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UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

What happened in 2006?

What Happened?

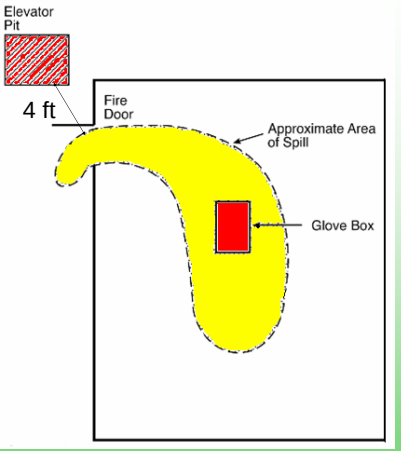
- On March 6, 2006, a spill involving 9 gallons (35 liters) of highly enriched uranium solution occurred.
- The solution spread out on the floor in a puddle both around the equipment and out an interior door.
- The solution was discovered by an NFS employee and management was contacted.
- NRC resident inspectors were called to the scene.
- NFS stopped all work in the immediate area and the solution was safely cleaned up.
- Within days, technical experts from the NRC Headquarters and Region II offices reviewed the event.
- The building was shut down for six months while the incident was reviewed and changes to the plant and procedures were made.

Was Anyone Hurt?

- No one was injured.
- No one received an increased radiation dose.
- The spill was cleaned up and did not impact the environment
  - The local water, air, and land remained unaffected by the incident.
- The incident did not cause harm to the public.

The uranium solution spilled from the glove box (pictured above) and dripped onto the floor.

Layout of Spill



The uranium solution created a puddle on the plant floor which extended beyond the process room into the plant hallway. A distance of six feet was between the solution puddle and the elevator pit.

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NFS License and Performance

The NRC license permits NFS to:

- Process uranium into products.
- Perform chemistry and other laboratory tests.
- Provide services such as storage and repair.
- Research and develop new products.
- Treat and dispose of waste.

The NRC license requires NFS to:

- Have workers trained and qualified to work safely.
- Have equipment and facilities that protect health and minimize danger.
- Have procedures that protect health and minimize danger.

Previous three performances

January 2005 – February 2006

- NRC found 8 areas needing improvement over a 13 month span.
- NRC was concerned that many small problems can lead to bigger problems.
- Extra NRC inspections continued.
- Note: A second Resident Inspector started in 2005.

February 2006 – October 2006

- NRC found 6 areas needing improvement over an 8 month span.
- Fewer violations found, but half the plant was shutdown.
- Extra NRC inspections were continued.

October 2006 – July 2007

- NRC found 1 area needing improvement over 9 month span.
- Improvement noted, but plant was not challenged with new processes.

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Responses to the Incident

What was the response from the NRC?

- Six additional NRC inspections were conducted at NFS to investigate the event and confirm corrective actions.
- The NRC performed a complete review of all licensed operations at NFS to determine if operations were being performed safely.
- After verifying corrective actions for safe operations, the NRC authorized NFS to resume operations after a six month shut down.
- The NRC identified violations and considered issuing fines. However, the NRC agreed with NFS's proposal to make corrections, beyond what is required, to prevent problems from occurring in the future.
- NFS agreed to upgrade its equipment management and have an independent third party assess the safety culture at NFS to make improvements. In return, the NRC agreed to not impose a fine.
- The NRC ordered NFS to improve its equipment control program to prevent improper installations, such as the valve in the glove box.
- The NRC ordered NFS to make additional improvements.
- The NRC inspections have not identified significant safety issues since restart.

What was the response from NFS?

- NFS voluntarily shut down operations in this building immediately following the event and cleaned up the spill.
- The glove box system was disconnected from the main transfer line.
- Five days after the spill, NFS identified another issue - an elevator pit that was not analyzed for safety. This failure *could have* led to a localized radiation burst (criticality) if enough solution had collected in the pit.
- NFS verified proper configuration of every system and made changes to procedures and drawings to prevent similar problems in the future.
- NFS filled the elevator pit with concrete to ensure that it would not pose a criticality threat in the future. (see picture to right)

Continued inspections at fuel fabrication facilities

The NRC performs a many different types of inspections at fuel fabrication facilities. These inspections focus on:

- Safety
- Security
- Emergency Preparedness

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How does the NRC oversee Fuel Cycle facilities?

What is a Fuel Facility?

A fuel facility is a factory that makes fuel for nuclear power plants, research reactors, or the federal government.

- There are ten operating factories in the USA.
  - This includes Nuclear Fuel Services, Inc. (NFS) in Erwin, TN

How does NRC inspect the Fuel Facilities?

- The NRC has two different types of inspectors:

  On-site Resident Inspector: works at only one factory, full time.

  - Two NRC on-site resident inspectors are at NFS.

  Specialist Inspectors: travel to all the fuel facilities and do many different types of specialized inspections.
- The inspections help ensure that the facilities are operating safely and that they have not broken NRC rules or limits.
- NRC inspections ensure safety in:
  - Radiation
  - Fire
  - Chemical
  - Security
  - Emergency preparedness
  - Nuclear criticality
  - Material accounting and control - to ensure the facility has not lost nuclear material

- If a facility breaks an NRC requirement, the NRC will issue a violation. The violations are evaluated based on the importance of safety and security.
- The NRC issues a review of the performance of the facility. The review reflects the number of violations issued and the areas needing improvements. The NRC typically reviews NFS once a year.

How does NRC license Fuel Facilities?

- In order to operate, the fuel facility must have an NRC license.
- The licensing process is an evaluation of the safety and security controls in the factory.
  - The facility must demonstrate that they can operate safely and securely.
  - The facility must demonstrate that they will not cause harm to the environment.
- A fuel facility license is typically good for 10 to 40 years.
  - NFS must apply for a new license every 10 years.
- The fuel facility can change portions of their license. For significant changes, the facility must request the NRC to review the change and to determine if it will be safe and secure.

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Why does the NRC withhold information?

History

- The NRC's objective is to protect people and the environment.
- The NRC strives to be open in our regulatory process.
- Some information must be held from the public such as:
  - Classified information
  - Trade secrets
  - Financial information
- After the September 11, 2001 terrorist attacks, the NRC reviewed public records and pulled information which would be considered useful to a terrorist or international enemy.

What changed in 2004?

- The NRC identified additional information that poses security risks. Such information could endanger the plant or the public.
- In response to DOE, the NRC removed public access to most information on NFS and another facility.

What is the policy now?

- In 2007, the NRC Commission and members of Congress expressed concern that the NRC was holding too much information from the public.
- The NRC's Commission decided to make more information available to the public.
- Most of the information withheld since 2004 will be released.
- Classified and other security information will not be released.

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What could have happened and why is the NRC concerned?

Worst Case Scenario

The worst case scenario regarding the high enriched uranium spill is a nuclear criticality.

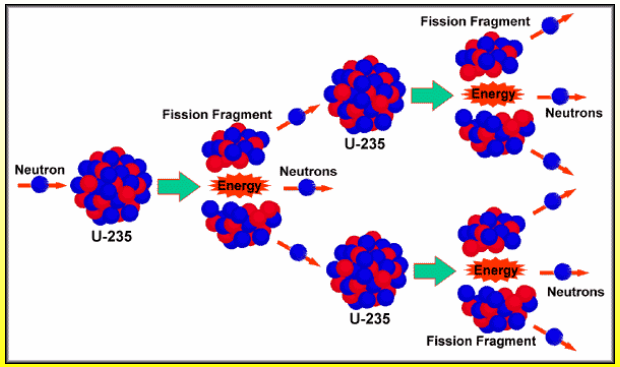
What is a Nuclear Criticality?

When a large amount of nuclear material, like uranium, is accumulated in a small space, the uranium can cause a chain reaction (pictured to the right) and give off large amounts of energy.

How is Nuclear Criticality Prevented?

A material will remain subcritical (not enough neutrons for a chain reaction) when there is limited mass and the material is spread out.

Example of a Chain Reaction (U-235 = Uranium)



Scenario 1

A criticality in the glove box.

Possibility:

If about **34 gallons** of uranium solution had collected in the glove box, a criticality would have happened.

Actual:

About 54 gallons were available, but **less than 1 gallon** collected in the glove box - the rest of the 9 gallons drained to the floor.

Scenario 2

A criticality in the elevator pit

Possibility:

If about **26 gallons** of uranium solution had collected in the elevator pit, a criticality would have happened.

Actual:

About 54 gallons were available, but **no uranium solution** made it to the elevator pit.

What would have happened if a criticality had occurred?

If a criticality had occurred, large amounts of radiation would have been released. The dangers from the radiation lessen the farther you are from the uranium. Due to normal work activities inside of the facility, one worker could have died from the released radiation. Other workers could have received radiation doses above the NRC limit. The radiation would have mostly been contained in the building.

A criticality accident at NFS *would* ***not*** have caused an explosion similar to Hiroshima or Chernobyl. The radiation released at the facility boundary could have been above the NRC limit for doses to members of the public, but under the NRC limit for workers; an amount without health effects.