Nuclear Fuel Services Frequently Asked Questions

Table of Contents

I. Authorized Releases to the Environment

A. Regulations for authorized environmental releases

i. What is the public dose limit?

The public dose limit is 100 millirem per year[1]. The public dose limit is roughly equal to 10 chest x-rays.[2] The public dose limit is 2 percent of the amount workers in the industry are allowed to receive -- 5,000 millirem per year.

Radioactivity is present in nature, various medical treatments, and several commercial products in addition to nuclear facilities. The dose resulting from these sources is called the background dose. The background dose or dose of an average individual living in the United States is 360 millirem per year. This dose is larger than the NRC public dose limit with the nuclear fuel cycle only contributing a small fraction to that dose as shown in the table below. Most of the background dose (300 millirem per year) is attributed to natural sources such as radon, natural radioactive components in rock and soil, and radiation from outer space.

Average Annual Effective Dose Equivalent to Individuals in the United States[3]			
Source	**Effective Dose Equivalent (millirem)**		
Natural Radon Other than Radon Total	200 100	 300	
Nuclear Fuel Cycle Consumer Products Medical Diagnostic X-rays Nuclear Medicine Total	0.05 9 39 14	 62	
Grand Total		about 360 millirem per year	

[1] International Commission on Radiological Protection, *Radiation Protection,* Recommendations of the International Commission on Radiological Protection, ICRP Publication 26, Pergamon Press, Oxford, UK, January 1977.
[2] Health Physics Society – Frequently Asked Questions: http://hps.org/publicinformation/ate/faqs/
[2] NRC Regulatory Guide 8.29 – Introduction Concerning Risks From Occupational Radiation Exposure-Table 3

ii. **Which regulatory agency has jurisdiction over effluents from Nuclear Fuel Services and which regulations apply to the control and release of effluents?**

The NRC has jurisdiction over radiological effluent releases, which are the liquid and gas releases, from the plant. NRC regulates the radiological parts of the effluents, while the State of Tennessee regulates the chemical parts.

Nuclear Regulatory Commission (NRC)
10 CFR 20.1301 (Dose limits for individual members of the public), and 10 CFR 20.1302 (Compliance with dose limits for individual members of the public) have jurisdiction over the radiological portions of plant effluents. 10 CFR 20.1301 requires that the dose to the public may not exceed 100 millirem in a year. 10 CFR 20.1302 describes two methods for complying with this limit. The first method of compliance is for the licensee to calculate the dose of the public member who is most likely to receive the highest dose. The second method is for the licensee to release effluents with concentrations less than the effluent concentrations listing in 10 CFR 20, Appendix B, Table 2. The second method is more conservative since it includes the dose to an individual continuously present at the site boundary. Both methods include airborne and liquid effluents and are crafted to ensure that the highest dose from the licensed operation does not exceed 100 millirem in a year.

The NRC regulation, 10 CFR 20.2003 (Disposal by release into sanitary sewerage) limits the radiological material discharged to the sanitary sewer. The monthly average concentration limit is listed in 10 CFR 20, Appendix B, Table 3.

Tennessee Department of Environment and Conservation (TDEC)
The state has regulatory jurisdiction over the chemical constituents in the effluents. The state issues permits for all chemical releases from the site.

B. Nuclear Fuel Services effluents

i. **How many outfalls (liquid release points) does NFS have and are they authorized?**

Nuclear Fuel Services has four outfalls. Each outfall is authorized by Tennessee National Pollutant Discharge Elimination System (NPDES) permits.

Nuclear Fuel Services has one main outfall into the Nolichucky River. This is a discharge line which carries the treated water from the NFS onsite waste water treatment facility. The water is required to be sampled and must be below NRC regulatory limits for radionuclides before being released into the river. The NPDES permit TN002038 was issued by the TDEC and limits the non-radiological chemicals in the liquid effluent. The NRC receives notification if NFS violates its state permit.

The NPDES permit TN002038 lists a second outfall, but this outfall is no longer in operation. It was physically removed (pipe removed, capped and sealed) during environmental cleanup of the North Site.

The site has two other outfalls from the NFS property into Martin Creek for storm water. Nuclear Fuel Services does not release process material through these outfalls. They contain storm water runoff from the site and are authorized by NPDES permit TNR050873. The first storm water outfall carries the majority of storm water from the

site. The second outfall carries storm water from the parking lots and a small portion of the east side of the plant property. It also includes the Banner Springs Branch, a natural groundwater spring that was re-routed around the NFS site. Nuclear Fuel Services monitors the storm water discharge for radiological constituents at a point downstream of both outfalls as required by its NRC license.

ii. **Where is the water from the lagoons (former waste water settling ponds) pumped?**

The NFS lagoons were used in the 1950s through the 1970s. The land around and beneath the lagoons has been cleaned up and the soil has been shipped to an authorized off-site disposal facility. Nuclear Fuel Services no longer uses settling ponds in their waste treatment process but processes liquid waste in contained tanks.

The North Site portion of the NFS property (where the lagoons were located) has been cleaned up. As a result of this process, the area contains large pits which have not yet been refilled with soil. The pits fill naturally with groundwater and rain water to form "onsite ponds." The licensee samples the surface water from these onsite ponds monthly.

The licensee pumps the water from the onsite ponds to the groundwater treatment facility. The facility treats the water and samples the final product before its release into the sanitary sewer. The groundwater treatment facility treats the water for volatile chemicals and also removes uranium and other heavy metals from the water. The NFS discharge to the sanitary sewer is below NRC regulatory limits.

iii. **A June 1996 inspection report stated that a significant amount of groundwater was treated by the groundwater treatment facility. How can this vast amount of water be treated for uranium considering that the release limits are so small?**

The groundwater treatment facility was designed to process large amounts of water. The groundwater treatment facility releases are below the release limits.

Inspection Report 70-143/1996-014 from November 1996 states that at "the end of October 1996, the total volume of groundwater treated in the groundwater treatment plant since the start up (799 days) was 4,765,162 gallons." This is an average of 5,964 gallons per day, which is significantly less than a quarter of the facility's maximum capacity. The purpose of the groundwater treatment facility is to treat the water prior to discharge to the sanitary sewer of the City of Erwin - Publicly Owned Treatment Works. These discharges are conducted in accordance with a formally issued pretreatment permit. The radionuclides (including uranium) released into the sewer between January and June of 2009[4] were on average 1.0 percent and 0.7 percent of the NRC limits detailed in 10 CFR 20, Appendix B, Table 3.

[4] ML092570831- NFS Biannual Effluent Monitoring Report January through June 2009

iv. **In 2007, a 2005 inspector follow-up item (IFI 2005-03-04) was closed in Inspection Report 70-143/2005-07 for an elevated stack sample above the licensee's action limits. How did the inspector determine whether or not the elevated stack sample represented a release above regulatory limits?**

The release associated with the elevated stack sample was below the regulatory limits. The inspector follow-up item was originally opened when NFS identified an elevated stack sample during routine stack sampling. The elevated sample was caused by a buildup of liquid waste in the hydrogen dilution ventilation system. Nuclear Fuel Services submitted the air sample filter to an offsite laboratory for isotopic analysis. The inspector follow-up item was opened to ensure that the NRC reviewed the results of the analysis when they became available. The inspector follow-up item was later closed by another NRC inspector after reviewing the results. This inspector determined that the stack release did not contribute to a significant dose to the public, but did not elaborate in the report on how that conclusion was reached.

During the 2009 environmental inspection, NRC inspectors followed up on the closed inspector follow-up item in order to gather more information. The inspectors reviewed how NFS calculated public dose from that elevated release and how they intended to prevent a recurrence. The inspectors determined that the licensee used an approved methodology and an off-site laboratory accredited by the National Environmental Laboratory Accreditation Program to aid in determining the dose. The dose value was below the NRC's limits defined in 10 CFR 20.1301 (100 millirem in a year and 2 millirem in any one hour). The inspectors also determined that the corrective actions to prevent recurrence were adequate and had been implemented.

v. **Are NFS effluents above the regulatory limit for uranium-234 and other isotopes?**

Nuclear Fuel Services effluents are currently below the regulatory limits for all isotopes, including uranium-234. The NRC license specifies that NFS use a combination of the public dose compliance methods described in 10 CFR 20.1302 (which are the explicit action levels listed in 10 CFR 20, Appendix B or a public dose calculation based on releases). Nuclear Fuel Services calculates public dose if the measured effluent concentrations are above the concentrations listed in 10 CFR 20, Appendix B. The radiological constituents in the liquid effluents and air effluents were below the 10 CFR 20, Appendix B levels for the first half of 2009.

The concentration of uranium-234 in the liquid effluents is also below the effluent concentrations listed in 10 CFR 20, Appendix B, Table 2. The data is presented in the chart below.

	Nuclear Fuel Services Biannual Effluent Monitoring Report[5] Jan - June 2009 Average Concentration	Action Level for Effluent Concentration 10 CFR 20, Appendix B
Concentration of uranium-234	89 picocuries per liter	300 picocuries per liter

[5] ML092570831- NFS Biannual Effluent Monitoring Report January through June 2009

II. Environment

A. The 1986 Markey hearing files indicate that the ground around the NFS 310 Warehouse is contaminated. When was the 310 Warehouse built? Also, is there contamination, paint thinner, motors, and other waste buried 45 feet underneath this building?

The 310 Warehouse was constructed in 1969. At present, environmental sampling results indicate no significant radiological or chemical contamination underneath the 310 Warehouse.

The NRC staff requested that NFS investigate whether significant contamination (radiological or chemical) was present approximately 45 feet below the 310 Warehouse. The NFS investigation into NRC's request indicated no evidence of significant contamination below the 310 Warehouse. As part of the investigation, NFS interviewed the project engineer who managed the construction of the 310 Warehouse in 1969. He stated that there was no known burial in the land beneath it. To verify this conclusion, NRC reviewed summaries of the history of the 310 Warehouse, which has been used to store all types of radiological materials. In addition, NRC reviewed NFS's monitoring well records for the NFS property. NRC's review indicated that bedrock is present at a depth of approximately 20 feet. Therefore, burial of items at a depth of 45 feet was unlikely. In addition, NRC reviewed the sampling results for the last five years for monitoring wells near and downhill from the 310 Warehouse (Wells 104A, 105A, and 106A). NRC determined that all three wells were at or below the detection limits for gross alpha, gross beta, and technetium-99.

The NFS response to NRC's request noted the fact that the southwest burial trenches (located approximately 30 feet west of the 310 Warehouse on NFS property) indeed once had equipment, tanks, and other large debris buried in them. The southwest burial trenches were approximately 15 feet deep. However, the trenches were emptied and the contaminated soils removed by May 2000. The NRC determined that no significant environmental issues currently exist in the area.

In addition, during NRC's routine environmental protection inspection, conducted July 20 through 24, 2009, the NRC inspectors reviewed groundwater sampling records for the site and did not identify any issues regarding the wells around the 310 Warehouse. The results of that inspection will be documented in NRC inspection report 70-143/2009-003, covering the period July 1 through September 30, 2009. This report is expected to be issued in November 2009.

B. Nuclear Fuel Services purchased the property at 275 Stalling Lane in Erwin. Does this mean that the property was contaminated?

No, NFS never believed the property was contaminated. To confirm there was no contamination, NFS performed a radiological survey of the property, which was observed by the NRC. The survey found that the property was not contaminated.

When the contamination question was raised, NRC requested that NFS investigate. Nuclear Fuel Services advised that the land was purchased due to the value of the land and its proximity to the plant. Nuclear Fuel Services also advised, and NRC confirmed, that the house is located uphill from the NFS facility. Therefore, groundwater flows from the house to the plant. This fact eliminates groundwater as a potential pathway for contamination from the plant, leaving air as the only possible source of potential contamination to the house. Nuclear Fuel Services reviewed recent, offsite sampling results for air, stream, soil, and vegetation near the property. No contamination was found. In addition, NFS conducted a radiological survey of the property that was observed by an NRC inspector. Again, no contamination was found.

The NRC's routine environmental protection inspection, conducted on July 20 through 24, 2009, reviewed the licensee's air monitoring records and processes for the site. The inspectors did not identify any significant issues. The results of that inspection will be documented in NRC inspection report 70-143/2009-003, covering the period July 1 through September 30, 2009. This report is expected to be issued in November 2009.

C. Technetium in groundwater

i. **What is the status of radioactive technetium-99 (Tc-99) contamination in the groundwater?**

Technetium-99 is present in the groundwater onsite at NFS. Nuclear Fuel Services detected elevated levels of Tc-99 in onsite groundwater monitoring wells between 1998 and 2004. The highest level was recorded at 25,770 picocuries per liter (pCi/L) in July 1999. When it was first detected, well pumping was used to reduce Tc-99 concentrations. Since 2004, Tc-99 levels onsite have remained near or below 1 percent of the NRC limit from 10 CFR 20 Appendix B value for offsite water effluent releases of Tc-99 (60,000 pCi/L). Therefore well pumping was stopped.

ii. **How did technetium-99 (Tc-99) get into the groundwater?**

In the late 1990s, NFS was contracted to recover uranium that had been trapped in large filters. The material originated from one of the Department of Energy sites and contained Tc-99. As NFS processed the material, Tc-99 entered the plant's effluent. Nuclear Fuel Services installed filters which kept the airborne and liquid effluents within the regulatory limits. Nuclear Fuel Services periodically cleaned the filters and collected the filter debris in a large tank. The tank subsequently leaked through a concrete pad into the groundwater. After the leak was identified, it was repaired, stopping any additional Tc-99 from entering the groundwater. Subsequently, the material was removed and building and process area was torn down.

iii. **Has technetium-99 (Tc-99) entered the Nolichucky River?**

There is no evidence that Tc-99 has entered the river. Water samples from the river contain such low levels of radioactive isotopes that there is no need to specifically analyze the samples for Tc-99. In addition, monitoring wells between the site and the river have not indicated Tc-99 above 0.5 percent of the NRC limit from 10 CFR 20 Appendix B value for offsite water effluent releases of Tc-99 (60,000 pCi/L).

III. NRC Inspection Program, Licensing, and Enforcement

A. How many safety-related escalated enforcement violations (along with civil penalties) has NRC cited NFS for since 1989?

Since 1989, NFS has had eight escalated enforcement violations involving safety-related activities. Safeguards-related escalated enforcement actions (which involve physical security and material control and accounting) are handled as Official Use Only and therefore are not publically available. Of the eight safety-related escalated enforcement violations, four included civil penalties. The civil penalties totaled to $92,500.

The following is a list of the safety-related violations:

1. Failure to implement criticality safety controls, which resulted in a $10,000 civil penalty (Enforcement Actions (EA) 1990-124 and 1991-004);
2. Failure to implement a criticality safety control (EA 1991-186);
3. Failure of a process control that led to a fire and a failure to implement a criticality safety control, which resulted in a $37,500 civil penalty (EA 1992-231);
4. Failure to implement adequate configuration control and management systems, which resulted in a $12,500 civil penalty (EA 1996-213);
5. Failure to properly maintain criticality alarms (EA 2001-098);
6. Failure to properly implement a criticality safety control including the falsification of a record (EA 2003-178);
7. Failure to follow procedures for material transferred to the Waste Water Treatment Facility (EA 2004-197); and
8. Failure to properly implement criticality safety controls, which resulted in a $32,500 civil penalty (EA 2005-093).

B. Which confirmatory orders are currently being applied to NFS?

As of October 29, 2009, NFS is subject to only one safety-related confirmatory order, the order dated February 21, 2007[6].

On February 21, 2007, NRC issued a confirmatory order to NFS in response to six potentially escalated enforcement actions. The order required that NFS perform the following:

1. Respond in writing to the six enforcement actions listed in the order;
2. Submit a license amendment to strengthen the configuration control program;
3. Implement a third party assessment of the safety culture of the site;
4. Establish a safety culture improvement program; and
5. Implement a second third party safety culture assessment.

[6] The order can be reviewed in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/readingrm/adams.html, under accession number ML071990558

Due to the sensitive nature of the information and material NFS handles, the following physical security orders also apply to NFS:

1. Interim Compensatory Measures Orders (Issued August 21, 2002 and April 29, 2003);
2. Requirements for Protecting Certain Safeguards Information (Issued November 5, 2004);
3. Fingerprinting and Criminal History Check Requirements for Access to Safeguards Information (Issued March 1, 2007); and
4. Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material or Other Property (Issued April 30, 2007).

The following physical security orders are available publicly in ADAMS:

1. ML042980004 - Requirements for Protecting Certain Safeguards Information
2. ML072640409 - Fingerprinting and Criminal History Check Requirements for Access to Safeguards Information
3. ML070950163 - Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material or Other Property

C. Why did NRC not conduct an environmental impact statement for NFS?

The NRC has procedures for conducting environmental reviews[7]. For fuel facilities requesting license renewal or modifications, our procedure is to begin with an environmental assessment to determine whether any significant impacts are identified. If significant impacts are identified, NRC will prepare a more detailed environmental impact statement. However, if none are identified, the environmental review is complete and no environmental impact statement is required.

[7] Environmental Review Guidance for Licensing Actions Associated with NMSS Programs, NUREG-1748.

IV. Facility and Operations

A. Is NFS storing radiological material at its Industrial Park Facility?

Yes. The Industrial Park Facility is a general-purpose warehouse used primarily for storage of low-level radioactive waste in approved shipping containers prior to loading onto railcars for shipment to a disposal facility.

B. What are the waste streams leaving the Commercial Development Line?

There are currently three general waste streams (liquid and solid) leaving the CD Line:

Scrubber blow-down: The building ventilation uses a scrubber system to remove contaminants from the various glove boxes as well as the room atmosphere. The scrubber water blow-down is directed to the waste water treatment facility. The water is processed using a lime treatment. Most of the ammonium fluoride in this solution would precipitate out as calcium fluoride and be shipped to an off-site disposal facility. Any remaining liquid hydrofluoric acid (HF) would be neutralized with a caustic to form water and a salt. The remaining liquid is sampled and sent to the Nolichucky river once the release criteria have been met.

Ammonium diuranate (ADU) filtrate: The sublimation stations convert the uranium hexafluoride (UF_6) to a solution composed of uranyl fluoride (UO_2F_2) and HF. This solution is then processed through the ADU precipitation system where ammonium hydroxide is added to precipitate out ammonium diuranate ($(NH_4)_2U_2O_7$). The liquid HF is converted to liquid ammonium fluoride (NH_4F). Most of the ammonium fluoride solution ends up in the filtrate water as waste. It is then pumped to the filtrate waste columns. From there it is pumped to the waste water treatment facility. So far only two of these transfers have been made (~1000 liters). The goal is to eventually solidify the contents of this tank. This solid waste will then be shipped to an authorized off-site disposal facility for burial.

Building solid waste (trash): This material is collected and placed in either 55 gallon drums or other bulk shipping container. Less than one drum per day is produced. This solid waste is then shipped to an authorized off-site disposal facility for burial.

C. What is the worst off-site release of hydrogen fluoride that can occur during operation of the Commercial Development Line?

The worst case accidental release (a fire involving a cylinder containing 24.9 kilograms UF_6) of hydrogen fluoride from operations related to the Commercial Development Line would result in a 0.4 parts per million potential exposure at the site boundary, which would result in no adverse public health effects. Therefore, the worst case accidental release of hydrogen fluoride gas would not require any offsite response.

V. General

A. During the presentation on September 24, 2009, NFS presented a slide regarding employee identified items. What were the items classified as having a "high" safety significance that were reported during 2006 and 2007?

Nuclear Fuel Services characterized seven items in the January 1, 2006, to September 18, 2009 timeframe as having a "high" safety significance. Of these events, only one event involved radioactivity while the others involved industrial safety. The NFS presentation can be reviewed in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/readingrm/adams.html, under accession number ML092730303.

Date Event	Type	Description
February 16, 2006	Industrial	An employee was driving a forklift on a portable ramp connected to a tractor trailer. The portable ramp was not properly set up and separated from the trailer causing the forklift to fall from the ramp. The employee received injuries as he jumped from the forklift.
March 13, 2006	Radiological	During inspections of the facility, the employees identified an elevator pit which lay below floor level. The pit did not have any safety features to prevent a leak of uranium-bearing liquid into the pit. There was not any radiological material in the pit. A criticality did not occur.
November 10, 2006	Industrial	An employee injured his leg after he stumbled backward during construction work.
December 13, 2006	Industrial/ Electrical	During the removal of a tree, a limb fell across nearby power lines. This was characterized as a "near-miss" event as it did not result in serious injury. Nuclear Fuel Services conducted an investigation and collected "lessons learned" from the incident.
December 15, 2006	Industrial	During a fire, there was confusion regarding fire alarm pull stations. An industrial fire extinguishing technique is to create an oxygen-deficient environment which puts out the fire because a fire cannot burn without oxygen. An employee was exposed to the oxygen-deficient environment after miscommunication amongst employees. The employee was sent to the hospital for observation.
February 22, 2007	Health	An employee requested assistance after having a medical emergency.
December 6, 2007	Electrical/ Industrial	Electrical wiring was improperly disconnected from service. Although the event did not result in any injuries, the facility received an National Electrical Code violation.

B. Did a criticality almost occur happen at NFS due to the March 6, 2006 spill of the high enriched uranium solution?

No. The liquid containing the high-enriched uranium was never close to the conditions required for a criticality accident. The issue was that NFS lost control of the liquid transfer and did not know where the liquid was going. NRC licensees that handle enriched uranium must maintain control of the material at all times to avoid conditions favorable for a criticality accident.

On March 6, 2006, nine gallons of high-enriched uranyl nitrate solution leaked into a glovebox and spilled onto the process floor. A criticality did not occur due to the functioning glovebox drains and lack of nuclear material that leaked. The puddle of solution was approximately six feet from an open elevator pit. The elevator pit had the potential of collecting the solution into a geometry favorable for criticality and did not have controls in place to prevent the build up. For additional details, refer to NFS inspection report 70-143/2006-006[8].

C. Has NFS ever operated a nuclear reactor called the Southwest Experimental Fast Oxide Reactor (SEFOR)?

No. Nuclear Fuel Services has never operated nor has it been licensed to operate any type of nuclear reactor facility including the SEFOR.

During the 1960s and 1970s, NFS manufactured SEFOR nuclear fuel in Building 234. The processing equipment was removed and the building torn down years ago. However, some contaminated material remains in the soil and in a cell below ground. Nuclear Fuel Services has erected a large tent over the building site. Nuclear Fuel Services has indicated an intent to resume work cleaning up the remaining contamination.

D. Is waste from the West Valley, NY former commercial spent fuel reprocessing facility located at NFS? Also, is waste from NFS located at Bumpass Cove, TN?

No. Waste from the West Valley, NY former commercial spent fuel reprocessing facility is not located at NFS. In addition, NFS does not have waste located at Bumpass Cove, TN.

The NRC was aware that the mixed oxide fuel work that NFS performed for West Valley in the 1970s resulted in contamination of the land beneath Building 234 on the NFS site. However, this waste resulted from operations at NFS, not the disposal of West Valley waste at NFS. Nuclear Fuel Services, under NRC's oversight, has and will continue to decommission and decontaminate that portion of the property. Nuclear Fuel Services has indicated an intent to resume Building 234 decommissioning activities as early as 2010.

In addition, waste from the NFS Erwin facility has not been buried at Bumpass Cove. The NRC staff conferred with the federal Environmental Protection Agency and state

[8] The inspection report can be reviewed in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/readingrm/adams.html, under accession number ML072630328.

officials who stated that the Bumpass Cove landfill was cleaned up and the site was archived as an EPA Superfund site[9] in 2003, meaning no further environmental action will be taken. For further details contact the Environmental Protection Agency or the Tennessee Department of Environment and Conservation.

E. What is the status of the Building 234 (plutonium) decommissioning?

Nuclear Fuel Services has not restarted the clean up or decommissioning of the plutonium building. However, they have indicated an intent to do so, perhaps as early as next year. The company is identifying the major tools and equipment needed to start the project. The NRC is evaluating the project and NFS' plans.

[9] EPA Superfund Site: http://cfpub.epa.gov/supercpad/cursites/calinfo.cfm?id=0404056&prnt=Y