



U.S. DEPARTMENT OF  
**ENERGY**

*Overview of the DOE-EM Environmental Legacy:  
Current Status and Long-Term Strategies for  
Decommissioning and Environmental Restoration*

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**(Presented by Mark Gilbertson)**

***U.S. Department of Energy***  
***Office of Environmental Management***

**International Experts' Meeting on Decommissioning and Remediation  
After a Nuclear Accident, IAEA Headquarters  
Vienna, Austria ❖ January 28-February 1, 2013**



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**safety ❖ performance ❖ cleanup ❖ closure**

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# Mission of DOE-EM Program



- **The Department's Responsibility**
  - **Decommissioning** and cleanup of radioactive waste generated by nuclear energy research and weapons production
  - **Remediation** of groundwater and soil contamination
  - **Reduction of risk** to the nation's citizens
  
- **Significant Progress** in Our Cleanup Effort
  - Demonstrated **advancement** in cleanup
  - **Technological** breakthroughs
  
- **Our Future**
  - Continuing Decommissioning **challenges** to solve
  - Implications for the **lessons learned**

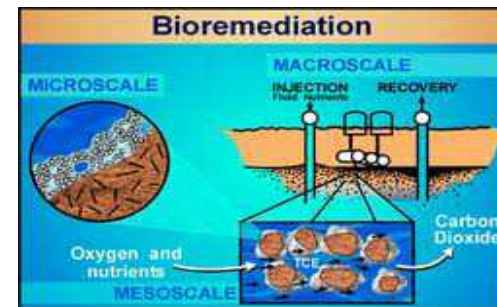


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# Strategy to Address Completion of EM Mission

- **Constructing and operating facilities to treat radioactive liquid waste**
- **Securing and storing nuclear material in a stable, safe configuration**
- **Transporting and disposing of transuranic wastes**
- **Deactivating and decommissioning facilities, and**
- **Remediating contaminated soil and groundwater**



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# Our Mission – Every Project as Successful as This

1960s: Plutonium Manufacturing  
Rocky Flats, Colorado



Rocky Flats today:  
National Wildlife Refuge

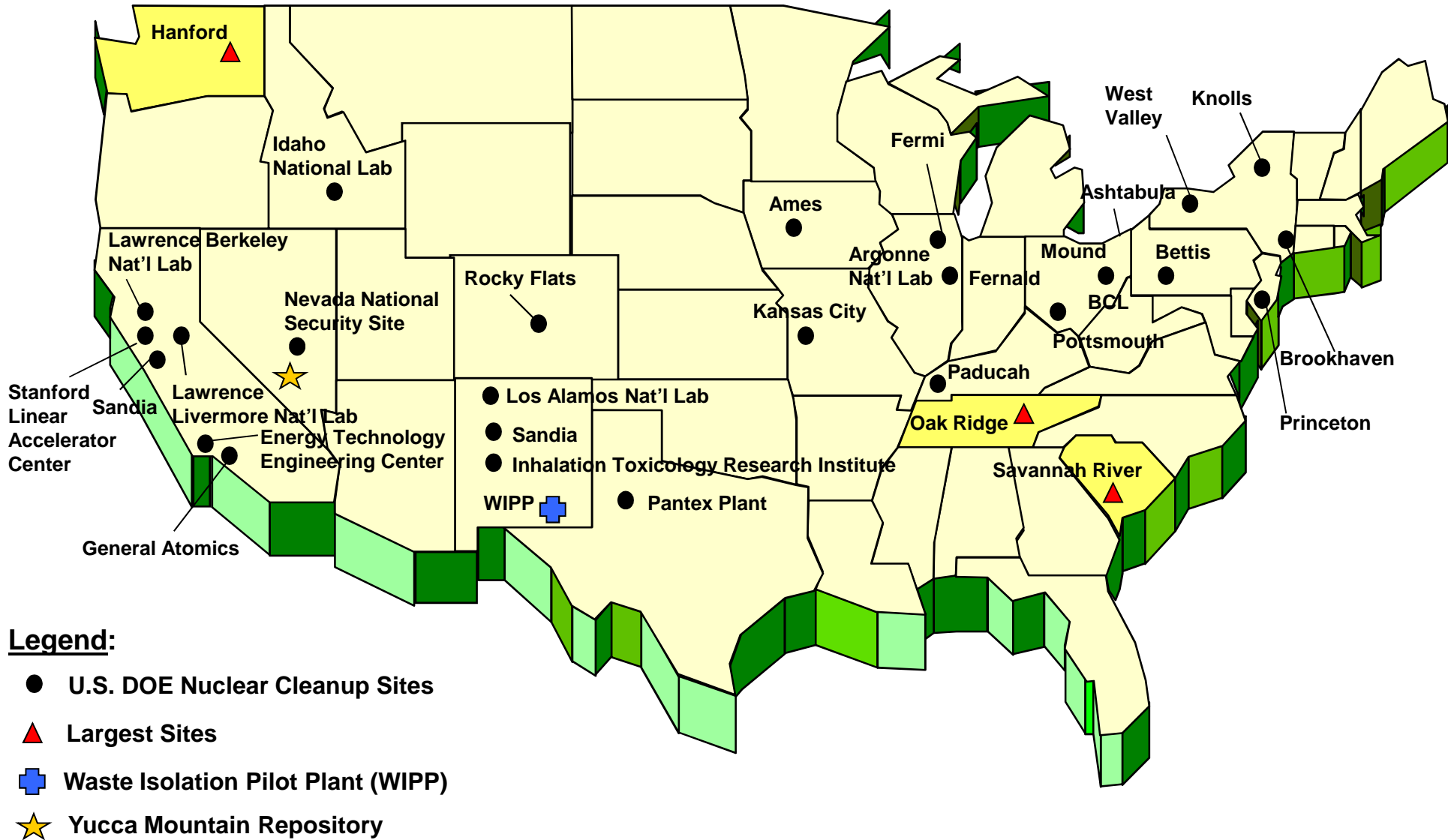


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# The U.S. Department of Energy's Cleanup Sites





# We are Making Progress Every Day



Completed cleanup at **86 of 108** total sites across the U.S.



Brought down more than **1,700** facilities



Annually dispose of **one million cubic meters** of low-level waste (a football field over 200 meters high)

Paducah Gaseous Diffusion Plant: Plume Map



Stabilized more than **100** groundwater plumes



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# The Inherently High-Risk Work of Nuclear Cleanup

We work with some of the most **dangerous substances** known to humanity...



Workers using glovebox to handle plutonium



Holding basin for spent nuclear fuel

Performing **first-of-a-kind tasks** in highly hazardous work environments



Working with high-level waste



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# ***Acceleration of EM Cleanup Made Possible by American Recovery and Reinvestment Act (ARRA)***

➤ **More than 200 Facilities were decommissioned in a two year period**

Number of Facilities Removed by Hazard Class

Site	ANL	BNL	Hanford	INL	LANL	NNSS	ORO	Paducah	Portsmouth	SRS
Nuclear	0	0	2	27	1	0	1	0	0	0
Radiological	2	3	14	31	17	2	31	2	0	14
Industrial	0	0	63	34	6	1	18	1	13	16
<b>Total</b>	<b>2</b>	<b>3</b>	<b>79</b>	<b>92</b>	<b>24</b>	<b>3</b>	<b>50</b>	<b>3</b>	<b>13</b>	<b>30</b>





# ***ARRA Funds Facilitated Major Progress at Oak Ridge Site***

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- **DOE's largest ever demolition project – former K-25 uranium enrichment plant has been demolished**



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# But Significant Cleanup Challenges Lie Ahead



Retrieving 3000+ million liters of liquid radioactive waste . . .



. . . Safely storing it in 200+ underground tanks . . . and



. . . Solidifying it for safe disposal



Cleaning up 240 sq. km. of contaminated groundwater



Maintaining a stable and skilled workforce



Developing technologies – vitrified waste from Savannah River, South Carolina



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# Examples of Future Decommissioning Projects

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- **Portsmouth and Paducah Gaseous Diffusion Plants – very large facilities; Portsmouth Plant covers 37 ha (93 acres) and Paducah Plant covers 30 ha (74 acres).**



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## ***Examples of Future Decommissioning Projects (contd.)***

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- **Three story 324 building at Hanford – has two large hot cells – discovery of very large radiation levels ( ~ 89 sieverts) beneath the facility has complicated decommissioning.**



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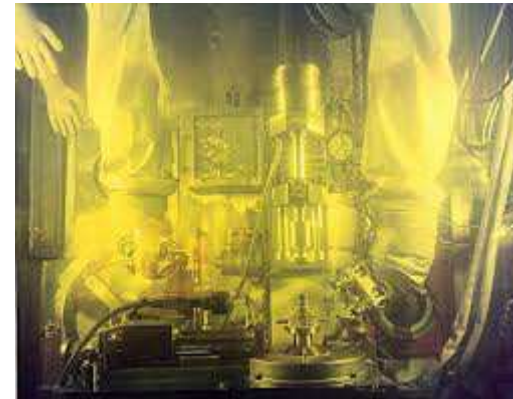
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# ***Examples of Future Decommissioning Projects (contd.)***

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- **Building 235-F at Savannah River site, a highly contaminated facility.  
High specific activity of Pu-238 combined with micron sized particles makes this material exceedingly difficult to remove**



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## ***Examples of Future Decommissioning Projects (contd.)***

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- **WESF Facility at Hanford site, holding 1,335 cesium capsules with 2.7 million terabecquerels and 601 strontium capsules with 1.2 million terabecquerels of radiation.**



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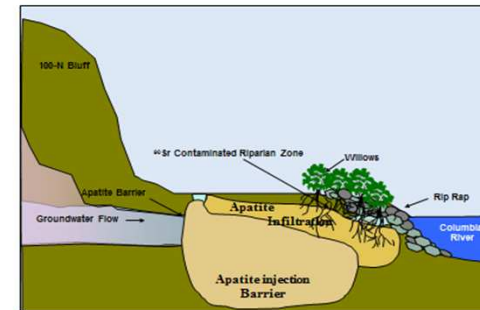
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# Examples of Groundwater Projects

## Challenge at Hanford Site:

- **Strontium-90 plume near Columbia River: Multiple injection systems approach to Appetite Barrier**
- **8+ Sq. kilometers (5 Sq. Miles) groundwater plume at great depths in central plateau: Pump and Treat Tc-99, U, organics and metals**
- **Uranium contamination at the 300 area: Cost-effective technologies to immobilize and attenuate rads**

Systems Approach to Address 100-N <sup>90</sup>Sr



Pump and Treat Facility



Treatment of Uranium Contamination in 300 Area



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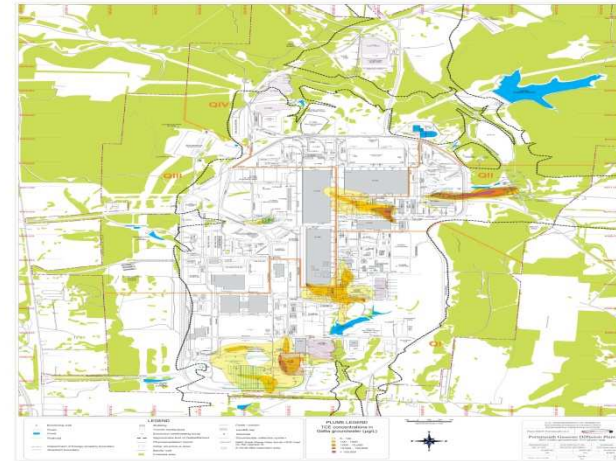
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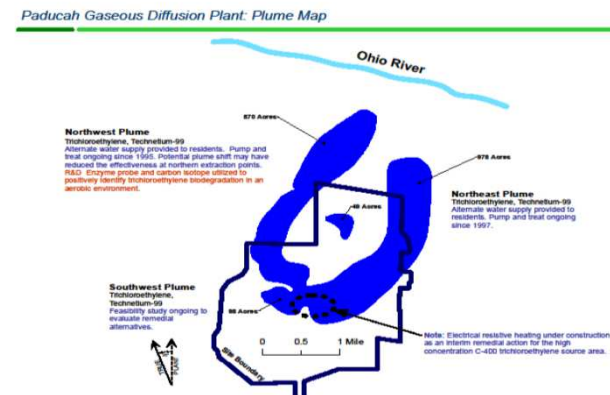
# Examples of Groundwater Projects

## Challenges at Portsmouth and Paducah

- Portsmouth – Matching remediation technologies to unique characteristics of multiple source area and plumes
- Paducah – Cleaning up chief sources and multiple off-site risk of 807 hectares (1,999 acres) of groundwater contamination



Plumes of trichloroethylene contaminated groundwater at the Portsmouth Gaseous Diffusion Plant



Groundwater Plume at Paducah Site



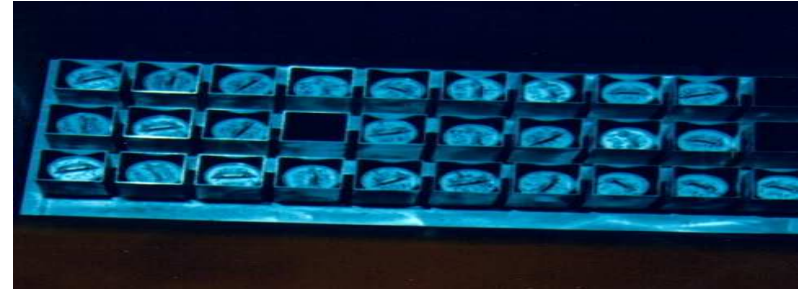
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# Significant Challenges Besides Decommissioning and Soil/Groundwater Remediation

- Spent Nuclear Fuel
- Stabilization of Tank waste
- Disposition of Low Grade Plutonium
- Treatment and disposal of waste in underground tanks at Hanford and Savannah River sites.



Require construction and operation of large, costly facilities



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# *In Conclusion*



***U.S. Department of Energy decommissioning and remediation activities provide cleanup today and advanced technological solutions for tomorrow***

**Our record proves that safe, effective decommissioning and remediation is possible:**

- We have effectively reduced risk to the environment and the community
- Each year, our knowledge and skill base grows

**Our work provides global benefits beyond nuclear cleanup:**

- Advancing state-of-art during a stagnant time for the nuclear industry
- Enhancing global security and nuclear non-proliferation

**Enormous challenges lie ahead:**

- The ability to continue to make technological leaps forward
- The willpower of societies to continue to pursue difficult, expensive work



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