
NNSA
National Nuclear Security Administration
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# Water Ingress from Fire the Suppression System

## Is it credible?

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# History

- Fire Suppression System
- 2014 operations paused to reconsider water ingress from the FSS
  - ESS-14-002 Implemented
    - 2 different generic limit sets applied
      - ~ single sub-critical parameters from ANSI 8.1
      - Metal or solution

# Credible Water Ingress - Take #1

- Standard calculation to decipher how much water from fire suppression system can enter a glovebox.
  - Based on a 2-hour release event
  - NM Tech experiments
- Typical Calculational results
  - ~13 gallons ingress
  - Less than 2-inches depth
- Flooded containers
  - Administrative controls
    - e.g. Limited Tray Height, Open Container Volume, Total Container Volume, Seismically Qualified Glove Boxes etc.

# Credible Water Ingress - Take #2

- Use standard calculation(s) to decipher how much water from fire suppression system can enter a glovebox
- Water does not directly enter glove ports based on sprinkler location
  - Initial parabolic trajectory followed by a straight fall
  - Based on a 2-hour release event
  - NM Tech fire experiments
- Typical Calculational results
  - Less than 3 gallons
  - FAR Less than 2 inches depth
- Flooded containers
  - Thickness of the glove port provides sufficient distance to preclude water ingress
  - Administrative controls
    - Limited tray height

# Credible Water Ingress - Take #3

- **Fire Protection Program (DSA)**
  - Combustible Loading Control Program
    - Implemented in both the room and gloveboxes
    - Limit the quantity and provides separation of combustible materials
  - Ignition Control Program
    - Evaluates new heat generating devices
  - Fire suppression sprinkler system and water supply
    - Limit the size of a fire
  - Fire detection and alarm system
    - Laboratory space sprinklers
    - Thermal detectors in each glovebox to initiate a fire alarm

# Credible Water Ingress - Take #3 (Continued)

- **Fire inside a glovebox**
  - 94 kW required to activate individual sprinkler head
  - Energy required to breach to glove and activate FSS >> 100 kW
  - Combustible loading limit <100 kW
  - Large Fire - Quenched due to a lack of oxygen
  - Small fire - Not enough energy to sustain
    - NM Tech Calculations
- Water ingress resulting from a fire outside of the glovebox judged to be *not credible* to cause a criticality
- **Fire outside a glovebox**
  - Fire must be located directly below glovebox to damage gloves or glovebox
  - Fire would be quenched by fire suppression system before glove or glovebox damage
- Water ingress resulting from a fire inside or outside of the glovebox is judged to be *not credible* to cause a criticality

# Credible Water Ingress - Take #3 (Continued)

- **Seismic Events without Fire**
  - FSS safety significant and can be credited to maintain function and remain intact
- **Seismic events and Fire**
  - Post-seismic fires are not expected to occur in the facility (DSA)
  - Requires certain final configurations after seismic event.
  - Fire suppression system minimizes fire
  - Overhead objects cannot compromise glovebox integrity during and after a seismic event
    - Facility construction - Seismically rated systems
    - Combustible Loading Limits
    - No Combustible Gases
    - Laminate, shatter-resistant glass windows
- Non-fire-related water ingress to a glovebox resulting from an earthquake is *not credible* to cause a criticality

# Questions?

# FMOR process at LANL

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Los Alamos NATIONAL LABORATORY EST. 1943

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# Annual Operational Review Form

- 2014 Form
  - Four areas of verification and review.
  - Three Signatures
  - Part of Facility Implementing Document

- 2019 Form
  - 2 sections
    - Document Review
      - Emergent Issues
    - Field Review
    - 24 total questions
  - Three Signatures
  - Form and Emergent Issues Memo Owned by Criticality Safety

# Emergent Issues Memo

The issues were identified during  assessments, walk-downs, corrective actions management, fact findings, etc. The memo should be referred to while performing a Fissionable Material Operational Review and identify issues by entered into the corrective actions system to be addressed.

Includes issues like

- Presence of permanent or temporary radiation shielding
- Terminology
  - Waste
  - Staging
- CSP Format
- Engineered Requirements