

# Perma-Fix Northwest Richland Inc. Limited Part 70 License Criticality Safety

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nuclear



technical



waste

# Purpose

- Discuss PermaFix Northwest (PFNW) facility approach and regulatory strategy regarding Criticality Safety



# PFNW Facility Overview

- Operating for over 20 years under a radioactive materials license issued by the Washington Department of Health.
- Currently processes mixed waste from DOE and commercial waste generators
- Process of interest consists primarily of physical inspections of the wastes, removal of non-conforming items and sizing/repackaging the wastes for subsequent disposal.
  - Stabilization of small quantities of incidental non-radioactive regulated liquids and solids is also performed.



# PFNW Facility Aerial View



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# PFNW Facility Overview

- Currently authorized to receive radioactive wastes including Special Nuclear Material (SNM) as permitted by Washington state
- PFWN to process similar DOE wastes containing SNM of moderate strategic significance
  - 600-gram Pu-equivalent SNM possession limit / 450-gram process area limit.
  - SNM not in pure bulk form – dispersed throughout waste with other radioactive materials
- Processed waste to be returned to DOE for ultimate disposal



# PFNW Part 70 License

- A limited Part 70 license is necessary due to the Part 150 constraints on Agreement State licensing of SNM
- Application based on guidance provided in NUREG-1520 Rev. 2, SRP for Fuel Cycle Facilities License Applications
- Based on nature of work and characterization of the waste, three exemptions are anticipated



# Proposed Exemptions

- 10 CFR 70, Subpart H Exemption
  - Formal criticality safety evaluation (CSE) will demonstrate the conservatism of the 600-gram Pu-equivalent SNM possession limit, and the 450-gram process area limit.
- 10 CFR Part 74, Subpart D Exemption
  - Uncertainty associated with the waste packages processed by PFNW are large and result in conservative overestimates.
  - PFNW's MC&A program will be management and control of the waste mass, from receipt to return.
- 10 CFR 73.67(d)
  - An exemption to certain physical security requirements in 73.67(d) related to preventing theft of the SNM will be made based on the inability to separate or extract the SNM from the waste.



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# PFNW Approach

- Part 70 License possession limit of 600-gram Pu-equivalent at the existing facility



# Physical and Operational Constraints

- Criticality scoping study identified physical and operational constraints
  - 600-gram Pu-equivalent possessed at the mixed waste facility
  - Excludes water soluble forms of SNM; if water soluble forms to be processed, the facility limit is 200-gram Pu-equivalent
  - All process rooms limited to 180-gram Pu-equivalent except large component segmentation and packaging shop with a limit of 450-gram Pu-equivalent



# Physical and Operational Constraints

- Designated storage area may hold packaged quantities up to the 600-gram Pu-equivalent limit; however, individual packages limited to 450-gram Pu-equivalent
- Overpacks may be loaded/unloaded in the designated storage area
- Additional SNM management procedures to handle and process the proposed increased facility SNM possession and total throughput will be created
- Implementing procedures to evaluate and track SNM quantities in the various matrices based upon waste mass distribution
- Assignment of SNM quantity in repackaged “daughter” containers will be addressed in implementing procedures



# Physical and Operational Constraints

- Waste free of SNM will be defined as <0.5 Pu-equivalent grams based on NRC Form 741 reporting
- Controls for monitoring secondary waste accumulation from processing
- SNM assay and subsequent disposition will be provided for any liquids released during compaction
- Reagents used will be identified and evaluated for compatibility with the chemical forms of SNM
- Radiation monitoring, including a criticality accident alarm system (CAAS) in both the large component segmentation and packaging and designated storage area
- Elements important to criticality safety will be explicitly addressed in facility implementing procedures



# Part 70 Exemption Request

- Subpart H exemption request to be based on Criticality Safety Evaluation
- Criticality Safety Evaluation (CSE) will demonstrate subcriticality based on system parameters
- No Integrated Safety Analysis (based on exemption)
  - No radiological hazards
  - No fire hazards



# Criticality Safety Evaluation

- NUREG-1520 provides several different ways to demonstrate sub-criticality
- Subcritical margin will be expressed in terms of system parameters rather than system  $k_{\text{eff}}$ 
  - Waste Material Mass with limiting percentage factor
  - Geometry Control (Distance between processes/storage containers)



# CSE Considerations

- SNM percentage factors will be based on 450 grams Pu-equivalent plus DOE determined measurement uncertainty
- Based on optimal mixture in an infinite matrix, 1 wt% Be or 1 wt% BeO and  $k_{inf} < 0.9$ 
  - Beryllium percentages based on WIPP acceptance criteria



# CSE Considerations

- Percentage factors determined for all fissile isotopes in PFNW process streams
  - Isotope percentage factors used to determine Pu-equivalent inventory
- Will address any “pure forms” of chemicals containing carbon, fluorine, magnesium, or bismuth in bulk quantities into post-segmentation storage containers
- Large component segmentation and packaging process streams will be free of highly water-soluble forms of SNM





# CSE Considerations

- Large component segmentation and packaging process and stream will be free of highly water-soluble forms of SNM
- Will support the acceptable use of incidental quantities of liquid fixatives for contamination control in segmentation and packaging process
- Anticipated administrative and engineered controls to be used to ensure no free liquids are in the segmentation and packaging or designated storage areas



# Discussion



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