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LANL's Role in the U.S. Fissile Material Disposition Program

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March 27, 2015

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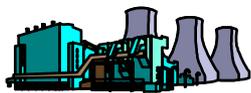
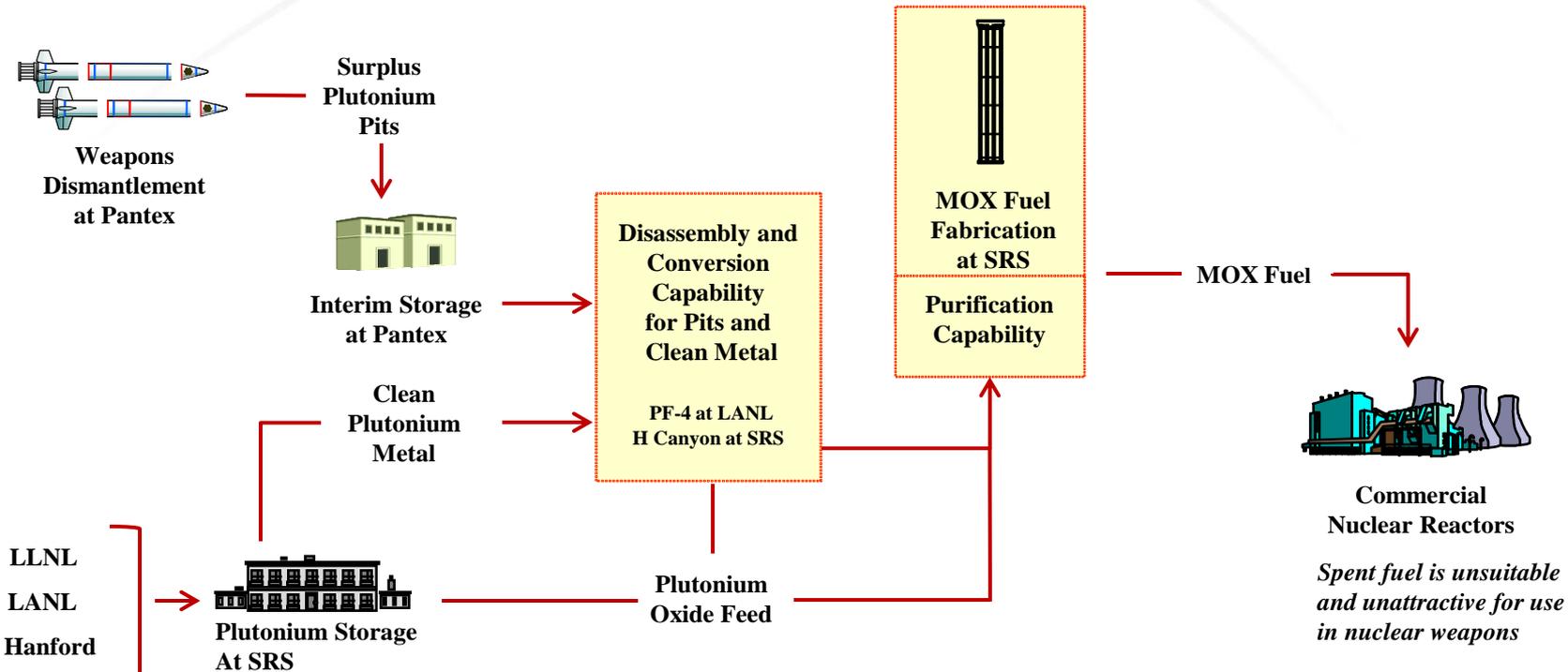
Outline

- **Introduction**
- **ARIES Project History**
- **Oxide Production Program**
- **Summary**

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Fissile Material Disposition Program



Commercial Nuclear Reactors
Spent fuel is unsuitable and unattractive for use in nuclear weapons

LLNL – Lawrence Livermore National Laboratory
 LANL – Los Alamos National Laboratory
 SRS – Savannah River Site
 WIPP – Waste Isolation Pilot Plant

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Fissile Material Disposition

2000 - the United States and Russia entered into a Plutonium Management and Disposition Agreement, each pledging to dispose of at least 34 metric tons of surplus weapons-grade plutonium (Pu).

In support of the U.S. Pu disposition mission, Los Alamos was tasked to develop a methodology to dispose of the excess plutonium.

The Advanced Recovery and Integrated Extraction System (ARIES) was developed for this purpose.

ARIES became operational in 1998 and soon demonstrated:

- pit disassembly,
- conversion of Pu metal to oxide, and
- packaging for long-term storage.

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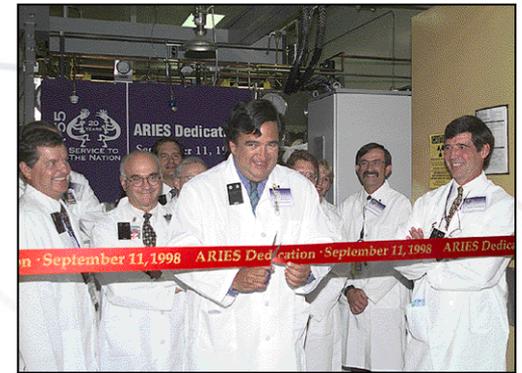
Long-Term Storage Container being measured on the Automated Non-Destructive Assay Instrument



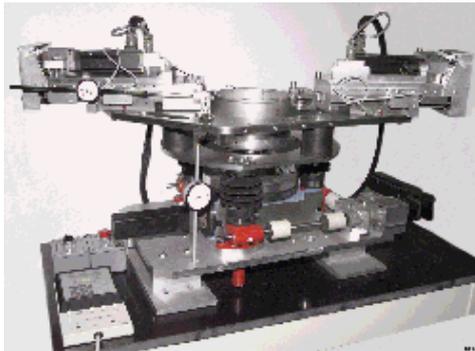
Direct Metal Oxidation Equipment

ARIES Project History

- Operational July 9, 1999 with disassembly of 4 pits.
- 1st ARIES Demonstration (September 1999) focused on “proof-of-principle” testing of pit disassembly and conversion
 - Issues with pit bisector, worker dose, and mechanical separations identified.
- 2nd ARIES Demonstration (2001-2002) focused on the disassembly and processing of all “pit classes” in the surplus inventory.
 - Pit disassembly demonstrated that the lathe was a better tool for disassembly, considering requirements of dose, operations, and waste.



ARIES Dedication Ceremony
Governor Bill Richardson
September 1998



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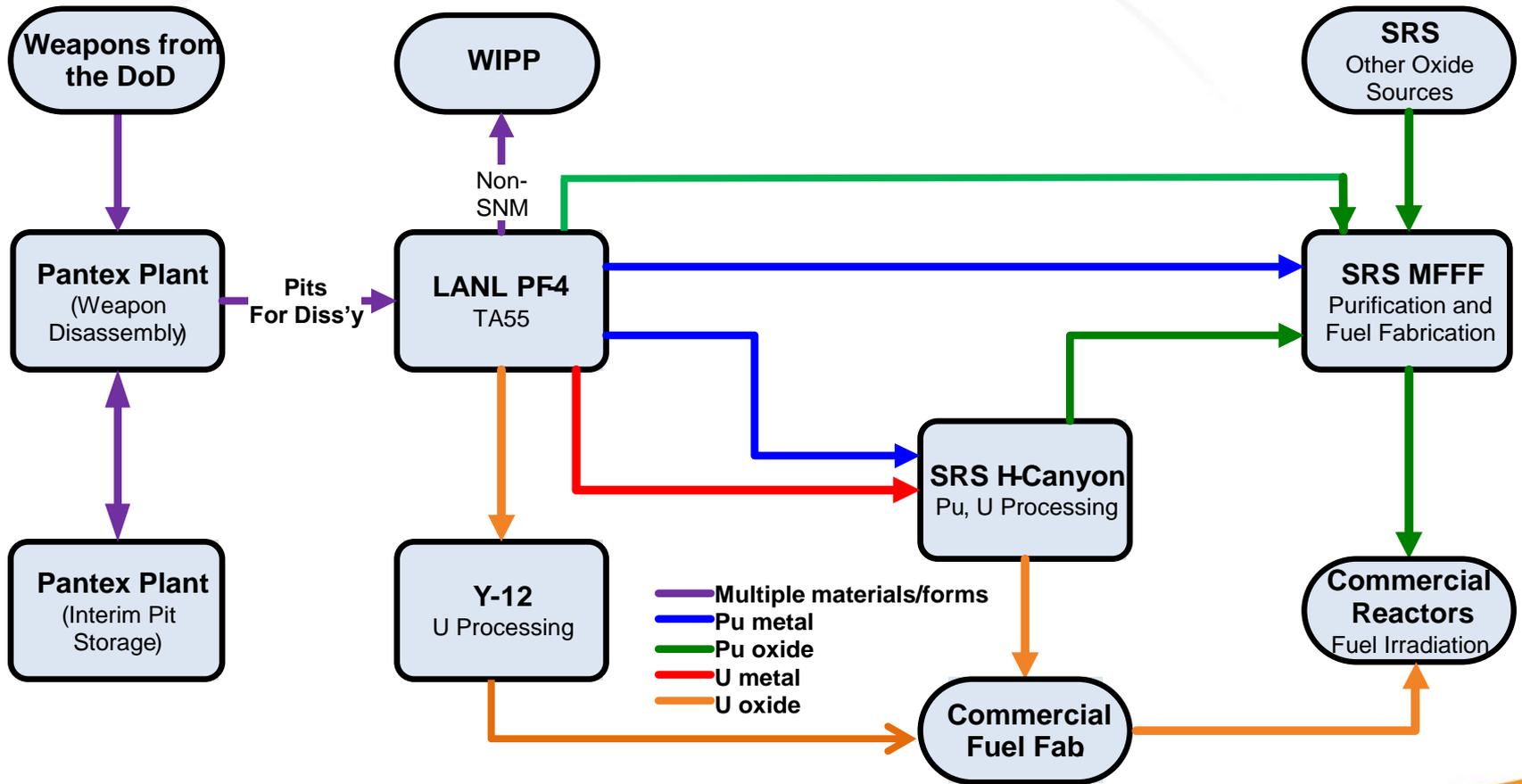
ARIES Project History (continued)

- LANL produced preliminary equipment design for incorporation into the larger production-scale Pit Disassembly and Conversion Facility (PDCF) in 2002.
- Resumed demonstration testing June 2007 with testing of the Direct Metal Oxidation (DMO-2) furnace.
- 3rd ARIES Demonstration (2008 – 2012) was performed to address the outstanding needs involving prototypical equipment validation and verification on special nuclear material.
- LANL directed in 2012 to use ARIES capability and capacity to support a limited (2MT) oxide production campaign as feed for the MOX Fuel Fabrication Facility at a nominal annual rate.

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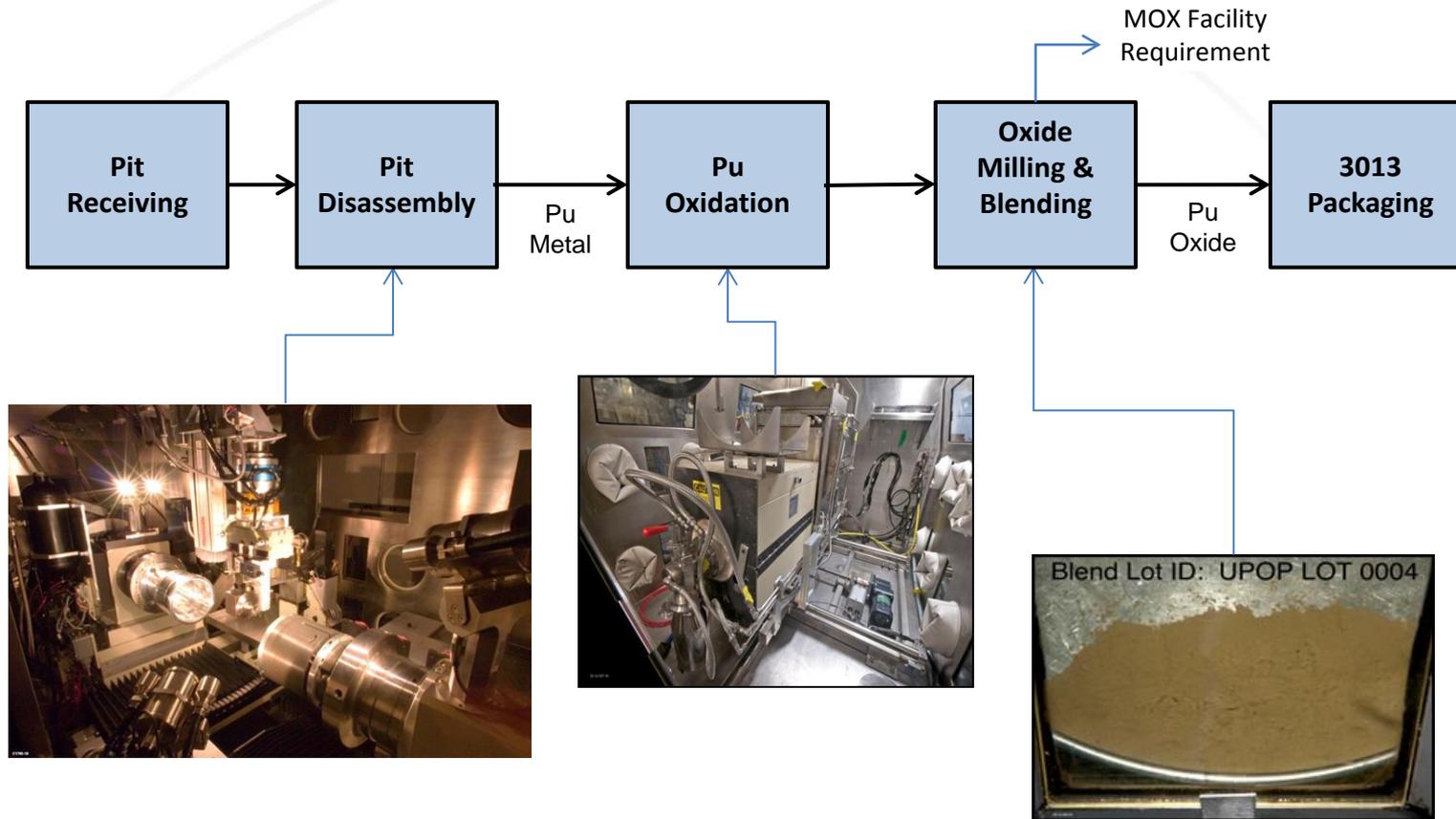
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Los Alamos Plutonium Facility is Central to U.S. Excess Fissile Material Disposition



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Pit Disassembly and Oxide Production

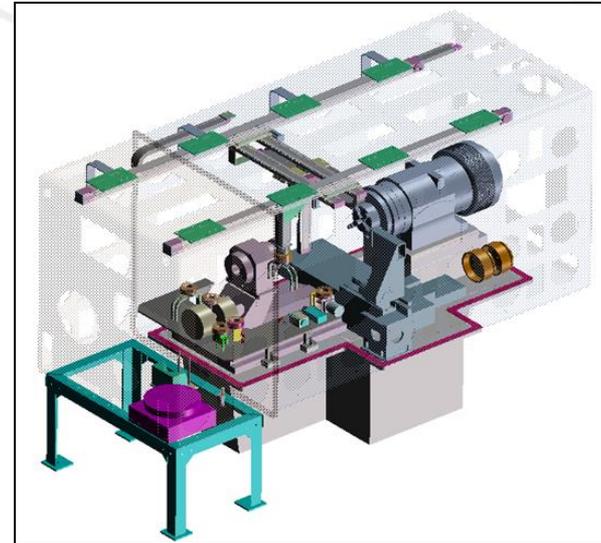


- **Gloveboxes for disassembly, oxidation, milling, and packaging**

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Pit Disassembly

- Manual lathe was used for disassembly of plutonium hemishells
- Manipulator and Wrist on the newer robotic lathe moving a chuck in the Pit Disassembly Module

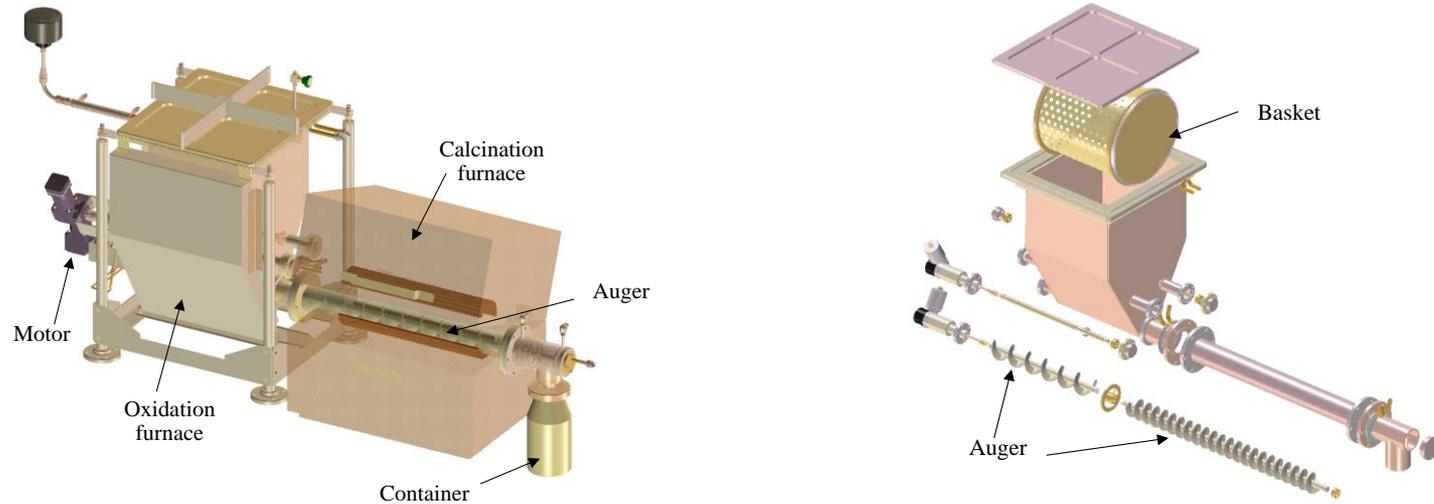


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Pu Conversion

- Model of Direct Metal Oxidation (DMO)-2 furnace used for plutonium metal-to-oxide conversion



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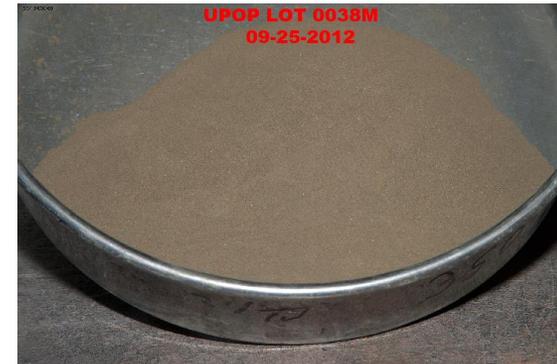
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Pu Conversion

- The DMO-3 Furnace



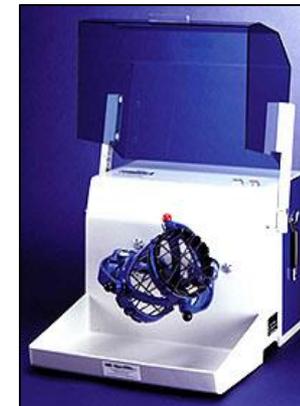
- Muffle Furnace and plutonium oxide



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Oxide Processing

- Rod mill used to mill the DMO oxide product
- Terbula Blender used to blend oxide in a homogeneous batch
- Plutonium oxide before and after milling



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3013 Packaging

- 3013 container set - outer, inner, and Cogema convenience cans
- Electrodecontamination fixture for Inner 3013 container
- Automated welder station for the inner container

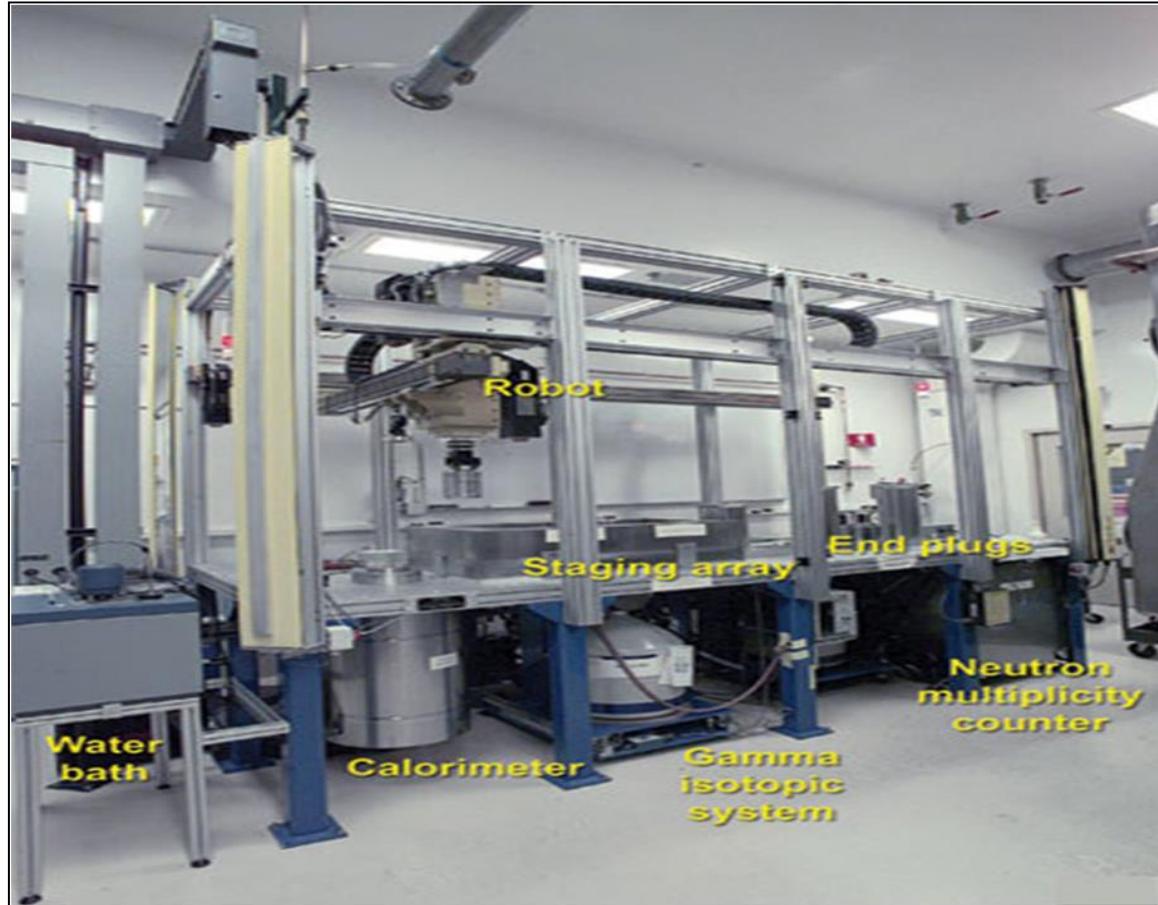


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Nondestructive Assay (NDA)

NDA Table



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Quality Assurance Program for Feed Acceptance

- **Plutonium oxide being produced as feed for the planned Mixed oxide Fuel Fabrication Facility (MFFF), currently under construction at the Savannah River Site in South Carolina, which is licensed by the U.S. Nuclear Regulatory Commission**
- **Los Alamos is a QL-1 supplier to Shaw AREVA MOX Services for supplying plutonium oxide feed.**

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Production-Scale Pit Disassembly and Conversion

- After many years of design, the U.S. cancelled its project to construct and operate a production-scale pit disassembly and conversion facility.
- Studies have been performed focusing on the utilization of existing nuclear facilities including LANL (PF-4) to perform this function.
- LANL capabilities would be expanded and support Pu metal and oxide production at a higher rate if needed to support the plutonium disposition mission.

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