West Valley Probabilistic Performance Assessment (PPA)

Inventory Update – Waste Form

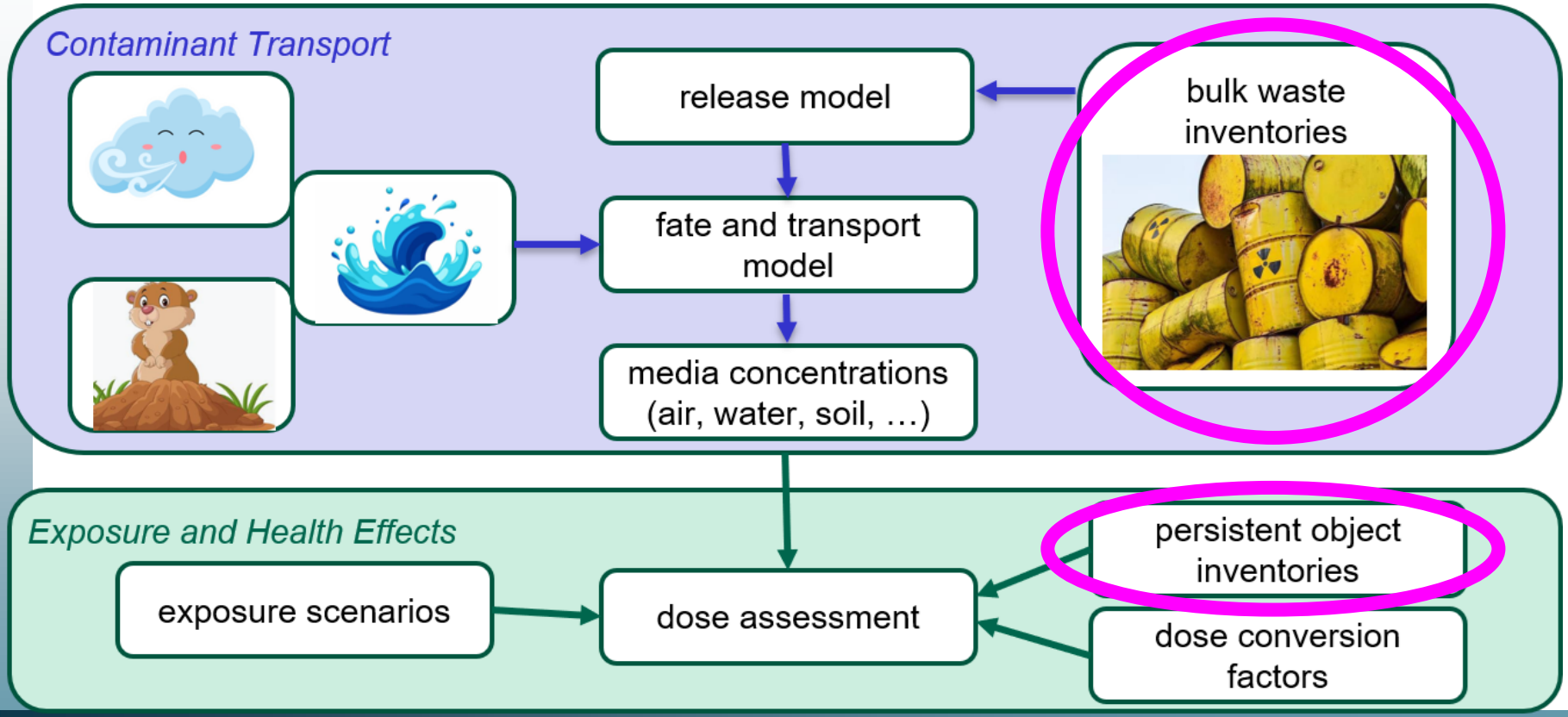
Neptune and Company, Inc.

November 18, 2026

Agenda

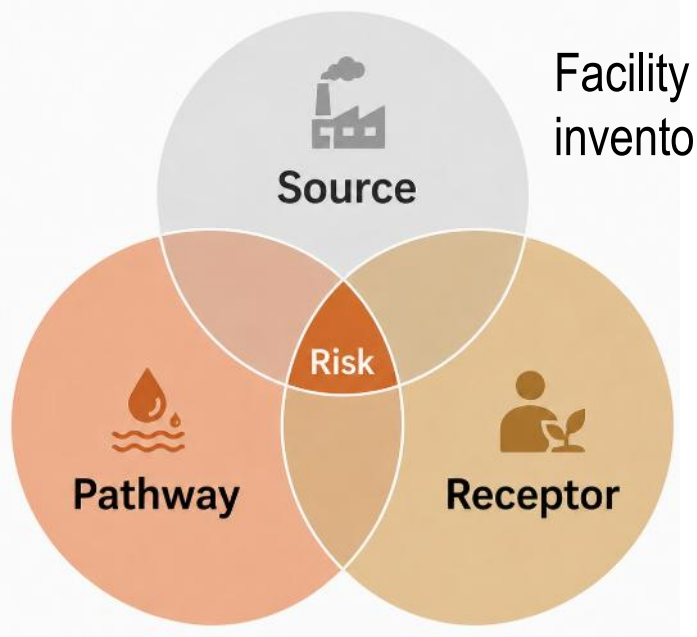
1. Modeling framework
2. NRC-licensed disposal area – NDA
    a. Hulls, hardware
    b. Reprocessing plant waste – equipment, filters, soil
    c. WVDP decommissioning waste
3. NY State-licensed disposal area – SDA
    a. Low dose-rate materials from reprocessing
    b. Offsite commercial shipments
4. Waste Tank Farm
    a. Contaminated surfaces, sludge, zeolite
    b. Supernatant Treatment System (STS) components

PPA Modeling Framework



Risk Assessment Modeling Framework

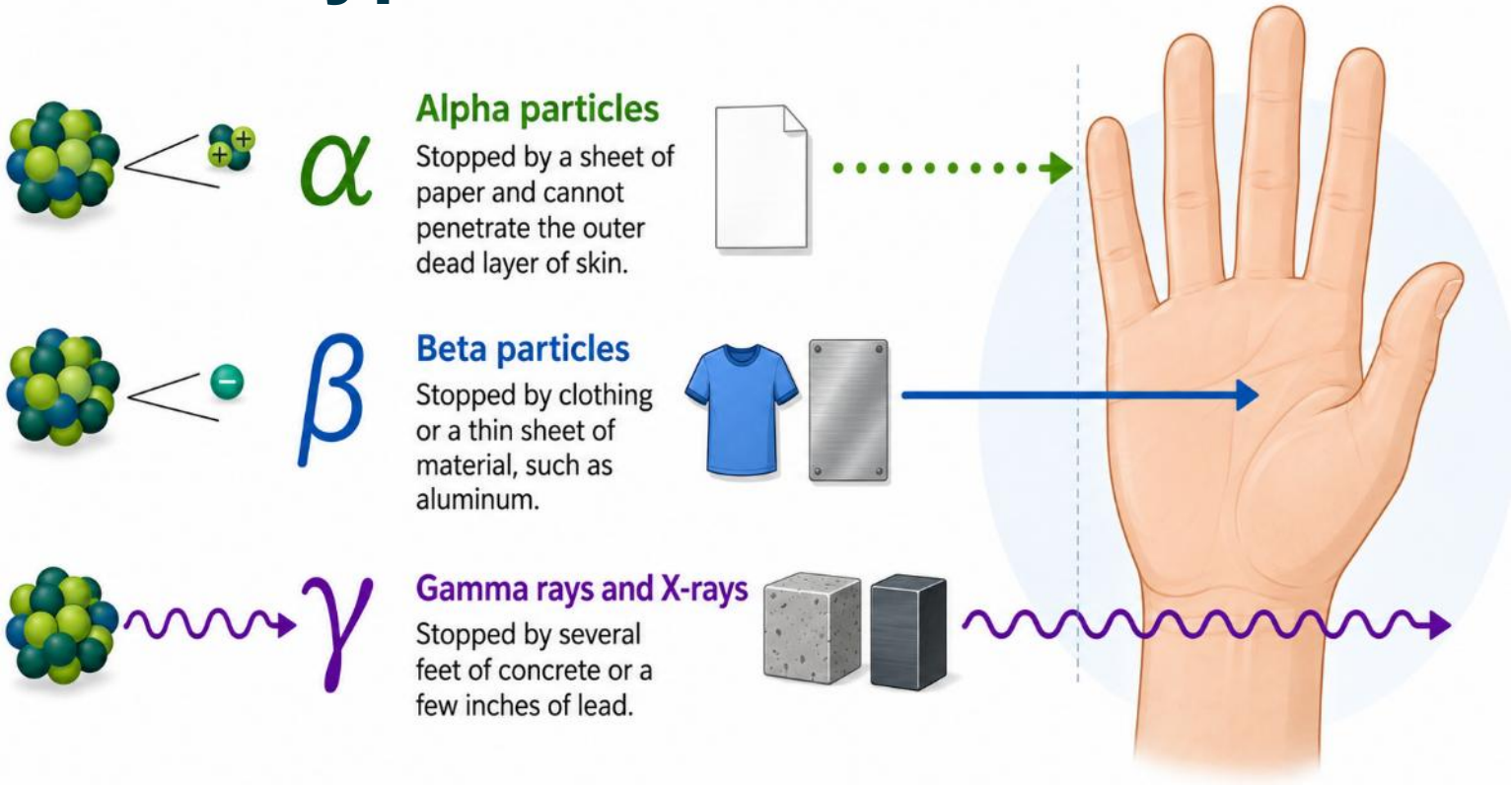
Facility inventories



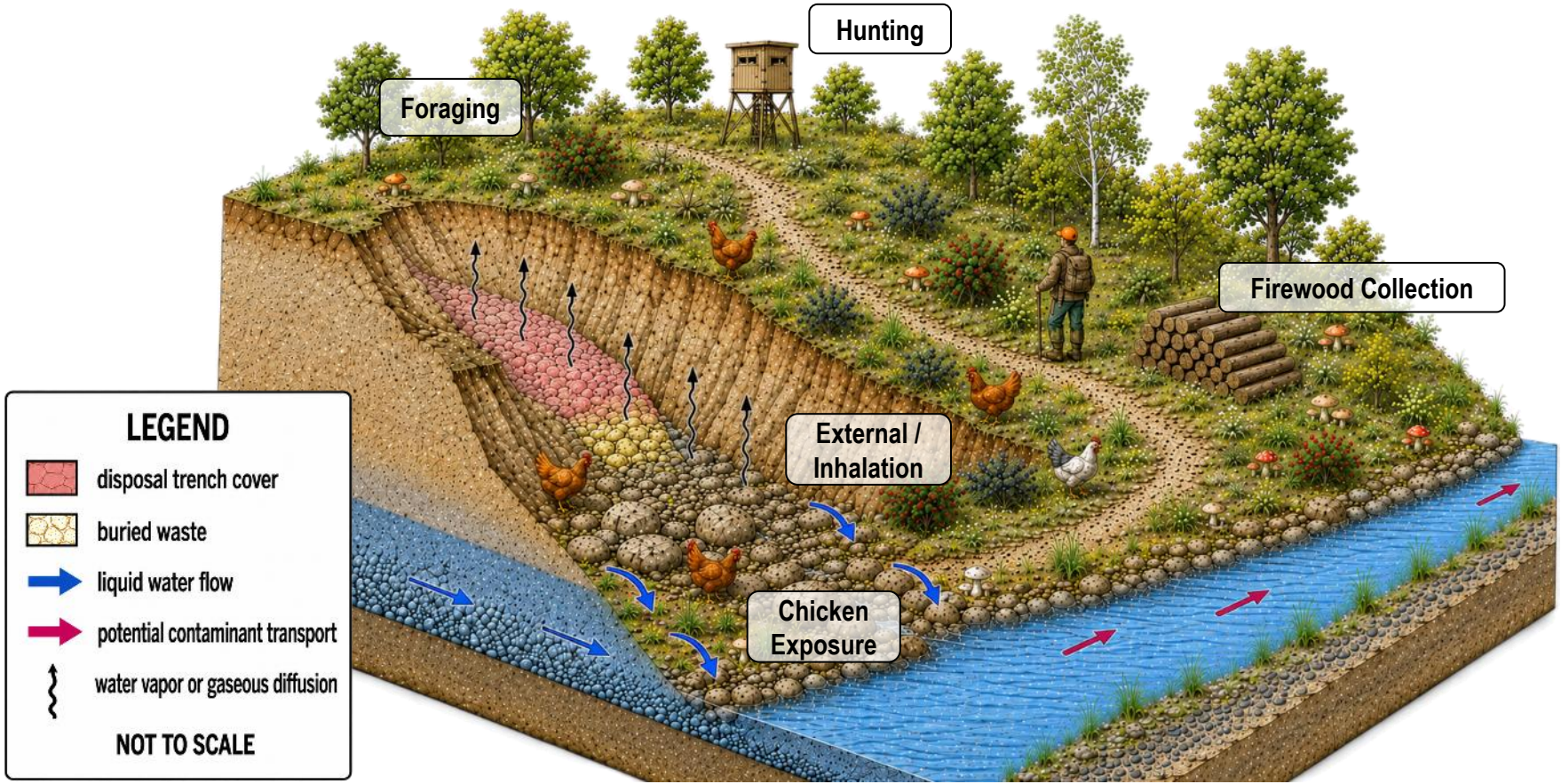
Ex: groundwater → irrigation → plant uptake → produce ingestion

Ex: resident farmer; activities and lifestyle

Types of Radiation

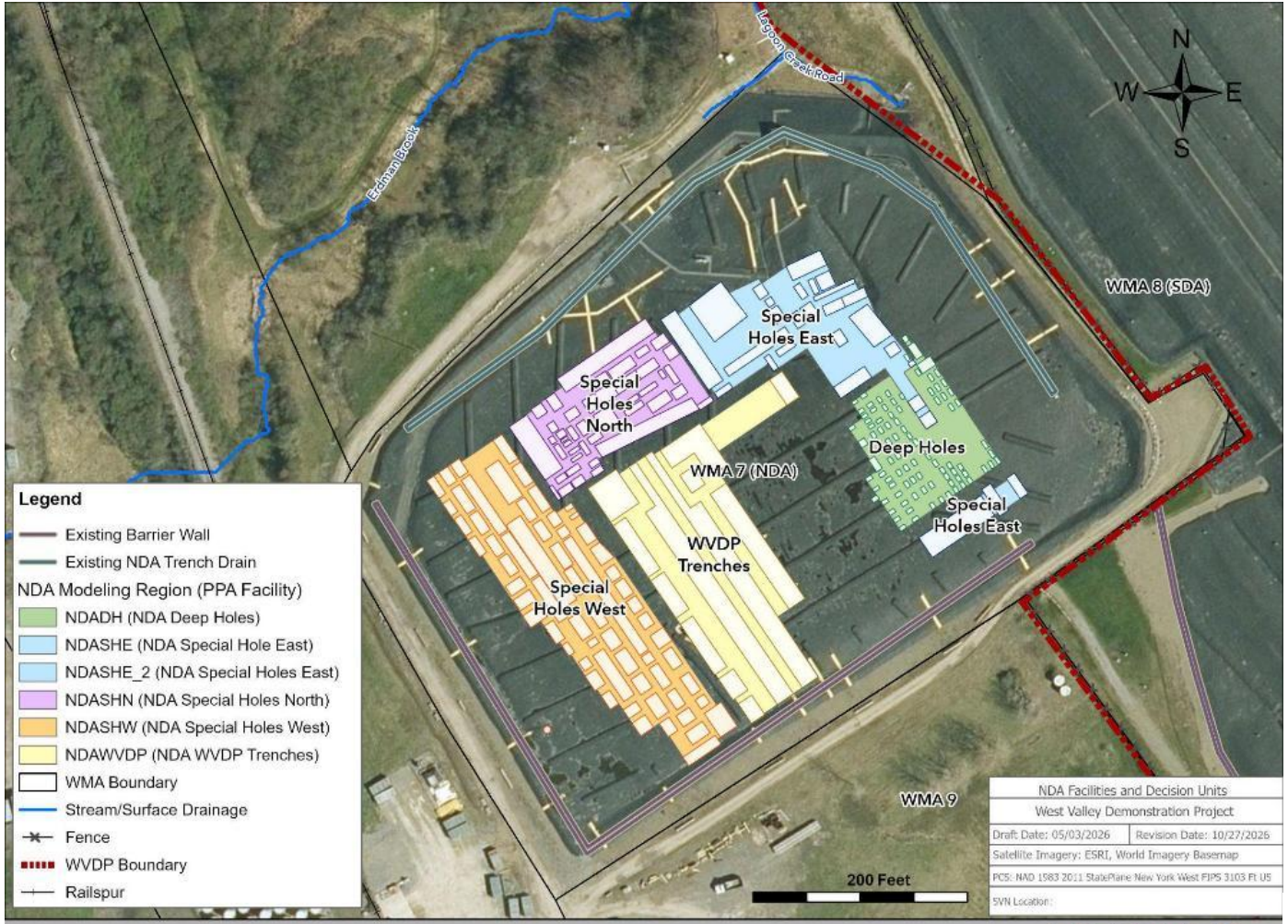


Hillslope Exposure to Onsite Resident Farmer



NDA

1. Hulls, hardware
2. Reprocessing plant waste – equipment, filters, soil
3. WVDP decommissioning waste



WMA 8 (NDA) Facilities

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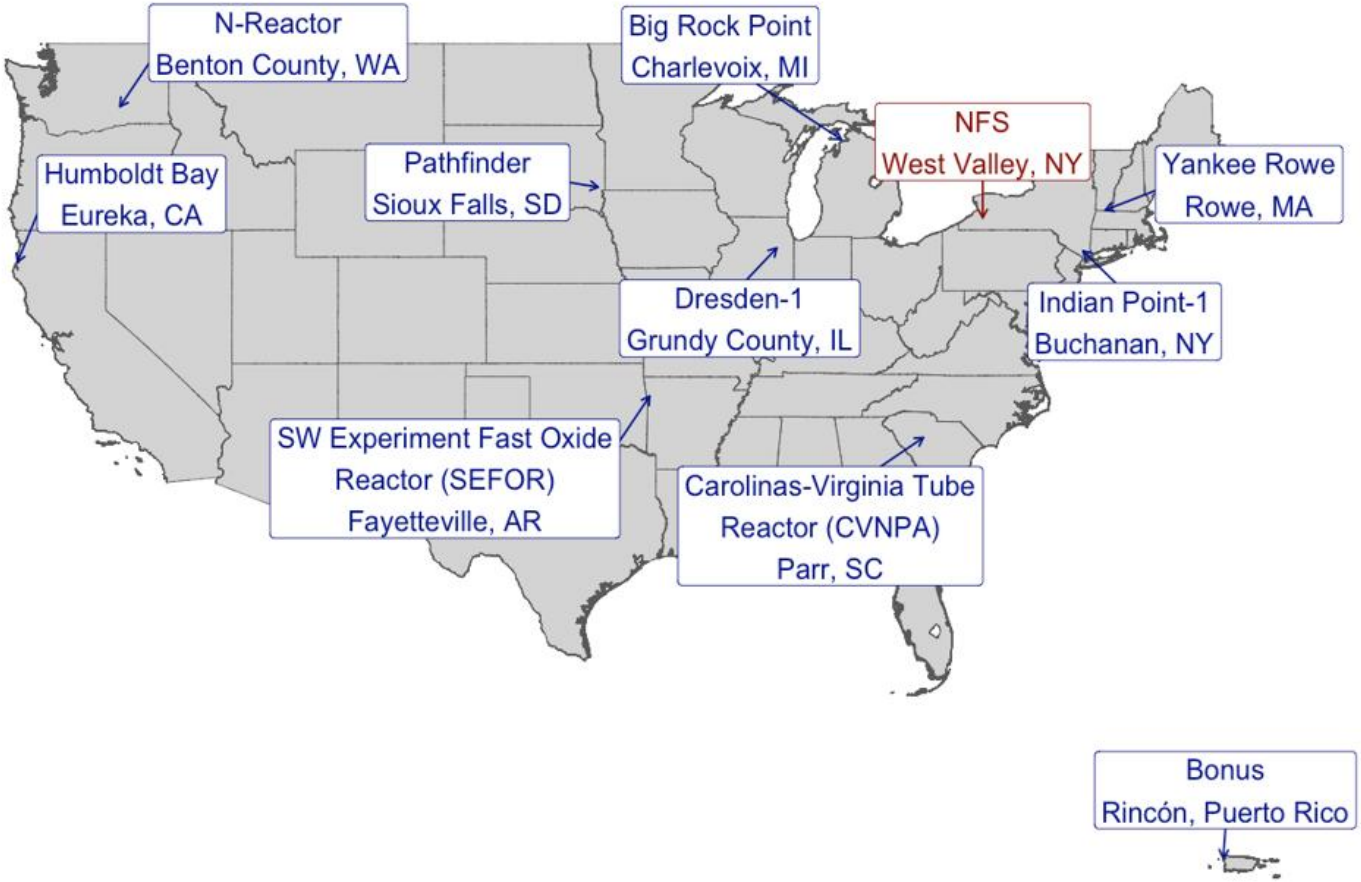
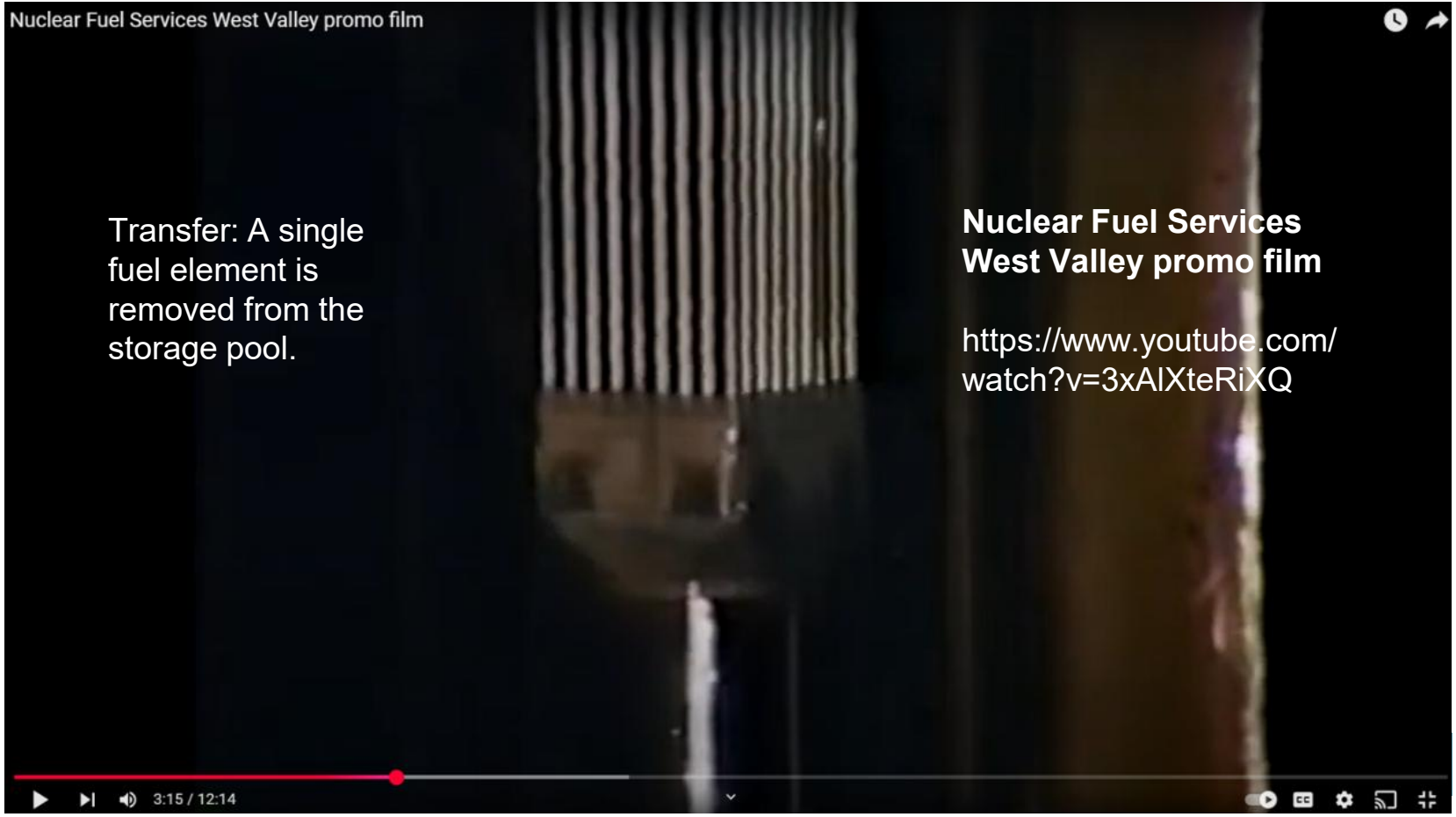
NDA – Hulls and Hardware





https://youtu.be/3xAIXteRiXQ?t=340
- start at 3:00; stop at 4:34. restart at 5:40 until 6:14

NDA – Hulls and Hardware



Transfer: A single fuel element is removed from the storage pool.

Nuclear Fuel Services West Valley promo film

https://www.youtube.com/watch?v=3xAlXteRiXQ

NDA – Hulls and Hardware

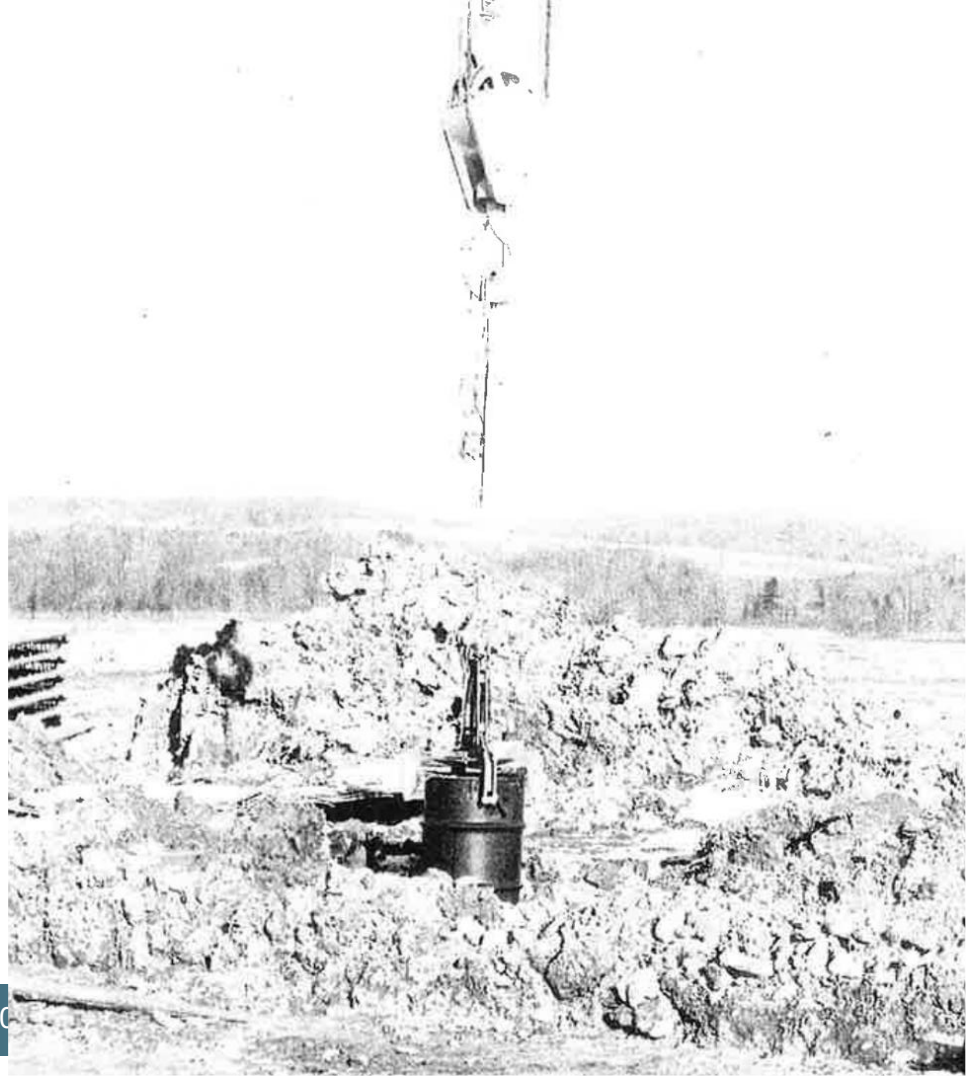


NDA – Hulls and Hardware



Shearing: The fuel bundles are fed into a mechanical shear which chops the rods into short lengths.

NDA – Hulls and Hardware



NDA – Hulls and Hardware

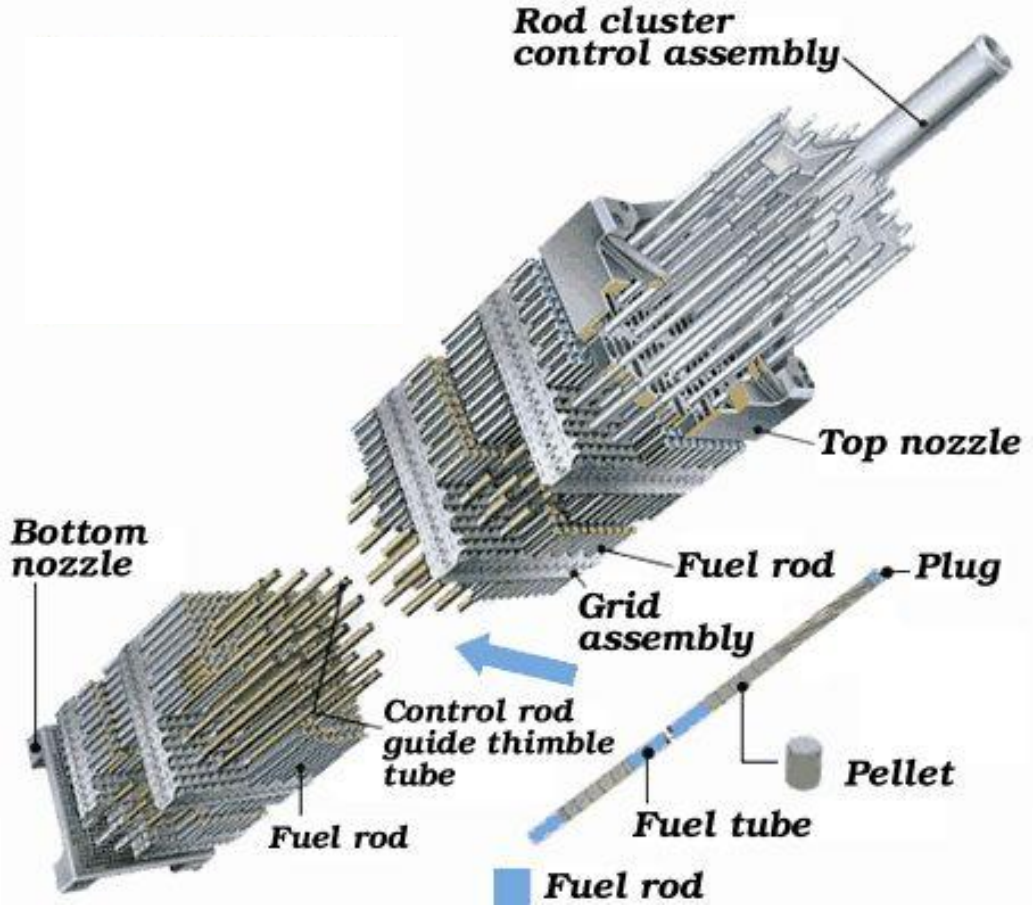
Fuel assembly end fitting





Fuel cladding hulls

NDA – Hulls and Hardware



Schematic of PWR fuel assembly (from World Nuclear Association)

NDA – Hulls and Hardware



Fuel element from N-reactor (wikipedia)

NDA – Reprocessing Plant Waste

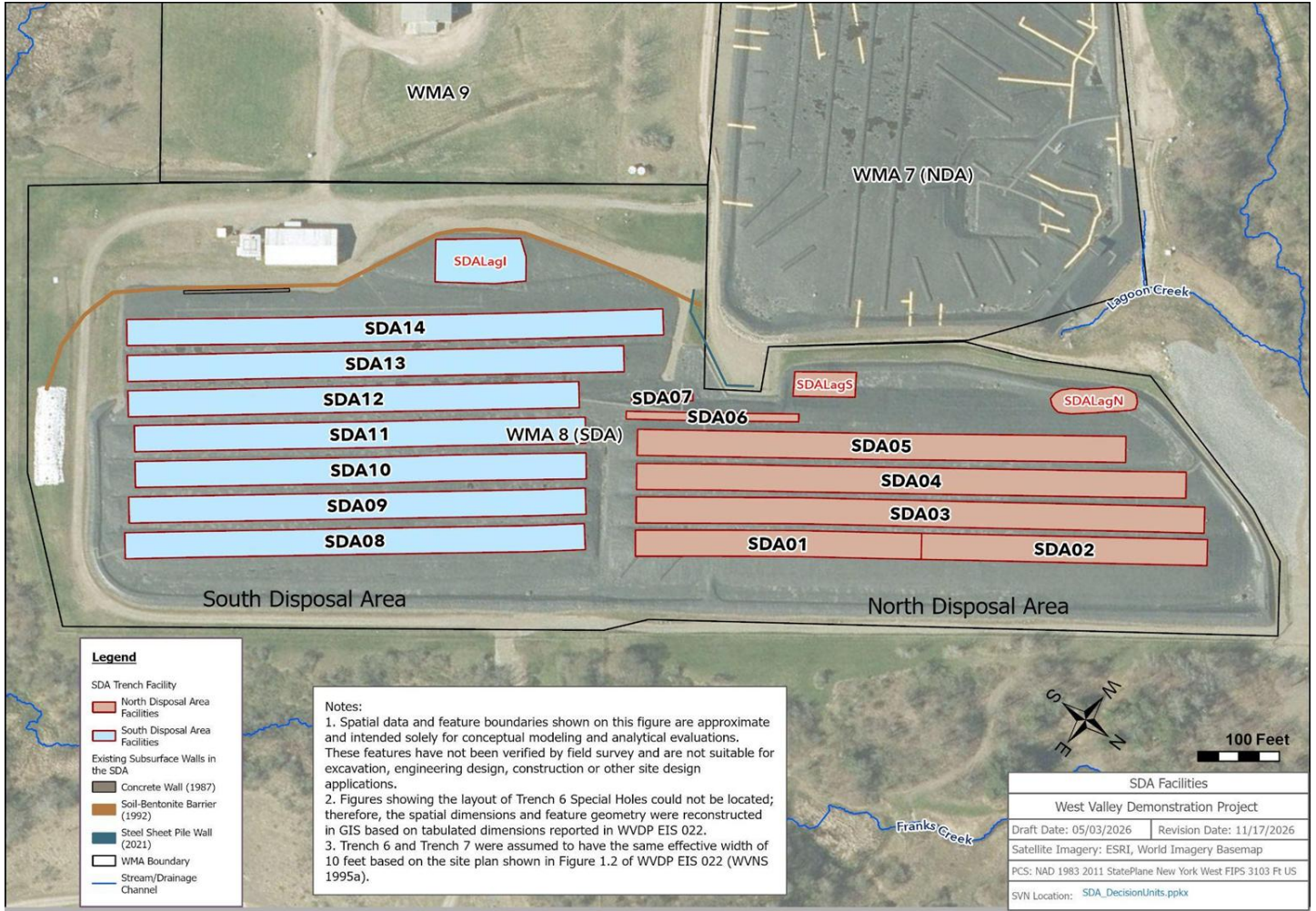
- Hulls and hardware in Deep Holes
- High dose-rate material from the plant
  - Contaminated equipment
  - Filter media (e.g., ion-exchange resins, cartridge filters, air filters)
  - Solidified extractant
  - Soil cleaned up from spills
  - Damaged NPR fuel elements disposed with NRC approval
- Disposed during NFS operational period

NDA – WVDP Decommissioning Waste

- Similar waste forms to reprocessing plant waste; disposed by DOE 1982–1986.
  - Contaminated equipment
  - Filter media
  - Soil cleaned up from spills

SDA

- Low dose-rate material from the reprocessing plant
- Offsite commercial disposal
  - Typically low dose-rate —Trenches 1–5 and 8–14
  - Higher dose-rate materials with regulatory authorization — Trenches 6 and 7
- Unspecified, soil, filters, debris
- Activated metals from nuclear power plants — control rods, thermal shields, core barrel, vessel head, shroud tubes, shims, followers, machine parts, aluminum end fittings, isotope production target tubes, bulk cyclotron scrap
- Sealed sources
- Wastes solidified in concrete or disposed in a concrete container



SDA Trench Facilities

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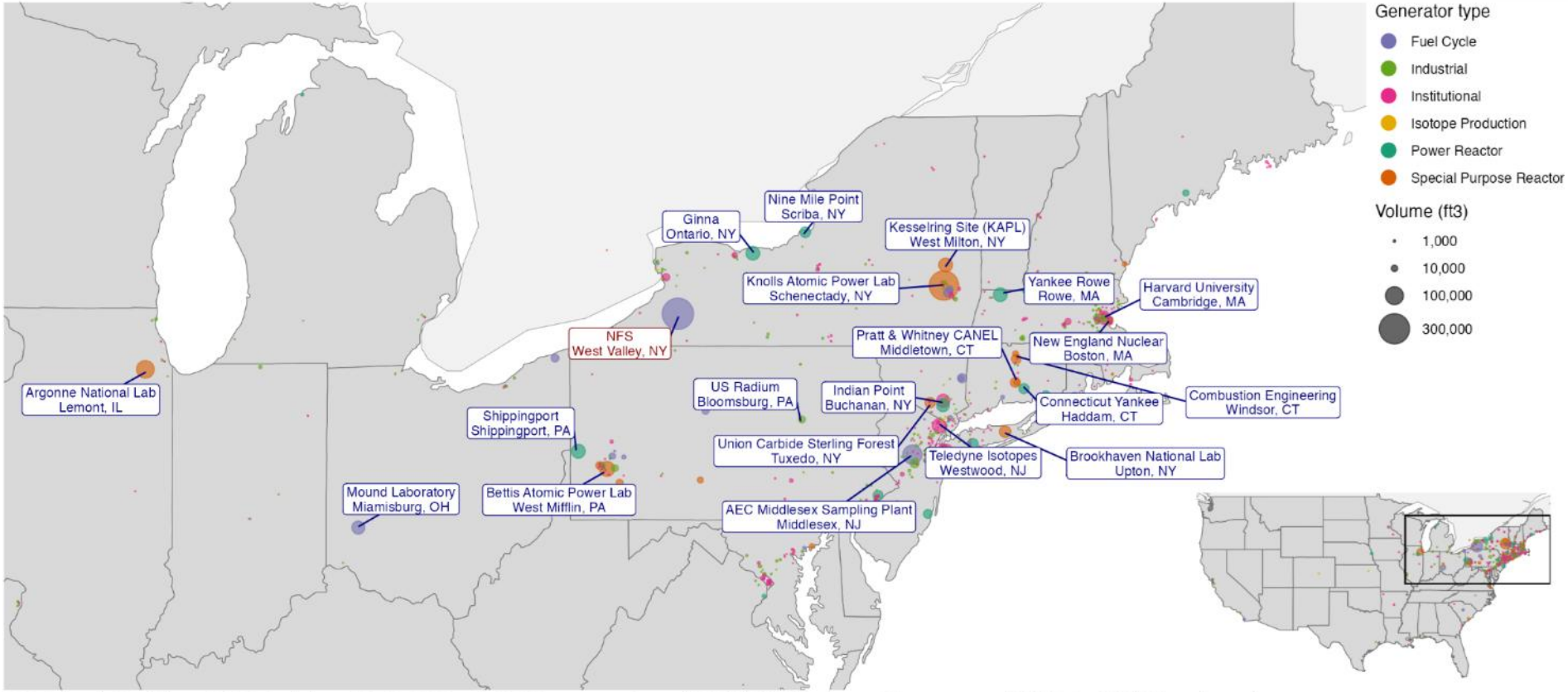
SDA – Generator Map

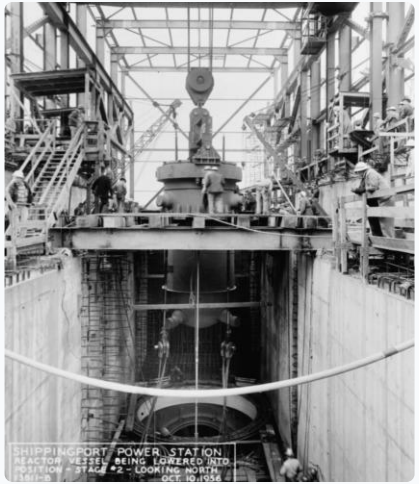


SDA burials, Nov 1963 to Mar 1975. 833 of 1086 generators (SOURCE) placed by name (99.3% of SDA volume).
Labeled: NFS and the 20 largest generators by volume or activity. Not shown: Puerto Rico (BONUS, PR Nuclear Center), McMurdo Station.

SDA Activated Metals



"PWR-2 thermal shield entering vessel, April 11, 1964"



"Reactor vessel being lowered into position, Oct 10, 1956"

Shippingport Reactor. Library of Congress engineering-survey photos, https://commons.wikimedia.org/wiki/Category:Shippingport_Atomic_Power_Station. They show the 1964 Core 2 installation, the same outage that removed the Core 1 parts sent to the SDA, so the parts shown are nearly identical.

Shippingport Reactor Parts

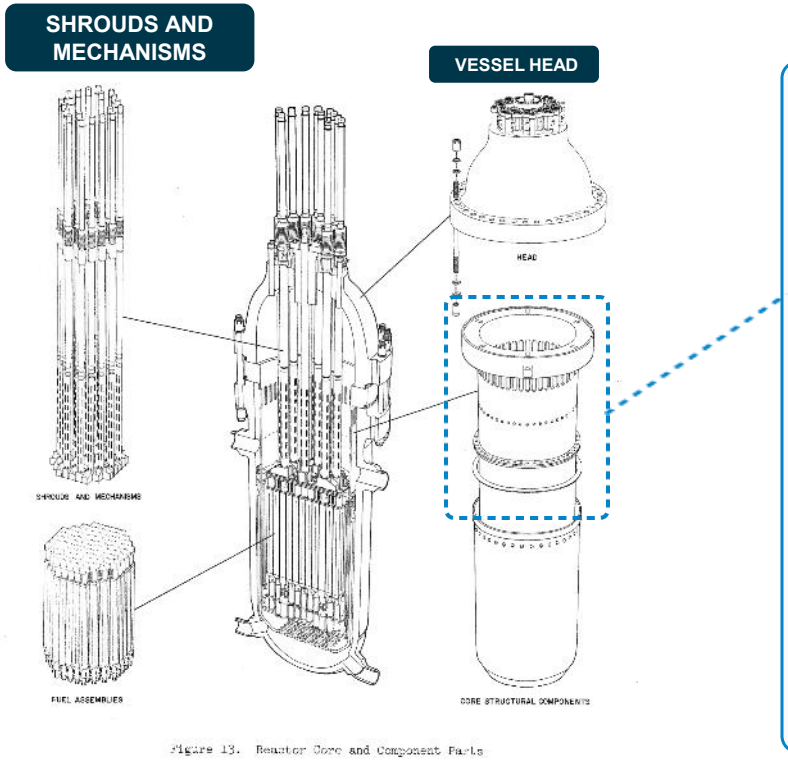
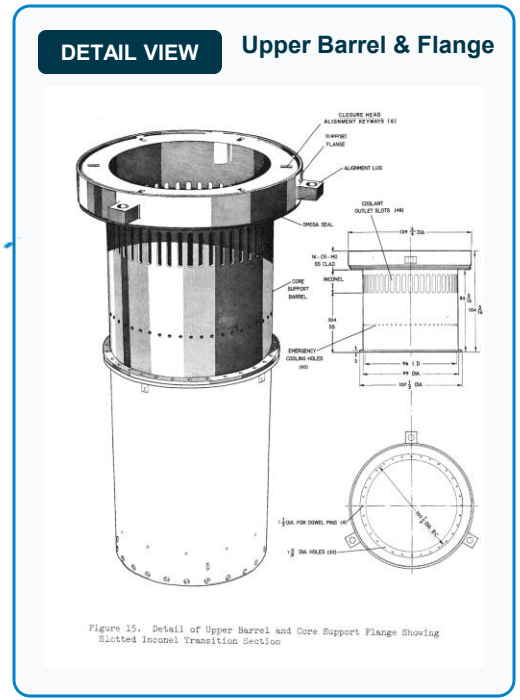


Figure 13. Reactor Core and Component Parts



Shippingport (PWR) reactor core and component parts: vessel cutaway with closure head, core structural components (core barrel and thermal shields), control rod shrouds and mechanisms, and fuel assemblies. Core 2 design shown; Core 1 components shipped to the SDA in 1967 were essentially the same. Source: Atherton et al. 1968, WAPD-296, Fig. 13.

SM-1 Control Rods and Absorbers

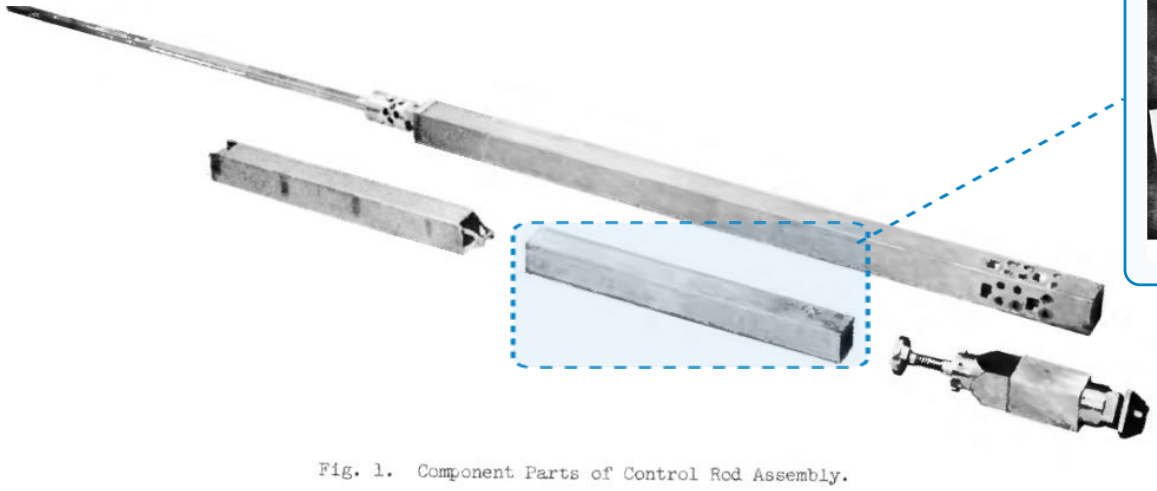


Fig. 1. Component Parts of Control Rod Assembly.

DETAIL VIEW **Absorber Section**

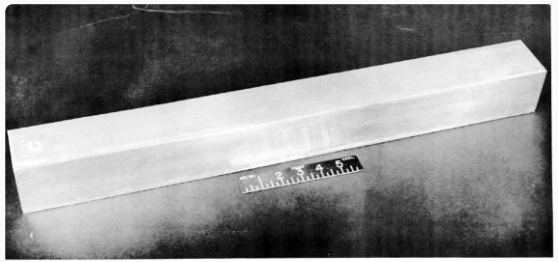


Fig. 2. The Eu_2O_3-Bearing Absorber Section.

SM-1 (army reactor at Fort Belvoir, VA) Core II control rod assembly components (ORNL photo Y-28194). The europium-bearing absorber section is a square tube of four welded Eu_2O_3–stainless steel plates, 2.62 × 2.62 × 26 in. Source: Leitten et al. 1959, ORNL-2733, Fig. 1.

Yankee Rowe Cruciform Blade

EXAMPLE: CRUCIFORM BWR CONTROL BLADE

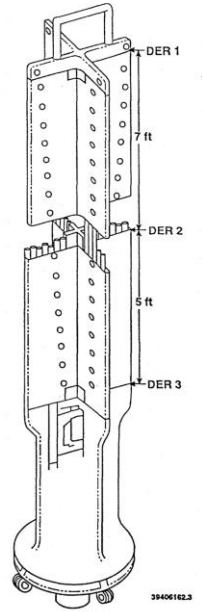


Figure 2.1 Schematic of BWR Cruciform Control Rod Showing Sampling Locations DER-1, DER-2, and DER-3.

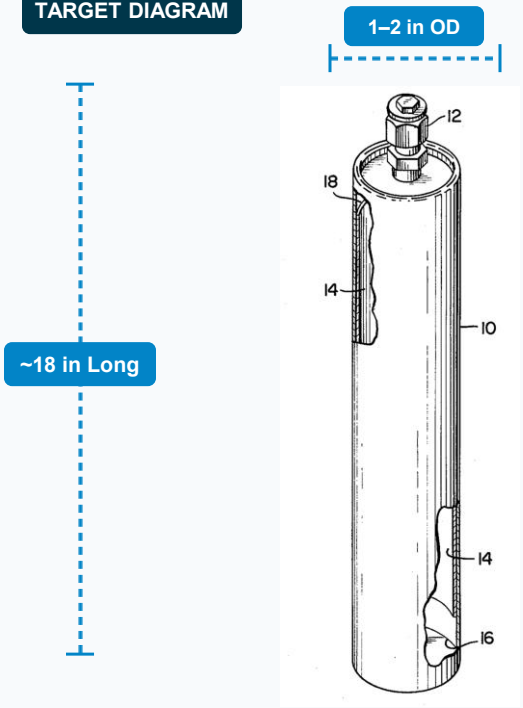
YANKEE ROWE BLADE SPECIFICATIONS

- **Design:** Similar to the Cruciform BWR control blade shape pictured.
- **Dimensions:** 7.865 in. across × 0.265 in. thick; total length ~15 ft (~2× fuel length).
- **Absorber Section:** Ag-In-Cd (later hafnium) absorber section (~92 in. long).
- **Follower:** Zircaloy or stainless steel follower of similar length.

Source: YAEC-136, *The Nuclear Design of the Yankee Core*, Feb 1961 and NUREG/CR-6390, Radiological Characterization of Spent Control Rod Assemblies, Oct 1995)

Union Carbide Target Tubes

TARGET DIAGRAM



TARGET TUBE SPECIFICATIONS

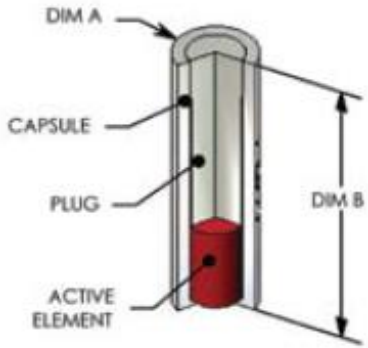
Union Carbide Mo-99 Primary Target

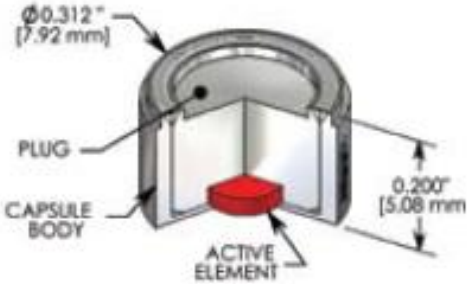
- **Material:** Sealed Type 304 stainless steel tube
- **Dimensions:** About 18 in. long and 1–2 in. OD (Outer Diameter)
- **Internal Coating:** Enriched UO_2 electroplated on the inner wall
- **Operation:** Irradiated, then opened at the port where uranium was dissolved in place

Source: Arino et al., U.S. Patent 3,940,318, Feb. 24, 1976 (assignee Union Carbide Corp.).

Sealed Sources



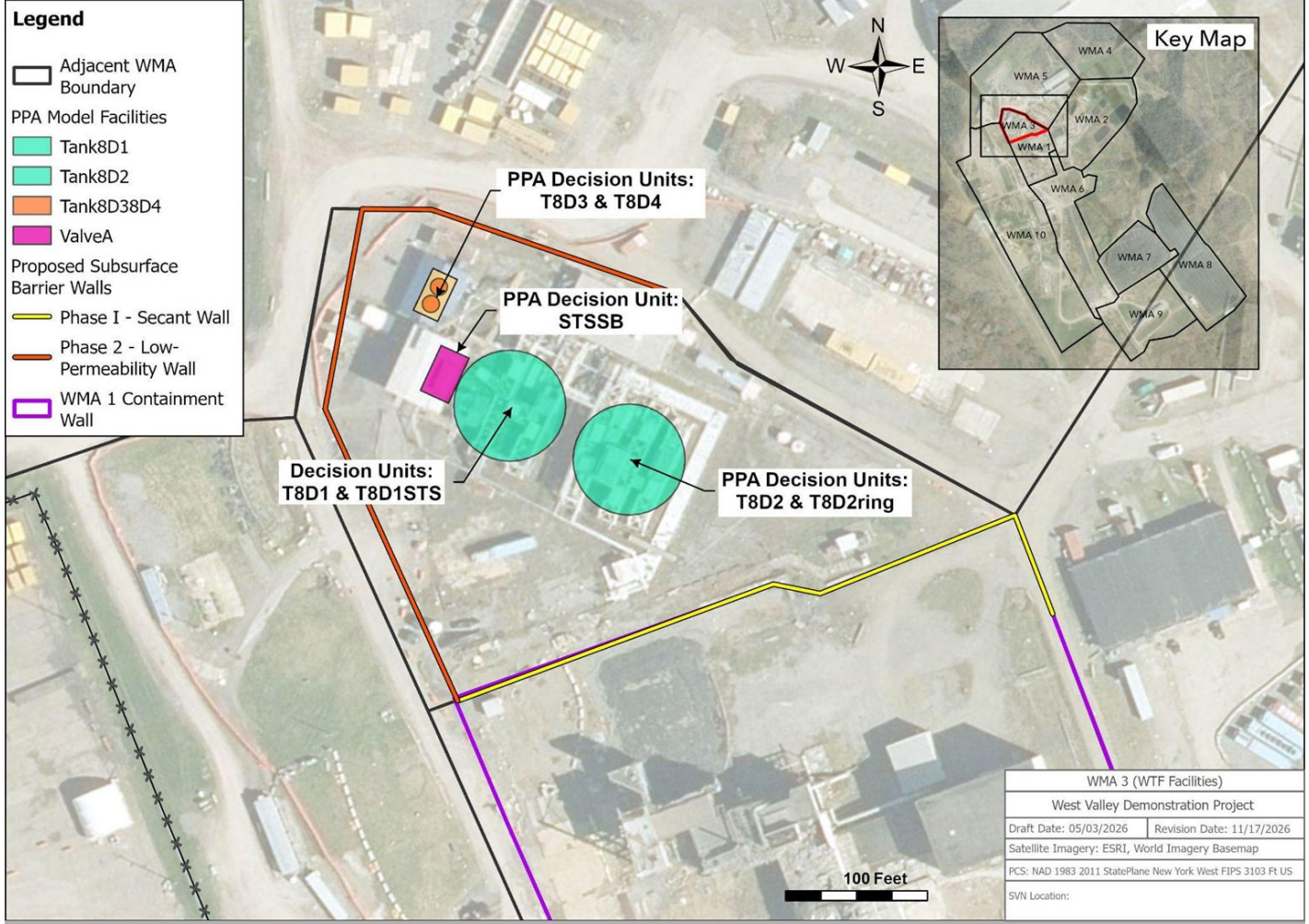




Images published by Eckert & Ziegler Environmental Services

Waste Tank Farm

- Carbon steel Tanks 8D-1 and 8D-2 with surface contamination
- Stainless steel Tanks 8D-3 and 8D-4 with surface contamination
- “Bathtub ring” of scale in Tank 8D-2
- Sludge in Tanks 8D-2 and 8D-4
- Zeolite (filter media) in Tank 8D-1
- Filter columns in Tank 8D-1
  - Supernatant Treatment System — removed Cs from tank liquids to permit some liquids to be solidified as low-level radioactive waste (LLRW)
  - Stainless steel vessels hung from the vault roof, with zeolite filter media in them



WMA 3 Facility Map: Waste Tank Farm

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SHIELD STRUCTURES

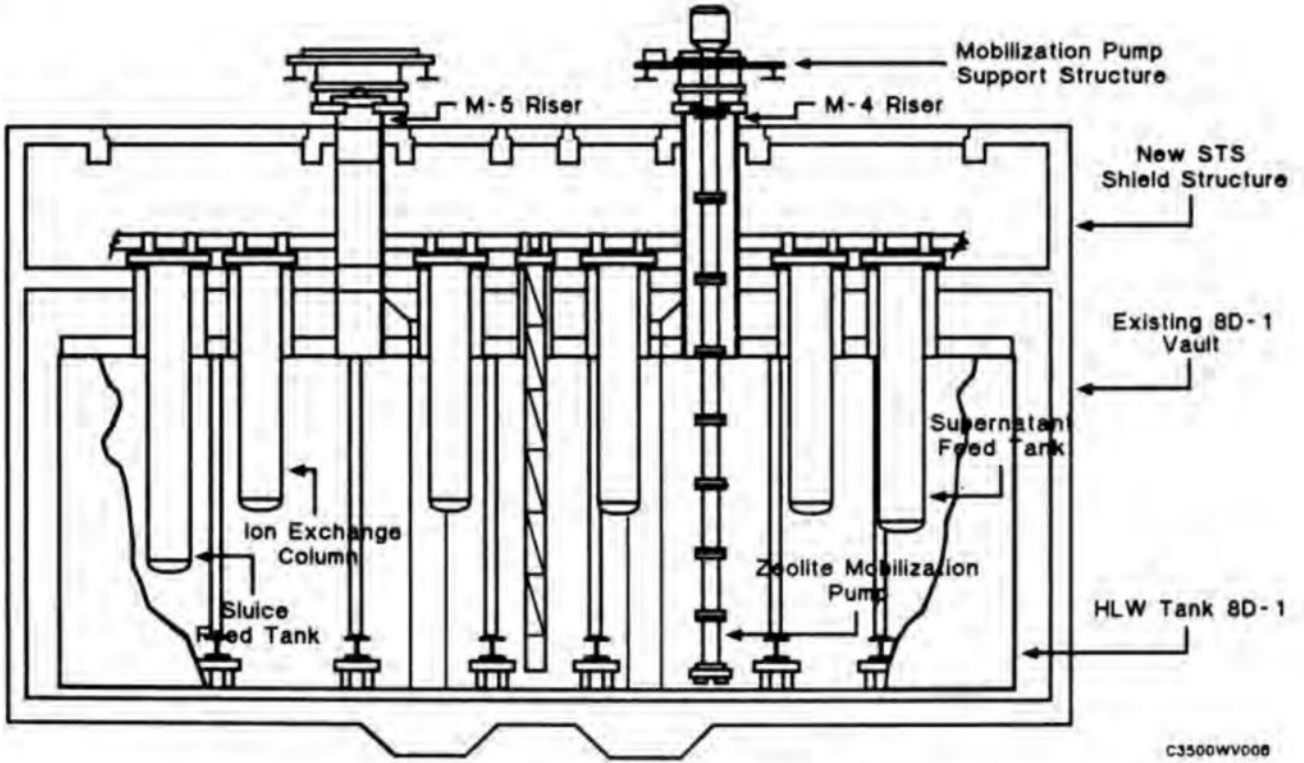

Fig. 4. Elevation View of STS Process Equipment.

What's Next

- Radioactivity for different types of waste forms
- Allocate to persistent objects vs. bulk soil
- Modeling risk from different waste forms