ICP

IDAHO CLEANUP PROJECT

Collection and safekeeping of TRIGA® Spent Nuclear Fuel

Presented by

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2013

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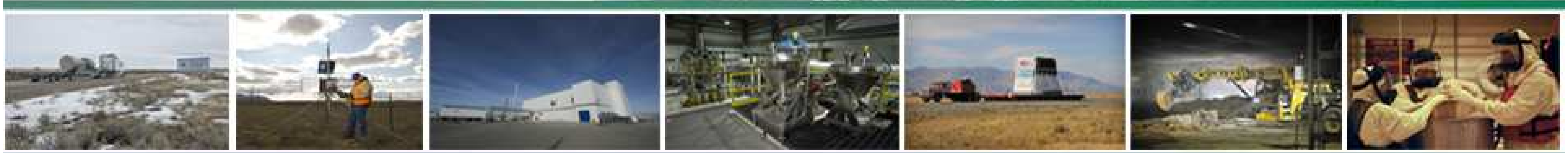
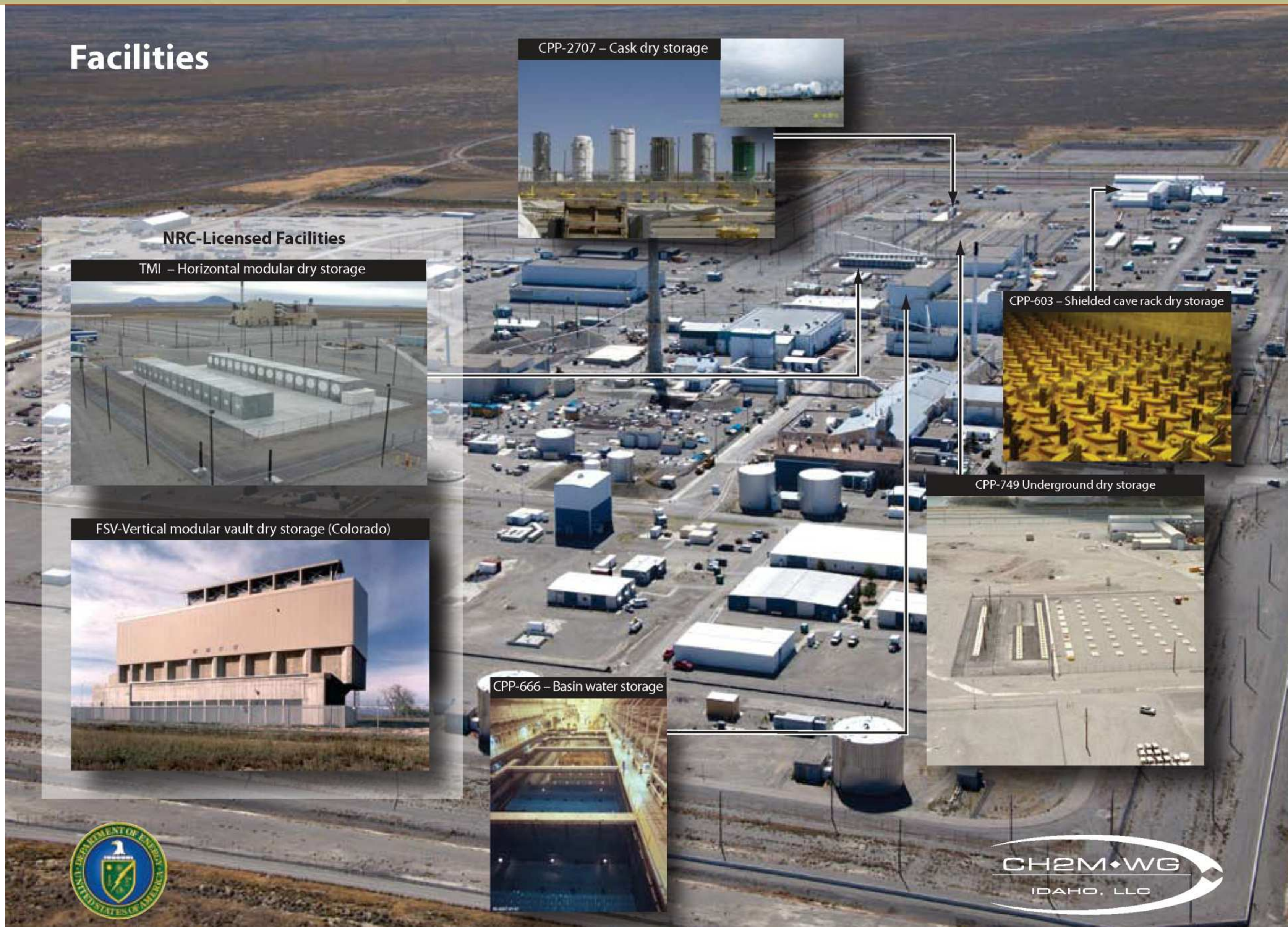


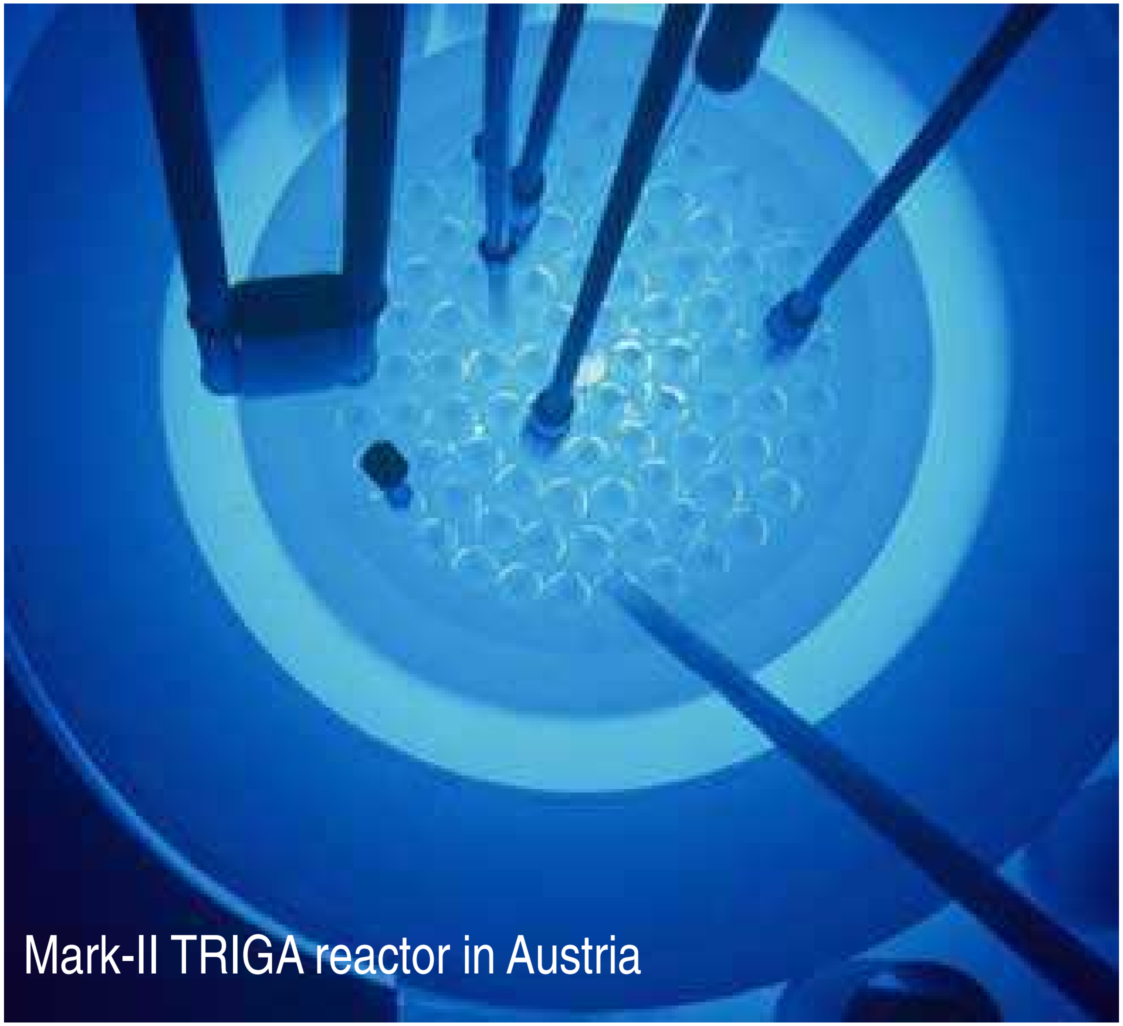
SAFELY PLAN • MOTIVATE • DELIVER

Spent Nuclear Fuel at the Idaho Cleanup Project



Atoms for Peace

- **Since the 1950s, the United States has provided peaceful nuclear technology to foreign nations in exchange for their commitment to only use this technology for energy and research purposes.**
  - Medical isotope production
  - Research and Education
  - Geological/archeological isotopes
  - Training – reactor operators, radiation control technicians, anti-terrorism



Mark-II TRIGA reactor in Austria

Atoms for Peace, continued

- International Atomic Energy Agency created by Atoms for Peace Program.
- Under Atoms for Peace, DOE is the organization tasked with the responsibility for the collection, safekeeping, and eventual disposition of U.S. origin spent nuclear fuel.
- Reasons for returning the fuel include reactor closure, spent fuel storage limitations, and conversion of a reactor from high enriched uranium to low enriched uranium.

TRIGA® Spent Nuclear Fuel

- TRIGA® stands for Training, Research, Isotopes, General Atomics. (TRIGA® is manufactured by General Atomics)
- TRIGA® fuel is used in over 60 American and international research reactors at universities and institutes around the world.

Idaho site receives 1-5 shipments of FRR/DRR each year. Since 1999, Idaho has received shipments from:

Domestic research reactor fuel (DRR)

- State University of New York
- Texas A&M
- University of Wisconsin
- Oregon State
- Washington State
- California
- Reed College
- INL Neutron Radiography Laboratory
- University of Illinois
- Cornell University

Foreign research reactor fuel (DRR)

- Austria
- England (closed)
- Germany (closed)
- Indonesia
- Italy
- Japan (closed)
- Mexico
- Romania
- S. Korea (closed)
- Slovenia

Process: Inspection

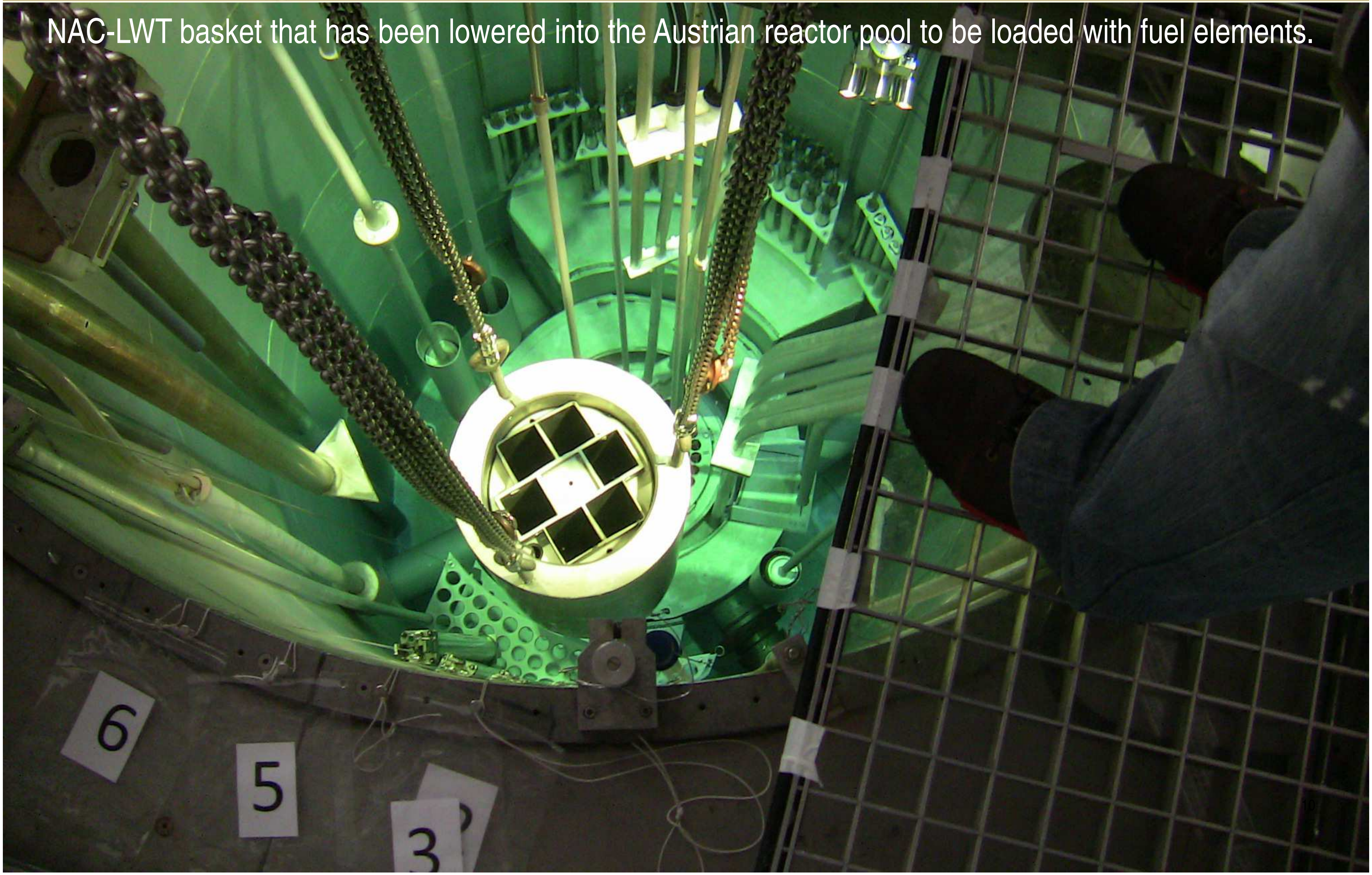
Certified fuel examiners visit the research reactor at Oregon State University to examine fuel before it is packaged for shipment.

Process: Inspection

Process: Documentation

- **Results of the inspection (fuel condition, serial number) and historical data from reactor facility, is used to develop Required Shippers Data (RSD) documentation**
- **RSDs reviewed by Idaho Cleanup Project:**
  - Safety analysis
  - Criticality safety
  - Engineering
  - Packaging and transportation
  - Radiation control
  - Quality assurance
  - Fuel receipt coordinator
  - Safeguards
  - Environmental safety
  - Systems engineering
  - Materials and technology
  - Nuclear engineering
  - Fuel receipt facilities and operations
- **These groups develop site-specific documentation following this review.**

Process: Documentation



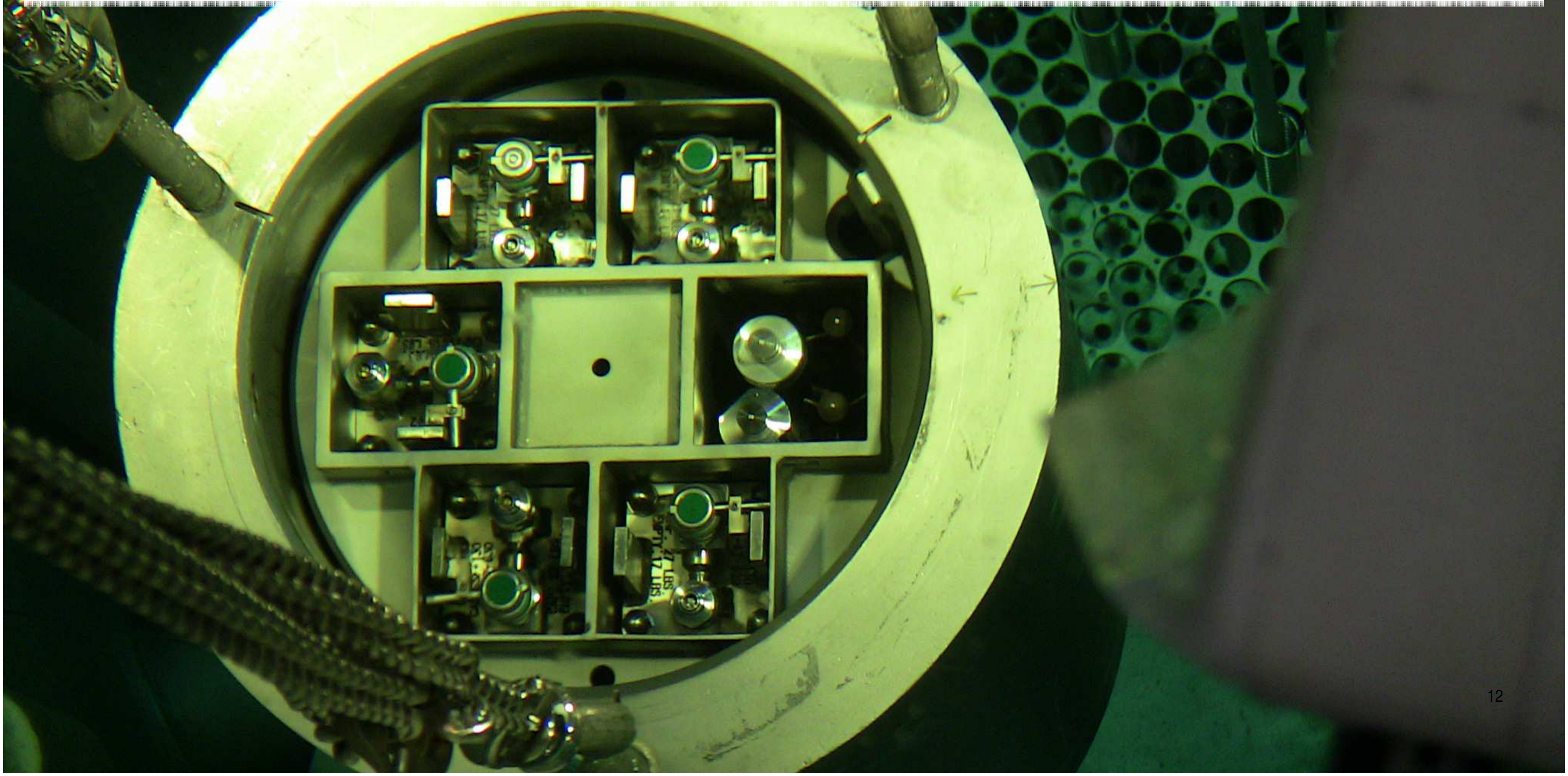
NAC-LWT basket that has been lowered into the Austrian reactor pool to be loaded with fuel elements.

Process: Payload planning

- **Careful planning is required to determine the fuel elements to be shipped, and how they will be configured in the shipment and for storage at INTEC.**
- **Nuclear Regulatory Commission and/or the Department of Transportation oversee cask transportation within the U.S.**
- **International Atomic Energy Agency (IAEA) oversees foreign transport.**
- **ICP foreign/domestic research reactor team works with shipper to determine:**
  - Allowable amounts of fuel in each cask,
  - How it will be packaged,
  - Weight,
  - Decay heat that will be produced, and
  - Verification that all receipt and storage requirements are met.

Process: Payload planning

In the Austrian reactor, the NAC-LWT basket has been loaded with elements and sealed failed fuel cans and is ready to receive the lid and be transferred to the shipping cask.



Process: Packaging

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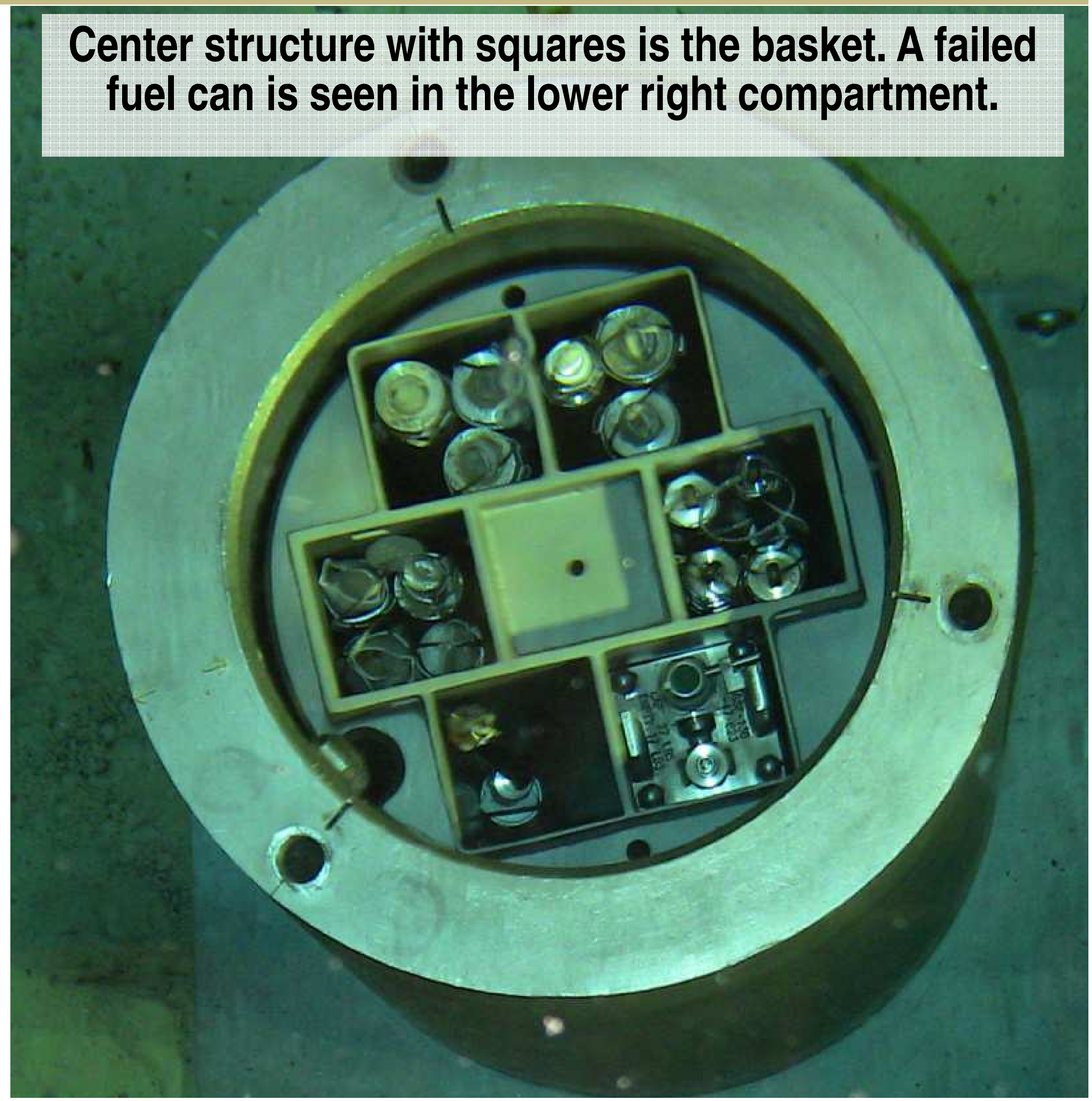
- Fuel elements are inserted in a basket. Defective fuel elements are placed in a “failed fuel” can (purged, backfilled with helium and sealed).
- Transport cask (NAC-LWT) can hold up to 120 TRIGA® fuel elements.
- Time, distance, shielding – critical parameters for handling TRIGA® .

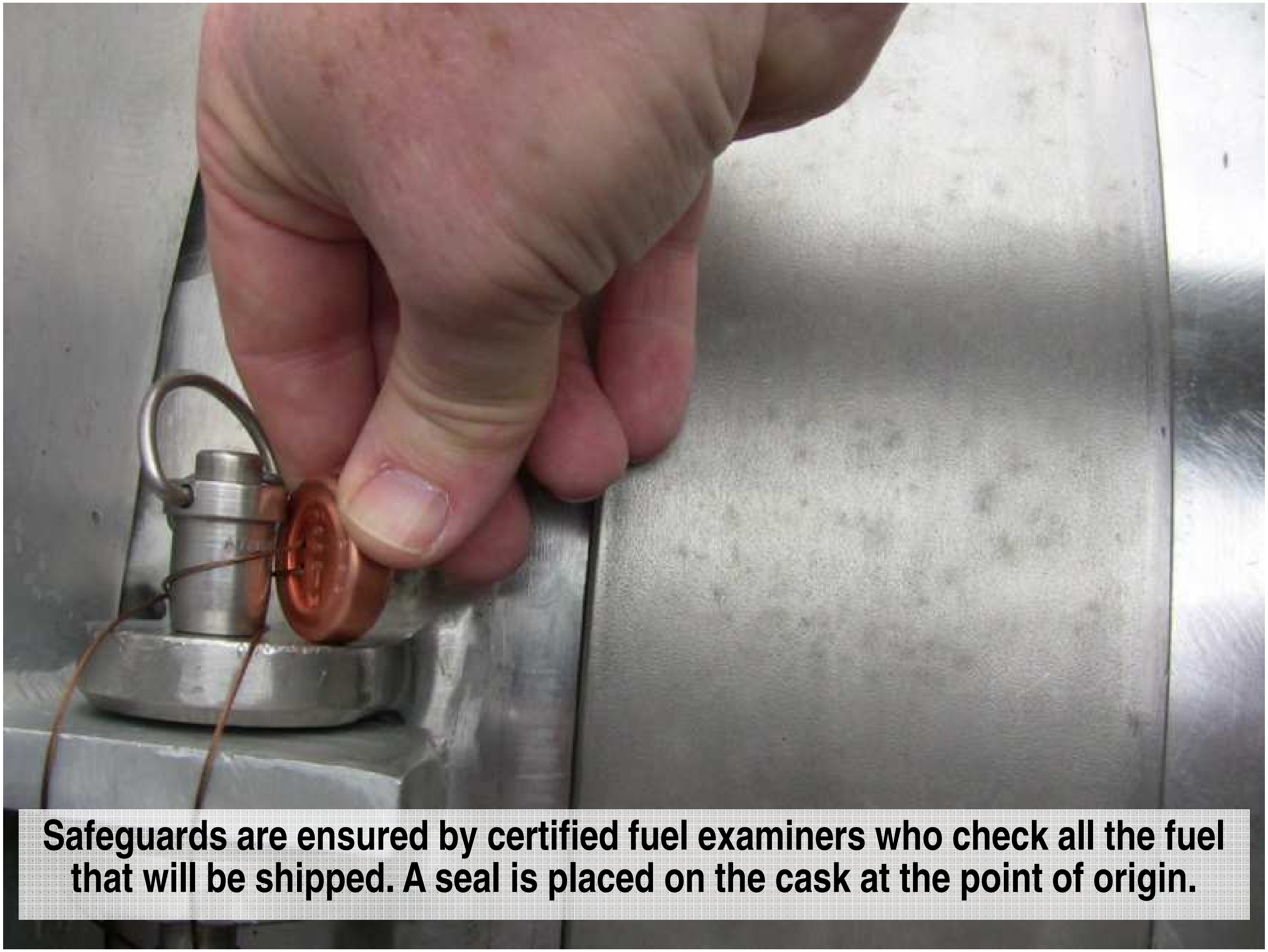


Center structure with squares is the basket. A failed fuel can is seen in the lower right compartment.

Process: Shipment

The cask is loaded in an ISO container for shipment.

Process: Shipment



Safeguards are ensured by certified fuel examiners who check all the fuel that will be shipped. A seal is placed on the cask at the point of origin.

E10200302OBDS

Process: Shipment

The seal is removed when it reaches INTEC.

Fuel arrival at Idaho Site

Cask/ISO arrives by truck at Idaho Site.

The ISO shipping container is lifted off the trailer by crane. Left, operators guide the container into place for cask removal.

Fuel arrival at Idaho Site

The ISO lid has been removed. Workers are removing the cask impact limiters.

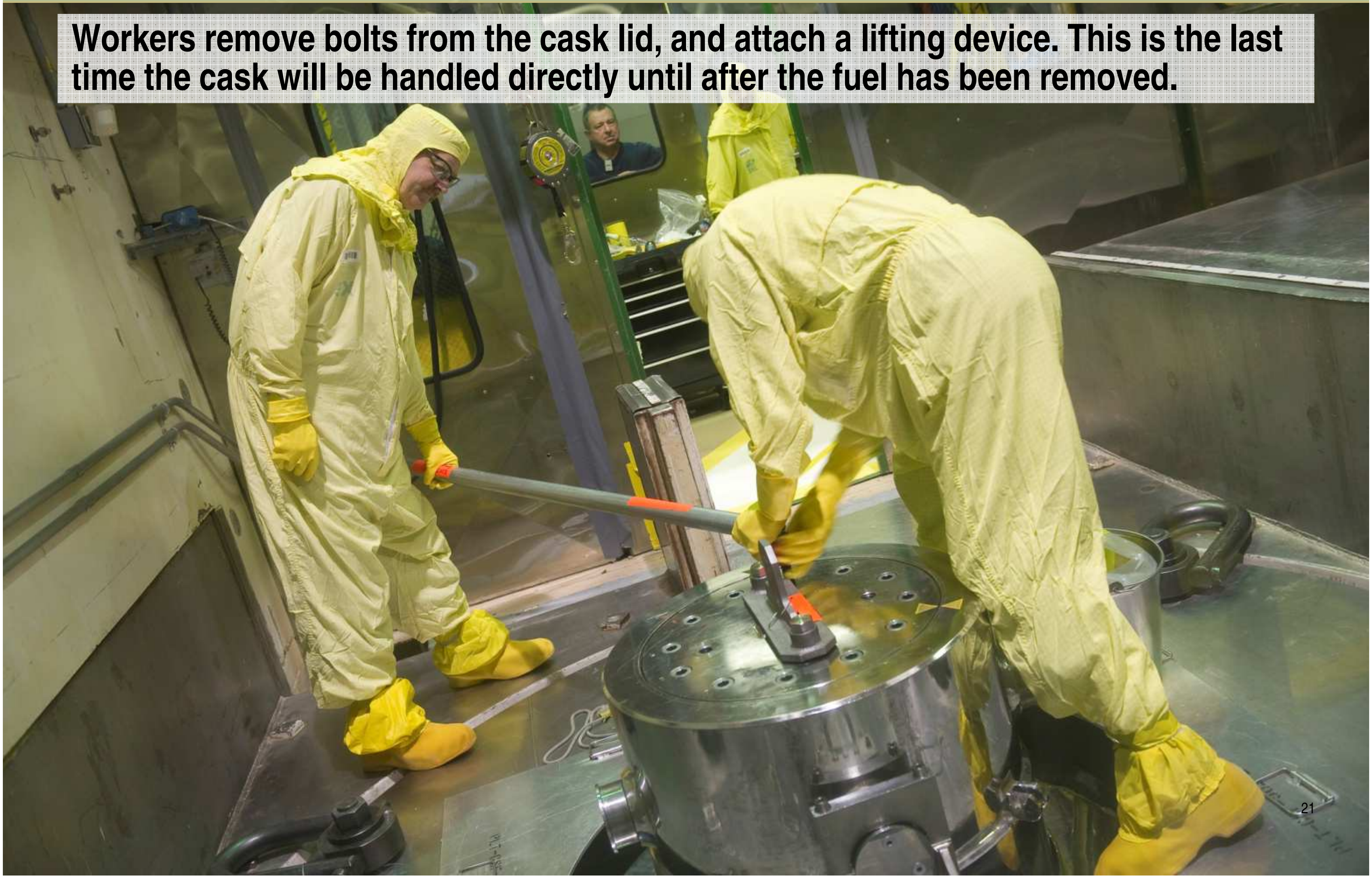
Fuel arrival at Idaho Site

The cask is moved by crane into the permanent containment structure. From there, it will be transferred into the remote fuel handling cell.

Fuel arrival at Idaho Site

The cask is surveyed by a radiation control technician after it has been vented.

Fuel arrival at Idaho Site



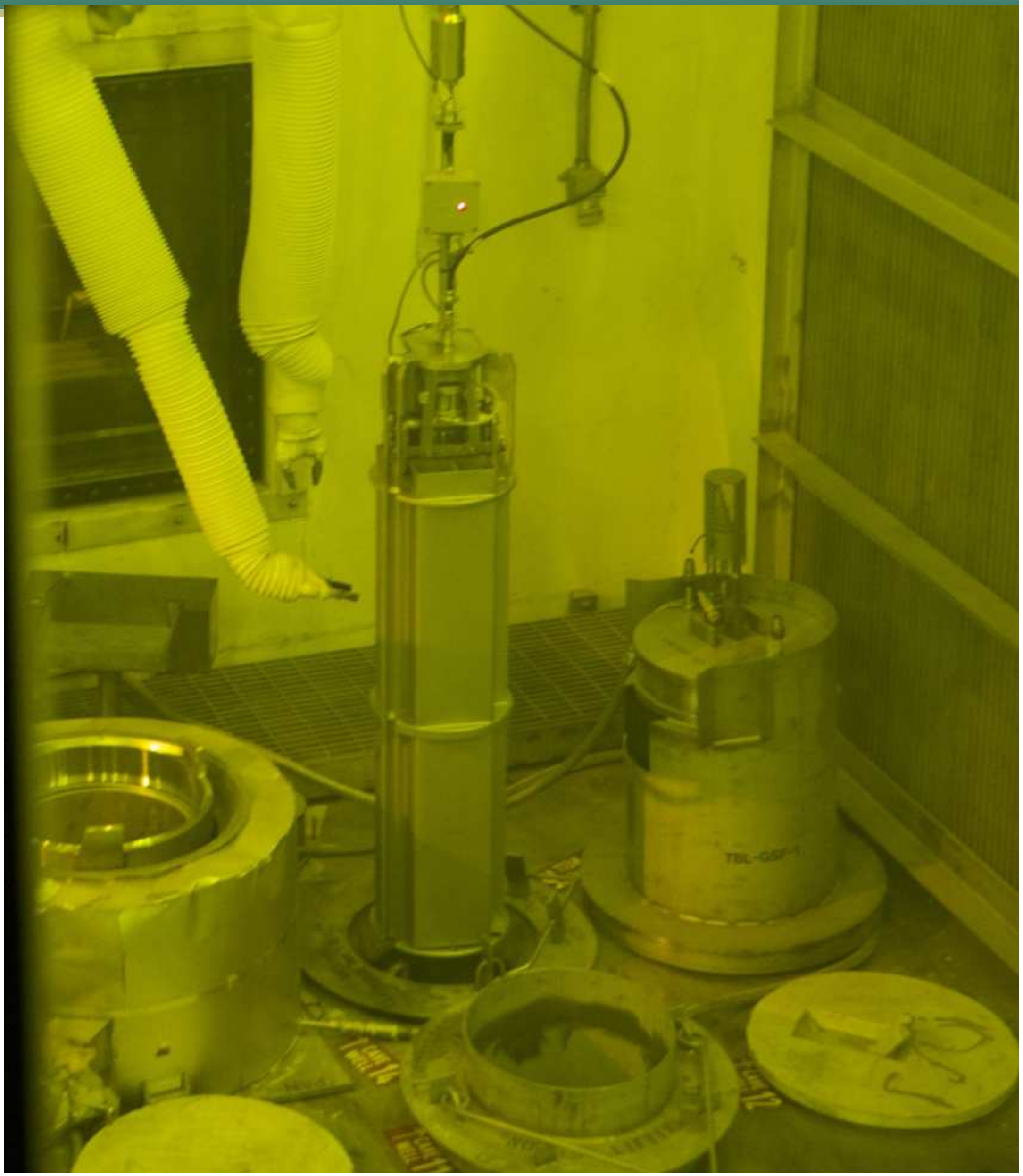
Workers remove bolts from the cask lid, and attach a lifting device. This is the last time the cask will be handled directly until after the fuel has been removed.

Transfer to Interim Storage

Operators use camera monitors and the view through the window to their left to guide fuel movement from shipping cask to storage canister.

Transfer to Interim Storage

The basket (center) has been lifted from the cask. To reduce the amount of handling of individual fuel elements, they are placed into fuel storage canisters, still in the baskets and cans they were shipped in.



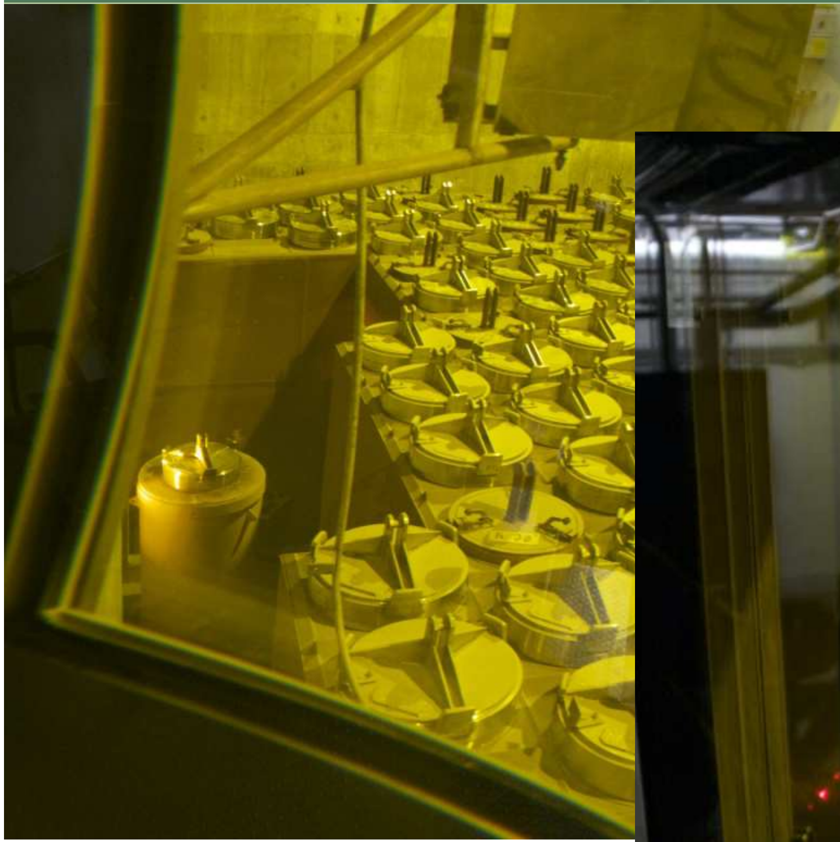
Transfer to Interim Storage

An operator uses a remote manipulator to assist transferring the fuel from the cask to the storage canister.

Transfer to Interim Storage

The operator's view through the shielded window.

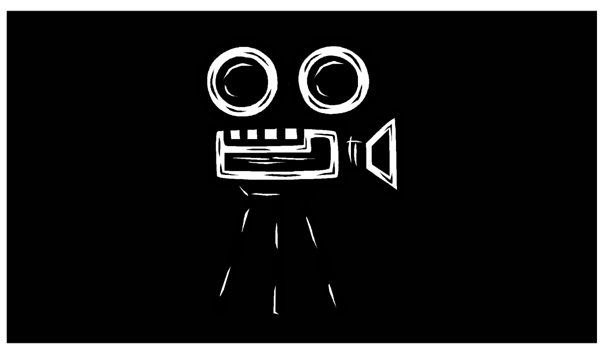
Transfer to Interim Storage



The loaded fuel storage canister is transferred to the Irradiated Fuel Storage Facility Array.

Conclusion

- **All FRR/DRR received at the Idaho Site is placed in interim dry storage in the Irradiated Fuel Storage Facility at CPP-603.**
- **End date for receipt of foreign fuel under the Atoms for Peace program is 2019.**
  - Completed Mexico and Austria in 2012
- **Foreign and domestic entities wishing to return TRIGA® fuel to the United States must initiate and coordinate their request through DOE.**
- **Per the 1995 Settlement Agreement between the state of Idaho, U.S. Navy, and the U.S. Department of Energy, all spent nuclear fuel must leave Idaho by 2035.**



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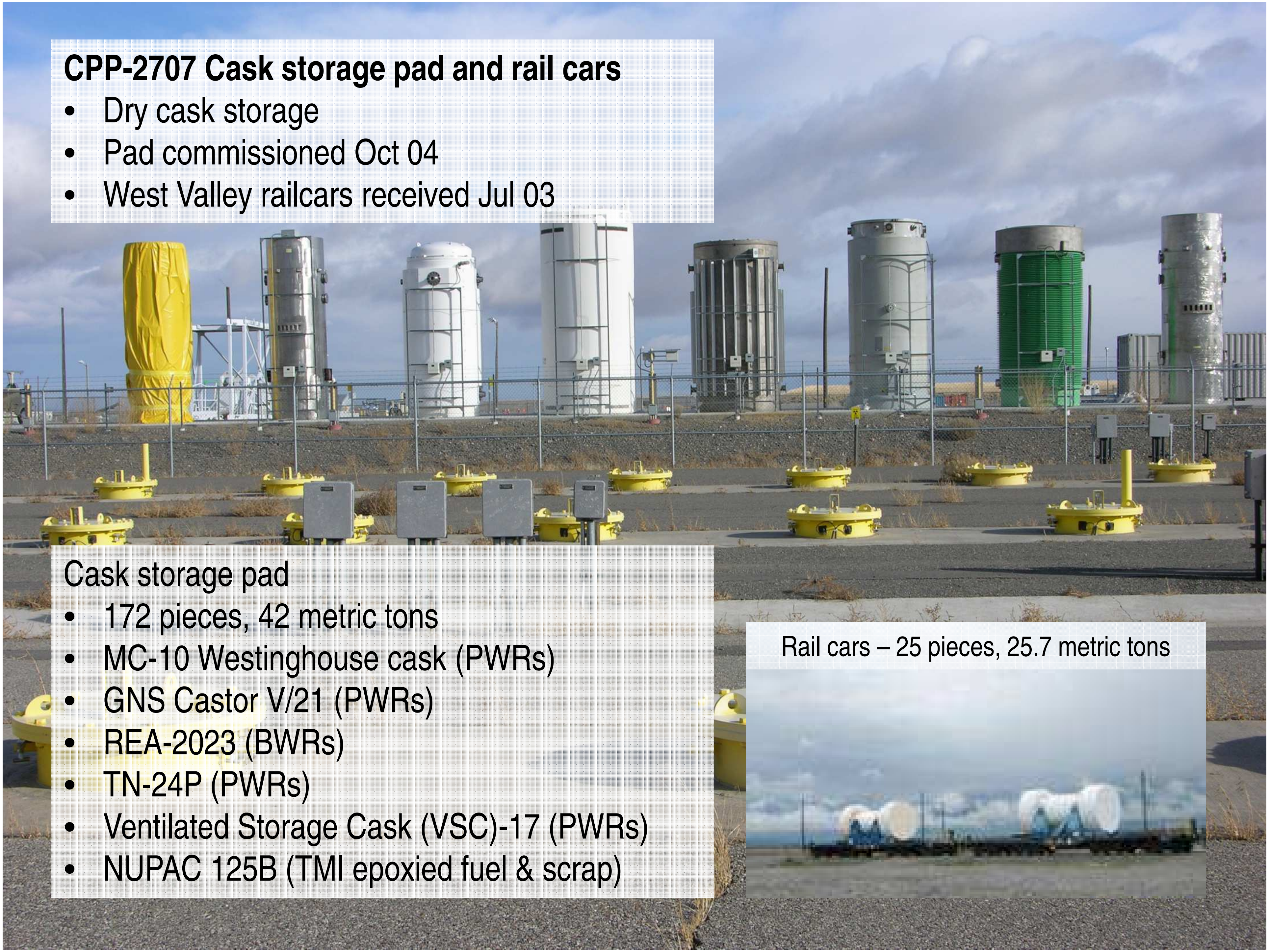


CPP-2707 Cask storage pad and rail cars

- Dry cask storage
- Pad commissioned Oct 04
- West Valley railcars received Jul 03

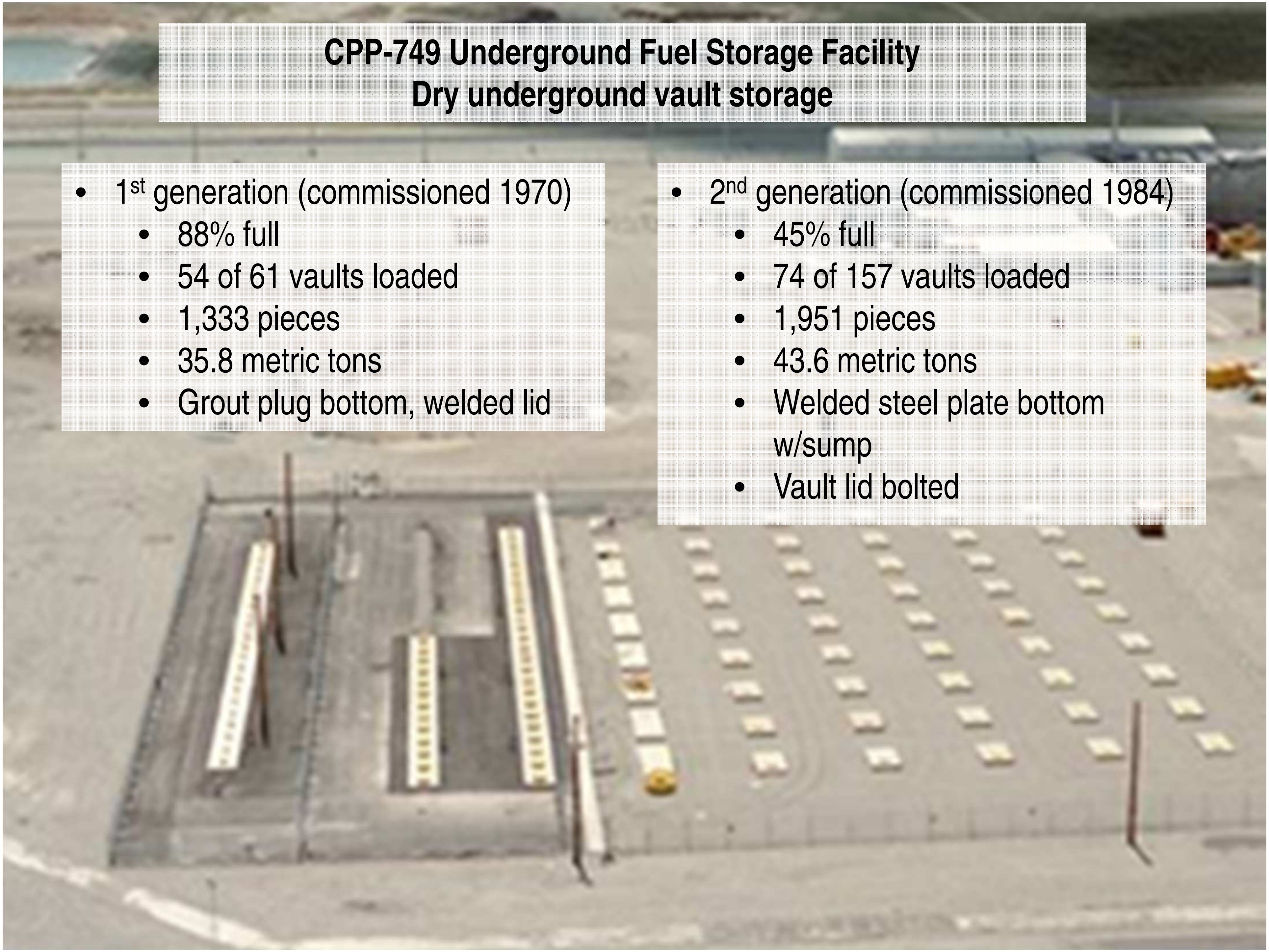
Cask storage pad

- 172 pieces, 42 metric tons
- MC-10 Westinghouse cask (PWRs)
- GNS Castor V/21 (PWRs)
- REA-2023 (BWRs)
- TN-24P (PWRs)
- Ventilated Storage Cask (VSC)-17 (PWRs)
- NUPAC 125B (TMI epoxied fuel & scrap)

Rail cars – 25 pieces, 25.7 metric tons

CPP-603 Irradiated Fuel Storage Facility (IFSF)

- Dry, above ground shielded rack storage
- Commissioned 1974
- Originally built for FSV fuel
- 636 storage positions
- 91% full
- 13,371 pieces
- 18.579 metric tons



CPP-749 Underground Fuel Storage Facility
Dry underground vault storage

- 1st generation (commissioned 1970)
  - 88% full
  - 54 of 61 vaults loaded
  - 1,333 pieces
  - 35.8 metric tons
  - Grout plug bottom, welded lid
- 2nd generation (commissioned 1984)
  - 45% full
  - 74 of 157 vaults loaded
  - 1,951 pieces
  - 43.6 metric tons
  - Welded steel plate bottom w/sump
  - Vault lid bolted

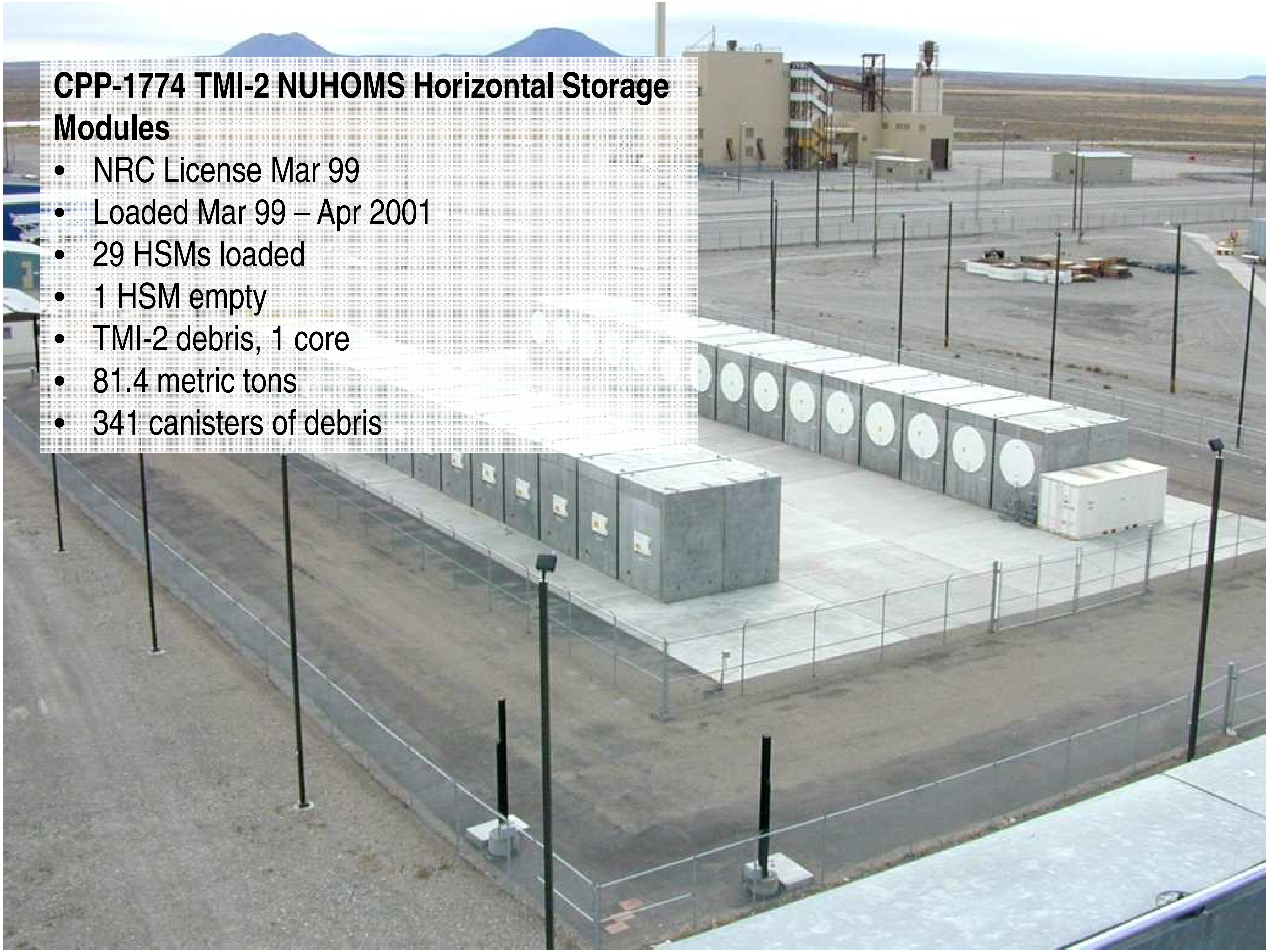
CPP-666 Fuel Storage Area – Basin storage

- History
  - First fuel arrived April 84
  - Last fuel dissolution campaign May 88
  - Fuel reprocessing ended 92
  - Mission: interim fuel storage – 92
- Current missions:
  - Surveillance & maintenance
  - Wet to Dry mission (DOE EM-owned fuel) – completed June 2010
    - 3,186 FHUs transferred to dry storage,
    - 21 fuel types, 14 campaigns
  - Navy fuel return to NRF
  - ATR reactor fuel receipts

Statistics:
Average depth ~30 feet
3.5 million gallons of water
33% full
7,084 fuel pieces, 8.5 metric tons

Fort St. Vrain (Colorado) Modular Vertical Dry Storage

- Constructed 1991
- NRC License Nov 91
- Fuel loaded Dec 91 – Jun 92
- NRC License renewed 2011
- 1,464 HTGR fuel elements
- 14,676 metric tons


CPP-1774 TMI-2 NUHOMS Horizontal Storage Modules
• NRC License Mar 99
• Loaded Mar 99 – Apr 2001
• 29 HSMs loaded
• 1 HSM empty
• TMI-2 debris, 1 core
• 81.4 metric tons
• 341 canisters of debris