# Industry Views on Vacuum Drying


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# Inaccurate NRC Statements in Letter to Vendors

- "Vulnerabilities of the spent fuel vacuum drying system process were identified as a concern during an event that occurred at the Byron Station":
  - The event at Byron involved the annulus cooling system, not the vacuum drying system (VDS); they are two separate, independent systems.
- "During the event on August 29, 2010, the vacuum drying process may have been left unattended for an entire night":
  - The vacuum drying system was not operating during the time of the event; the VDS was isolated from the canister. The annulus cooling process was left unattended.
- "could result in loss of retrievability":
  - Retrievability is a requirement (per 10 CFR 72.122) of the loaded and certified storage system.

# Inaccurate NRC Statements in Letter to Vendors

- "Safety analysis reports classify the vacuum drying system as not important to safety or fail to classify the system at all and therefore do not receive the same level of attention as those that are classified as important to safety.":
  - This statement implies that not important to safety components are provided less scrutiny than ITS components. This is in contradiction of a robust nuclear safety culture.
- "…how cask vendors would minimize the probability of a confinement boundary failure with subsequent air ingress":
  - The confinement boundary is not established at the time of loading/drying; cover plates, cover ring and associated welds have not been installed. Confinement boundary is established after welding and leakage testing of the closure welds.

# Regulatory Basis of Safety Classifications

- NUREG-1536 defines Important to Safety (ITS) as:
  - Those features of a dry storage system that have one or more of the following functions: (1) maintain the conditions required to store spent nuclear fuel safely; (2) prevent damage to the spent nuclear fuel cask during handling and storage; or (3) provide reasonable assurance that spent nuclear fuel can be received, handled, containerized, stored and received without undue risk to the *health and safety of the public*. (based on 10 CFR 72.3)
- Additionally, NUREG-1536 states: "The cask system description provided in the SAR may include a variety of components that are not important to safety such as transporters, ram systems, ***vacuum drying systems***, drain and fill quick disconnects, support pads and other concrete structures not important to safety."

# Assessment of Vacuum Drying System to ITS Criteria

- "Maintain the conditions required to store spent nuclear fuel safely"
  - Vacuum Drying system (VDS) is not used during the *storage* of spent nuclear fuel. Additionally, any failures or off-normal operation of the VDS would be assessed and corrected prior to placing affected fuel in storage.
- "Prevent damage to the spent nuclear fuel cask during handling and storage"
  - VDS is not used during handling (i.e., movement) or storage of the cask.
- "Provide reasonable assurance that spent nuclear fuel can be received, handled, containerized, stored and received without undue risk to the *health and safety of the public*."
  - Operation of the VDS does not impact the health and safety of the public; operated within the fuel handling building/cask loading area. *There is no credible event that can lead to a public health and safety consequence.*

# Public Health and Safety

- Public health and safety is defined as affecting the probability or consequences of an off-site release.
- Vent lines during drying are routed to the existing radwaste systems of the plant.
  - Any release of radioactive material is detected and sequestered in accordance with plant processes and procedures (similar to the rare cases when single rod bursts have occurred during vacuum drying).

# Examples of Industry Actions Taken in Response to IN 2011-10

- Procedure updates to require performance of a detailed inspection of all hoses/piping/valves and associated connections for degraded conditions and loose connections prior to leak-testing the VDS.
- During the vacuum drying system's use a qualified operator shall be available to monitor VDS performance.
- A qualified supervisor shall also be staffed during all drying phases of VDS operation

# Examples of Industry Actions Taken in Response to IN 2011-10

- Development of additional guidance to VDS operators in the Loading Procedure to address VDS stoppages (planned or unplanned) during the drying process to ensure what state/condition the canister components shall be in during the stoppage as well as what system monitoring is required to ensure compliance with the CoC and T/S.
- Procedure updates to include steps and cautions to immediately isolate the canister before securing the VDS pump in an emergency (e.g., evacuation of the fuel handling building) to prevent air ingress.

# Sequence of Events Needed for Radiological Release

- Need a gross (double ended guillotine) breach of the VDS hose.
- Need substantial air ingress to produce an oxidizing environment in the canister cavity
- Need a breach of the fuel cladding. (i.e., damaged fuel)
- Need elevated temperature to cause fuel oxidation/swelling
- All of these steps need to occur in a rapid timeframe such that the rise in pressure due to loss of vacuum and air ingress is not observed on instrumentation (pressure gauges).

Need multiple, sequential, rapid and unobserved series of events to occur in conjunction to cause a radiological release – This is not credible

# Conclusions/Summary

- Vacuum drying systems are appropriately classified as not important to safety in accordance with NUREG-1536 (as determined by NRC).
- Lesson Learned: Active systems need to be monitored while in service so that appropriate actions can be taken in the event of loss of vacuum.
- Updates to pre-operational checks and operating procedures ensure applicable monitoring is in place during all phases of vacuum drying.

# Back-up Slides


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# Confinement Boundary

- Canister shell
- Baseplate/lower shield
- Closure Lid
- Vent/Drain port covers
- Closure ring
- Associated welds