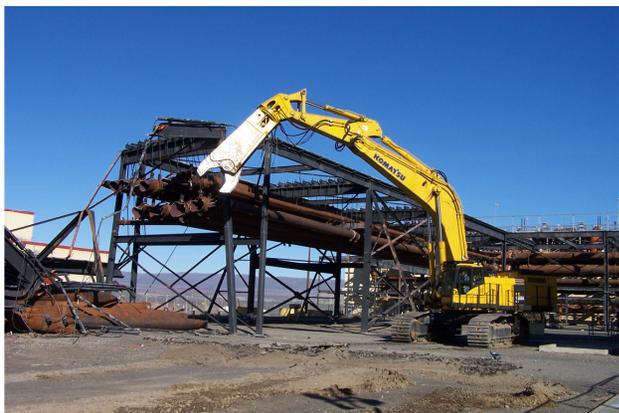


U.S. Department Of Energy

Facility Deactivation & Decommission Appendix B — D&D Project Basics

2009 Edition

A brief explanation of the DOE's Complex-wide facility D&D work



Final Review Copy

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- **What is D&D?**
- **Why is D&D Important?**
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What is D&D?

- D&D Projects encompass the many stages of taking an active/excess/abandoned facility to a final disposition end state. Various documents interchange the following words for the “D” in “D&D” projects. These labels can be overlapping in activity types. However, the general goal is the same for D&D project: reduce risks, maintenance costs and foot print. The multiple “D” phases cause some D&D projects to be referred to as D4.
- The following are general definitions:
 - **Decontamination:** the removal of radiological, chemical, or hazardous materials to reduce the safety and health risks. The extent and costs of removing contamination influences the disposition alternatives and the D&D work methods. Decontamination can occur in any or all of the phases described below.
 - **Deactivation Phase:** the removal of radioactive materials, process chemicals, hazardous materials, and shutting down of process systems and equipment; relocating personnel that eliminates the need for costly surveillance and maintaining active security, or utility systems. Resulting facility is a minimum-cost safe surveillance and maintenance condition (**long-term min-safe storage**) ready for demolition.
 - **Stabilization:** A stabilization phase may be needed for a facility with unstable process materials needing neutralization and/or containers prior to removal.
 - **Decommissioning:** The dictionary definition involves the steps to remove items necessary to maintain original mission purpose or to take out of service. Resulting facility is ready for final disposition end-state. “**Decommissioning**” is sometimes used to encompass the whole D&D and restoration process or later disposition phases. **DOE O 430.1B guides** use “**Decommissioning**” to mean final disposition process phase, post-deactivation, including various end-states. Two “reactor decommissioning” definitions: (1) all phases from de-fueling to soil remediation or (2) decommissioning occurs at post –de-fueling and ends with vacant building. Note the potential confusion if two parties are using different definitions for the scope of “decommissioning” work.
 - **Disposition:** The applicable dictionary meaning is final settlement of a matter or power to dispose of a thing. Final disposition is the end-state established for the facility such as federal reuse, release to public use, in-situ entombment, or demolition. **DOE O 430.1B guides** use “**Disposition Process**” to describe all D&D stages from deactivation to final end state.
 - **Demolition or Dismantlement Phase:** The complete or partial removal of the facility structure. Debris is either recycled or disposed of as waste depending on the type of contamination or material economics. This phase may leave bare ground, the concrete foundation, or the core structure based on end-state agreements or transition to environmental (soil & water) cleanup projects.
- The starting point for D&D projects varies depending on the stage or condition the facility has been left in. D&D can be funded and managed in distinct phases or as one continuous project.



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Why is D&D Important?

Work Scope Background: Since the early days of the Manhattan Project, in the 1940's, the nuclear weapons program was under schedule-driven deadlines to deliver products. Costs, environment and even sometimes, safety were secondary to delivering results. Facilities were built in record-breaking size and speed, often for short-lived, mission-specific purposes. The 40 years of Cold War, from the 1950's through the 1980's drove similar production quota priorities. Old facilities were often unfunded and abandoned, as additional facilities were built for newer missions and changes in technology. As the Cold War closed and the veil of secrecy lifted, it revealed a huge environmental legacy including a large inventory of radiological facilities needing final disposition.

The key drivers for D&D are reduction in safety and environmental hazards or liability; the reduction in facility and infrastructure footprint and the associated the surveillance and maintenance costs. **The longer these facilities sit in disrepair the more dangerous and costly they are to maintain and/or disposition.**

The goal for D&D is establishing the radiological facility end-of-life disposition path and getting the facility out of the DOE EM inventory.



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Facility Category Types Requiring D&D



Nuclear Facilities

Nuclear facilities are buildings that contain or have contained nuclear materials that warranted robust designs both in structural mass and system redundancies. These are typically the reactor buildings, separation process canyons, nuclear process testing buildings, and nuclear materials fabrication buildings. Disposition of nuclear facilities requires detailed characterization, rigorous planning, application of appropriate technologies and thousands of man-hours of work in highly hazardous conditions.



Radiological Facilities

Radiological facilities are typically buildings that handled radioactive materials whose types or quantities allowed less robust structures and systems. These are typically radiological support operations such as laboratories, test facilities, or waste handling and storage buildings.



Industrial Facilities

Industrial facilities are buildings and structures that provide non-radiological support operations. These can have a wide variety of hazards ranging from radioactive, chemical, and physical. These facilities include various ancillary structures whose inventory, contamination and other factors do not require categorization as nuclear or radiological hazards.

The majority of these facilities are 40–50 years old; many with minimal surveillance and maintenance; some abandoned with some level of physical degradation.

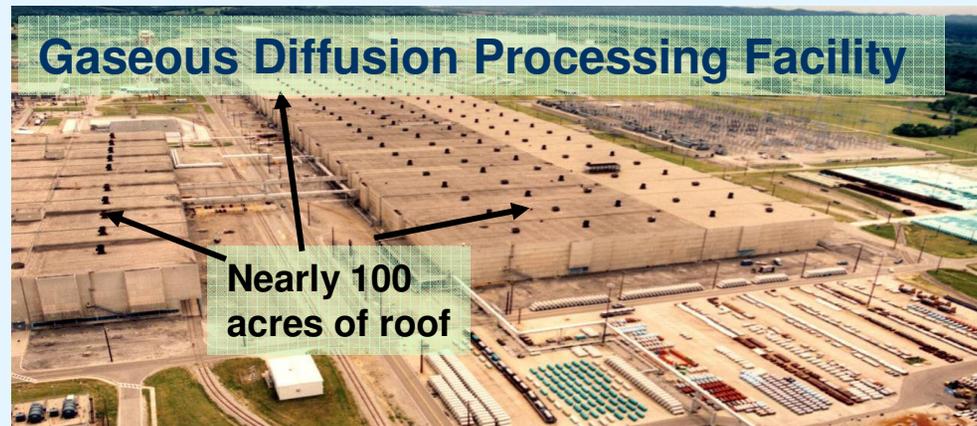
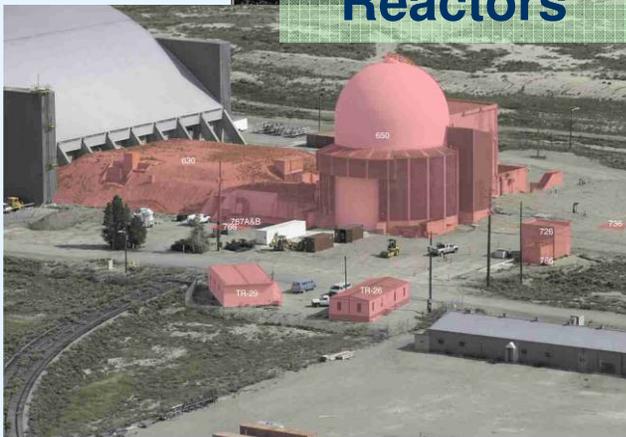
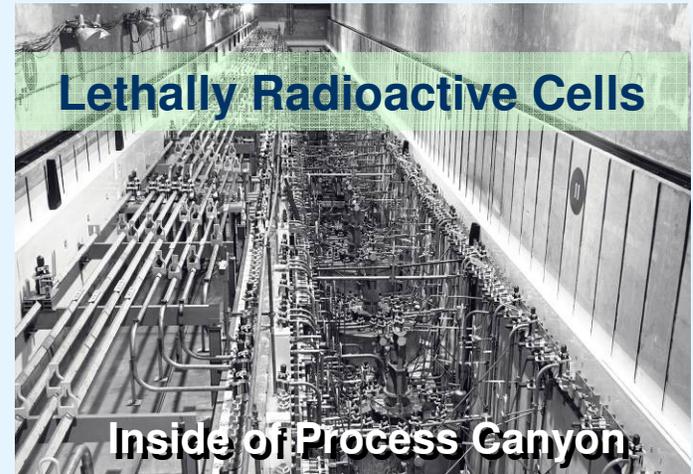
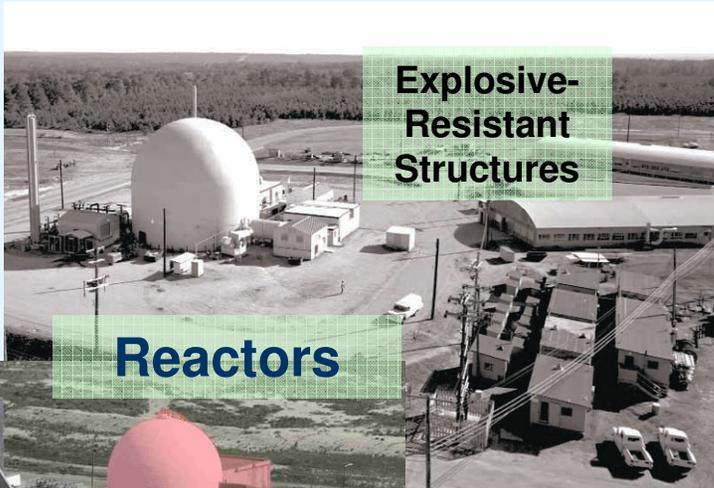


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Major Nuclear Facility Types To Be D&D



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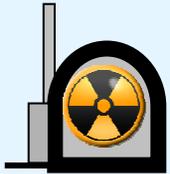
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Nuclear Facility D&D End-State Options

Temporary, Partial, Complete



Long-term Min-safe Storage (Long-term Min-Safe S&M) (cold & dark) (long-term hold): This is a minimum safe, low-cost surveillance and maintenance storage or “moth-balled” condition. All significant quantities of nuclear material are removed and facility is deactivated by shutting down the active safety and utility systems. The facility is monitored on a minimal cost schedule to maintain integrity of the passive containment structures. Twenty-year life structural upgrades provided as needed. Not a final end state. Allows prioritization flexibility to delay final disposition costs.



Partial D&D to Cocoon: All significant quantities of nuclear material and waste are removed and facility support buildings and utility systems are demolished. The building’s central massive shield/containment structure is integrated with a new containment “cocoon” structure for passive containment of highly radioactive portions over a minimum 50 to 100-year life with minimum monitoring. Not a final end-state. Reduces worker hazard exposure and waste disposition costs by allowing hazard reduction through natural radiological decay. This is most applicable to older, cast-in-place, reactor cores, and is the implemented strategy for the Richland reactors along the Columbia River.



Partial D&D to In-Situ Disposition (ISD): Similar to cocooning but is considered a final end state. ISD (entombment) is designed to take advantage of robust contaminated structures and grouted cavities to ensure “encapsulation” of chemicals/radioactive materials as required by performance assessments. Additional low level waste may be entombed in cavities prior to grouting and final capping. Minimum 1000-year life assumed in design. This reduces cost of demolition and waste disposition.



Complete D&D All Structures : All structures and waste are removed. Most costly, but least controversial end-state. **Brownfield end-state:** Property is retained for limited, controlled (limited access or industrial) uses. **Greenfield end-state** (extremely high cost): property is cleaned to condition of unlimited reuse and releasable for private use.



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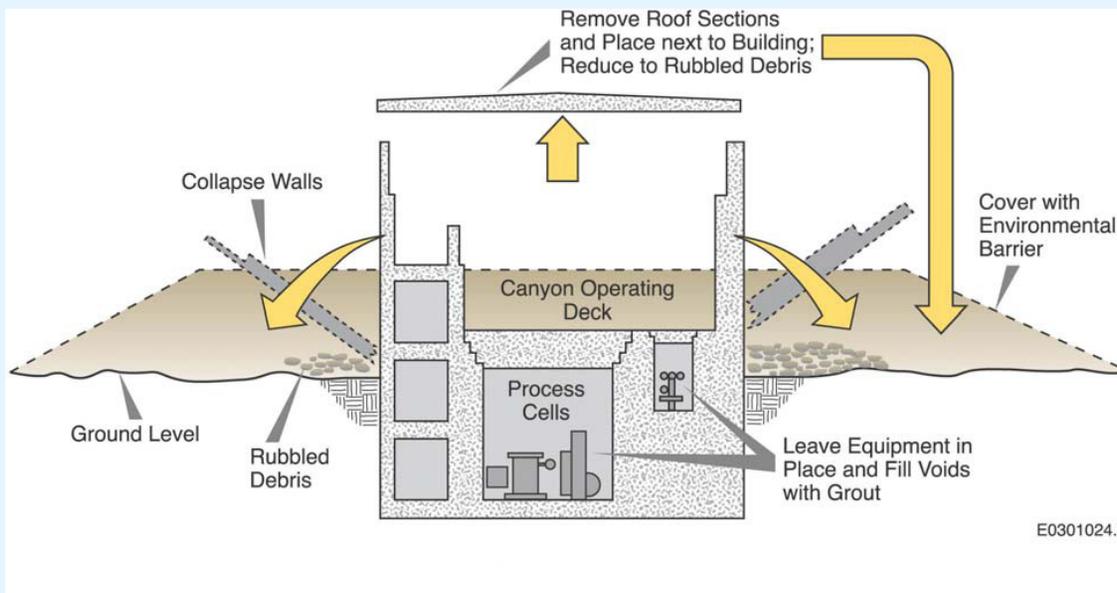
Nuclear Facility D&D Options

Cocoon or In-Situ Disposition (ISD)

Partial D&D Hanford “C” Reactor Cocoon



Partial D&D Hanford “U” Canyon In-Situ Disposition (ISD) Option



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Major Challenges to D&D Program



Lack of Priority – D&D has been a lower EM priority in risk based prioritization. Most facilities are maintained at a minimum surveillance and maintenance cost, in various states of partial or complete shutdown and are not seen as high risks requiring immediate disposition. However, some old facilities are not maintained and even those facilities in long-term storage have a limited life before major investments must be considered to maintain ability to safely enter the deteriorating structures for D&D work. Experience throughout the complex (most recently at Oak Ridge K-25 project) has repeatedly demonstrated the increased risks and project costs resulting from deferred D&D.



Non-EM Facilities/Future Liabilities/Expanding Scope – EM inherited a large backlog of legacy facilities from fifty years of nuclear research and operations. Other DOE Program Offices continue to identify additional surplus facilities to be transferred to EM for D&D in the 5+ out-years. This backlog is continuing to grow.



Negotiations to Resolve Final End-State – Each site has its own unique combination of stakeholders with their separate and often conflicting interests. Citizen advisory boards are established to create a forum where these conflicting positions can be discussed and compromise solutions defined that allow the D&D projects to move toward an established and agreed upon goal



Risk Modeling – In parallel to the political interests of the end-state, there are the technical issues for establishing confidence that the end-state is safe and environmentally sound for the environmental regulators and the general public. This requires extensive characterization and risk modeling to define the most cost-effective end-state technical requirements.



Waste Disposition Mapping – One of the earliest strategic planning elements of D&D is characterizing the sizes and conditions of the facilities, and the nature or levels of contamination. From this characterization, the classifications and volumes of generated waste are estimated to determine that each type of waste has, or will have, a disposition path and final destination. Disposition for wastes with no disposition paths are difficult, expensive and time consuming efforts.



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How is DOE D&D Managed?

- **EM Management D&D Strategy and Budgeting Priority:**

- Highest risk reduction
 - Highest S&M cost reduction (often interdependent with high risk)
 - High value (visibility) foot print reduction
- Some sites are managed by DOE Environmental Management (EM) as a total site environmental restoration project and some D&D projects are managed by EM in cooperation with NNSA or SC Operations at their sites for selected facility foot print reduction within an operating site.
 - D&D projects are bid and awarded to experienced contractors at the site level or facility level.
 - Most D&D projects are managed under a letter of agreement with the EPA as CERCLA “non-time-critical removal” projects with DOE EM as the lead agency.
 - DOE is self-regulated for radiological waste under the AEA and uses DOE O 435.1 for waste management and oversight guidance. DOE also uses many Orders and Guidance's in Project Management, Conduct of Radiological Operations, and Quality Assurance.



DOE Facility Disposition or D&D Specific Guides & Standards are also used:

- [DOE G 430.1-2](#) (Guide, 9/29/1999, EM) **Implementation Guide for Surveillance and Maintenance during Facility Transition and Disposition** -This Guide was prepared to aid in the development, planning, and implementation of requirements and activities for down grading S&M during the transition or deactivation phase at Department of Energy (DOE) facilities.
- [DOE G 430.1-3](#) (Guide, 9/29/1999, EM) **Deactivation Implementation Guide** -This Guide was prepared to aid in the development, planning, and implementation of requirements and activities during the Deactivation phase at Department of Energy (DOE) facilities
- [DOE G 430.1-4](#) (Guide, 9/2/1999, EM) **Decommissioning Implementation Guide** -This Guide was prepared to aid in the development, planning, and implementation of requirements and activities during the Decommissioning or demolition phase at Department of Energy (DOE) facilities
- [DOE G 430.1-5](#) (Guide, 04/24/2001, EM) **Transition Implementation Guide** -This Guide was prepared to aid in the development, planning, and implementation of requirements and activities during the transition phase at Department of Energy (DOE) facilities that have been declared or are forecast to become excess to any future mission requirements.



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Why Are Waste Types Important?

The wastes resulting from D&D activities have various levels of hazardous constituents. Disposal sites are licensed to accept waste within established limits. Therefore, D&D waste must be segmented into the types that can be sent to the appropriate disposal path. Radiological and hazardous waste costs are driven by stricter disposal standards, higher fees, and longer shipping routes to remote locations. Some waste disposition paths are hard to establish (and a few aren't resolved) and will define the critical path of the project schedule. The general D&D goal is to minimize the most expensive waste

types. General types of waste (in order of increasing costs to disposition) are as follows:



Reusable equipment or recyclable materials: clean or decontaminated items with marketable value are sold through excess process. A DOE moratorium prohibits recycling metals from a radiological area. Resolving this moratorium could result in significant cost offsets.



Commercial waste or fill material: Uncontaminated waste materials can be taken to commercial landfills, or waste disposal sites.



Hazardous waste: Waste made up of or contaminated with chemicals, minerals, or bio-hazards that are classified as harmful to life. Hazardous waste is incinerated or buried at facilities licensed for this type of waste.



Low-level Waste (LLW): Waste that is contaminated at low thresholds with radioactive materials makes up the majority of D&D waste. LLW can be disposed at licensed LLW burial grounds, either remote or on site, if on site burial operation is established.



Mixed Waste or Mixed LLW (MW or MLLW): Hazardous waste that has radiological contamination or vice-versa. This waste is difficult to dispose of due to the dual category that disposal licenses rarely allow.



Transuranic Waste (TRU): Waste that is contaminated to thresholds, with primarily long-life, man-made alpha/beta emitters such as plutonium. Presently the Waste Isolation Pilot Plant (WIPP) is the only licensed disposal site for TRU waste.



High-Level Waste (HLW): Waste that is made up of materials with high levels of radioactivity, mostly gamma/ neutron emitters. This waste is kept in shielded dry casks or submerged in water pools at origin sites or licensed temporary storage site, until a HLW disposal site is licensed by the NRC.



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Major Special Interest Group Types

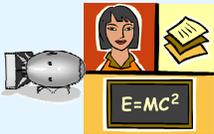
DOE sites have many stakeholders and private citizen groups with interests in the outcome or final disposition end-state of the D&D projects. To help resolve the inherent conflicts and manage the input of these interest groups, DOE assists in the creation of **citizen advisory boards (CABs)**. These CABs provide a venue for building consensus and getting rational public input to the projects. Interest groups are generally motivated to:



Retain or Revitalize the Nuclear Mission: Groups that are interested in retaining the jobs and financial support structure that exists. Try to maintain the status quo as much as possible.



Convert Facilities to Commercial / Industrial / Research: Groups that support cleanup but want to retain the economic vitality by finding new federal missions or private businesses.



Historical Preservation: Groups that want to preserve areas and facilities for their scientific, World War II or Cold War historical significance.



Pristine Environmental Restoration: Groups that want to remove all trace of the facilities and return the land to some form of nature park or preserve for public access.



Native American Rights: Native American Groups that want to regain rights or access for historical or sacred traditions.



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Demolishing Facilities with Conventional or Explosive Methods

Conventional equipment demolition (Hanford 100N)



Utilization of explosive fracturing (Hanford H Reactor)



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