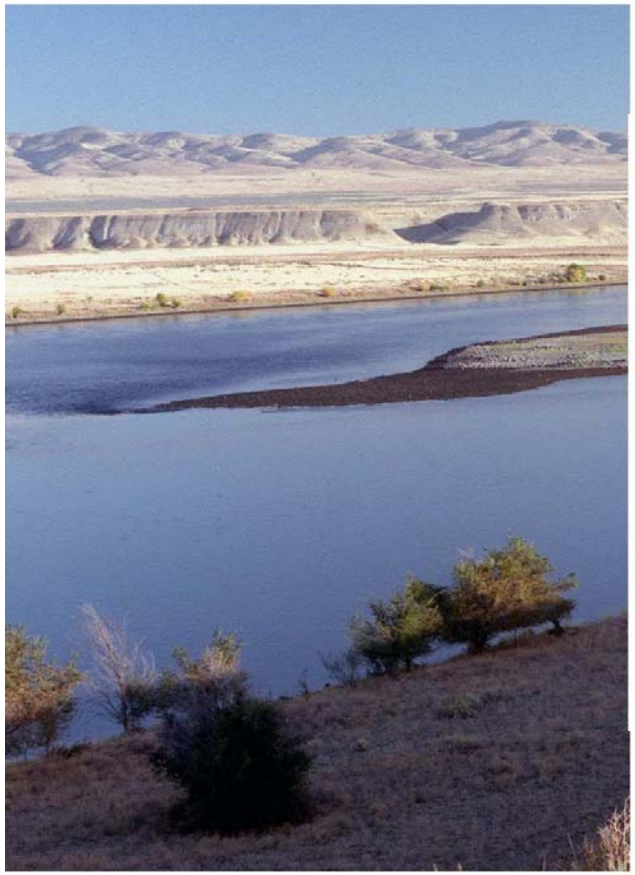

# Impact of HAB and Public Input on Record of Decision for Remediation of 200-CW-5, 200-PW-1, 200-PW-3, 200-PW-6 Operable Units

Presented to: Hanford Advisory Board River and Plateau Committee

Presented by: J.D. Dowell, DOE-RL, Central Plateau Assistant Manager

December 7, 2011

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# Overview

*Today's goal: Discuss input received, how it influenced the decision, continue the dialogue on Central Plateau cleanup*

- Background
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process
- What we heard
- How input influenced the decision
- A closer look at the Record of Decision (ROD)
- Other information available for discussion

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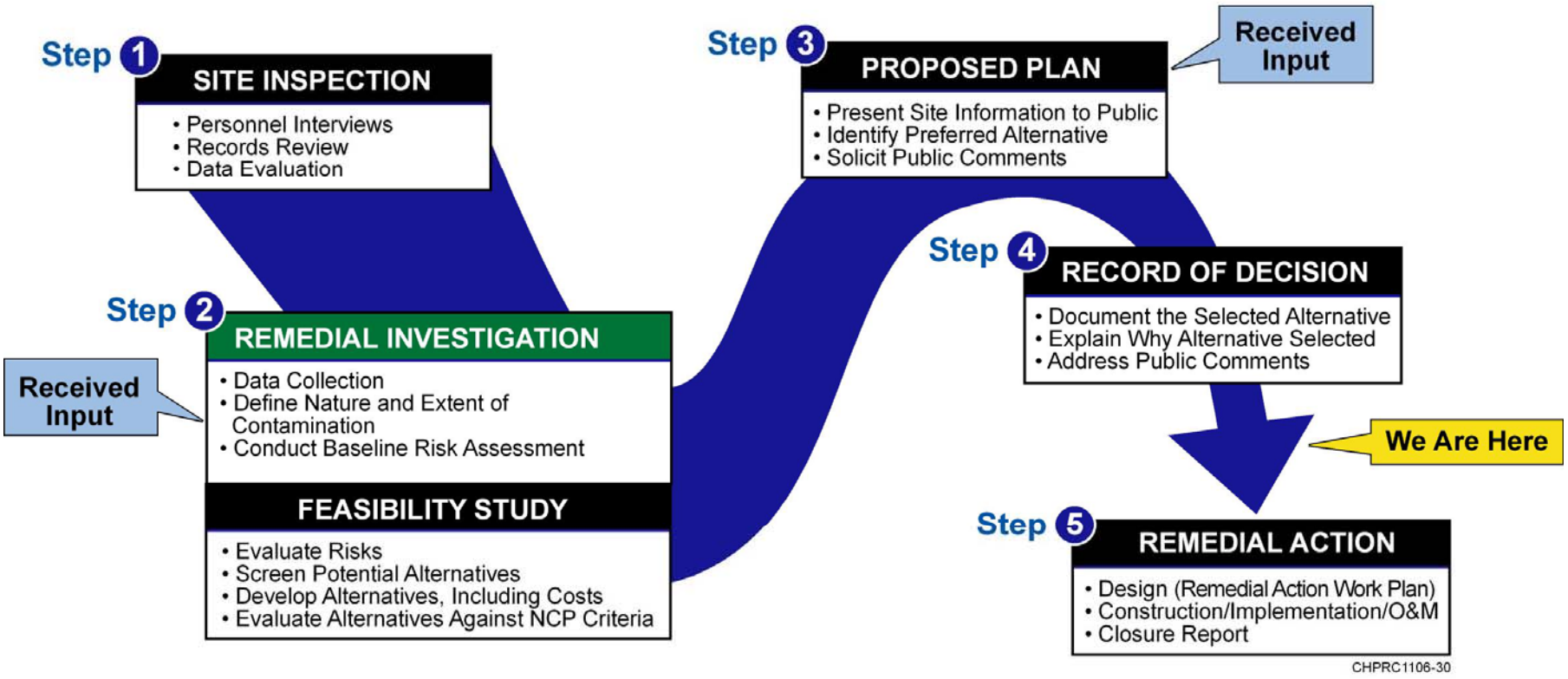
# Background

- 60-day public comment period on the Proposed Plan ended September 6, 2011
- Received 318 comments from 122 individuals/groups
- The U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) signed the ROD on September 30, 2011
- Remedial Design/Remedial Action Work Plan is due to EPA by September 2015

# CERCLA Process

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# What we heard

- Excavate and remove all plutonium and cesium
- Dig deeper than two feet in the high-salt waste sites
- Ship plutonium offsite
- Plutonium is mobile
- Don’t rely on caps/barriers/institutional controls
- Government control is not long-term stewardship
- Model for seismic activity, floods, climate change
- Use a more conservative (lower) cleanup level for plutonium
- Insufficient scientific data
- Use Resource Conservation and Recovery Act (RCRA) to determine cleanup for the Settling Tanks
- Support for leaving cesium in place

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# How input influenced the ROD

- Earlier input (2008) shaped the proposal, moving from primarily capping to including more Removal, Treatment, Disposal (RTD)
- DOE will consider removing more plutonium-contaminated soil at the High-Salt Waste Sites
- A more conservative cleanup value was selected for plutonium 239/240
- A requirement was added to ensure the Settling Tanks are cleaned up to satisfy state regulations

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# A closer look at the Record of Decision

| Waste Group | Waste Sites Description | Selected Remedy |
|---|---|---|
| Z-Ditches | 3 Shallow ditches, 1 tile field, and 1 unplanned release site received cooling water containing plutonium, americium, cesium and other contaminants. | RTD of contaminated soil to meet cleanup levels with disposal at the Environment Remediation Disposal Facility (ERDF) or Waste Isolation Pilot Plant (WIPP), as appropriate. |
| High-Salt | 3 below surface waste sites received highly acidic liquid waste containing plutonium, americium, and carbon tetrachloride. | RTD to remove soil to 0.6 m (2 feet) below the bottom of the disposal structure to a depth of 20 – 23 feet from the surface. Plutonium-contaminated soil will be disposed of at WIPP or ERDF, as appropriate. A soil vapor extraction system will continue to be used to treat organic contamination. Evapotranspiration (ET) barriers will be constructed over the remaining contamination. |
| Low-Salt | 4 cribs received liquid waste containing plutonium and americium. This waste was not acidic. | RTD to remove soil up to a depth of 22 - 33 feet from the surface. Plutonium-contaminated soil will be disposed of at WIPP or ERDF, as appropriate. ET barriers will be constructed over the remaining contamination. |

# A closer look at the Record of Decision (cont'd.)

| Waste Group | Waste Sites Description | Selected Remedy |
|---|---|---|
| Cesium-137 | 4 cribs and 1 unplanned release site received liquid waste containing cesium-137. | A 15-foot layer of soil cover will be maintained over these waste sites. |
| Settling Tanks | 2 settling tanks collected waste particles (sludge) before the liquid waste was discharged. | The remaining sludge in the tanks will be removed. The sludge will be sent to WIPP for disposal. |
| Other Sites | 1 French drain and 1 injection/reverse well that do not have high levels of contamination. | No action since these waste sites do not pose an unacceptable risk to human health and the environment |

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# Conclusion

- ✓ Background
- ✓ CERCLA process
- ✓ What we heard
- ✓ How input influenced the decision
- ✓ A closer look at the ROD
- • Other information available for discussion
  - – Human Health Cleanup Levels for Plutonium
  - – Plutonium Mobility in the Subsurface at the Hanford Site

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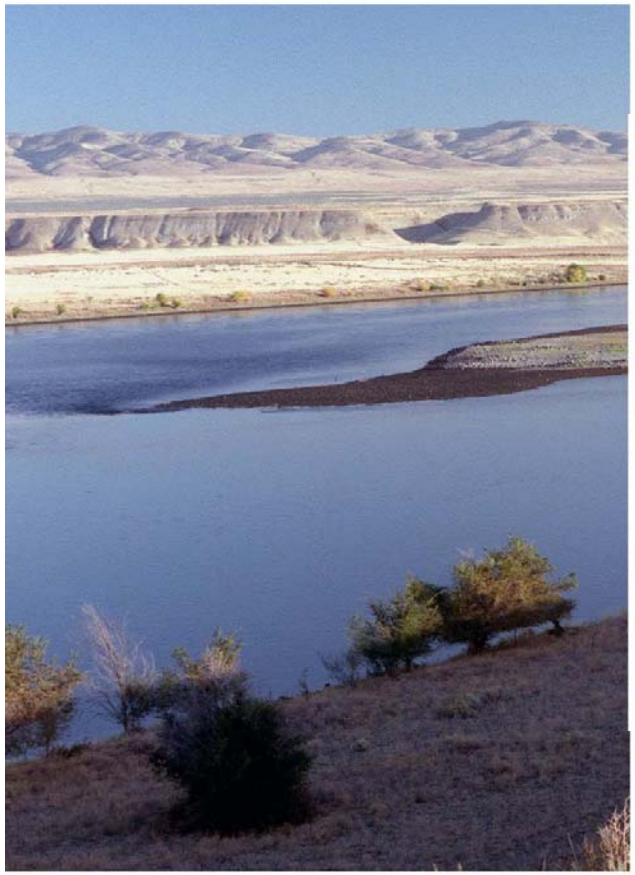
# Backup Slides



# Human Health Cleanup Levels for Plutonium

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# Numbers You May See Relating to Cleanup Activities

- Screening levels
  - Not national or state cleanup standards
  - Used to identify and define areas, contaminants and conditions that do not require further federal attention
  - Do not, by themselves, trigger a need for response actions or define unacceptable levels of contaminants in soil
- Preliminary Remediation Goals (PRGs)
  - Calculated by environmental toxicologists using site-specific information and in accordance with state and federal guidance
- Cleanup Levels
  - Established by decision makers based on PRGs, stakeholder input and other modifying criteria (including cost)

# Human Health Cleanup Levels for Radionuclides (Plutonium)

- Developed for each site to reflect site conditions, specific radionuclides and potential cumulative impacts
- Can change with time, as guidance is updated to reflect better understanding of influencing factors or as understanding of site conditions improves
- Influencing factors
  - Exposure scenarios
  - Dose conversion factor (Federal Guidance)
  - Mass loading and exposure factors
  - Anticipated land use, climate, physical setting
  - Federal Guidance on use of carcinogenic and target risk level risk ($10^{-4}$ to $10^{-6}$)
  - Consideration of cumulative impacts

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# Derivation of Cleanup Levels for the PW-1/6 and CW-5 Waste Sites

- Using factors judged appropriate for the Hanford Site Inner Area (industrial) and specific waste site characteristics, a PRG was developed, including:
  - 2,900 picoCuries/gram of soil ($10^{-4}$ target cancer risk)
  - Washington Department of Health reviewed and concurred with methodology
- In response to public comment and concern, a cleanup level was derived based on a more conservative target cancer risk
  - 765 picocuries/gram ($3 \times 10^{-5}$ target cancer risk)

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# How These Numbers Will Be Used in PW-1/3/6 and CW-5 Site Remediation

- Commitments in the ROD for removal of soil
  - Soils contaminated above the cleanup levels, and at a depth less than 15 feet, will be removed and disposed of in an appropriate disposal facility (ERDF or WIPP) for all sites
  - RTD to 2 feet below the disposal structure in 3 high salt waste sites
  - RTD to a depth of 22-33 feet in 4 low salt waste sites
- After excavating to the specified depths in the high salt waste sites, plutonium-239/240 levels will be assessed. Approach will be further detailed in the Remedial Design/Remedial Action Work Plan.

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# Comparison of the 765 pCi/gram Cleanup Levels to Other Known Values

| Site or Source | Exposure Scenario | Target Risk | Calculated PU-240 Concentration (pCi/g) |
|---|---|---|---|
| Hanford Inner Area | Worker | $10^{-4}$ | 2,900 |
| Hanford Inner Area | Worker | $3x10^{-5}$ | 765 |
| EPA Radionuclides PRGs(1) | Indoor Worker | $10^{-4}$ | 2,440 |
| EPA Radionuclides PRGs(1) | Outdoor Worker | $10^{-4}$ | 1,410 |
| Rocky Flats, Colorado | Indoor Worker | 15 mrem(2) | 1,088 |
| Lawrence Livermore National Laboratory (LLNL) | Resident | 15 mrem(2) | 122(3) |

1. Available at http://epa-prgs.ornl.gov/radionuclides/ — obtained on 11/30/2011.
2. 15 mrem was used by the EPA as an interim guidance until 1997. Final guidance is based on target risk levels.
3. 2.5 pCi/g was the screening level value for LLNL based on $10^{-6}$ target risk.

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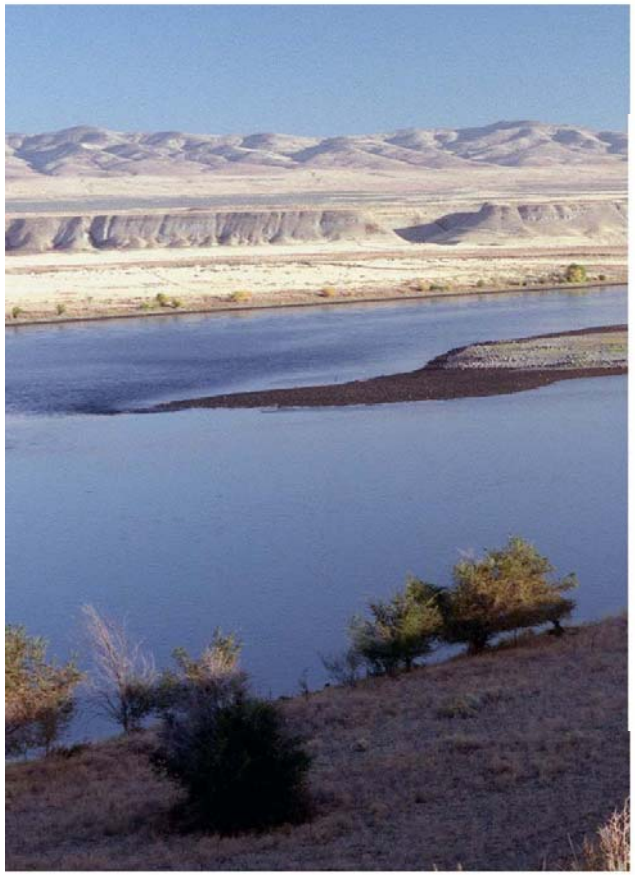

# Plutonium Mobility in the Subsurface at the Hanford Site

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# Plutonium Mobility in the Subsurface at the Hanford Site

- Conditions can exist to cause plutonium to move in the subsurface
  - Pu at Z-9 Trench reached ~120' depth due to large liquid volume (1+ Mgal) and the highly acidic and organic-rich waste stream
- Plutonium chemistry is highly complex
  - Mechanisms that can cause migration are a focus for on-going research
  - Multiple valence states can be influenced by geochemical conditions
  - Formation of colloids and nanoparticles can facilitate mobility
- Hanford's early history from 1945 to the early 1960s provides important case studies that provide a direct means to evaluate the question of Pu mobility at Hanford
  - 216-B-5 Reverse Well
  - Z-9 Trench
  - Extensive GW monitoring history provides a directly observable record
- The current evidence is that plutonium is not mobile in the subsurface at Hanford under typical conditions

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# Case Studies of Plutonium Mobility

- 216-B-5 Reverse Well
  - 10 Mgal of Pu-bearing liquid waste discharged directly to GW from 1945-1947
  - The only location where Pu is routinely detected in the GW above the drinking water standard
  - Several characterization campaigns, mid-90s treatability test (GW extraction) and continued GW monitoring show that Pu
    - Remains localized
    - Is not migrating from the discharge site
    - Adsorbs strongly to sediments
- Z-9 Trench
  - Pu migrated to depth of 120' bgs due to co-disposal with large volumes of acidic, high-salt wastes containing organic complexants
  - Low pH associated with migration
  - pH of sediment buffered to normal conditions at 120' (also confirmed in slant borehole directly beneath the trench)
  - Driving force of large discharge flow is no longer present
  - Under typical Hanford subsurface conditions, Pu is very insoluble and adsorbs strongly to Hanford sediments

# Observations of Plutonium in Hanford Groundwater

- Groundwater (GW) monitoring history
  - 3 wells within 7 meters of the B-5 reverse well routinely show Pu GW concentrations as high as 1 – 40 pCi/L
  - 1 location adjacent to Z-9 showed a concentration above 1 pCi/L in three samples; no evidence of wider breakthrough or migration
  - During 1990-94 an extensive survey of Pu in Hanford GW was conducted in all areas of the Site (3,600+ samples from 475 wells)
    - The only concentrations above 1 pCi/L were found near B-5 reverse well and 1 well near Z-9 trench
  - Despite extensive continued monitoring there is no evidence of breakthrough to GW or significant migration within GW
- Colloidal-facilitated transport
  - Provided Oregon with 8 references to studies that are specific to Hanford
  - One study examined role of colloid transport of Pu at 100-K (K Basin leak) – ultra-sensitive methods (detection levels as low as $10^{-6}$ pCi/kg) were used; “no clear evidence of colloid facilitated transport of plutonium in GW at the Hanford Site…”

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# How did we model plutonium transport at the Z-9 trench?

- Assume Pu contamination under each trench has migrated all the way down through the Cold Creek unit to the top of the Ringold formation – Remaining travel distance to water table = 70-100 ft

- Use a conservative kd (0.5) which assumes that pH does not neutralize throughout the vadose zone (extremely conservative assumption) – A more representative kd value is 20-100 (mL/g); EPA screening calculation for Pu mobility uses a kd value of 5

- Under all these conditions, no significant breakthrough to GW was found within the 1,000 years of simulation time

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# Continuing Research and New Information

- On-going Office of Science Research
  - PNNL is engaged with LLNL and other researchers to continue investigating Pu mobility at Hanford including studies of Z-9 samples
  - Studies are focused on redox processes, role of nanoparticles and colloids, role of organic solvents, and impact of complexants on subsurface transport of transuranics
  - Researchers are open to discussion of on-going work

- Factoring new information into Hanford cleanup decisions
  - GW monitoring is being focused on key interest areas
  - Scientific research is continuing to support future decisions at Hanford and decisions at other DOE sites
  - CERCLA process includes 5-Year Reviews that evaluate new information and protectiveness of remedies

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