Facility Inspection, ML081440078

- 08/28/06 *NFS Inspection Report: P&IDs for strip columns not updated to reflect new configuration. IR 70-153/2006-11, Inspection dates 6/05-7/17/06, CAL No. 02-06-003, Events 42393 and 42411, ML073060416*
- 09/11/06 *NFS Inspection Report. Discrepancies between the as-built configuration, process and instrument drawings (P&IDs) and equipment labeling; Procedure discrepancies; SOP covered two different processes which used the same equipment and had similar steps; SRE number for drain on P&ID labeled SRE-2 instead of SRE-1; One locked valve not identified as locked on P&ID; Two locked closed valves not identified as locked on P&ID. IR 70-143/2006-012, Inspection dates 7/24/06-7/28/06, ML073060434*
- 11/29/06 *NFS Inspection Report. Diffuse nature of configuration management program contributed to BPF spill event:*
- *Outdated configuration control boundary postings on in-service piping*
  - *Signs were from previous method of identifying configuration control boundaries when equipment was installed in the area several years previously*
  - *Configuration management did not assure all required aspects of facility changes be addressed*
  - *Failure to codify scope requirements of 10 CFR 70.72(a)*
  - *Configuration management procedure NFS-GH-901 had been revised to control screening of facility changes against the requirements of 10 CFR 70.72(a)*
  - *Electrical SRE drawings had not been maintained nor updated with no independent drawing review and facility changes could have occurred without the drawings being updated*
  - *The drawings had been issued for installation, but no post-installation "as-built" verification nor review had been done. NFS had recently committed to NRC to place all SRE electrical component loop diagrams in the configuration management program by Dec. 31, 2008. The inspectors considered the lack of configuration control on the safety related electrical (SRE) drawings to be a significant configuration control weakness*
  - *33 Safety Related Equipment (SREs) required special test*
  - *No procedure nor checklist guidance was specified nor available to aid the Process Hazards Analysis (PHA) review for loss of power*
- IR 70-143/2006-019, Inspection dates 10/09-10/16/06, ML073250411

12/01/06

*NFS Licensee Performance Review (LPR): The NRC still has concern for the areas needing improvement noted in this report. All of the areas needing improvement are repetitive of areas identified in the last LPR. Two of these resurfaced primarily from the BLEU Preparation Facility (BPF) event of March 6, 2006. These areas are verification and implementation of equipment and controls identified in nuclear criticality safety analyses, and utilization of the problem identification and corrective action program. The other areas needing improvement are control of SSNM, and engineering design, verification, and configuration control. Given the number, significance, and repetitiveness of these issues, the confidence normally provided through a robust safety program is not evident, indicating that actions are still necessary to provide additional assurance that facility operations will be conducted safely. These issues are also indicative that further action to improve your safety culture is warranted. Trends indicated inadequate response to certain recurring issues:*

- *Failure to maintain dual Criticality Accident Alarm System detector coverage at waste water treatment facility*
- *Use of less than adequate configuration management system failed to ensure the safety impact of the partially installed and un-isolated change was addressed per requirements of 10 CFR 70.72*
- *Failure to provide adequate procedures for the operation of the enclosure components*
- *Failure to correctly implement the configuration control program during modification of an active engineered control, in that a failsafe feature of the explosive gas detection was defeated*
- *Electrical schematics of an active engineered controls not placed under configuration control and relied solely on post maintenance testing to verify proper configuration. Weakness identified in configuration management program. LPR of Licensed Activities for NFS, Inc., Inspection dates 02/05/06-10/13/06, ML071930522*

05/30/07

*Nuclear Regulatory Commission Meeting at Rockville, Maryland:*

*NFS management and NRC Region II Officials met with NRC Commissioners. William Travers, Regional Administrator, Region II, stated the issues occurring at NFS started in June of 2004 when the BLEU facility began operations. (p. 8) The most significant event occurred in March 2006, (35 liters of high enriched uranyl nitrate spilled into a glove box, then onto the floor within a few feet of an elevator pit NFS was not aware of). This was significant and two severity level 2 Apparent Violations because the configuration management controls that were not in place could have resulted in an inadvertent criticality in either the glove box or elevator pit (p.9) and ranked No. 2 on the INES Scale (p. 10)*

*A number of enforcement actions occurred over the last year or so. Eight severity level 3 issues were identified. (p.12) Alternative dispute resolution (ADR) was offered to NFS. They accepted. "We believe we've leveraged their willingness to agree that safety culture, configuration management, and areas of concern, including performance, procedural adherence, and corrective actions really were the issues that need to be resolved through a great deal of management attention." (p. 13) "There is a requirement for NFS to do a safety culture survey within two years, but after that not for the life of the facility." (p. 23)*

*The Executive Vice President of HEU Operations stated "We at NFS have found our performance as described by the staff as being unacceptable in the past. (p. 25) Additionally, we found that we*

were not putting safety first." (p. 27) Commissioner McGaffigan: "NFS is as safe as it's ever going to be." (p.47) Closed session between NFS, NRC Region II and the Nuclear Regulatory Commission, 5/30/07, ML071930389 (Note: NFS requested a license extension for 40 years on 6/30/09)

- 10/17/07 *Subject: NFS Request for Additional Information Concerning Configuration Management Amendment (TAC L32632).* Kevin M. Ramsey, NRC to B. Marie Moore, NFS, 10/17/07, ML072340065
- 11/14/07 *NFS Inspection Report.* Staff of the NRC performed a routine and announced NCS inspection of the AREVA Erwin facility (Licensed under Nuclear Fuel Services, License No. SNM-124) in Erwin, TN. Failure to have NCS approval in an Standard Operating Procedure (SOP), Letter of Authorization (LOA), or other formal method for flexible lines located in the Oxide Conversion Building (OCB) as required by procedure. Weakness with configuration control of local criticality alarm panel. IR 70-143/2007-208, Inspection dates 10/15-10/19/07, ML073110391, superceded by ML080670299
- 02/16/08 Team of expert consultants was assembled to serve as the NFS Safety Culture Board of Advisors (known as the SCUBA Team) to characterize any needs for improvement in safety culture and establish an initial baseline of information on the NFS-Erwin organizational culture that can be used to support trending activities in the future. The SCUBA Team identified areas where NRC "regulatory expectations" (as implied by the information presented in NRC Regulatory Issue Summary 2006-13) were either not being met or were being minimally met.
- Application of evaluation criteria led to the identification of a significant number of identified "Areas for Improvement" and "Areas in Need of Attention." *The SCUBA Team identified that most components of the NFS-Erwin Safety Culture failed to meet Safety Culture Components. Nine did not meet regulatory expectations as set forth or implied by NRC RIS 2006-13) with three meeting minimum regulatory expectations and one partially meeting regulatory expectations. NFS-Erwin Site 2007 Independent Safety Culture Assessment Results Report, 15N080037, GOV0155504, SCUBA REPORT, 2/16/08*
- (Note: Excerpts from The 2007 Independent Safety Culture Assessment Result Report-02/16/08.)*  
CONFIGURATION MANAGEMENT: (NRC Confirmatory Order-2/21/2007) The SCUBA Team has concluded the Configuration Management (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 documentary 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. However, 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. (p.101)

**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 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. The Configuration Management (CM) program needs to be adequately resourced to ensure that regulatory commitments are met on schedule and in a high quality manner.* (p. 29)

*"The Team observed degraded conditions, some of which create industrial-personnel safety risk. (p. 32) NFS has a reactive approach to preventive maintenance and tends to operate equipment until it fails (p. 33.) One contributing factor includes a value system that encourages putting production ahead of procedural compliance. Organization standards are principally focused on getting tasks completed to support production. Observations and interviews indicated very little supervisory time is spent on establishing, and reinforcing safety performance standards, including procedural compliance (p. 41.) 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 is necessary to address and correct this continuing problem. (p.42) 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. Stated another way, Safety Related Equipment and Items Relied on for Safety are run to failure (p. 57.)" NFS-Erwin Site 2007 Independent Safety Culture Assessment Results Report, 15N080037, GOV0155504, SCUBA REPORT, 2/16/08 (See Relaxation of Section V.3.B of Order dated 2/21/07, To Incorporate Upgrades To The Safety Culture Implementation Plan For NFS at 11/19/07 in the Confirmatory Order (CO) and Confirmatory Action Letter (CAL) Section Tab)*

04/07/08

NFS did not meet the criteria established in SECY-02-0216 for discussion at this year's AARM (Agency Action Review Meeting). *NFS was discussed at last year's AARM meeting, and Region II and NMSS recommend the status of the NFS improvement actions be discussed this year due to the unique aspects of NRC oversight at the facility. In particular the establishment of a Safety Culture and Configuration Management Improvement Oversight Panel that is evaluating NFS implementation of the Feb. 21, 2007 Confirmatory Order. NFS's current performance, as indicated by the number of violations identified since mid-2007, has not significantly improved since the last license performance review (LPR) and continue to indicate NFS needs to improve its manage-*

ment oversight to ensure adherence to operational, radiological protection, and engineering procedures. This area for improvement is longstanding as indicated by two of the previous three LPRs. Update of NFS, Inc., Enclosure 4, AARM-Agency Action Review Meeting, NMSS, 4/7/08, SECY-0800048, ML080580192 (Note: NFS is the only fuel facility that has two full-time resident inspectors. p. 21, NRC AARM Meeting, 5/14/09, ML091390764)

05/05/08

*NFS Inspection Report. Follow-up on Previously Identified Issues: The inspectors reviewed licensee corrective actions for apparent violations (AVs) identified in Inspection Report 70-143/2006-006 related to the BLEU spill event. These AVs were discussed in the February 21, 2007, Alternative Dispute Resolution (ADR) Confirmatory Order (CO) which exercised discretion not to proceed with enforcement action but required a written response to the proposed violations. The licensee written response was provided on April 20, 2007, and included corrective actions associated with the apparent violations. The licensee corrective actions were reviewed and accepted by the NRC in the transmittal letter for Inspection Report (IR) 70-143/2007-007. The inspectors reviewed corrective action completion and adequacy through document reviews and interviews with licensee staff and management.*

Apparent Violations Status Summary:

AV 70-143/2006-006-01: Failure to notify the NRC within one hour of discovery of an event consisting of a spill of HEU material into an unapproved and unfavorable geometry enclosure when no safety controls or IROFS were available and reliable to prevent a nuclear criticality accident. *The inspectors identified three licensee corrective actions related to this violation and determined the corrective actions were complete. This item is closed.*

AV 70-143/2006-006-02: Failure to verify proper installation of the solvent extraction tray dissolver filter enclosure drains, as required by Safety Condition S-1 of the license and License Application Section 4.1.1.1.3. *The inspectors identified 7 licensee corrective actions related to this violation and determined the corrective actions were complete. This item is closed.*

AV 70-143/2006-006-03: Failure to establish management measures for the solvent extraction tray dissolver filter enclosure drain system as required by 19 CFR 70.62(d), which resulted in the failure to ensure the filter enclosure met performance requirements of 10 CFR 70.61(d) for limiting the risk of a nuclear criticality accident under credible abnormal conditions. *The inspectors identified 9 licensee corrective actions related to this violation and determined the corrective actions were complete. This item is closed.*

AV 70-143/2006-006-04: Failure to meet the requirements of 10 CFR 70.61(d), in that the solvent extraction room did not meet performance requirements for criticality safety with respect to the credible abnormal condition of fissile solution accumulation on the solvent extraction room floor when there were no controls available to prevent a spill of fissile solution from accumulating into an unsafe geometry elevator pit (EA-06-179). *The inspectors identified 5 licensee corrective actions related to this violation and determined the corrective actions were complete. This item is closed.*

AV 70-143/2006-006-05: Failure to assume, as required by the license and license application Section 4.1.1, in the tray dissolver system NCS analysis, the occurrence of a credible abnormal condition. Specifically, NFS failed to assume that fissile solution could be misdirected from the

solvent extraction feed transfer line to the tray dissolver filter enclosure. *The inspectors identified one NFS corrective action related to this violation and determined the corrective action was complete. This item is closed.*

AV 70-143/2006-006-06: Failure to establish a configuration management system to evaluate, implement, and track changes to filter enclosure M205 as required by 10 CFR 70.72(a). *The inspectors identified 6 NFS corrective actions related to this violation and determined the corrective actions were complete. This item is closed.*

AV 70-143/2006-006-07: Failure to conduct SNM operations and safety function activities with procedures, as required by Safety Condition S-1 of the license and Section 2.7 of the license application. The inspectors identified 6 NFS corrective actions related to this violation and determined the corrective actions were complete. *The inspectors also noted NFS has properly submitted the license amendment for modifications to the configuration control program, which is under review at headquarters. This item is closed based on the completed actions by NFS.*

IR 70-143/2008-001, Inspection dates 01/01-04/05/08, EA-06-179, Events #43883, 43937, 44104, NMED #080012, 080056 and 080185, 5/5/08, ML081270020

05/22/08

*NFS Safety Evaluation Report: Since 2002 a growing number of significant violations occurring at the NFS facility, in Erwin, TN have been reflected in successive Licensee Performance Reviews (LPRs). Despite numerous root cause investigations and corrective action plans, NFS continued to experience chronic noncompliance issues. Civil penalties and other sanctions imposed by the NRC did not have the desired effect for improving overall compliance with regulatory requirements. The normal enforcement process did not result in adequate improvement. It was the conclusion of the NRC Headquarters and RII staff and management to focus NFS resources on actions that would improve the licensee's program and reduce repeat violations.*

The proposed strategy recommended use of the Alternate Dispute Resolution (ADR) process, which required the licensee to develop an improved Configuration Management (CM) program based on benchmarking they have done, and to amend License SNM-124 to implement the program.

The goal of the CM program is to ensure that accurate and current documentation matches the facility's physical/functional configuration, ensuring that items relied on for safety (IROFS) are available and reliable, and the facility complies with regulatory requirements. The licensee commits to a CM program in accordance with the requirements of 10 CFR 70.62(d), 10 CFR 70.64, and 10 CFR 70.72. The licensee commits to implementing the Configuration Management (CM) program for new processes throughout facility design, construction, testing, and operation after June 30, 2008. Safety Evaluation Report—Configuration Management Program Amendment (TAC L32632), for NFS, 5/22/08, ML080980319

05/22/08

*Amendment #82—Approval of NFS, Inc. Configuration Management Program (TAC L32632). This Amendment is a requirement of a Confirmatory Order dated February 21, 2007. Safety Condition S-53 for compliance dates has been added to read as follows:*

S-53: For existing processes (designed, installed, or in operation prior to June 30, 2008) the *Configuration Management program will be applied in accordance with the following schedule*: (1) apply throughout BLEU Prep Facility—September 2008; (2) apply throughout Navy Fuel Operations—June 2009; (3) apply through- out NFS—December 2010. Letter to B. Marie Moore, Vice President, Safety and Regulatory, NFS, from Robert C. Pierson, Director, Office of NMSS, NRC, 5/22/08, ML080980314

03/04/09 *Glove box Overflow Drains May Be Inadequate to Perform Their Safety Function. NFS Event Report 44890 (Note: There should not be a single glove box that has only one drain—and a single drain should allow discharge at a rate equal to inflow to prevent a critical mass accumulating in a given configuration. A single drain cannot be deemed an IROFS because material can easily block a drain if this glove box has a wet process. License condition).*

04/03/09 *NFS, Inc., Site Status Summary. NFS met the declining “performance trend” criteria established in SECY-08-0135 for Agency Action Review Meeting (AARM) consideration. Specifically, *the NRC inspections and events at NFS, prior to and during 2006, revealed significant performance issues that lasted more than one inspection period.* The performance issues resulted in escalated enforcement actions that warranted *extraordinary NRC actions* (i.e., an Augmented Inspection Team Inspection in 2006, and issuance of a Confirmatory Order (CO) in February 2007). **The Order required NFS to revise its Configuration Management (CM) programs and implement a comprehensive safety culture improvement initiative.** The NRC response to the performance issues also included heightened NRC oversight at NFS (i.e., additional inspections, the assignment of a second resident inspector, and more frequent Licensee Performance Reviews (LPR’s). The problems that led to issuance of the CO are deeply rooted and a *sustained effort will be required by NFS as part of its safety culture improvement initiative to enhance its overall performance. The NRC will disposition several apparent violations extending from 2006 to the present with similarities to the performance issues that resulted in the 2007 CO, and that may result in escalated enforcement. A sustained period of heightened oversight by NRC is also warranted.**

The staff is currently developing a strategy to determine appropriate criteria for future modification or closure of the CO. It is anticipated the strategy will include substantial inspection activities by NRC, including independent NRC assessment of safety culture at NFS through application and adaptation of existing inspection tools such as Inspection Procedure 95003.

*Three pending escalated enforcement actions currently exist at NFS. A fitness-for-duty-case (EA-08-103) resulted in the identification of several apparent violations that could result in escalated enforcement, including individual actions. Apparent violations related to the processing of a weapon onto the site (EA-08-346) were identified that could result in escalated enforcement action. An apparent violation that involved the potential willful falsification of medical records (EA-08-321) could also result in escalated enforcement action.*

On December 31, 2008, *Amendment 85* to License SNM-124 was issued to reflect an indirect transfer of control of the licensee from NFS Services, LLC, to NOG-Erwin Holdings, Inc. (a subsidiary of Babcock and Wilcox (B&W)). On January 1, 2009, David Kudsin became the President of NFS. This was the only personnel change at the site: NRC, ML090550079, 4/03/09 (Note: *The assignment of a second resident inspector was made in 2004.*

07/06/09

*Inspection Report.* 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*.

- PIRCS 12815 was initiated after a *container of material was discovered in a storage rack not approved for that type of material*. Licensee determined root causes of the event to be *failure of configuration control of the storage system and a failure to train personnel to be knowledgeable of the storage requirements*.
- PIRCS 14537 was initiated on July 22, 2008 and its apparent cause evaluation had three corrective actions associated with it. 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 action did not exist. The three corrective actions assigned were given initial completion dates of February 28, 2009. 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. IR 70-143/2009-010, Report dated 7/06/09, Inspection dates 04/27-29/09, ML091880007.*

end

(Product of Erwin Citizens Awareness Network, Inc., P. O. Box 1151, Erwin, TN 37650)

## ENGINEERED CONTROLS, SAFETY RELATED EQUIPMENT AND ITEMS RELIED ON FOR SAFETY (IROFS) ISSUES

*(Note: (R) Means Word or Text Has Been Redacted. IR Means Inspection Report)*

- 1986 "There is a severe problem with uranium contamination at NFS, both inside and outside of the facility. *Outside areas and roofs of buildings are contaminated.* Process equipment frequently leaks contaminated solutions. Due to the age of the facility, contamination containment has not been well engineered into the process equipment. NFS uses dikes around areas where leaks frequently occur, but NFS performs no surveys in these areas and intentionally discharges contaminated liquids into these areas". Hearing Before the Subcommittee on Energy Conservation and Power, pp.10, 190-191, 9/18/86
- 11/07/91 *Raffinate Released to Unsafe Geometry/Loss of Criticality Safety Controls.* Raffinate columns were released to unsafe geometry tanks by mistake. U/I content was (R) and (R). Normal Release Limit (R). *Reported on 11/14/91. FC911248*
- 11/09/92 *In-line Monitor Failure.* Discovery of the failure of the in-line monitor isolation valves for the (R) tanks. *Reported on 11/25/92. FC921044*
- 01/28/93 *In-Line Monitor Inoperable.* Licensee discovered the inline radiation monitor in the pipe between the column and the tank was inoperable. FC940895
- 02/04/93 *Failure of In-Line Monitor.* Failure of an in-line uranium monitor to operate for approximately 9 hours. Approximately (R) of highly enriched U-235 in the form of uranyl nitrate liquid was discharged through the line without being monitored. No personnel exposures or releases to environment. FC940844
- 07/02/94 *Failure of Criticality Alarm System.* Commercial (R) were lost to the criticality alarm system for approximately (R). FC940619
- 09/27/94 *Criticality Monitoring System Alarm Disabled.* The audible alarm for the criticality monitoring system was found to be turned off (disabled). FC941881
- 03/22/96 *Criticality Alarm System Alarm Locked.* FC960199
- 04/02/96 *Fire at NFS Subject of NRC review.* The fire began in a piece of process equipment inside a building at the plant which processes radioactive material and spread into a section of ventilation exhaust ductwork for the incinerator at the facility. Waste, contaminated with uranium, was being burned in the incinerator at the time of the fire according to NRC officials. The Erwin Record, 4/10/96 (NFS team at work on incident assessment, future safeguards. NFS team at work on fire incident assessment, future safeguards pertaining to fire on April 2, 1996 that began in an incinerator and spread to ventilation ducts outside the building. Also stated corrective actions ordered by NRC following a similar fire in 1983 were either not done or had not been maintained

over the years. The Erwin Record, 4/17/96) Declaration of a site area emergency due to a fire exceeding 15 minutes, a **breech of containment** and the potential for a radioactive release. The fire was detected in the #302 incinerator room. It spread to the ducting on the roof and *breeched the ducting*. The incinerator was burning radioactive material at the time so the potential existed for a radiological release. Licensee determined there was a maximum of 800 grams of HEU available for release. The fire damaged approximately 150 feet of ventilation ducting on the roof. Latest measurements indicate the amount of material involved was approximately 8 grams in the ventilation system and approximately 45 grams in the actual burn. U.S. Nuclear Regulatory Commission Operations Center Event Report, Event #30220, Facility—NFS, ML051640507, 04/02/96

Violation A involved your *failure to implement and maintain a configuration control and management system for the Building 302 incinerator which was used to handle uranium*. Violations B.1 and B.2 involved *failure to institute adequate procedures for the safe operations of the incinerator and multiple examples in which your staff failed to follow procedures*. Of particular concern was your *failure to verify the operability* of the quench tank spray nozzles prior to operation of the incinerator because such verification contributes to assuring the effectiveness of the incinerator exhaust cooling. Violation C involved failure to identify the incinerator as safety related which resulted in *failure to implement a preventative maintenance and surveillance program for components essential to safety*. Violation D involved *failure to implement an adequate training program for personnel operating the incinerator equipment*. *The root cause of the violations appears to be a lack of attention in ensuring that safety systems and controls remain in place and that changes which might affect them are controlled and reviewed*. Collectively, the violations represent a significant regulatory concern because they are indicative of a **significant** lack of attention toward licensed responsibilities. Specifically, multiple processes and barriers to preventing unsafe operations of the Building 302 incinerator failed including equipment, procedures, and personnel which culminated in the April 2, 1996 fire. A further example of your lack of attention is the fact that corrective actions in response to a similar fire in 1983 were not effective in preventing the April 1996 fire and were not fully implemented. The consequences of the fire, both potential and actual, would have been mitigated had you effectively implemented corrective actions following the 1983 fire. **Adequate controls for the licensed activities you were conducting should have been implemented and in effect, and they were not.** Letter from Luis A. Reyes, NRC, Region II Administrator, Subject: Notice of Violation and Proposed Imposition of Civil Penalty-(NRC Inspection Report #70-143/96-05), to Dwight Ferguson, President, NFS, 8/21/96

08/07/96

*Failure of Criticality/Fire Alarm System. FC960472*

09/29/98

*Criticality Monitoring Instruments Inoperable. Licensee reported that the inverter component of the (R) had failed during a test causing (R) criticality monitoring system failures. Due to (R) concerns, no additional details are provided. Procedure error was viewed as the primary cause of this event as the Plant Superintendent did not issue or authorize a work request for repair of the (R) System. FC981021*

02/26/99

*Criticality Alarm System Inoperable. Event # 35414, FC990133*

- 02/28/99 *Criticality Alarm System Was Out Of Service. Event# 35425*
- 05/06/99 *Failed Criticality Alarm Detector. Event #35691, FC990293*
- 03/05/01 *Safety Equipment Failure—Insufficient Coverage of Criticality Alarm System Used for Storage. Event # 37811, FC010212*
- 04/01/01 *Safety Equipment Failure—Loss of Power To Criticality Alarm System. Event # 37881, FC010314*
- 05/19/01 *System Degradation Related to Detection/Monitoring. Licensee reported a (R) system degradation related to detection/monitoring. This system degradation resulted in the loss of all (R) systems due to a total power outage. The power outage caused a criticality alarm, which necessitated an evacuation. Event 38014, FC010479*
- 05/31/01 *Safety Equipment Failure—Inadvertent Loss of Power To The Criticality Accident Alarm System. Event # 38044 "During testing of a portion of the system that has not been used for many years, a short circuit in the system occurred that resulted in system failure and loss of power to certain safety and safeguards equipment." NFS—Uninterruptable Power Supply Update, Region II, Items of Interest, Week Ending June 1, 2001, FC010506*
- 06/05/01 *Temporary Loss Of Criticality Accident Alarm System Due To Power Failure. Event # 38054, FC010522 (Note: Did NFS' Uninterruptible Power Supply (UPS) not work either?)*
- 07/20/01 *A pre-decisional enforcement conference was conducted at NRC Headquarters in Rockville, Maryland, with members of NFS and their staff to discuss an apparent NRC violation pertaining to the storage of up to 20 kilograms of highly enriched uranium (HEU) in the Building 306E bins for approximately 46 days without adequate criticality alarm system (CAS) coverage. Based on the results of NRC calculations, we have determined the NFS CAS *would not* have detected and annunciated an accidental criticality in Building 306E. *Failure to have adequate CAS coverage is of significant concern to the NRC because criticality alarm systems are designed to mitigate radiation exposure to workers and the public resulting from accidental criticality.* A severity Level III violation was issued on 9/24/01 (EA-01-098). Letter to Dwight Ferguson, President, NFS, Subject: Notice of Violation (NRC Inspection Report 70-143/2001-203), from /RA/ Martin J. Virgilio, Director, Office of Nuclear Material Safety and Safeguards (NMSS), EA-01-098, 9/24/01 (See 6/22/01)*
- 07/23/01 *24 Hour NRC Bulletin 91-01 Report. Partial loss of one control (in-line monitor). Concentration is used to control mass. Air in line (created by Area 800 discharge pump) caused 'trickling effect' through the line past the detector when Area 800 solution is being discharged. *Upon immediate observation of the situation, discharge to WD01/WD02 was suspended (Area 800 was only stream being discharged).* The tank contained approximately 400 gallons or approximately 16.5 grams U-235. Event # 38166, FC010705*
- 09/23/01 *One Hour Security Report. Safeguards system degradation related to power supply functions. Event # 38306*

- 10/27/01 *Partial Loss Of One Control Used For Double Contingency (In-Line Monitor). It was determined the peak for the solution had drifted outside the region of interest for the system (i.e., 185 Kev peak for U-235). Scan results indicated approximately 55.7 grams U-235 in the tank. Event# 38434, FC010972 (Retracted on 10/28/01)*
- 01/18/03 *A routine inspection of NFS by the NRC found some minor violations. The inspection was done Oct. 13 and Nov. 23<sup>rd</sup>. According to a letter from the NRC to NFS dated Jan. 7, the plant was cited for one violation, while no citations were issued for three other violations. The NRC said the cited violation was classified and no further information would be released to the public. Two other non-cited violations included failure to assure reliability of safety-related equipment through testing and the location of an excessive number of nuclear material storage containers in one place. The third non-cited violation was also classified. Inspectors said that in the non-cited (NCV) violation, several storage containers were located where only one should have been. Johnson City Press, 1/18/03 (Note: NFS violations are classified information? The Official Use Only "OUO" Policy didn't start until August 22, 2004. Letter from NRC Chairman Dale Klein to Congressman Bart Stupak, Chairman, House Subcommittee on Oversight and Investigations; and, NRC News Release, 9/04/07)*
- 03/10/03 *Bulletin 91-01: 24 Hour Report Due To Failed In-Line Concentration Monitor. Discharge to waste tanks WD01 and WD02 was suspended. Approximately 11 liters of solution with a U-235 concentration of approximately 0.02 grams U-235/liter was discharged to the waste tanks. Approximately 4.0 grams U-235 was calculated to be in the waste tank based on sample and non-destructive assay scan of the tank being filled. Event #39656, FC030194*
- 04/18/03 *The Division of Fuel Cycle Safety and Safeguards staff met with NFS licensing staff to discuss proposed management measures for Items Relied on for Safety (IROFS), part of the review of the BLEU Uranyl Nitrate Building license amendment application. NFS submitted its management measures commitments, dated 4/16/03. "These measures are intended to address the requirements in 10 CFR 70.62(d) that NFS establish management measures to ensure that engineered and administrative controls identified as IROFS are designed, implemented, and maintained—and to ensure they are available and reliable to perform their function when needed". Nuclear Fuel Services Meeting on Management Measures, Division of Fuel Cycle Safety and Safeguards, NRC, 4/18/03*
- 05/14/04 *Loss of Criticality Safety Controls. NFS Event Report 40750 (May 14, 2004, licensee reported a previously unidentified failure mode for a piece of safety related equipment (SRE) had been identified during review of an integrated safety analysis (ISA). The SRE item was a conductivity probe and was designed to detect and prevent the transfer of moderating materials (R). The operation was in a shutdown state when the problem was identified—the condition had existed since system operation commenced in 1999). IR 70-143/2004-04, 6/28/04, Inspection dates 4/18-5/29/04, ML081440457. (From system startup in 1999 until May 14, 2004, an engineered control was unable to detect an undesired situation, was unable to implement corrective action without requiring human intervention, and was not capable of performing the criticality safety purpose for which it was specified). Pre-decisional Enforcement Conference Agenda, NFS, 9/24/04, ML081500428 & ML081430457, FC040347 (Six Years!)*

- 05/17/04 From September 9, 2002 through January 12, 2003, operations which involved more than a safe mass of licensed material, where double batching was possible, were performed without a detailed criticality safety analysis. IR 70-143/2004-003, Inspection dates 3/07-4/17/04, ML081440458 The NCS controls in place to prevent double batching to produce more than a safe mass *were not sufficient* to adequately prevent credible changes in process conditions that could lead to a criticality accident. The main concern for criticality safety for this operation was preventing more than a safe mass from getting in (R). Solutions pumped (R) had a concentration limit that was not to be exceeded but *administrative controls on concentration of solutions did not work and solutions above the limit was (R) on at least one occasion*. Response to Disputed Notice of Violation, IR 70-143/2004-03, ML081360341
- 06/04 From process startup in June 2004 to January 7, 2005 the safety related equipment process logic controller (SRE PLC) for the (R) process was not capable of performing the criticality safety purpose for which it was specified. IR 70-143/2005-01, Inspection dates 1/23-3/03/05, 04/04/05, EA-05-032, ML081440195 (Eight Months!)
- 07/15/04 Nuclear Fuel Services Praises NRC's OK for Uranium Project. The Greeneville Sun, 7/15/04  
Note: The NRC issued a 92 page report supporting the latest licensing amendment as meeting federal safety standards. "NFS has constructed hazard analysis that identified and evaluated and established safety controls to provide reasonable assurance of a safe facility operations," the agency said. Nuclear Fuel Services In Erwin Begins 'Down blending' Uranium, The Greeneville Sun, 10/14/04
- 07/26/04 A fire occurred (R); cause of the fire was determined to be (R). In response to the fire, NFS replaced damaged lexan panels and HEPA filters (*safety related items*); Review of test records noted the values obtained for the differential pressure across the filters *fell below the minimum expected value, but operation of the equipment continued due to the filters being newly installed*; the test did not state what acceptable operating values were and did not clearly state required action if values outside expected values were obtained. IR 70-143/2004-08, Inspection dates 7/11-8/21/04, 9/20/04, ML081440246
- 08/02/04 As part of the safety program NFS committed to establish management measures to maintain the reliability of Items Relied on for Safety (IROFS). The inspectors found the initial calculation for the nitrogen supply tank indicated *very little safety margin or conservatism for the safety system to fully function*. The inspectors noted that several sole IROFS, which referred to the tank structure for (R) chemicals (R), had been deleted from the Integrated Safety Analysis (ISA) that had been approved by the NRC licensing branch. Subsequent guidance from the NRC licensing branch indicated deletion of sole IROFS under these circumstances was acceptable. IR 70-143/2004-05, Inspection dates 3/29-6/18/04, ML081290542
- 10/06/04 Safety Related Needle Valves in Incorrect Position. Potential Vulnerability to workers and the public of a high consequence event involving failure of safety controls that were designed to prevent a **hydrogen explosion** in the BLEU Preparation Facility U-Aluminum Dissolution glove-boxes/dissolvers. NFS Event Report 41097 It was determined the valves were closed on 9/30/04

due to a level switch malfunction causing a caustic solution spill. On 10/05/04, the system was restarted but the procedure did not provide guidance to check the status of needle valves. FC070002

- 10/26/04 *Failure of Safety System Causing Unfavorable Geometry.* A transfer of low concentration HEU solution from favorable to unfavorable geometry initiated upon sampling data that was not representative of the solution. The solution was determined to be above the transfer concentration limit. NFS Event Report 41149, FC050002
- 12/13/04 A fire resulted (R) due to the temporary manifold mixing of the flammable gases into the inert gas line. *One fire safety IROFS inoperable. IROFS out of service due to operational errors.* IR 70-143/2004-10, Inspection dates 10/3/04-11/13/04, ML081440453
- 01/07/05 *Faulty Programmable Logic Controller (PLC) for Oxide Dissolution Operation. (Loss of or Degraded Safety Items.)* NFS Event Report 41316 The material involved was approximately 9,900 grams of Uranium enriched to about 65 weight percent U-235. FC05004
- 02/11/05 Tracking of licensee's actions to adequately justify the acceptability of replacing an engineered control with an administrative control. IR 70-143/2004-207, Inspection dates 12/13-12/17/04, ML081440512 & ML081440511
- 03/24/05 *Loss or Degraded Safety Items—Equipment Piece for Storage Rack Not in Place for Safe Storage of Special Nuclear Material (SNM.)* NFS Event Report 41523, FC070005
- 04/04/05 *NFS Inspection Report. From process startup in June 2004 to January 7, 2005 the safety related equipment process logic controller (SRE PLC) for the (R) process was not capable of performing the criticality safety purpose for which it was specified, in that the PLC was not capable of monitoring or detecting holdup of material in the process and would not properly control (R) material mass as required.* IR 70-143/2005-01, Inspection dates 1/23-3/05/05, EA-05-032, ML081440195 (Eight Months!)
- 04/28/05 *Inadequately Controlled or Analyzed Pathway for Material Accumulation.* A solution (with approximately 3 grams of U235) accumulated in a HEPA filter housing on the building (R) roof. Further reviews of the system design identified *potential pathways from the Uranium-Aluminum dissolution system that did not appear to be adequately controlled or analyzed.* NFS Event Report 41651 As of April 28, 2005, the BLEU (R) dilution ventilation system had only **one drain** and no (R) so that double contingency was not established. The solution accumulation was in the section of the housing containing the first HEPA filter which was saturated. The event appeared to violate off-gas system NCS controls such as the HEPA drain. One violation was identified involving a **non-existent item credited for maintaining safety** in the BLEU (R) dilution ventilation system. IR 70-143/2005-203 and Notice of Violation, 6/02/05, Inspection dates 5/02-04/05, ML081480315 The cause was an incorrect valve alignment that occurred when transferring caustic discard solution. The operator failed to follow the valve lineup procedure and the supervisory verification was not performed in an independent manner. The solution was inadvertently transferred to the off-service centrifuge system. A number of process alarms were received, but operators believed

*the alarms to be false because they were associated with a system not believed to be in operation. The solution was subsequently pushed up through the hydrogen dilution system and into the hydrogen off-gas ductwork. Approximately 20 liters of solution overflowed from a drain located on the ductwork. The significance of the event was not immediately recognized. The source material was unsealed source SNM, Radionuclide—HEU. This was not an Agreement State Reportable Event. Event Date—4/07/05, Discovery date—4/28/05, Report date—4/29/05, Last updated—11/07/05. Item #FC05006*

- 06/02/05 *NFS Inspection Report. Criticality Safety Inspection to review Event 41651 that occurred on April 7, 2005 involving the discovery of uranium contaminated caustic solution of the (R) dilution system HEPA filter housing. On April 28, 2005, the BLEU (R) dilution ventilation system had only one drain and no (R) so that double contingency for the backflow of solution into the (R) dilution process ventilation system is a violation (70-143/2005-203-01. The inspectors noted more than three weeks had been assigned to accomplish the corrective action even though an accumulation in a HEPA filter housing would violate Nuclear Criticality Safety (NCS) controls. IR 70-143/2005-203, Inspection dates 5/02/05-5/04/05, ML081480315 (cover letter) & ML081480316 (IR). (Reported to NRC over 3 weeks later on 4/29/05, ML081440517)*
- 10/08/05 *Criticality Alarm System Inoperable in the NDA/Loading Dock area due to Detector Failure (Safety Equipment Failure). NFS Event Report 42047, FC050011*
- 10/19/05 *Exceeded Mass Limit Requirements. (Unanalyzed Condition) Failure of IROFS for Environmental Safety Program. Released (R) of liquid waste effluent from (R) to unfavorable geometry tanks without confirmation of the U235 concentration. NFS Event Report 42131 (Note: Discovery date 11/08/05, FC050013)*
- 10/21/05 *Potential Degradation of Glove-box Overflow Drains Under Certain Vacuum Conditions (Loss or Degraded Safety Items.) The degraded safety scenario would involve HEU concentration solution entering the glove box. NFS Event Report 42133 (NRC notification on 11/10/05) (Note: "The NRC further notes these enclosures are present throughout the NFS facility and their drains are the only protection against the accumulation in them (R)". Notice of Violation and Proposed Imposition of Civil Penalty, NFS Event Report 42133, 4/21/06, ML081500190) The enclosure vacuum was not considered in the set-point analysis for these drains such that, under vacuum circumstances above normal, the drains may not function as intended. FC060005 (Note: Six months before the HEUN spill on 3/06/06)*
- 10/28/05 *Discard of Caustic Solution to Waste Tank Without Sample and Analysis (Safety Equipment Failure). Solution volume discarded without sampling was 270 liters. NFS Event Report 42089 Licensee released waste effluent from the Caustic Discard hold columns without the demonstration that U-235 concentration was less than (R). IR 07000143-2004-207, Inspection dates 11/01/04-11/05/04, Report date 2/10/05, ML081440507 Subsequent analysis showed the solution consisted of 8.91 grams of U-235 enriched to 65 weight percent, for a concentration of 0.003 grams of U-235 per liter. FC0500012*

- 11/08/05 Exceeded Mass Limit Requirements (Unanalyzed Condition). Failure of IROFS for Environmental Safety Program. Released (R) of liquid waste effluent from (R) to unfavorable geometry tanks without confirmation of the U235 concentration. NFS Event Report 42131
- 12/16/05 Inadequate design basis of process enclosure drains to a common cause failure. A poorly controlled modification of a process enclosure drain, such that the drain may not have functioned due to lack of control of the elevation of the drain, since the IROFS mentioned were the only IROFS in an accident sequence leading to a criticality, and since those IROFS were subject to common cause failure, the *potential consequences of this issue are severe*. IR 70-143/2005-10, Inspection dates 10/02-11/12/05, ML081480307
- 12/22/05 Safety Equipment Failure. NFS Event Report 42226. Cause: Design, Manufacturing, or installation error. FC06002
- 01/05/06 Monitor Setpoint Improperly Set (Loss of or Degraded Safety Items) Failure to adjust the set-point of the inline monitor for the (R) discard system to the required value stated in the nuclear criticality safety evaluation configuration control. 10 CFR 61 performance criteria could not be met. NFS Event Report 42244 (It was determined the set-point for the Building (R) condensate Tank in-line uranium concentration monitor was set at a non-conservative value. Upon discovery of the situation, transfer operations to the condensate tank were suspended. WWTF sample results were reviewed which confirmed low uranium concentrations. IR 70-143/2006-001, 3/06/06, Inspection dates 12/25/05-2/04/06, ML081490104; FC060003
- 03/07/06 Unanalyzed Condition of Criticality Controls. NFS Event Report 42393 A spill of HEUN material consisted of approximately 35 liters of solution with 266 grams of uranium per liter, and an enrichment of approximately 63 weight percent U-235 during construction of a new process. On several occasions before the spill, workers had reported signs of a yellowish liquid in the filter glove box. Supervisors had failed to fully investigate the reports because they assumed the yellowish liquid was natural uranium solution used to initially test the new process system. Criticality was possible in the filter glove box due to the size and shape of the glove box, and because **no controls** were present in the filter glove box to prevent accumulation of solution. The solution leaked out of the glove box through uncontrolled drains to the floor of the new process area. Investigation of the event revealed the floor contained an uncontrolled accumulation point, an elevator pit, where criticality was also possible. *The total volume of the transfer was more than enough solution for criticality to be possible in the glove box or the elevator pit. If a criticality accident had occurred in the glove box or elevator pit, it is likely that at least one worker would have received an exposure high enough to cause acute health effects or death.* Source material: Unsealed source SNM—HEU Nitrate Solution. Cause: Management deficiency. Event date—3/06/06, Discovery date—3/07/06, Report date—3/07/06. Last updated—5/16/08, Item FC060004, p.302 of 348 03/13/06 Potential Unsecured Accumulation Point Identified (All Safety Items Unavailable) NFS Event Report 42411 Cause: Failure to identify and control the elevator pit during initial construction and operation of the facility and Management deficiency. FC060007

- 03/10/06 NFS management failed to recognize the significance of the 3/6/06 HEU spill event. Specifically that the facility was operating in an unanalyzed condition without any approved controls to prevent a nuclear criticality accident. ML072630328
- 03/13/06 *Potential Unsecured Accumulation Point Identified (All Safety Items Unavailable) NFS Event Report 42411* Cause: Failure to identify and control the elevator pit during initial construction and operation of the facility and Management deficiency. FC060007
- 03/28/06 *NFS License Performance Review (LPR).* Failure to comply with *criticality safety postings* which restricted the number of drums stored in the QC vault; *Potential NCS control failures resulting in fissile solution accumulation in the BLEU U-AI dissolution process off-gas system.* LPR for NFS, Inspection dates 1/23/05-2/04/06, ML072490009
- 05/20/06 *Criticality Evacuation Alarm Failure (Safety Equipment Failure.) NFS Event Report 42612* (Placing the detector in alarm status on May 31, 2006, after resetting it without success and not completing repairs on the detector until July 15, 2006, without implementing compensatory measures neither met the requirement of 10 CFR 70.24(a)(1) nor your commitment to the ANSI/ANS standard. Response to Notice of Violation, 11/07/06, ML081490354. *Licensee reported the criticality accident alarm system (CAAS) in the (R) Complex was not capable of providing a site-wide evacuation alarm in the event of a criticality.* Discovery date—5/31/06, Event date—5/20/06, Report Date—6/01/06. FC070007
- 05/23/06 Improperly uranium designed aluminum process overflows. Failure of an Administrative IROFS in the Environmental Safety Program (WWTF). *Caustic solution transfer made and mass limit was exceeded for uranium. IROFS failure block and bleed valves left open. 270 liters of unsampled caustic discard solution transferred.* IR 70-143/2006-003, Inspection dates 3/19-4/29/06, ML073060269
- 06/30/06 After discovery of some type of solution in the glove box in 2003/2004, the station limit card was replaced with a "no SNM allowed" sign, but subsequent discoveries of solution in the glove box were not noted as a problem. The NRC continues to be concerned with the use of generic procedures in some areas to cover activities such as draining of systems that contain SNM. *Since the ISA that was submitted in response to the Oct. 2004 due date, NFS has discovered occasional unanalyzed, credible accident sequences in both BPF and (R). This, combined with the number of ongoing changes within BPF and (R) can lead to further unanalyzed conditions and unidentified credible accident sequences.* NFS has not yet fully implemented management measures to assure that IROFS will be available and reliable. NFS must be diligent against the problems that occurred in BPF from happening in (R). Request for Supplemental Response to Confirmatory Action Letter, to Dwight B. Ferguson, President, CEO, NFS, from /RA/ Douglas M. Collins, Director, Division of Fuel Facility Inspection, ML081440078
- 07/07/06 Synopsis of NRC's (OI) report regarding NFS personnel willfully recorded incomplete and inaccurate information of transfer of containers of SNM. Failure of Criticality Alarm System (CAS) due to lightning strike. (Event 42612) IR 70-143/2006-004, Inspection dates 4/30-6/10/06, ML073060562, OI Case #2-2005-028

- 01/11/07 *Failure of Gamma Spectrometer Waste Monitor (Only One Safety Item Available.) Failure of this IROFS fails to meet the minimum performance criteria *and may have been in a failed state for more than eight hours.* NFS Event Report 43090; FC070008*
- 03/01/07 *Potential Degradation of Safety Systems (Loss or Degraded Safety Items.) Accumulation of fissile materials exceeding the controlled limit found in an enclosure. Failure of IROFS. NFS Event Report 43204 (Retracted 3/03/07) (An operational upset resulted in an excessive amount of fissile material to accumulate in a portion of a glove box. IR dated 4/23/07, 70-143/2007-002, Inspection dates 2/11-3/24/07, ML073060098) Source/Material: Fuel Fabrication Material—SNM. FC070009*
- 07/14/07 *Items Relied on for Safety (IROFS) Discovered Inoperable. Event 44345*
- 12/29/07 *Safety Equipment Failure of the Criticality Alarm System. NFS Event Report 43883, FC080001*
- 01/15/08 *Inadequate Inspections on Thru-wall Piping Penetration Sleeves. NFS Event Report 43937 Since 2004, NFS failed to adequately test eight of the eleven process sleeves due to the inability to visually verify the condition of the process pipe and sleeve. In eight out of a total of eleven sleeves (and penetrations) a fire sealant material (grout) covered the outside of the pipe such that it was not possible to determine the condition or existence of the sleeve. These sleeves are considered IROFS. Long term corrective actions include a redesign of all the sleeves, relocations of others and an update to the ISA. IR 70-143/2008-001, 5/05/08, ML081270020, Inspection dates 1/01-4/05/08 During a two-year review of safety-related equipment test, it was determined the test could not be performed as written and that the test did not verify the continued reliability and availability of the sleeve. The discussion in the supporting safety analysis was insufficient. Potential criticality consequences included a leak of uranium (R) solution from the pipe and sleeve into the wall. FC080002 (Four Years!)*
- 01/30/08 *Licensee Performance Review (LPR). The NRC noted an upward trend in the number of procedural violations identified during this review period including eight violations in a five month period. The review revealed the need for improvement in management oversight to ensure adherence to operational radiological protection, and engineering procedures, and is particularly noteworthy as it is a longstanding area needing attention as indicated by two of the previous three LPR's. At least one of these procedure violations involve failure to adhere to procedures implemented as a corrective action following the March 2006 incident involving the spill of HEU solution. LPR, Inspection dates 7/29-12/31/07, ML08033451*
- 05/05/08 *Failure to maintain an IROFS. A Non-Cited Violation (NCV) was identified as a result of the Building 333 down blending in-line monitor being in an operable but degraded state. IR 70-143/2008-001 dated 5/05/08, Inspection dates 1/01-04/05/08, ML081270020*
- 05/09/08 *NRC Office of Investigations (OI), Region II substantiated the fire alarm annunciation system in the Central Alarm Station (CAS) and the Secondary Alarm Station (SAS) were willfully tampered with by unidentified individual(s) employed by Murray Guard Corporation at NFS or an NFS employee*

who had access to the CAS and SAS fire control panels. IR 70-143/2009-001, 5/04/09, ML091240427.

06/04/08

*NFS discussed at AARM Meeting because of their deficient safety culture. ML080580192, 4/28/08*  
 At last year's AARM Commission meeting, staff identified a number of areas requiring improvements from successive LPR cycles dating back to 2002. Victor McCree, NRC, described the March 2006 spill of HEU as a "significant safety event". NFS' adherence to operational, radiological protection and engineering procedures are longstanding areas needing improvement. Several recent license amendment requests were not adequately prepared. Tolerance of degraded conditions was one of 9 areas needing improvement. U.S. NRC Briefing on the Results of the AARM, 6/04/08, ML081580430

(Note: The 2007 SCUBA Report dated 2/16/08 states: "The Team observed degraded conditions, some of which create industrial-personnel safety risk (p.32) and concluded an embedded tolerance of degraded conditions raised significant concerns regarding the current *general safety culture and the potential for carryover effects on nuclear safety.* (p.28) NFS has a reactive approach to preventive maintenance and tends to operate equipment until it fails. (p.33) *One contributing factor includes a value system that encourages putting production ahead of procedural compliance.* Organization standards are principally focused on getting tasks completed to support production. Observations and interviews indicated very little supervisory time is spent on establishing, and reinforcing safety performance standards, including procedural compliance. (p.41) 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 is necessary* to address and correct this continuing problem. (p.42) 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. *Stated another way, **Safety Related Equipment and Items Relied on for Safety are run to failure.*** (p.57) NFS-Erwin Site 2007 Independent Safety Culture Assessment Results Report, SCUBA Report, 15N080037, GOV0155504, 2/16/08

07/11/08

*Items Relied on for Safety (IROFS) Discovered Inoperable. NFS Event Report 44344*

07/14/08

*Item Relied on for Safety (IROFS) Discovered Inoperable. NFS Event Report 44345*

07/21/08

*On July 21, 2008, the inspectors evaluated the fire brigade's performance in response to a fire. The inspectors noted licensee had not inspected the fire dampers for the past two years, including fire dampers designated as IROFS. During review of the ISA for Building 310 Warehouse, the inspectors determined the only identified IROFS was inadequate for meeting 10 CFR 70.61 (b) requirements for the identified high consequence (i.e. potentially life-threatening events) to have a very low likelihood of occurring. NFS determined a fire in the warehouse could result in a high consequence event due to a chemical release. The inspectors noted the monthly surveillance in Building 310 Warehouse had been identifying non-compliances with the Combustible Control Program since July 2008. The inspectors determined the management measures in place for IROFS FIRE-2 were not ensuring the reliability of the control to prevent a fire. The failure to meet the performance requirements of 10 CFR 70.64(b) and the failure to have adequate management measures to ensure the effectiveness of IROFS are being evaluated for enforcement. The*

Emergency Plan (EP) and applicable implementing procedures were revised to require approval at 1000 mr/hr (one rem per hour). IR 70-143/2008-003, Inspection dates 7/06/-10/04/08,10/30/08, ML083040312

09/26/08

*Inspection Report.* Licensee stated that when an IROFS has to fail once to exceed the performance requirements of 70.61 is when an IROFS would be considered a sole IROFS. Licensee staff indicated this practice is used multiple times throughout the facility. Licensee staff indicated this same issue (relying on the failure of a sole IROFS multiple times) has been raised by NRC technical reviewers during their Commercial Development Line (CDL) amendment. Licensee staff believes the NRC approved this methodology during a previous license amendment review. *This issue will be tracked as an Unresolved Item (URI) while licensee determines whether the methodology was previously approved.*

Failure to demonstrate the adequacy of subcritical margin under all normal conditions associated with BPF centrifuge bowl cleaning. The inspectors determined the licensee was required to demonstrate the adequacy of subcritical margin for bowl cleaning by showing that  $k_{eff}$  for centrifuge bowl transfer operations was less than 0.90 under a reasonably defined normal condition.

*Licensee committed to review other Nuclear Criticality Safety Evaluations (NCSEs) for similar failures to define normal conditions. Licensee documented 20 issues for correction during future NCSE revisions. Licensee also committed to submit a license amendment to clarify requirements for analyzing reflection conditions by December 31, 2008. IR 70-143/2008-206, Inspection dates 9/8-11/08, ML082620240 (Question: NFS gets to decide? Doesn't the NRC know?)*

10/21/08

*IROFS Failure in Area 600.* The accident scenario of concern is release of the flammable gas into the glove-box and an explosion in the building. It was determined that IROFS Fire 6-6 was degraded. NFS Event Report 44584

12/09/08

An open management meeting was conducted with NFS in Rockville, MD. The purpose of the meeting was *to discuss significant unresolved issues in the NFS application to operate the new Commercial Development (CD) line.*

- Criticality Safety—In May 2008, the NRC requested an additional item relied on for safety (IROFS) for accident sequences involving a criticality accident caused by too much uranium in a glove box. NFS identified an IROFS as being a trained operator that complied with a regulated limit of uranium in the container (glove box). The control was failed twice. The NRC concluded that failing the same control twice is not sufficiently independent to demonstrate compliance with criticality safety requirements.
- Chemical Safety—In May 2008 the NRC requested additional information regarding accident scenarios involving dermal exposure (e.g., skin or eye contact) with hydrofluoric acid (HF). The CD Line produces a liquid HF solution that will be pumped through an overhead pipe. In August 2008, NFS provided additional information and noted that there is no standard for dermal exposure to liquid HF solutions. The NRC stated that it would accept other information if it provided a reasonable basis for assessing consequences. Despite ongoing discussions, this issue is still unresolved.
- Decommissioning Financial Assurance—In May 2008, the NRC requested a letter of intent from a Government agency stating that it intends to budget funds to decommission

the CD line. NFS responded with an excerpt from the U. S. Department of Energy Prime Contract. In August 2008, the NRC informed NFS that the issue was still open because the contract stated that a private company and the Government assumed the obligation to pay for decommissioning. *It was unclear what portion each party intended to pay.* NFS stated that it would obtain a letter of intent to clarify that the Government intends to fund all decommissioning costs. *Efforts to obtain the letter are ongoing.*

*The NRC management expressed its concern that these issues remained unresolved after extensive staff level discussions. Memorandum to Peter J. Habighorst, Chief, Fuel Manufacturing Branch, Office of NMSS from Kevin M. Ramsey, Project Manager, Fuel Manufacturing Branch, Office of NMSS, Subject: Summary of 12/09/08 Management Meeting with NFS, Inc., Regarding Application to Operate New Commercial Development (CD) Line, ML090150597, 12/09/08 (Note: The greatest impacts to the public from accidents would be experienced at Y-12 and NFS, at both of which the involved facilities are relatively close to site boundaries (in the case of NFS, the site is small) and population centers. The UF6 blending technology will not even be available unless the potential commercial blenders make the business decisions to deploy it. pp. 19 & 23, DOE Record of Decision for the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement, 7/29/96*

- 12/23/08 *Degraded Safety Equipment.* The accident scenario of concern is release of the flammable gas into the glove box where it could mix with oxygen, creating a potential for an explosion inside Building 302. NFS Event Report 44740
- 01/12/09 *Identification of Apparent Violations From NRC Inspection Report No. 70-143/2008-003.* Two Apparent Violations (APV) were identified relating to Unresolved Item (URI) associated with the IROFS identified for the 310 Warehouse.
1. *Prior to August 29, 2008, the fire accident scenarios indicated in the 310 Warehouse ISA summary had insufficient engineered or administrative controls. Only one administrative IROFS had been designated to prevent or mitigate a high consequence event.*
  2. *Prior to August 29, 2008, NFS had not implemented a safety program that would ensure IROFS FIRE-2 would perform its intended function when needed. Non-compliances with the combustible loading program in the 310 Warehouse (the critical component of FIRE-2) were identified, but corrective actions were ineffective. Specifically, unacceptable amounts of combustible material were found in the warehouse repeatedly for several months. Letter from NRC dated 1/12/09, ML090120305*
- 03/03/09 *Loss or Degraded Safety Items. Degradation of Item Relied on For Safety (IROFS).* NFS Event Report 44887 Failure of a component designated as safety related equipment (SRE) used as IROFS. The IROFS (level switch) failed to fulfill its safety function in securing a pump in the presence of a low fluid level. *The failure resulted in a high consequence event failing to meet the highly unlikely category.* IR 70-143/2009-001, 5/04/09, inspection dates January 1 through April 4, 2009, ML091240427
- 03/04/09 *Glove box Overflow Drains May Be Inadequate to Perform Their Safety Function.* NFS Event Report 44890 (Note: There should **not** be a single glove box that has only one drain—and a single drain should allow discharge at a rate equal to inflow to prevent a critical mass accumulating

in a given configuration. A single drain cannot be deemed an IROFS because material can easily block a drain if this glove box has a wet process. *License condition*).

- 03/23/09 *NRC to Investigate Problems With Glove Box Drains at NFS. The NRC is launching a week-long special inspection March 23 at NFS to look into a problem involving numerous overflow drains for glove boxes where HEU solution is handled. NRC said operations were shut down in 23 glove boxes. NRC said the inspectors also will look at the adequacy of the company's root cause analysis after a similar event in 2005. Jenny Weil, Washington, Platts, The McGraw-Hill Companies, 3/23/09 "It was determined that in some instances a single drain alone was not capable of maintaining a solution depth to within design parameters in some localized areas within the glove box". IR 70-143/2009-001, 5/04/09, ML091240427*
- 04/04/09 *NRC Planning Own Evaluation of Safety Culture at NFS. "NRC spokesman Roger Hannah said the evaluation probably would not take place until next year. The NRC said it placed a lot of emphasis in its inspection on the uranium aluminum (UAL) area, where dissolvers had clogged and caused material to back up into overflow columns. "These operational upsets had occurred several times over the week. Each overflow situation placed a significant burden on the operations staff because each of the overflow lines are safety related equipment". The level probes for the product column were replaced due to faulty readings. Despite this initiative, another overflow situation occurred during the week of the inspection. Another overflow situation occurred requiring a halt in operations and another inspection of the safety related overflow lines. The federal agency concluded there were problems in company procedures and an alarm, which did not sound initially. "The inspectors anticipated the recent spills in the U-AL area would have generated a more conservative or questioning attitude with regard to responding to alarms". Johnson City Press, 4/04/09 (Note: 5 Spills)*
- 04/24/09 *Inspection Report. Special Inspection Team (SIT) inspection conducted from March 23-27, 2009 at NFS to inspect and assess the facts and circumstances surrounding the *discovery of design issues regarding glove box drains identified as IROFS*. Fourteen glove boxes in the fuels area and nine glove boxes in the BLEU (BPF) Facility were impacted (23 glove boxes) by Event #44890 on March 4, 2009. During a review of calculations for flow rates of overflow drain(s) on glove boxes for the new CD line process, an engineer noted a discrepancy between his peer-reviewed calculations and the contractor's initial calculation. On Feb. 27, NFS identified *all potentially affected glove boxes (23 total) within the facility*. Reported to NRC on March 4, 2009. As an immediate corrective action, licensee removed uranium bearing materials from the affected glove boxes and declared them out of service to further evaluate the implications and extended condition of the event. IR 70-143/2009-007, 4/24/09, inspection dates 03/23-27/09, ML091140536*
- 06/30/09 *Safety Equipment Failure of the Criticality Alarm System. NFS Event Report 45179. NRC notification date, 7/01/09*
- 10/13/09 *Unanalyzed Condition; Nitrous Oxide (NOx) Generation Rate Higher Than Expected After Aluminum fines Were Introduced. Event No. 45446. On 10/13/09, NFS began using the Bowl Cleaning system to dissolve U-Al fines (very small particles of U-Al) rather than adding them to the normal dissolver column. After the dissolution process began, the Operator noticed the temp-*

erature of the system was increasing and that NO<sub>x</sub> (In the form of a brown cloud) was beginning to form inside the Bowl Cleaning station containment vessels. *Laboratory analysis of similar U-Al fines material was conducted Oct. 14-16. It behaved in the laboratory in the same manner as what was observed during the operational event.* It was determined the NO<sub>x</sub> generation for the fines was significantly higher than the previously analyzed NO<sub>x</sub> generation for the U-Al ingots. Using the generation rate specific for the fines results in *high occupational consequences. Potential worker and public exposure to NO<sub>x</sub>.* Oct. 19, 2009, it was determined that insufficient IROFS were in place and the performance criteria of 10 CFR 70.61 were not met. Radiological Hazards involved including: HEU: quantity approximately 1,000 g; U-235 quantity approximately 710 grams. Chemical Hazards involved including: Chemical—NO<sub>x</sub> gas; *Quantity approximately 1.85 lbs.* *Event date—10/13/09; Notification date—10/19/09.*

10/20/09 *NFS Investigated After Heat From Chemical Reactions Warps Ventilation System.* A Special Inspection team (SIT) from the NRC came Monday to NFS to get to the bottom of an accident in which a stronger than expected chemical reaction in the plant *caused the ventilation system to warp from the heat.* The accident occurred last Tuesday (Nov. 13, 2009), when materials with LEU was dissolved in nitric acid and levels of nitrous oxide and heat went higher than expected, said Joey Ledford and Lauri Turpin, spokesmen for the NRC and NFS respectively. The incident occurred in the BLEU Processing Facility. The portion of that facility where this incident happened has not been used since. Asked to rank the event on a scale of one to 10 Ledford said he couldn't begin to assess that. But he said any time we send a SIT in, we consider it a serious event. Turpin said NFS did not alert the public before Monday about the incident because the public was not in danger. Johnson City Press, 10/12/09, P. 1-A & 10-A (Note: The Event Report 45446 above stated potential worker and public exposure to NO<sub>x</sub>. It was serious enough for a SIT Team and and AIT Team. It was serious enough for NFS to shut down on 12/31/09, and a Confirmatory Action Letter on January 7, 2010. See 10/13/09 & 10/23/09, 12/31/09 & 01/08/10)

10/23/09 *NRC to Expand Review of NFS.* The NRC said it is increasing the scope of its review into an Oct. 13, incident at NFS in which a chemical reaction caused a vapor that warped the ventilation system and has formed what it calls an Augmented Inspection Team (AIT). An AIT is formed by the NRC to review more significant events on issues at NRC licensed facilities and the AIT will expand the scope of the Special Inspection Team (SIT) sent to the site earlier this week. NRC spokesman Joey Ledford said "We want to take a long look at the licensee's decision-making process as far as equipment and procedure modifications that occurred prior to this event. Asked whether this incident was a step backward for NFS, Ledford said it should not have occurred with a proper safety culture. Johnson City Press, 10/23/09, p. 1A & 8A.

12/31/09 *Offsite Notification/News Release—Temporarily Suspend Certain Process Areas.* NFS is implementing organizational, facility and management changes that will ensure an even more stringent level of safety controls and processes at the facility. During the implementation, NFS will temporarily stand down certain process areas. NFS is making these specific changes following a recent NRC review. *Suspended operations include production operations, the CD Line and the down blending facility.* These facilities will be brought back on line pending a third party review and NRC review of the safety improvement implementations. Event Report #45601, 12/31/09

01/01/10

*Temporary Halt Put On Some NFS Operations.* NFS announced that *operations at several process areas will be temporarily suspended to address and implement safety measures NFS and the NRC have agreed upon.* NRC spokesman Joey Ledford said the suspension of the process lines comes after several recent events at NFS, including the Oct. 13 incident at a bowl cleaning station when nitrogen compound gases were released, and after an NRC augmented inspection team (AIT) was dispatched to NFS on Oct. 22. Ledford said NFS agreed not to resume operations until the shortcomings identified by the NRC inspection team have been corrected.

Ledford said the NRC intends to send a Confirmatory Letter next week to NFS, which outlines the safety steps agreed upon by the two bodies. *NFS sent a letter to the NRC outlining nine actions it will take before resuming operations and three actions after restarting. It also provides 11 other actions NFS intends to take.* Johnson City Press, 1/01/10, p. 1 & 6-A

01/08/10

*NRC Orders NFS Safety Overhaul.* The NRC issued a Confirmatory Action Letter (CAL) to NFS requiring the company to keep its TN processing facility shut down until it resolves safety issues raised by an Oct. 13 incident that melted some vent pipes at the plant and could have led to what the NRC called "high occupational consequences" to workers. The letter requires NFS to *follow through on commitments it made to NRC in a Dec. 30 letter to revamp its waste handling, hazard evaluation and safety management procedures to address shortcomings cited by a SIT sent to the plant after the Oct. 13 incident.*

The NRC letter also suggested "perceived production pressures" may have contributed to the incident at the plant's uranium aluminum process lines, and said NFS had to change its management structure "to ensure separation between production goals and safety priorities." according to an NRC press release. The NRC further expresses particular concern about decisions made by NFS management, in both Oct. and Nov. 2009, to restart the uranium aluminum process lines *without fully understanding the causes of the events and correcting the underlying problems that caused them.*

In an interview with *The Energy Daily*, NRC Chairman Gregory Jaczko said NFS had a long history of safety issues and that his agency would be closely following the company's safety management overhaul to be sure it was effective. "They have significant issues with safety culture," he said. "Our focus right now is on making sure the facility is safe." *The Energy Daily*, 01/08/10

01/12/10

*NRC Issues Confirmatory Action Letter.* The NRC made it official last week—production at NFS will remain on hold until the company assures the NRC it can "safety operate" the nearly 53-year-old facility. The NRC issued a Confirmatory Action Letter (CAL) Thursday, Jan. 7, that it said was "designed to address issues that contributed to recent events at the facility, including an Oct. 13 incident being reviewed by an NRC Augmented Inspection Team (AIT). The letter is in response to NFS' written agreement with the NRC that it take actions in response to "shortcomings identified by the inspection team." Neither NFS or the NRC will speculate on how long production will be offline.

In addition to the closure of its production processes, NFS has also applied for a 40-year license renewal. *Company officials have said that closing of production shouldn't have any bearing on the*

*NRC's decision to approve the plant for another four decades of work in Erwin. The Erwin Record, 1/12/10, p.1 & 6-A.*

03/19/10

The purpose of the Augmented Inspection Team was to inspect and assess the facts and circumstances surrounding the Oct. 13, 2009 process upset at the NFS facility that resulted in unexpected levels of heat and nitrogen compound gas (NOx) due to a chemical reaction during the dissolution of scrap material containing low levels of uranium in the BLEU Preparation Facility (BPF) uranium aluminum (U-Al) process area.

The team performed an independent review of the safety basis of this accident sequence in the ISA. The ISA documented two IROFS as providing protecting against NOx emissions: IROFS BPF-43 (the NOx detection/alarm system for evacuation) and IROFS BUA-43 (addition of a chemical reagent into the caustic dissolution system). *On 10/13/09 licensee operated the U-Al system without first processing material in the caustic dissolution station. This station had the above two IROFS in place, however, the design change to directly input material into BCS resulted in IROFS BPF-43 as the only IROFS in place for the BCS. An additional IROFS needed to be in place to provide adequate risk reduction to meet the performance requirements for a high consequence event. In addition to exceeding the safety basis of the ISA, NFS operated the BCS without sufficient IROFS in place to meet performance requirements. The operations that occurred on 10/13/09 in the BCS failed to meet the performance requirements of 10 CFR 70.61(b) due to insufficient IROFS being available. Failure to meet performance requirements of 10 CFR 70.61(b).*

The team performed an independent assessment of the safety basis for NOx generation in the U-Al system and identified concerns with the technical basis for IROFS BUA-43. The control was designed to limit UO<sub>2</sub> production in the caustic dissolution portion of the process (which limits NOx production in the BCS) through the addition of a chemical reagent. The team review of the technical basis for BUA-43 indicated *licensee had not adequately quantified the effectiveness of this IROFS. Upon notification of the issue, licensee failed to present adequate calculations that indicated that sufficient addition of the chemical reagent would prevent the release of excess NOx.*

*The team review of the calculations, including those for the U-Al process, concluded that several controls, already in place (control of material addition, chemical reagent addition, ventilation system, etc.) for the process areas were mitigating the consequences of the accident scenarios. These mitigating controls were required to be identified and controlled as IROFS to ensure that the accident scenario remained low consequence. 10 CFR 70.61(e) states, in part, that each engineered or administrative control or control system necessary to comply with the performance requirements of this section shall be designated as an item relied on for safety (IROFS). Failure to identify engineered or administrative controls as IROFS for several accident scenarios in the above processes involving NOx generation. Failure to identify engineered or administrative controls as IROFS required by 10 CFR 70.61(e). Licensee's ISA was not adequate to meet the performance requirements in 10 CFR 70.61, in that a high consequence accident scenario did not have a sufficient number of IROFS identified and implemented.*

As part of the team's review of corrective actions, the team noted a corrective action to develop a formal engineering basis for IROFS BUA-43. *Upon questioning the licensee regarding this corrective action, licensee stated the intent was only to generate an engineering document that captured*

*the literature references that supported the chemistry involved in BUA-43. Licensee had not identified the lack of quantification of the effectiveness of BUA-43 as an issue in its review. The team determined the corrective action related to the technical basis of BUA-43 was inadequate. NRC Augmented Inspection Team (AIT) Report No. 70-143/2009-011, Event # 45446, ML100780127, 3/19/10*

## NFS DESIGN PROBLEMS/ISSUES

(Note: (R) Means Word Or Text Has Been Redacted. IR Means Inspection Report)

- 6-08/79 *Missing Uranium Explained by NRC.* A loss of 24½ pounds was indicated in 1979 because the scrubber which serves the ventilation system was operated improperly during the period. Inadequacies were identified in both the **design** and operation of the waste measurement system. For the period of June through August *gaseous releases* of uranium were understated by 766 grams to the uranium inventory differences. The error was about one pound and 11 ounces. *An understatement of about 20 pounds of uranium in liquid discharge was noted in the report. The liquid discharge travels from the plant to a wastewater treatment facility (Hereafter WWTF) and then into the Nolichucky River.* Johnson City Press Chronicle, 10/29/80
- 10/29/80 *Missing Uranium Explained By NRC.* NRC states that 48 lbs. of uranium reported missing from NFS earlier this year was primarily lost through larger than reported releases of gas and liquid waste and slow buildup of uranium in equipment. *Al Gibson, chief of the radiation support section of the NRC office in Atlanta said "release of radiation from NFS was in one sense more hazardous than the accident at Three Mile Island(TMI)." Gibson said radiation released at TMI radiates a person's entire body, while "NFS radiation exposure was a different type--to an individual organ, the bone. The inhalation of radioactive dust particles are absorbed in the blood and deposited in bone tissue. The dose to the bone near NFS was, in fact, probably higher than TMI. The loss of seven pounds of uranium occurred when a maintenance man turned off a leaking pump to make repairs causing another pump to overheat. Inadequacies were identified in both the design and operation of the waste measurement system.* Johnson City Press Chronicle, 10/29/80
- 11/29/81 *Little Progress Made at Nuclear Plant.* The CDC began its 1st cancer study after a 1978 investigation by the Atlanta Journal Constitution revealed the NFS plant had been dumping 250 pounds a year of enriched uranium into a nearby river and venting radioactive fallout on surrounding homes. For 20 years, first the Atomic Energy Commission and later the NRC, *which now is responsible for monitoring the facility, failed to stop the plant from making the discharges. Despite a history of waste discharge problems and a consistently high cancer death rate in the surrounding county, an Erwin, Tenn., nuclear fuel plant still has an inadequate program for controlling and measuring radioactive waste released into the environment according to a recent report by the NRC.*
- Because of concern over the continued discharge of uranium effluents from the facility, the CDC has begun a new study of cancer deaths in Unicoi County, where the plant is located. The cancer death rate remains higher in the rural area than the state average or that of surrounding counties according to 1981 statistics obtained from the Tennessee State Department of Health. Initial research completed in 1979 concluded a dramatic increase in Unicoi cancer deaths between 1957 and 1977 could not be linked to the plant discharges. But because of a latency period of 5 to 50 years after exposure, the research team concluded that several more years of testing would be necessary before it could be certain no link exists. The first 14 month study blamed most of the deaths on a gradual increase in the average age for the county's population of 16, 285. But the researchers expressed concern about the "unexpected" increase in leukemia--often viewed by cancer specialists as the first sign of a link to radiation exposure. There were six leukemia deaths in the county during 1975-1977 as compared to nine over the two previous decades. There have*

*been four more during the last 3½ years. Caldwell ordered the follow-up study after learning of an Oct. 7 release of 100 grams of uranium fluoride gas from the facility. We know that radiation causes cancer and we know that there have been releases, that's why we're continuing to watch it" Caldwell said.*

County residents were assured by NFS that radiation releases have always been within the licensing limits established by the NRC. The NRC also insisted the releases posed no health hazard to the surrounding communities. *A Sept. 29, 1981 NRC report indicated that a number of possible health and environment impacts continue to exist at the plant.* The September report, containing observations by NRC officials, covered the following problems:

- Quality Assurance program; "A significant weakness in the plant program for effluent and environmental monitoring has been the lack of a good quality assurance for control program. This also applies to other health physics/radiation protection measurements".
- Outside contaminated control areas "the surfaces (asphalt, soil, etc) in these areas have been permitted to become contaminated to the limits specified in the license. The contamination is **re-suspended** into the atmosphere and also discharged from plant environs through surface water runoff. Licensee has no control over the quantity discharged nor is the licensee able to satisfactorily measure the quantity of material released".
- *In addition to the potential migration of radioactive waste from the treatment ponds to the groundwater, NFS has buried waste lines which could leak and a solid waste burial ground on site from which contamination could be released to the groundwater.*
- Groundwater monitoring: "In addition to the potential migration of radioactive waste from the treatment ponds to the groundwater, NFS has buried waste lines which could leak and a solid waste burial ground on site from which contamination could be released to the groundwater. Currently only one well is used to monitor the burial site, the **design of which is not understood.**"
- Devises measuring release of radioactive particles: "A *comparison of the results shows very poor correlation between the primary and redundant stack samples,*" the officials wrote of devises which measure the amount of uranium particles often vented up smokestacks, during the chemical process which converts the uranium into nuclear fuel. "Consequently the representativeness of the stack sampling is questionable." NRC officials concluded.

*In its first study the CDC relied on effluent measurement data supplied by the NFS plant and the NRC to use in calculating radiation exposure to county residents. If that information was wrong, Unicoi residents could have received larger doses of radiation. "If we correct for aging (in the new study) and it still looks like the cancer rate is increasing, there could be something wrong with the exposure data," said Dr. James Rutenber, Jr., who will coordinate the CDC research. "They really haven't, in the past, come up with accurate off-site monitoring methods that would adequately reflect what those people are being exposed to," he continued. *If dangerous levels of radioactive discharges have been occurring with any frequency since the plant opened, it would take anywhere from 5 to 50 years for it to have an effect on the local population. Atlanta Journal Constitution, 11/29/81* (Note: Erwin Citizens Awareness Network has been unable to locate this cancer study)*

02/09/00

*Nuclear Fuel Services' Plant in Erwin Working to Contain Groundwater Contamination.* U.S. NRC officials confirmed that groundwater beneath the NFS plant is contaminated by a radioactive substance called technetium-99.

The NRC seemed more concerned about alleged repeated instances of non-compliance with proper safety procedures by NFS employees. A discussion of safety operations listed

a number of areas needing improvement. Among them were *self-identification of weaknesses in design, verification, testing and maintenance of process safety systems*. The Greeneville Sun, 02/09/00

- 07/20/01 A predecisional enforcement conference was conducted at NRC Headquarters in Rockville, Maryland, with members of NFS and their staff to discuss an apparent NRC violation pertaining to the storage of up to 20 kilograms of highly enriched uranium (HEU) in the Building 306E bins for approximately 46 days without adequate criticality alarm system (CAS) coverage. Based on the results of NRC calculations, we have determined the NFS CAS would not have detected and announced an accidental criticality in Building 306E. *Failure to have adequate CAS coverage is of significant concern to the NRC because criticality alarm systems are **designed** to mitigate radiation exposure to workers and the public resulting from accidental criticality.* A severity Level III violation was issued on 9/24/01 (EA-01-098). Letter to Dwight Ferguson, President, NFS, Subject: Notice of Violation (NRC Inspection Report 70-143/2001-203), from /RA/ Martin J. Virgilio, Director, Office of Nuclear Material Safety and Safeguards (NMSS), EA-01-098, 9/24/01
- 04/18/03 The Division of Fuel Cycle Safety and Safeguards staff met with NFS licensing staff to discuss proposed management measures for Items Relied on for Safety (IROFS), part of the review of the BLEU Uranyl Nitrate Building license amendment application. NFS submitted its management measures commitments, dated 4/16/03. *These measures are intended to address the requirements in 10 CFR 70.62(d) that NFS establish management measures to ensure that engineered and administrative controls identified as IROFS are **designed, implemented, and maintained—and to ensure they are available and reliable to perform their function when needed**.* Nuclear Fuel Services Meeting on Management Measures, 4/18/03, Division of Fuel Cycle Safety and Safeguards
- 02/06/04 *Officials: People Living Near NFS Safe In Case of a Disaster—A nuclear disaster that could harm residents living close to NFS is **extremely unlikely**, NRC officials said Thursday. According to the NRC, due to the **design of the facility here**, there would be a low-to-minimum risk of any radioactive contamination. Should failure occur in the facility or by human fault, officials said only employees within a confined radius would be exposed to possible lethal or long-term damaging effects. In terms of an evacuation—we are not going to have that kind of hazard here. **We don't have an evacuation plan in place.** (Local authorities) may respond to block roads if needed, but the likelihood of needing an evacuation is not there. Officials said even though there are nuclear facilities in America that do have such plans, the need for a plan here is not warranted due to the type of material housed at NFS.* Johnson City Press, 2/06/04
- 04/28/04 *Notice of Violation.* The blended LEU (BLEU) (R) ventilation system (R) so that *double contingency was not established* for scenario 4.1.3. Scenario 4.1.3 of NCSE, 54T-04-022, Revision 2, dated April 27, 2004, takes credit for (R) to prevent solution from back-flowing into the ventilation system. *Section 4.1.1 of the license application requires that all process equipment and systems be **designed to incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality is possible.*** Notice of Violation, Inspection dates 5/02-04/2004, IR Report dated 6/02/04, ML081440203
- 05/14/04 *Loss of Criticality Safety Controls.* NFS Event Report 40750 (May 14, 2004, licensee reported a previously unidentified failure mode for a piece of safety related equipment (SRE) had been iden-

tified during review of an integrated safety analysis (ISA). The SRE item was a conductivity probe and was **designed** to detect and prevent the transfer of moderating materials (R). The operation was in a shutdown state when the problem was identified—the condition had existed since system operation commenced in 1999). IR 70-143/2004-04, 6/28/04, Inspection dates 4/18-5/29/04, ML081440457. (From system startup in 1999 until May 14, 2004, an engineered control was unable to detect an undesired situation, was unable to implement corrective action without requiring human intervention, and was not capable of performing the criticality safety purpose for which it was specified). Pre-decisional Enforcement Conference Agenda, NFS, 9/24/04, ML081500428 & ML081430457; FC040347 (Six Years!)

- 05/17/04 *NFS Inspection Report. From September 9, 2002 through January 12, 2003, operations which involved more than a safe mass of licensed material, where double bathing was possible, were performed without a detailed criticality safety analysis. Failure to develop a Pre-Fire Plan when two new projects were being **designed**, constructed and operated. IR 70-143/2004-03, Inspection dates 3/7/04-4/17/04, ML081440458 (Five months!)*
- 06/28/04 *NFS Inspection Report: May 14, NFS reported a previously unidentified failure mode for a piece of safety related equipment (SRE) had been identified during review of an integrated safety analysis the SRE item was a conductivity probe and was **designed** to detect and prevent the transfer of moderating materials (R). Testing verified the probe was not able to meet the specified performance criteria in that the conductivity probe was not capable of detecting certain moderating materials that could be present in (R) material. *The condition had existed since system operation commenced in 1999.* Addendum 2 of the Nuclear Criticality Safety Evaluation (NCSE) for the area identified this conductivity cell as the only criticality control to prevent transfer of moderating material (R); The NCSE identified the presence of various types of moderating material and the potential for a process upset which could result in an undesirable transfer of moderating material not detectable by the conductivity probe to the (R). Only one criticality control remained fully in effect, the geometry control on the (R). Inspection Report #70-143/2004-04, Inspection dates 4/18/04-5/29/04, ML081440457*
- 10/05/04 *Safety Related Needle Valves in Incorrect Position. Potential vulnerability to workers and public of a high consequence event involving failure of safety controls that were **designed** to prevent a hydrogen explosion in the BLEU Preparation Facility U-Aluminum Dissolution glove-boxes/dissolvers. *Needle valves were closed on the U-Aluminum dissolver to protect against a Hydrogen Explosion in the enclosure or at the dissolver interface.* Other controls were in place to partially mitigate a potential hydrogen explosion. NFS Event Report 41097 It was determined the valves were closed on 9/30/04 due to a level switch malfunction causing a caustic solution spill. On 10/05/04, the system was restarted but *the procedure did not provide guidance to check the status of needle valves.* FC070002. "A violation involved NFS's identification of a previously unidentified failure mode for a piece of safety related equipment (SRE) during an Integrated Safety Analysis (ISA) review. The amount of material available was sufficient to form a critical mass and the inability of the instrument to perform its specified criticality safety function under certain conditions constitutes a violation of Section 4.1.1 of NFS' License Application. Enforcement Discretion, IR 70-143/2004-04, Inspection dates 4/18/04-5/29/04, ML081500427*
- 11/15/04 *Wet Offgas (WOG) Line Calculation Not Performed. IROFS (R) was not reliable and available on (R) and (R) transfers to (R) which occurred on Oct. 28, Nov. 2, Nov. 11, 2004 and Nov. 15, 2005.*

NFS Event Report 41197, FC070003 *The wet off-gas (WOG) line for the raffinate column (R) in the (R) area was not properly sized. A review of completed set-point analyses identified a set-point analysis for raffinate column WOG vent (R) that had failed the specified performance criteria. Specifically, WOG vent (R) could not handle the flow rate when SNM (R) solution was transferred to sump columns (R) and (R) using pump (R). There was no formal process for performing set-point analyses, poor turnover communication, and no verification and validation. An investigation identified several additional set-point analyses as having not been performed. Cause: Management deficiency. FC070003* September 8, 2005 licensee failed to document transmittal of design information and failed to maintain BLEU preparation facility design changes. An upset condition/overflow from the (R) system which identified a violation of NFS design procedures associated with the documentation for (R) system modifications performed by subcontractors; **Failure to maintain configuration control of facility design modifications.** IR 70/143/2005-08, NFS Inspection dates 8/21/05-10/01/05, Events 41197 & 41839, ML081480305

04/07/05

*Inadequately Controlled or Analyzed Pathway for Material Accumulation.* On April 7, 2005, licensee attempted to rework (R) waste solution (R). The operation required manipulation of several manual valves, and the lineup was performed in error such that the waste solution was pumped to the off-service (R) column. *The operation eventually filled the column, which overflowed into the (R), filled the process off-gas piping, and overflowed into the (R) dilution ventilation system on the roof. The operation was finally shut down when solution was discovered that had drained from the ventilation system onto the operating spaces floor. The event was reported to the NRC on April 29. (Event #41651).* Misaligned valves in the BLEU process area resulted in a spill of uranium contaminated caustic solution. Corrective action was to be completed by April 29, 2005, which meant that more than 3 weeks had been assigned to accomplish the corrective action even though an accumulation in a HEPA filter housing would violate NCS controls. (R) of caustic solution to the floor in the BLEU Process Facility. Licensee indicated this event occurred during an attempt to return caustic discharge solution to (R) with an incorrect valve line-up and while level transmitters were giving incorrect level readings (R). As a result, caustic solution was pumped into the (R) dilution system through the process off-gas lines. IR 70-143/2005-203 dated 6/02/05, Inspection dates 5/02-04/05 ML081480315 There was apparently no validation of expected system response to the operation in progress. Although a significant volume of liquid was moved, there was inadequate validation that the operation was proceeding as expected. *When the full extent of the issue was realized on April 28, the (R) system was shut down for review and revision of the safety basis, and also design and completion of physical modifications to the system. IR 70-143/2005-03 dated June 27, 2005, Inspection dates 04/17-05/28/05, ML081440517 (Discovery date 04/28/05, Report date 4/29/05. Approximately 9 liters of solution were removed from the housing. FC05006)*

On 04/28/05 a solution (with approximately 3 grams of U235) accumulated in a HEPA filter housing on the building (R) roof. *Further reviews of the system design identified potential pathways from the Uranium-Aluminum dissolution system that did not appear to be adequately controlled or analyzed. NFS Event Report 41651* As of April 28, 2005, the BLEU (R) dilution ventilation system had only one drain and no (R) so that double contingency was not established. *The solution accumulation was in the section of the housing containing the first HEPA filter which was saturated. The event appeared to violate off-gas system NCS controls such as the HEPA drain. One violation was identified involving a nonexistent item credited for maintaining safety in the BLEU (R) dilution ventilation system. IR 70-143/2005-203 and Notice of Violation, 6/02/05, Inspection dates 5/02-04/05, ML081480315* The cause was an incorrect valve alignment that occurred when transferring caus-

tic discard solution. The operator failed to follow the valve lineup procedure and the supervisory verification was not performed in an independent manner. *The solution was inadvertently transferred to the off-service centrifuge system. A number of process alarms were received, but operators believed the alarms to be false because they were associated with a system not believed to be in operation. The solution was subsequently pushed up through the hydrogen dilution system and into the hydrogen off-gas ductwork.* Approximately 20 liters of solution overflowed from a drain located on the ductwork. The significance of the event was not immediately recognized. The source material was unsealed source SNM, Radionuclide—HEU. This was not an Agreement State Reportable Event. Event Date—4/07/05, Discovery date—4/28/05, Report date—4/29/05. Last updated—11/07/05. Item #FC05006 06/02/05—NFS Inspection Report: Criticality Safety Inspection to review Event 41651 that occurred on April 7, 2005 involving the discovery of uranium contaminated caustic solution of the (R) dilution system HEPA filter housing. On April 28, 2005, the BLEU (R) dilution ventilation system had only one drain and no (R) so that double contingency for the backflow of solution into the (R) dilution process ventilation system is violation 70-143/2005-203-01. IR 70-143/2005-203, Inspection dates 5/2/05-5/4/05, ML081480315 (cover letter) and ML081480316 (report). (Reported to NRC over 3 weeks later on 4/29/05. ML081440517) 3/28/06-NFS Licensee Performance Review (LPR): Failure to implement/establish a criticality safety control identified in the safety analysis for the uranium-aluminum (U-Al) hydrogen dilution ventilation system. Poorly controlled modification of a process enclosure drain. Failure to rework U-AL process caustic waste solution according to procedure led to a transfer to the ventilation system. The design basis of the U-AL enclosure drain safety system was inadequate. (EA 2006-018) in that enclosure vacuum was not considered. Licensee Performance Review (LPR) of Licensed Activities for NFS, Inc., Inspection dates 01/23/05-02/04/06, ML072490009 (See 04/28/04)

04/25/05

*NFS Inspection Report. Audits of the Transportation Quality Assurance (QA) program not performed during last three years addressing all applicable criteria of Subpart H of 10 CFR Part 71, using appropriately trained personnel not having direct responsibilities in the areas audited. NFS Implementation of the requirements of Subpart H of 10 CFR Part 71 of the Transportation QA Program was not adequate. This is considered a violation of 10 CFR 71.137.*

*NFS failed to adequately evaluate and qualify Century Industries for design, testing, and fabrication activities performed under PO0303038655 (Level IV violation of 10 CFR 71.115) IR 71-0249/05-201, Inspection dates 03/07-03/11/05, ML051160008 (Note: Cover letter states "The nature of the violations is of concern to the NRC and merits particular attention by NFS Management.) (Framatone, Inc, is now AREVA p.9)*

07/13/05

*Fire/Explosion in Waste (Calciner) Furnace loaded with Low Level contaminated scrap materials. Air contacted the hot gases leaking from the calciner and the gases were ignited. A pre-filter in the vent duct caught fire, the HEPA filter was damaged and part of the vent duct melted. NFS Event Report 41839 The flame was also drawn into the connecting ventilation ductwork. The fire alarm was not sounded, due to confusion between the scene of the fire and the alarm station operator who received a verbal report from the scene. The fire brigade did not respond to the scene. The event demonstrated this aspect of system operations also increased the probability of a fire in the enclosure. Source material—HEU. IR 70-143/2005-007, 9/19/05, Inspection dates 7/10-8/20/05, ML081480306, FC050010 10/31/05—NFS Inspection Report: September 8, 2005 licensee failed to document transmittal of design information and failed to maintain BLEU preparation facility design changes. An upset condition/overflow from the (R) system which identified a violation of*

*NFS design procedures associated with the documentation for (R) system modifications performed by subcontractors; Failure to maintain configuration control of facility design modifications. IR 70/143/2005-08, NFS Inspection dates 8/21/05-10/1/05, Events 41197 & 41839, ML081480305*

- 07/25/05 *NFS Inspection Report: On July 25, the (R) process was in operation when hot (R) solution overflowed from the (R), into the enclosure overflow line and onto the floor. The hot solution caused the clear (R) lines to sag and deform. The event was caused by poor level control in the (R). Design of the enclosure overflows did not foresee the possibility that solution at an elevated temperature would overflow (R). IR dated 9/19/05, 70-143/2005-007, Inspection dates 7/10/05-8/20/05, ML081480306*
- 10/31/05 *NFS Inspection Report: September 8, 2005 licensee failed to document transmittal of design information and failed to maintain BLEU preparation facility design changes. An upset condition/overflow from the (R) system which identified a violation of NFS design procedures associated with the documentation for (R) system modifications performed by subcontractors; Failure to maintain configuration control of facility design modifications. IR 70/143/2005-08, NFS Inspection dates 8/21/05-10/01/05, Events 41197 & 41839, ML081480305*
- 12/16/05 *NFS Inspection Report: An apparent violation (AV) was noted for failure to meet performance criteria relating to nuclear criticality safety. A poorly-controlled modification of a process enclosure drain, such that the drain may not have functioned due to lack of control of the elevation of the drain, since the IROFS mentioned were the only IROFS in an accident sequence leading to a criticality, and since those IROFS were subject to common cause failure, the potential consequences of this issue are severe. Two example of failure to provide adequate assurance that IROFS will be reliable and available to perform their function when needed was an apparent violation (AV) of NRC requirements. (Inadequate design basis of process enclosure drains to a common cause failure). IR 70-143/2005-10, Inspection dates 10/02/05-11/12/05, ML081480307*
- 01/23/06 *NFS Inspection Report. The in-line monitor failed but the process continued to run until an operator identified the failure. The in-line monitor was an IROFS in the down-blend system, although not an NRC violation, this was a negative observation, in that a failure mode for an IROFS was **not recognized in the design process**. Letter to Kerry Schutt, President/General Manager, Nuclear Fuel Services, Inc., from /RA/ David A. Ayres, Chief, Fuel Facility Inspection Branch 1, Division of Fuel Facility Inspection, NRC, IR 70-143/2005-011, Inspection dates 11/13-12/24/05, Events 42131 & 42191, ML081480308*
- 03/10/06 *NFS Inspection Report: (The spill of 37 liters HEU on March 6, 2006.) The Special Inspection Team (SIT) determined the events immediate safety consequences were very significant in that operators were unaware that their actions could result in transfer of high enriched uranium (HEU) to the filter enclosure. The root causes of the March 6 spill of uranyl nitrate solution included inadequate configuration control, change analysis and design requirements. Design Development Less Than Adequate. Licensee's design development guidance lacked any specific requirements to ensure that misdirected flow of SNM-bearing solution was prevented. IR 70-143/2006-006, Inspection dates March 13-17, 2006, ML072630328*
- 04/21/06 *Notice of Violation and Proposed Imposition of Civil Penalty: Failure to provide adequate assurance that items relied on for safety (IROFS) would be reliable and available to meet nuclear*

criticality safety performance criteria. Violation A involves the **failure to develop and implement a design for the (R) enclosure overflow system which provides adequate assurance that IROFS would be reliable and available to perform their function when needed.** The (R) Facility (R) enclosure overflow system (designated as an IROFS) may not have functioned properly due to the *elevation of the (R) drain.* Violation B involves the failure to report the above condition, as required by 10 CFR 70, Appendix A, paragraph (b) (1). The NRC has concluded that criticality is NOT highly unlikely under the expected and bounding process conditions that existed in the (R) enclosure, due to the failure to install the enclosure drains at the correct height. *The NRC considers the potential consequences of this event to be significant.* The NRC further notes these enclosures are present throughout the NFS facility and their drains are the only protection against the accumulation in them (R). Notice of Violation and Proposed Imposition of Civil Penalty, IR 70-143/2005-010, EA-06-018, Inspection dates 10/02/05-11/12/05, NFS Event Report 42133, Severity Level III Violation, ML081500190 Note: *The NRC issued a 92 page report supporting the latest licensing amendment as meeting federal safety standards. "NFS has constructed hazard analysis that identified and evaluated and established safety controls to provide reasonable assurance of a safe facility operations," the agency said.* Nuclear Fuel Services In Erwin Begins 'Down blending' Uranium, The Greeneville Sun, 10/14/04

- 04/21/06 A notice of Violation (NOV) and Proposed Imposition of Civil Penalties in the amount of \$32,500 was issued to NFS. This action is based on a Severity Level III problem associated with two violations. The first violation involved the failure to develop and implement a design for the uranium-aluminum enclosure overflow system which provided that IROFS would be reliable and available to perform their function when needed. The second violation involved the failure to report a condition that resulted in the facility being in a state that was not analyzed, and which resulted in failure to meet the performance requirements of 10 CFR 70.61. EA-06-018, NRC: Escalated Enforcement Actions Issued to Materials Licensees-N, <http://www.nrc.gov/reading-rm/doc-collections/enforcement/actions/ma...>
- 05/04/06 *NFS Inspection Report:* No guidance on how to properly design a system to prevent backflow into a process vessel. Design guidance for engineers vague or non-existent. Letter to Dwight Ferguson, President/CEO, Nuclear Fuel Services, Inc., IR 70-143/2006-07, Inspection dates 04/03-04/07/06, ML073060347
- 06/30/06 NFS response dated March 24, 2006 to Confirmatory Action Letter (CAL) 02-06-003 and additional information NFS provided at the meeting at NRC Headquarters on March 27, 2006, that discuss details of NRC's response. *NRC continues to have concerns about the information NFS provided to demonstrate the safe operation of the HEU fuel manufacturing processes.* NFS's response mentioned differences between the BPF and (R) and stated that processes in (R) had been at steady state for over five years. NFS also stated that (R) has been expanded over the past several years, primarily with duplications of well understood processes. **The BPF has had numerous design problems associated with new types of process equipment during its relatively short operational life, many of the problems that have occurred were associated with relatively simple, well-understood processes.** The event that occurred on March 6, 2006 was basically a well understood process of pumping a uranium (R) solution from one (R) to another for use as feed material for the solvent extraction system. *The lack of complexity as a design change should not be a key element in determining whether a change would impact safety.*

The second significant difference NFS mentioned was that **(R)** has a more experienced staff, and to strengthen the experience in BPF, personnel reassignments were made in 2005 to augment the BPF operation. *The NRC noted there have been relatively limited reassignments of more experienced staff to BPF and will continue to review the effects of such reassignments on the safety performance in **(R)**.* Another remaining issue is the amount of design guidance provided to the engineering staff for specific types of equipment with safety implications. The results of the inspections showed that specific design guidance was lacking for engineering staff and design reviewers for many basic systems, (piping, ventilation, electrical) *as well as key safety-related issues such as backflow prevention.*

NRC continues to have several concerns with the NFS configuration management program. Since the configuration management program is used throughout the facility, *problems that surface during the BPF event could also affect **(R)**.* *The NRC inspection of the BPF event and the subsequent inspection of **(R)** showed problems in a proper review, approval, documentation of the design, the as-built conditions, and the changes made to the facility.* The fact that most electrical drawings are not included in the existing configuration management program is a significant concern since many safety controls are electrically actuated. The response to the CAL did not fully address the concerns with the site-wide configuration management program. *The inspection found the independent review of P&IDs and the "vertical slice" of key operational areas in **(R)** consisted mainly of looking at six of the oldest P&IDs to see if they were accurate, assuming that these drawing would have the highest likelihood of inaccuracies because of their age.* The inspection found this was not an adequate review of the configuration management program to make broad conclusions regarding the program at NFS because the drawings reviewed were for areas that had minimal changes over the years and three of them were of utility systems that had no associated safety controls. *NFS's statement implying the "vertical slice" also included a reassessment of the **(R)** safety controls was inaccurate.* After discussion with safety management, the NRC and NFS determined this re-assessment was for the BPF facility, not **(R)** as implied by NFS' response.

The NRC continues to be concerned with the use of generic procedures in some areas to cover activities such as draining of systems that contain SNM. *Since the ISA that was submitted in response to the Oct. 2004 due date, NFS has discovered occasional unanalyzed, credible accident sequences in both BPF and **(R)**.* *This, combined with the number of ongoing changes within BPF and **(R)** can lead to further unanalyzed conditions and unidentified credible accident sequences.* NFS has not yet fully implemented management measures to assure that IROFS will be available and reliable. The inspection of the **(R)** conducted the week of April 3, 2006, revealed at least two problems associated with management measures in **(R)** stemming from apparent lack of program oversight. **(R)** *The functional tests associated with this isolation valve were consolidated into one set of instructions and one of the key safety systems affected by the isolation valve was left out of the functional test instructions.* Another instance involved the repeated plugging of a vent line that caused frequent actuation of the safety controls to shut down the affected operation. This repeated frequent challenge to a safety system was not addressed for several months and was not reviewed for its effect on the management measures associated with the control. *NFS must be diligent against the problems that occurred in BPF from happening in **(R)**.* The NRC requests that NFS provide a supplemental response to CAL 02-06-003 within 30 days of receipt of this letter addressing NRC's request for additional information noted above. Request For Supplemental Response to Confirmatory Action letter, to Dwight B. Ferguson, President/Chief Executive Officer,

Nuclear Fuel Services, Inc., from /RA/ Douglas M. Collins, Director, Division of Fuel Facility Inspection, ML081440078

- 12/01/06 *NFS Licensee Performance Review (LPR). The NRC still has concern for the areas needing improvement noted in this report. All of the areas needing improvement are repetitive of areas identified in the last LPR. *Two of these resurfaced primarily from the BLEU Preparation Facility (BPF) event of March 6, 2006. These areas are verification and implementation of equipment and controls identified in nuclear criticality safety analyses, and utilization of the problem identification and corrective action program. The other areas needing improvement are control of SSNM, and engineering design, verification, and configuration control. Given the number, significance, and repetitiveness of these issues, the confidence normally provided through a robust safety program is not evident, indicating that actions are still necessary to provide additional assurance that facility operations will be conducted safely. These issues are also indicative that further action to improve your safety culture is warranted. LPR of Licensed Activities for NFS, Inc., Inspection dates 02/05/06-10/13/06, ML071930522**
- 07/16/07 *NFS Inspection Report. Transfer of waste water from a geometrically safe to an unsafe geometry. Operator failed to properly select correct tank at control panel and sent contents to wrong waste water tank. Leaking check valve not correct design. No indication licensee realized this should be evaluated further for review to determine the extent of condition, severity of design/installation issues and to understand significance of this particular issue. IR 70-143/2007-004, Inspection dates 5/6-6/16/07, ML073050514*
- 01/15/08 *Inadequate Inspections on Thru-wall Piping Penetration Sleeves. NFS Event Report 43937 Since 2004, NFS failed to adequately test eight of the eleven process sleeves due to the inability to visually verify the condition of the process pipe and sleeve. In eight out of a total of eleven sleeves (and penetrations) a fire sealant material (grout) covered the outside of the pipe such that it was not possible to determine the condition or existence of the sleeve. These sleeves are considered IROFS. Long term corrective actions include a **redesign** of all the sleeves, relocations of others and an update to the ISA. IR 70-143/2008-001, 5/05/08, ML081270020, Inspection dates 1/01-4/05/08. *During a two-year review of safety-related equipment test, it was determined the test could not be performed as written and that the test did not verify the continued reliability and availability of the sleeve. The discussion in the supporting safety analysis was insufficient. Potential criticality consequences included a leak of uranium (R) solution from the pipe and sleeve into the wall. FC080002 (Four Years!)**
- 03/23/09 *NRC to Investigate Problems With Glove Box Drains at NFS. The NRC is launching a week-long special inspection March 23 at NFS to look into a problem involving numerous overflow drains for glove boxes where HEU solution is handled. NRC said operations were shut down in 23 glove boxes. NRC said the inspectors also will look at the adequacy of the company's root cause analysis after a similar event in 2005. Jenny Weil, Washington, Platts, The McGraw-Hill Companies, 3/23/09 "It was determined that in some instances a single drain alone was not capable of maintaining a solution depth to within design parameters in some localized areas within the glove box". IR 70-143/2009-001, 5/04/09, ML091240427*
- 04/24/09 *Special Inspection Team (SIT) inspection conducted from March 23-27, 2009 at NFS to inspect and assess the facts and circumstances surrounding the discovery of **design issues** regarding*

glove box drains identified as IROFS. Fourteen glove (14) boxes in the fuels area and nine (9) glove boxes in the BLEU (BPF) Facility were impacted (23 glove boxes) by Event #44890 on March 4, 2009. During a review of calculations for flow rates of overflow drain(s) on glove boxes for the new CD line process, an engineer noted a discrepancy between his peer-reviewed calculations and the contractor's initial calculation. On Feb. 27, *NFS identified all potentially affected glove boxes (23 total) within the facility. Reported to NRC on March 4, 2009. As an immediate corrective action, licensee removed uranium bearing materials from the affected glove boxes and declared them out of service to further evaluate the implications and extended condition of the event. IR 70-143/2009-007, 4/24/09, inspection dates 03/23-27/09, ML091140536*

07/23/09

*Some Citizens At 'Exit Meeting' Question Safety Of Operation. NFS could get approval from the NRC as early as next week to begin operating a new production line that will convert highly radioactive uranium hexafluoride into other compounds. Joseph Shea, NRC Region II director of the Division of Fuel Facility inspection, made that disclosure during an "exit meeting" Wednesday related to a operation readiness inspection for the new production line the NRC conducted in June. During the 4 p.m. meeting an NRC senior fuel facility inspector said the NRC had discovered some problems with the proposed new production line in June. But he said all the issues raised by the inspection had been resolved to the NRC's satisfaction.*

*NFS Vice President of Operations Timothy Lindstrom said that safety had been built into the new production line. "We're real proud of the safety that we've designed and constructed into the new facility," Lindstrom said. "And we're happy to see that the NRC inspection team validated that safety basis here today." The Greeneville Sun, 7/23/09*

07/24/09

*NRC Inspection Report (Operational Readiness Review Team Inspection of the Commercial Development Line (CDL). The inspectors determined licensee did not adequately examine an accident scenario associated with the sublimation stations. Licensee had established IROFS to prevent overheating of three transparent polyvinyl chloride (TPVC) process columns to ensure they would not deform into an unfavorable geometry which could lead to an accidental criticality. Licensee did not consider that, in the event that pump flow was lost, warm process gas could continue to be fed to the columns. Following discussion with the inspectors, licensee performed an extent of condition review to determine if TPVC columns used elsewhere in the plant could potentially deform from exposure to a high temperature solution. Licensee identified another TPVC column in the CDL process that could have been affected and elected to isolate sources of solution that could have potentially deformed the column. The inspectors reviewed licensee's actions and had no further issues. Other columns were identified elsewhere in the plant (beyond the CDL process) that could have been impacted, and the disposition of those issues are being reviewed by the NRC under a separate inspection. The inspectors noted licensee's initial investigation of the column issue did not include root causes or proposed long term corrective actions. Licensee revised the investigation report and documented **deficiencies with its design control process** (e.g., different processes for implementing original design and subsequent changes and added the deficiencies into its corrective action system (CAP) for disposition. pp. 3, 4, NRC IR #70-143/2009-009, Inspection dates 06/1-07/08/09, Operational Readiness Review Team Inspection for CD Line, 7/24/09, ML092050562*

07/29/09

*Subject—Confirmation of Commitments in Amendment 88 of License SNM-124 to Perform Actions Before Introducing UF<sub>6</sub> Into The Commercial Development (CD) Line. S-54—Introduction of*

uranium hexafluoride into the CD Line shall not occur until the Commission completes an operational readiness review to verify that (1) commitments in the amendment request have been fulfilled, (2) management measures for IROFS have been implemented, (3) the CD Line has been constructed in accordance with design requirements, and (4) other actions necessary for safe operations are complete.

NRC's verification that Condition (1) has been adequately addressed is captured, in part, by a Memorandum to File from K. Ramsey, NMSS titled "Confirmation of Commitments in Amendment 88 to Perform Actions Before Starting Operations In The New CD Line," dated July 28 2009. NRC's ORR inspection, conducted during June 1 through July 8, 2009, verified the licensee adequately addressed conditions (2), (3), and (4). Condition (2) was verified through a review of management measures of IROFS for the CD Line. Condition (3) was verified through a review of the operational safety portion of the inspection. Condition (4) was verified through a review of the remaining safety function programs under Radiological Controls and Facility Support. On the basis of the above verification that the elements of License Condition S-54 have been satisfied, DFFI recommends that you authorize introduction of UF<sub>6</sub> into the CD Line. Memorandum to Luis A. Reyes, Regional Administrator, NRC, Region II, from D. Charles Payne, Chief, /RA/ Fuel Facility Inspection Branch 1, DFFI, NRC, 07/29/09, ML092100364

02/12/10 *Inspection Report. Inadequate design of a system containing SNM. (VIO 70-143/2009-004-01) Licensee's corrective action program did not implement sufficient actions to prevent the fire that occurred in the Commercial Development (CD) line. IR 70-143/2009-004, Inspection dates 10/01-12/31/09, ML100430924*

03/19/10 The purpose of the Augmented Inspection Team was to inspect and assess the facts and circumstances surrounding the Oct. 13, 2009 process upset at the NFS facility that resulted in unexpected levels of heat and nitrogen compound gas (NOx) due to a chemical reaction during the dissolution of scrap material containing low levels of uranium in the BLEU Preparation Facility (BPF) uranium aluminum (U-Al) process area.

Procedure NFS-CM-004 Section 3.13 stated, in part, the CCB was to review non-urgent ECRs in accordance with NFS-CM-005, "NFS Change Control Board Charter." *This procedure stated the CCB was to evaluate ECRs according to eight (8) criteria. Item three of the criteria stated the CCB would review the impact of the change on the facility systems, process, activities and Facility configuration Information (specifically, "if design requirements and/or design basis are/were affected").* The CCB's review of ECR 20091919, which authorized the processing of fines directly to the BCS, failed to identify the design requirements and design bases were affected by the direct addition of fines into the BCS without first processing the material in the U-Al dissolvers.

Once the ECRs were authorized, licensee was to conduct technical and safety reviews prior to implementation of the changes. The team noted that the technical reviews performed for the procedure changes related to the processing of the fines material did not meet the established criteria in procedure NFS-GH-901. The technical reviews failed to identify that processing U-Al fines directly in the U-Al BCS, without processing the material through the caustic dissolution and centrifuge steps, was not analyzed in the ISA as part of the U-Al design basis.

The original laboratory analysis (HEU-11-02-02, Final Report: dissolution of U-Al Floor Sweepings and Dross, Rev. 0) warned not to process the U-Al fines due to vigorous reactions, and this fact

was *overlooked in the technical reviews*. The failure of the technical reviews to focus on assuring that ERCs 20091919 and 20092008 would preserve the design basis. *Technical reviews failed to identify the modifications of the design basis.* NRC Augmented Inspection Team (AIT) Report 70-143/2009-011, Event # 45446, ML100780127, 3/19/10

## NFS CALIBRATION ISSUES

(Note: (R) means word or text has been redacted. IR means Inspection Report)

- 03/16/00 *Radioactive Material in Waste Shipments Exceeded Limits.* Licensee reported that two waste shipments **(R)** and **(R)** to Envirocare, Inc., contained concentrations of radioactive material above that authorized by the Envirocare license. The waste consisted of approximately 480 cubic feet of soil contaminated with plutonium and americium. A total of 16 containers exceeded the limit by up to 37%. These waste shipments were buried by Envirocare prior to discovering this error. The licensee was notified by Envirocare on 5/10/00 that an over-check sample taken on waste shipment **(R)** indicated Am-241 activity higher than the licensee's reported value. The licensee's investigation determined that the calibration of the system they used to measure Am-241 in soil was inaccurate. *The inaccuracy was a result of a failure to account for an increase in Am-241 over time as Pu-241 in the source decayed to Am-241.* Reported 7/07/00. FC000497 (Note: Reported almost 2 months later!) NFS shipped Class C waste to Envirocare labeled as Class A waste. Significant Am-241 in-growth occurred in the calibration system *resulting in decline of the efficiency of the system.* The State of Utah will allow the waste to remain buried. Enforcement Action Tracking System, p.80, License History Report, NFS, 10/19/00, ML020420107
- 01/18/03 *A routine inspection of NFS by the NRC found some minor violations.* The inspection was done Oct. 13 and Nov. 23<sup>rd</sup>. According to a letter from the NRC to NFS, dated Jan. 7, the plant was cited for one violation, while no citations were issued for three other violations. Both the NRC and spokesman for NFS, Tony Treadway said *the cited violation was classified and no further information would be released to the public.* Two other non-cited violations included *failure to assure reliability of safety-related equipment through testing and the location of an excessive number of nuclear material storage containers in one place.* The third non-cited violation was also classified. The NRC report said "following a calibration and test on Oct.15, 2002, the monitor was alarmed (closing the valves to the WD tanks). NFS eventually determined the in-line monitor's software was an incorrect version. The NRC said the plant has made necessary changes and plans to replace the in-line monitoring system with a more modern system within the next year. Inspectors said that in the non-cited violation, several storage containers were located where only one should have been. Johnson City Press, 1/18/03 (Note: NFS cited and non cited violations are classified information?)
- 08/02/04 *NFS Inspection Report.* As part of the safety program, licensee committed to establish management measures to maintain the reliability of IROFS. During review of the fire protection IROFS for the **(R)** system, it was noted the functional test of the **(R)** detection interlocks did not verify the **(R)** detector was in calibration prior to performance of the test. *A test deficiency was identified in the IROFS tests that prevented backflow from the operations areas into the **(R)** chemical areas. The inspectors identified several SRE tests, which were inadequate, in that the tests did not properly verify the IROFS safety function and required significant modification.* IR, 70-143/2004-05, Inspection dates 3/29/04-6/18/04, ML081290542

- 01/11/07 *Failure of Gamma Spectrometer Waste Monitor. (Only One Safety Item Available)* Failure of this IROFS fails to meet the minimum performance criteria and may have been in a failed state for more than eight hours. System failed all calibration efforts including a self check. NFS Event 43090
- 04/23/07 *NFS Inspection Report: Testing of Nitrogen trickle flow system for UAL in BPF operations not on calibration frequency. Management measures less than adequate. IR 70-143/2007-002, Inspection dates 2/11-3/24/07, NFS Event Reports 43090 & 43204, ML073060098.*
- 04/27/07 *NFS Inspection Report. On January 11, 2007, licensee notified the NRC of an event involving the (R) condensate In-Line Monitor System (ILMS). During the routine 6 month calibration of the ILMS, NFS observed the calibration could not be completed. The in-line monitor is identified as an active engineered IROFS in the Integrated Safety Analysis (ISA), and the failure of this IROFS left only one IROFS in place. Appropriate management measures are required to be applied to all IROFS. IR 70-143/2007-202, Inspection dates 03/26-03/30/07, Event 43090, ML081500187*
- 07/11/08 *Item Relied on for Safety (IROFS) Discovered Inoperable. On July 11, 2008, it was identified the calibration gas used to functionally test the NOX (nitrogen dioxide, nitric oxide, etc.) detector had expired. The calibration expiration date was September 2007. The prior functional test of the NOX detector was performed on January 24, 2008. Due to use of expired calibration gas, it was determined the NOX detector (IROFS BPF-43) has been in a degraded condition since the last functional test (Jan. 08). Event 44344*
- 07/14/08 *Item Relied on for Safety (IROFS) Discovered Inoperable. NOX (nitrogen dioxide, nitric oxide, etc.) is IROFS BUND-17 for the LEU (Low Enriched Uranium) portion of the BPF. This IROFS is one of the two controls used to prevent chemical occupational exposure to NOX emissions due to the U-natural dissolution operation. On July 11, 2008, it was identified the calibration gas used to functionally test the NOX detector had expired. The calibration expiration date was September 2007. The prior functional test of the NOX detector was performed on January 11, 2008. A 2<sup>nd</sup> IROFS is credited in the NOX accident sequence, but with degradation of IROFS BUND-17, the performance criteria of 10 CFR 70.61 were not met. The event occurred due to a degraded management measure. NFS Event 44345.*

end

(Product of Erwin Citizens Awareness Network, Inc., P. O. Box 1151, Erwin, TN 37650)

## EARTHQUAKES/SEISMICITY

- 01/31/99 The NFS Erwin Plant is located in the Appalachian Tectonic Belt, an area of moderate seismic risk. The site is in an area classified by the 1994 Uniform Building Code as seismic hazard zone 2, which means moderate damage could occur to the buildings if there were an earthquake. Almost 700 earthquakes of intensity greater than MMI IV have occurred within 200 miles of the site since 1774. The earthquake of May 31, 1897 was the largest earthquake (MMI VIII, magnitude 5.8) recorded in a 50 mile radius of the site. The most recent earthquake above MMI IV (Magnitude 3.9) occurred October 26, 1995, at a distance of about 50 miles from the site. p. 3-11, 1999 NRC EA, ML050600258
- 11/09/01 A seismic study completed in 2001 by Performance Technology, Inc. for NFS provides additional information to update the NFS ER—December 1996. The NFS site is located within the Southern Appalachian Tectonic Province, which extends from central Virginia to central Alabama and from the western edge of the Piedmont Province to the Cumberland Plateau Province. The Southern Tectonic Province has a moderate level of historical and recent earthquake activity. Typically, these earthquakes rarely exceed magnitude 4.0 on the Richter scale. Specific earthquakes are not associated with known faults near the NFS site because of low seismic activity, uncertainties locating small events, and determining their depths. There is no evidence of geologically recent fault displacements that would be associated with capable faults in the NFS site area or surrounding region. For the 1.0 E-3 annual probability of exceedance (1000 year return period), the horizontal component of ground motion at the NFS site for safe earthquake shutdown is a peak ground acceleration of 0.06 gravity. The vertical acceleration is two thirds of the horizontal or 0.04 gravity (PTI 2001.) p. 3-5, 2001 NFS Supplemental Environmental Report (ER), ML050130093, 11/09/01
- Note: The regional geologic structure of the area is dominated by four major fault systems. All the faults are oriented in a northeast direction. The local geologic structures in the Rome Formation were determined from observations made on the condition of cuttings and cores collected during drilling and on two surface manifestations. The presence of faults or fractures from drilling was determined from strongly oxidized zones in shale and sandstone, from quartz fracture fillings in sandstone, from calcite fracture fillings in limestone, and from pulverized shale. *Figure 3.3 Bedrock features underlying the NFS Erwin Plant (modified from Ecotek, 1989), shows NFS is situated on top of two fault lines and 5 fractures.* p. 3-11, 3.5.1—Geology and Soils, NRC 1999 EA, ML050600258
- 06/30/02 NFS is located in the Southern Appalachian Tectonic Belt. The belt has a moderate level of historical and recent earthquake activity. Specific earthquakes are not associated with known faults near the NFS site. The faults at the NFS site and in the surrounding region show no evidence of geologically recent fault displacement that would be associated with capable faults. A peak ground acceleration of 0/6 m/s<sup>2</sup> (0.06G) with a return period of 1,000 years was calculated for the site. *(Reference 3 from B.M. Moore, NFS, Letter to NRC "Supplemental Environmental Report for Licensing Actions to Support the BLEU Project," 11/09/01),* 2002 NRC EA, ML050540096, 6/30/02

04/06/06

Most earthquakes result in little or no damage, but they are potentially the most dangerous of all natural hazards affecting this state. *Each year more than 200 earthquakes occur, but most are unfelt by the populace.* Several earthquakes have been large enough to cause structural damage in the western portion of the state in what is known as the New Madrid Seismic Zone (NMSZ). The NMSZ is the most seismically active area east of the Rock Mountains. The area for the greatest potential for earthquakes in Tennessee is the western third of the state. A series of large earthquakes with magnitudes above 7.0, happened in this zone during the winter of 1811-1812. The earthquakes formed Reelfoot Lake in northwestern TN, altered the course of the Mississippi River and caused death and destruction. An equivalent event today would wreak havoc on a portion of the mid-south, including the Memphis area. The vast majority of these events are detectable only with sensitive seismic instrumentation. However, *the state could experience a lesser magnitude but still damaging earthquake every 50 to 90 years.* A 5.6 magnitude in Marked Tree, Arkansas in 1976 caused minor damage over fifty miles away in Memphis. *There is concern that a large magnitude event grows more probable with each passing year. Such an event could directly affect more than 75% of the state's population.*

Unicoi County is at **moderate** risk of being affected by a **large New Madrid earthquake.** *Such an event could be expected to affect 75% of the county's population, primarily through a disruption of pipelines, services or commerce, as well as damage to older masonry structures.* *Such earthquakes typically occur once every 300-500 years.*

In 1993, an additional seismic zone was identified in East Tennessee running roughly parallel to Interstate 75 between Chattanooga and Jellico. The risk associated with this seismic area has not been rigorously quantified. *Although the maximum potential earthquake in East TN is unknown, there are no recorded earthquakes in the Southern Appalachian Mountains stronger than a 5.8, which occurred near Blacksburg, Virginia in 1895. The strongest earthquake recorded in East TN was a 4.6 event in Blount County in 1973. This earthquake, like many in East TN, was widely felt.* p. xiii, Unicoi County Emergency Plan, Tennessee Emergency Management Agency (TEMA), Emergency Operations Center, Military Department of TN, Nashville, TN, 4/07/06

05/18/07

*Letter to ATSDR—"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 many area residents (like me) take their drinking water from wells." ATSDR Reply: 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. p. 40, Agency For Toxic Substances and Disease Registry (ATSDR), Public Health Assessment for NFS, 5/18/07*

11/22/08

*Quake Study Shows Tennessee Would Likely Suffer Great Shakes:* A new federal study predicts Tennessee would see the highest level of damage if a major earthquake were to shake the New Madrid Seismic Zone in the southern and central part of the country. The Federal Emergency Management Agency released the two-year study this week as part of the Catastrophic Earthquake Disaster Response Planning Initiative. Besides Tennessee, the seismic zone includes areas of Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi and Missouri.

The study predicted the total economic impact of a series of earthquakes along the New Madrid fault was likely to be *"by far the highest economic loss due to a natural disaster in the USA."* The report included state-specific scenarios such as damage levels to buildings, highway bridges, electric power, drinkable water, waste water, communications facilities and pipelines from a 7.7 magnitude quake. On the Richter scale, an earthquake with a magnitude of 7 and above is deemed "major" capable of wide spread heavy damage.

In Tennessee, the study predicts 250,000 buildings would be moderately or more severely damaged, more than 260,000 people would be displaced and *well over 60,000 casualties would be expected.* *In the state alone, the direct economic losses would surpass \$56 billion.* The report is intended to give state and local emergency agencies information to create disaster response plans. *While the central U.S. is not typically considered an active region, the fault line there has a dangerous history.* During the winter of 1811 and 1812, a series of three earthquakes, with magnitudes of around 8, struck northeast Arkansas and southeast Missouri and *caused massive landslides along the Mississippi and Ohio River bluffs from Memphis to Indiana and created gaping crevices and fissures.* Few written accounts exists about the early quakes, *but reports said they were strong enough to awaken sleepers in Washington, DC.* The U. S. Geological Survey estimates a 7 to 10 percent chance of an earthquake similar in intensity in the next 50 years. *Johnson City Press, 11/22/08, p. 5A*

01/28/09

*Subject: Ratio of 2008 to 2002 hazard maps for Northeast TN.* The ground motions in northeastern TN from the 2008 USGS hazard maps appear to be less than the ground motions in the 2002 version of the maps for 1 s, 0.2 s, and peak horizontal ground accelerations at 2% probability of exceedance in 50 years on a *firm rock site condition* (760 m/s Vs30). *Email from Mark Petersen, U.S. Geological Survey (USGS), Denver, CO, to Kevin Ramsey, NRC, 1/28/09, ML090340171*

*Note: The bedrock beneath the plant is a section of the Rome Formation. This section contains areas of sandstone, siltstone, shale, dolomite, and limestone, with silty to sandy shale being the dominant rock type.* The maximum relief of the bedrock surface is about 67 feet from a point that is north-northeast in the Burial Ground area to a point south near Banner Hill Road. The overall slope of the bedrock surface is from the valley edge (southeast) toward the Nolichucky River (northwest).

The bedrock of the Rome Formation is overlain by unconsolidated alluvial material. Alluvial deposits range in thickness from less than 1 foot to approximately 21 feet and consist of clay, silt, sand, gravel, and cobbles. The sand and gravel have the greatest permeability and their thickness exceeds 18 feet in the area of Martin Creek. Less permeable silts and clays ranging in thickness from 0.5 to 18.5 feet are interbedded with the overlie the sand and gravel deposits. *Construction fill materials are widely distributed throughout the facility and consist of clay, silt, sand, and gravel mixtures.*

The regional geologic structure of the area is dominated by four major fault systems. All the faults are oriented in a northeast direction. The local geologic structures in the Rome Formation were determined from observations made on the condition of cuttings and cores collected during drilling and on two surface manifestations. *The presence of faults or fractures from drilling was determined from strongly oxidized zones in shale and sandstone, from quartz fracture fillings in sandstone,*

*from calcite fracture fillings in limestone, and from pulverized shale. The fluctuation of the water level in Pond 1, which reacts differently than that observed for Ponds 2 and 3, and the observation that Banner Spring is similar to other fault-controlled springs in the area, may be interpreted as indicating fault or fracture-controlled discharge. Figure 3.3 shows the bedrock surface expressions of two faults and five fracture zones interpreted from the above information. (Note: Figure 3.3, Bedrock Features Underlying the NFS Erwin Plant, shows NFS is situated on top of two (2) fault lines and five (5) fracture zones. p. 3-10 & 3-11, 3.5.1—Geology and Soils, NRC 1999 EA, ML050600258, 01/31/99*

*Note: 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.*

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. 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. (pp. 7 & 8)

*Question to ATSDR. 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 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?*

*ATSDR Reply—An ATSDR geologist has supplied information on karst formations and this has been added to the public health assessment. 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. (pp. 66 & 67) Agency For Toxic Substances and Disease registry (ATSDR), Public Health Assessment for NFS, 05/18/07*

07/09/09

A seismic study completed in 2001 by Performance Technology, Inc. for NFS provides the following site specific seismic information—The NFS site is located within the Southern Appalachian Tectonic Province, which extends from central Virginia to central Alabama and from the western edge of the Piedmont Province to the Cumberland Plateau Province. The Southern Tectonic Province has a moderate level of historical and recent earthquake activity. Typically, these earthquakes rarely exceed magnitude 4.0 on the Richter scale. Specific earthquakes are not

associated with known faults near the NFS site because of low seismic activity, uncertainties locating small events, and determining their depths. There is no evidence of geologically recent fault displacements that would be associated with capable faults in the NFS site area or surrounding region. For the  $1.0 \times 10^{-3}$  annual probability of exceedance (1000 year return period), the horizontal component of ground motion at the NFS site for safe earthquake shutdown is a peak ground acceleration of 0.06 gravity. The vertical acceleration is two thirds of the horizontal or 0.04 gravity. (p. 2-8)

NFS lies in the moderately active Appalachian Tectonic Belt, which is located in Seismic Zone 2, indicating that moderate damage could occur as a result of earthquakes. The NFS site is cut by many inactive faults formed during the late Paleozoic Era. There is no evidence of capable faults (as defined by 10 CFR Part 100) in the immediate area of NFS. The nearest capable faults are located 62.1 miles southwest and 124 miles northeast of the site. Strong earthquakes originating in more active regions southwest of the site have been felt in eastern TN, but no damage has been experienced at the site (DOE 1996). A maximum horizontal ground surface acceleration of 0.18 gravity at NFS is estimated to result from an earthquake that could occur once every 2,000 years. The facilities at NFS that are utilized for processing significant quantities of radioactivity were designed to withstand an earthquake with an acceleration of 0.18 gravity (NFS 1996b and 2007 ISA Summary Report). (p. 3-4)

The NFS site is located in the moderately active Appalachian Tectonic Belt, Seismic Zone 2, indicating that moderate damage could occur as the result of earthquakes. There is no evidence of capable faults as defined by 10 CFR 100 in the immediate vicinity of the NFS site. A seismic analysis of the NFS site conducted in 2001 determined the horizontal component of ground motion for a safe shutdown earthquake with a 1000-year return period has a peak ground acceleration of 0.06 gravity, and the vertical acceleration is two-thirds of the horizontal, or 0.04 gravity. (p. 1-18) NFS Environmental Report for Renewal of License SNM-124, May 2009, ML091900072, 7/09/09 (Note: License Renewal is for 40 years. This reference is the same one from NFS on 11/09/01)

JOHNSON CITY PRESS  
SEP. 6, 2010, P1A & 6A

# Area no stranger to quakes

By KEVIN CASTLE  
NET News Service

Three measurable earthquakes have been recorded in Southwest Virginia and East Tennessee within the past two years, including one earlier this week in Mountain City in Johnson County.

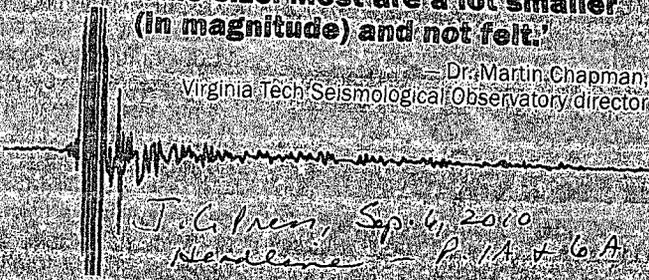
Seismic activity takes place nearly every day as our surrounding mountains shift, but most events are too small or insignificant to recognize, said Virginia Tech Seismological Observatory Director Dr. Martin Chapman.

"Now the one in Mountain City, you're not going to feel something like that every day because that was a sizable quake," he said of the event, which had a 2.7 reading on the Richter scale according to the U.S. Geological

▶ See **QUAKES** Page 6A

**'It's true that you have earthquakes that happen on a daily basis in Tennessee, sometimes more than once. I would say that every two to three days an event of some size. Most are a lot smaller (in magnitude) and not felt.'**

— Dr. Martin Chapman,  
Virginia Tech Seismological Observatory director



# Quakes

◀ Continued from Page 1A

## Survey

"It's true that you have earthquakes that happen on a daily basis in Tennessee, sometimes more than once. I would say that every two to three days an event of some size. Most are a lot smaller (in magnitude) and not felt. For every magnitude earthquake of substantial size, you'll have numerous subsequent quakes that will be small."

The two other quakes have been based in Scott County, Va. — one in 2009 in Nickelsville and one earlier this summer based in Rye Cove.

Chapman says the Tri-Cities region and the far corner of Southwest Virginia are located high above what is called the Eastern Tennessee Seismic Zone that stretches from Morristown to northeastern Alabama and is 60 to 100 miles wide.

"The entire width of the valley and ridge geologic province, from east to west, goes from the Cumberland Plateau to the Great Smoky Mountains," he said.

"We know from a perspective of geology that there is something unique about this region. There are gravity and magnetic anomalies in the area that indicate there are structures that are large scale that are involved (in the seismic activity). We just haven't been able to resolve the orientation of the major struc-

tures down there. These quakes go very deep, up to 25 kilometers down into the ground. That is unusual."

USGS research geologist Rus Wheeler noted that the daily quake quotient is difficult to comprehend because you have seismic activity that is miles deep into the earth's crust and sometimes cannot be detected by their equipment.

"We cannot go down to where they occur to observe and measure the process. Instead we have to rely on instruments that are on the surface and which record the shaking produced by the earthquake. The result is that, in general, east of the Rockies it is terrifically hard to identify which faults are responsible for earthquakes," Wheeler said.

According to the USGS, the strongest quake recorded in recent historic times in Virginia occurred in Giles County on May 31, 1897. The shock was felt from Georgia to Pennsylvania and from the Atlantic Coast westward to Indiana and Kentucky.

Although a major quake was reportedly recorded in Memphis in January 1843, a 4.6 scale earthquake and 30 aftershocks were registered in 1973 in Knoxville, causing cracks to form in the walls of the University of Tennessee Medical Center.

Learn more about the region's seismic past at [earthquake.usgs.gov](http://earthquake.usgs.gov).

**SCUBA II Report Excerpts on Nuclear Fuel Services, Inc., Erwin, TN, (SNM-124), June 21, 2010  
(ML101820096)**

Safety Culture initiatives were mandated by NRC Confirmatory Order (a docketed commitment) to NFS, Feb. 21, 2007. NFS made promises to NRC, which in return agreed not to pursue a number of pending escalated enforcement issues (p. 147). **However, NFS did not comply with the 2007 Confirmatory Order.** NFS made only nominal progress in improving safety culture since the 2007/2008 (SCUBA I) findings. Findings are essentially repeat from 2007/2008 (p.2). Findings for needed improvements increased from 41 (2007/2008) to 74 (2009/2010).

A Confirmatory Action Letter was issued on Jan. 7, 2010. NFS shutdown from Dec. 31, 2009 to March 23, 2010, due to safety concerns. On March 23, 2010, NRC authorized NFS to **deliberately** restart production activities in the Navy Fuel process lines (p. 13).

**SCUBA team believes the following are long-standing NFS cultural deficiencies: Lack of a questioning attitude/willingness to proceed in the face of uncertainty; Non-conservative decision-making/susceptibility to production pressure; Lack of formality and/or systematic approach; Lack of management oversight; A standard of "minimal regulatory compliance" (p. 10).** Non-conservative assumptions are tolerated. Inappropriate use of management authority may suppress questioning attitude. Decisions are not consistently developed with the requisite degree of conservatism, particularly when a potential for personal injury is involved (p. 43).

NFS has not yet demonstrated that it can successfully take on new processes without having safety and regulatory related upsets and problems (p. 23). Safety culture at NFS is generally deficient compared to industry norms and generally **fails to meet regulatory expectations.** (p. 24). Most of NFS's major projects are behind schedule and over budget (p. 53). NFS has no formal written internal or external Operating Experience (p. 93). NRC revealed in an August 3, 2010 public meeting that a Nuclear Quality Control/Assurance Program does not exist in the NFS license.

Despite repetitive urgings by the SCUBA team, NFS senior management had not conducted a single Effectiveness Review of the safety culture initiatives **that were declared to have been completed by NFS management** (p. 26). Actions/commitments processed through the Corrective Actions Program (CAP) are all too often inappropriately closed out based on future actions/promises that are frequently not rigorously followed up (p. 14). SCUBA's review indicated approx 50% of those completed actions do not meet acceptable standards for closure of an action (p. 26). **Signing that an action was complete when it was not are examples of falsification and/or fraudulent behavior** that are unacceptable at NFS. (p. 147).

NFS has demonstrated a bias for production, cost and schedule priorities over safety (p.26). Production pressures negatively influenced organizational priorities in that the **support for required new projects compromised safe facilities operations.** (p. 44). NFS policies indicating safety as the overriding priority were not practiced or reinforced (p. H-2).

NFS does not routinely drill its Emergency Response Organization to ensure it will operate well in an actual accident or event (p. 48). Site practice avoids invoking the ERO. There is essentially only one trained team and no back-up team in the event of an emergency (p. D-5 & 6).

NFS continues to tolerate **recurring equipment problems**, operational burdens and workarounds, **and degraded infrastructure** issues (p. 49). Rather than improving its safety culture and performance, NFS has continued to divert its resources to pursue new business opportunities (p. 52). **Equipment problems have become accepted on a basis of "run to failure" philosophy** (p. 53). (Includes Safety Related Equip, p. 89). **Fire dampers had not been inspected since 2003 and inaccurate information was given to NRC.** (Attach. G-1, p. G-2, 3 & 5). **There is significant potential for the list of degraded equipment/processes to undergo substantial expansion** (Attach. E-3, p. 7). There are no stated plans to back fit the large number of existing condition reports to assist with analyzing repeat or recurring events (p. 89)

Integrated Safety Analysis (ISA) functions need strengthening and Operational Readiness Reviews (ORRs) were ineffective (p. 76). Four recommendations made by INPO April 21-24, 2010, for the Configuration Management Program, all are currently open; they were classified as low priority (p. 104). **Security components are not in Configuration Mgt Program** (Attach. E-3, p. 24). Don't be misled by the de-facto "standards of acceptability" used by the NRC. These are not indicative of "world class standards." (Attach. E-3, p. 3)

**There is still evidence that employees perceive negative outcomes and retaliation from management and peers for raising concerns and safety issues** (p. 115). There is a long-standing antagonism between bargaining unit leadership and HR that is not being mitigated (Attach. E-3, p. 16). There were a number of areas where NFS did not meet OSHA requirements; executive mgt was not aware of these issues (Attach. E-2, p. 2). Chemical Safety is an area of risk at the Site (Attach. E-3, p. 3). The injury rate for the site does not compare favorably with the industry and any emphasis to improve the situation has been limited and not a priority (p. 76). The number of allegations received by the NRC concerning NFS is high, relative to other fuel facilities even given the caveat that a significant number come from outside the workforce (p. 108).

Significant problems related to accountability have continued to exist within the NFS (p.26). It is highly unlikely that NFS will be able to operate without another significant loss event unless/until it can resolve its accountability issues – especially those that exist in senior management. The tendency to downplay the significance of errors typified the Site's approach to problem solving, largely because these behaviors were practiced at the most senior levels of NFS management (Attach. H, p. H-1).

(This is a product of the Erwin Citizens Awareness Network, Inc. (ECAN), P. O. Box 1151, Erwin, TN 37650)

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 venturi 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 devices 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-AI 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 subordinated 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)

-end-

(Note: This is a product of the Erwin Citizens Awareness Network, P. O. Box 1151, Erwin, TN 37650)

**TAB F - License Violations (253 pages)**  
**(See Separate Binder)**

## Nuclear Fuel Services, Inc. (NFS), Erwin, TN, SNM-124, Docket 70-143

The following partial list of major NRC Enforcement Actions and EPA fines includes, when this information is available, civil-penalty reductions.

- 1985: \$80,000 NRC Civil Penalty, failure to maintain material access barriers, reduced to \$50,000
- 1985: \$20,000 NRC Civil Penalty, accumulation of U-bearing solids in equipment, reduced to 15,000
- 1991: \$20,000 NRC Civil Penalty, 2 Severity Level II (SL II) violations, reduced to \$10,000
- 1991: \$993,461 EPA fine, RCRA violations, settled for \$20,000
- 1992: EA-91-186, SL III, Safety-related violation for failure to implement a criticality safety control
- 1993: \$37,500 NRC Civil Penalty, SL II & III violations, fire & failure to implement criticality controls
- 1996: \$12,500 NRC Civil Penalty, SL III violations surrounding April 2, 1996 incinerator fire
- 2000: Confirmatory Order (CO) Modifying License dated July 20, 2000; possible security order
- 2000: Special Inspection Team (SIT) inspection, excessive concentrations of uranium in liquid effluent
- 2001: EA-01-098, SL III, failure to maintain criticality alarms for 20 kg HEU stored in Bldg. 306E
- 2002: Order for Interim Compensatory Measures dated August 21; security order
- 2002: Confirmatory Action Letter (CAL), October 15, Material Control & Accountability (MC&A) problems
- 2003: Report to Congress on Abnormal Occurrences, April 2003, Accountability Failure for SSNM
- 2003: AARM, April 22-23, areas needing improvement: procedural compliance (>3-yr prob.), MC&A,
- 2003: \$60,000 NRC Civil Penalty, accountability failure while under escalated enforcement
- 2004: EA-03-178, SL III, willful transfer of LEU without required verifications
- 2005: EA-04-199, SL III, failure to lock discharge valve to WWTF after transfer
- 2006: \$32,500 NRC Civil Penalty, SL III violation, failure to implement criticality safety controls,
- 2006: CAL No. 02-06-003 issued following March 6, 2006 major Loss of Containment in the BPF
- 2007: CO for Program Improvements, February 21, following ADR re Loss of Containment of 37-liters HEU
- 2007: Report to Congress on Abnormal Occurrences, April 2007, approx. "35 liter" spill of HEU solution
- 2007: AARM/Commission Briefing Closed Session, May 30<sup>th</sup>, regarding 2 near criticality accidents
- 2008: Report to Congress on Abnormal Occurrences, April 2008, update on actions to prevent recurrence
- 2008: AARM, June 4<sup>th</sup>, "three specific mandates" of CO: safety culture, config. mgmt., corrective measures
- 2009: Office of Investigations Annual Report, "OI substantiated that a senior executive" violated FFD
- 2009: CO re Fitness-For-Duty (FFD) of senior executive, EA-08-321, EA-08-103, IA-09-012, IA-08-036
- 2009: SIT inspection, adequacy of glovebox drains to remove liquids & prevent criticalities, March 23-27
- 2009: Report to Congress on Abnormal Occurrences, May 2009, update on actions to prevent recurrence
- 2009: SIT inspection, "nitric acid" reaction causing extreme heat & "nitrous oxide" fumes, Oct 19 NRC PR
- 2009: AIT inspection, "unexpected...heat" & "nitrogen compound gas fumes", Oct. 22 NRC Press Release
- 2010: CAL No. 2-2010-001 dated Jan. 7, issued following Oct. 13 nitrogen chemical reaction & meltdown
- 2010: AARM/Commission Briefing, May 27, 2010, regarding restart of operations and safety culture issues

By our accounting, NRC has only collected \$217,500 in Civil Penalties from NFS over a 25-year period, and EPA fines have totaled only \$20,000. That's despite the fact that over the same period, NFS routinely violated NRC regulations and incurred at least one Notice of Violation (NOV) &/or Non-Cited Violation (NCV) in nearly every NRC Inspection Report.

(Erwin Citizens Awareness Network, Inc., June 2010)

## FALSIFICATION OF DOCUMENTS

(Note: (R) Means Word or Test Has Been Redacted. IR Means Inspection Report)

- 04/11/00 *Senior shift supervisor directed NFS operators to electrically acknowledge that they had received training **before the training occurred.** (10 CFR 70.3 and 70.9 and License conditions). Enforcement Action Tracking System, License History Report, p.49, 1/28/02, ML020420107*
- 02/06/04 *NRC Plans Second Onsite Inspector For NFS. Company officials explained efforts to improve both safety and regulatory compliance with greater emphasis on self-assessment procedures. NRC's Office of Investigations for Region II initiated an investigation April 11, 2003 to determine if an NFS decommissioning supervisor **deliberately falsified records** documenting the transfer of low-enriched uranium (LEU) solution. Letter dated Jan. 16, 2004, from Region II's Office of Investigations substantiated decommissioning supervisor *willfully authorized transfer of LEU solution without conducting required verification and reviews prior to and/or during transfer.* The NRC regional administrator (Luis Reyes) said the violation status has been moved into consideration for escalated enforcement action and turned over to U. S. Dept. of Justice to determine if additional actions would be pursued regarding the violations. Elizabethton Star, 02/06/04*
- 03/16/04 *NFS Inspection Report: A transfer of waste solution containing (R) material had been transferred from favorable to unfavorable geometry without the required lab analyses; investigation identified the wrong sample result had been listed by the analytical lab (R); although no samples had been drawn on the waste solution which was transferred (R) indicated that samples had been received and analyzed. Operations personnel performed the transfer based on incorrect data in (R). Lab personnel failed, both on sample receipt and during sample analysis to verify the sample number on the sample containers against the listed number in (R). IR 70-143/2004-04 dated 06/28/04, Inspection dates 04/18/04-05/29/04, ML081440457.*
- 04/28/05 *Inadequately Controlled or Analyzed Pathway for Material Accumulation. A solution (with approximately 3 grams of U235) accumulated in a HEPA filter housing on the building (R) roof. Further reviews of the system design identified potential pathways from the Uranium-Aluminum dissolution system that did not appear to be adequately controlled or analyzed. NFS Event Report 41651 As of April 28, 2005, the BLEU (R) dilution ventilation system had only one drain and no (R) so that double contingency was not established. The solution accumulation was in the section of the housing containing the first HEPA filter which was saturated. The event appeared to violate off-gas system NCS controls such as the HEPA drain. One violation was identified involving a non-existent item credited for maintaining safety in the BLEU (R) dilution ventilation system. IR 70-143/2005-203 and Notice of Violation, 6/02/05, Inspection dates 5/02-04/05, ML081480315*
- 03/28/06 *NRC and licensee identified issues were not entered into the corrective action program (CAP) until requested by inspectors. The inspectors noted several issues which had been identified by NRC inspectors and discussed with licensee management, which were not entered in PIRCS until in-*

*spectors made repeated inquires. On each separate issue, inspectors had to either make repeated requests for information or point out to senior management that no entry was yet made in PIRCS. Two corrective action program entries related to radiation protection issues were not made until requested by the inspectors. One entry resolved a radiation protection (RP) violation by incorrectly documenting no violation occurred. Corrected after the inspectors reviewed the item. LPR for NFS, Inspection dates 01/23/05-02/04/06, ML072490009*

07/07/06 *NFS Inspection Report. Synopsis of NRC's (OI) report regarding NFS personnel willfully recorded incomplete and inaccurate information of transfer of containers of SNM; Event 42612. IR 70-143/2006-004, Inspection dates 4/30-6/10/06, ML073060562, OI Case No. 2-2005-028*

09/21/06 *Revision 3 of PR 5164 completion status was shown at 100% when Revision 3 was never issued. Commitment report never updated. No guidance on required actions before commitment closure or if they can be closed out on intent. NRC Safety Inspection Report and Compliance Inspection, IR-0249/2006-201, 9/21/06, ML062710015*

11/05/07 *NFS Inspection Report. Nuclear Criticality Safety Inspection. Tracking use of gapped reflector models of fissile systems. PIRCS entry indicated that no station limit had been violated when the overall entry implied a station limit had been violated. IR 70-143/2007-207, Inspection dates 10/15-10/19/07, ML07304221*

03/27/08 *The Matter before the Commission on a Motion to Quash a Subpoena issued by the NRC Office of Investigations (OI) was denied. During March 2006, the NRC received an allegation that an NFS executive may have violated provisions of the NRC Fitness-for-Duty regulations. On March 31, 2006 the NRC referred the allegation to NFS and requested NFS conduct an internal review of the events in question and report the result of that investigation to the NRC.*

NFS hired an outside counsel, Mr. Daryl Shapiro, to conduct the investigation and prepare a report responding to the NRC request. In an undated letter, Mr. Dwight Ferguson, NFS Chief Executive Office, responded to the NRC request, attaching a report prepared for NFS by Mr. Shapiro. The report summarized information collected during the investigation.

OI opened an investigation into whether NFS or the executive in question deliberately violated any NRC regulations. Certain NFS employees made sworn statements that contradict some of the statements in the Shapiro Report. The contradictions are re-enforced by documents produced by NFS. Violations of these regulations may be referred to the Department of Justice as possible criminal violation of federal statutes. Mr. Shapiro's testimony is to be taken within two weeks from the date of this Order. Nuclear Regulatory Commission, Commissioners Dale E. Klein, Chairman, Gregory B. Jaczko, Peter B. Lyons; In the Matter of Daryl M. Shapiro, NRC Investigation No. 2-2007-17, CLI-08-06, Memorandum and Order, Docketed 3/27/08, Served 3/27/08, ML080870303

05/01/08 *Licensee procedure for monthly inspections, NFS-HS-A-C-16, did not accurately represent the process the licensee staff was using to document monthly inspections. Licensee staff stated they*

would review NFS-HS-A-C-16 and determine if the procedure needed to be updated. IR 70-143/2008-203, 5/01/08, ML081210590

01/07/09

SUBJECT: NUCLEAR REGULATORY COMMISSION OFFICE OF INVESTIGATIONS, REPORT NO. 2-2006-017 AND NFS INSPECTION REPORT 007000143/2008401. "This refers to an investigation initiated on April 20, 2006 by the 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.*

- 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).
- On April 5, 2006, NFS granted the senior executive Self-Referral Rehabilitation in the NFS Employee Assistance Program after he had been notified of an ongoing Fitness for Duty investigation.
- *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 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, **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 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).*
- On May 2006 NFS failed to determine the senior executive's fitness 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 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 (DOE); 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.*

In addition, based on the OI investigation, multiple Apparent Violations by two NFS employees and two NFS contractors of "Deliberate Misconduct", were identified. Specifically, materially incom-

plete or inaccurate information was submitted to NFS and to contractors of NFS which, in turn, caused or contributed to failures in NFS implementation of 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.

In lieu of a pre-decisional enforcement conference, NFS 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 the NRC has decided to employ is mediation. The Institute on Conflict Resolution (ICR) at Cornell University has agreed to facilitate the NRC's program as a neutral third party. For administrative purposes this letter is issued as IR07000143/2008401. Letter from Kriss M. Kennedy, Director, Division of Reactor Safety, NRC, Region II, Atlanta, Georgia to Mr. David L. Kudsin, President, NFS, 1/7/09 (Note: This fitness for duty event occurred on March 7, 8 and 9, 2006, one day after the 37 liter spill of HEU nitrate on 03/06/06 that could have caused a criticality in two separate places, and a nuclear chain reaction. It was covered up by the NRC for 13 months before being reported to Congress. Alternate dispute resolution (ADR) is what the NRC offered to NFS for the spill on 3/06/06; NFS accepted).

04/03/09 *NFS, Inc., Site Status Summary. Three pending escalated enforcement actions currently exist at NFS. A fitness-for-duty-case (EA-08-103) resulted in the identification of several apparent violations that could result in escalated enforcement, including individual actions. Apparent violations related to the processing of a weapon onto the site (EA-08-346) were identified that could result in escalated enforcement action. An apparent violation that involved the potential willful falsification of medical records (EA-08-321) could also result in escalated enforcement action. NRC, 04/03/09, ML090550079*

11/24/09 *NRC Issues Confirmatory Orders to Nuclear Fuel Services and Its Contract Physician. The NRC has issued four Confirmatory Orders requiring NFS and the company's contract physician to correct deficiencies stemming from a former senior company executives violation of the NRC's fitness for duty requirements and the failure to administer required hearing tests to security officers. The orders related to the fitness for duty issue require the Erwin, TN based nuclear fuel fabrication facility to modify its fitness for duty procedures and training and establish avenues for the reporting of substance abuse-related concerns, including the creation of a corporate ethics hotline and policies allowing for anonymous reporting.*

An extensive NRC investigation and review found that a senior executive at NFS consumed alcohol less than five hours before a scheduled working tour of the facility in 2006. The NRC determined the company failed to immediately relieve the executive of his duties and also failed to administer testing to determine his fitness for duty. Additional apparent violations were identified related to the company's review of the matter and the executive's return to work. NFS's contract physician provided incomplete information to a contract professional retained by NFS to determine whether the senior executive was fit for duty. The contract physician also provided inaccurate information to NFS about the executive having entered a substance abuse rehabilitation program when he had not done so. The order noted that NFS has completed "disciplinary action and

organization change with respect to the senior executive. That executive is no longer employed by NFS and the company was acquired by Babcock & Wilcox Co, in early 2009.

*The Confirmatory Orders document the commitments NFS and the physician have made to the NRC, and those detailed were agreed upon as a result of the NRC's Alternative Dispute Resolution (ADR) process. The ADR process uses a neutral mediator with no decision making authority to assist the NRC and its license holders in resolving differences regarding enforcement actions. The NRC will not issue any violation or take any other enforcement action related to these issues. The NRC staff will evaluate the commitments during future inspections. NRC News, Office of Public Affairs, Region II, Atlanta, GA, 11/24/09 (Note: The contract physician for NFS denied in the Confirmatory Order (CO) the charges that he had anything to do with the Fitness For Duty incident. He never agreed with the charges in the CO on this allegation and told this to the NRC repeatedly. See 01/07/09)*

03/19/10 AIT (Augmented Inspection Team) Report. Attachment 2, Event Timeline for Unanalyzed Event caused by generation of excessive amounts of Nitrogen Oxides (NOx) during processing of Uranium Aluminum (UAI) in Bowl Cleaning Station (BCS) 2 . See Page 8. Timeline as follows:

12/1/09 0800 NRC Region II management is briefed by the NFS vice-president (VP) on actions that NFS has taken to justify restart of the UAI process (and continued operations of other processes). The VP states that NFS had reviewed a subset of modification packages as old as two years to ensure that recent modifications had not compromised the safety basis of the UAI system.

12/2/09 1530 At NRC Region II management's request, the NFS VP and technical staff briefs the RII management and members of the anticipated inspection team that will be launched to review NFS' actions for restart. The NFS staff states that modifications pages were not reviewed (**the VP apologized that he had misremembered the actions that the staff had taken**).

06/21/10 Signing that an action was complete when it was not are examples of falsification and/or fraudulent behavior that are unacceptable at NFS, (page 147).  
Fire dampers had not been inspected since 2003, and inaccurate information was given to NRC, (Attach. G, p. G-2, 3 & 5) Independent Safety Assessment Team Report (SCUBA II), ML101820096.

Note: "Any deliberate falsification of reporting by NFS to the state or the NRC is perjury and would subject NFS officials to fines, imprisonment or both." Dwight B. Ferguson, Jr., President and Chief Executive Officer, NFS, Erwin, Letter to the Editor, *NFS critics distort facts*, The Erwin Record, 3/18/08, pp. 4A & 5A

Question: With the above examples of falsification of documents/reporting, where are the fines and imprisonment for perjury?

(Product of Erwin Citizens Awareness Network, Inc., P. O. Box 1151, Erwin, TN 37650)

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Greg Lawson  
Decommissioning Operations Specialist

A water sample is serious business for NFS. Greg Lawson. He not only cares about the quality of the Nolichucky

River because it's his job - it's also his playground. An experienced kayaker who says our beautiful river is the greatest, Greg knows that his job helps assure that it's safe for everyone it touches. Greg is just one of 1,000 of NFS employees who are serious about protecting our river.

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