U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

Risk-Informing Environmental Cleanup Priorities

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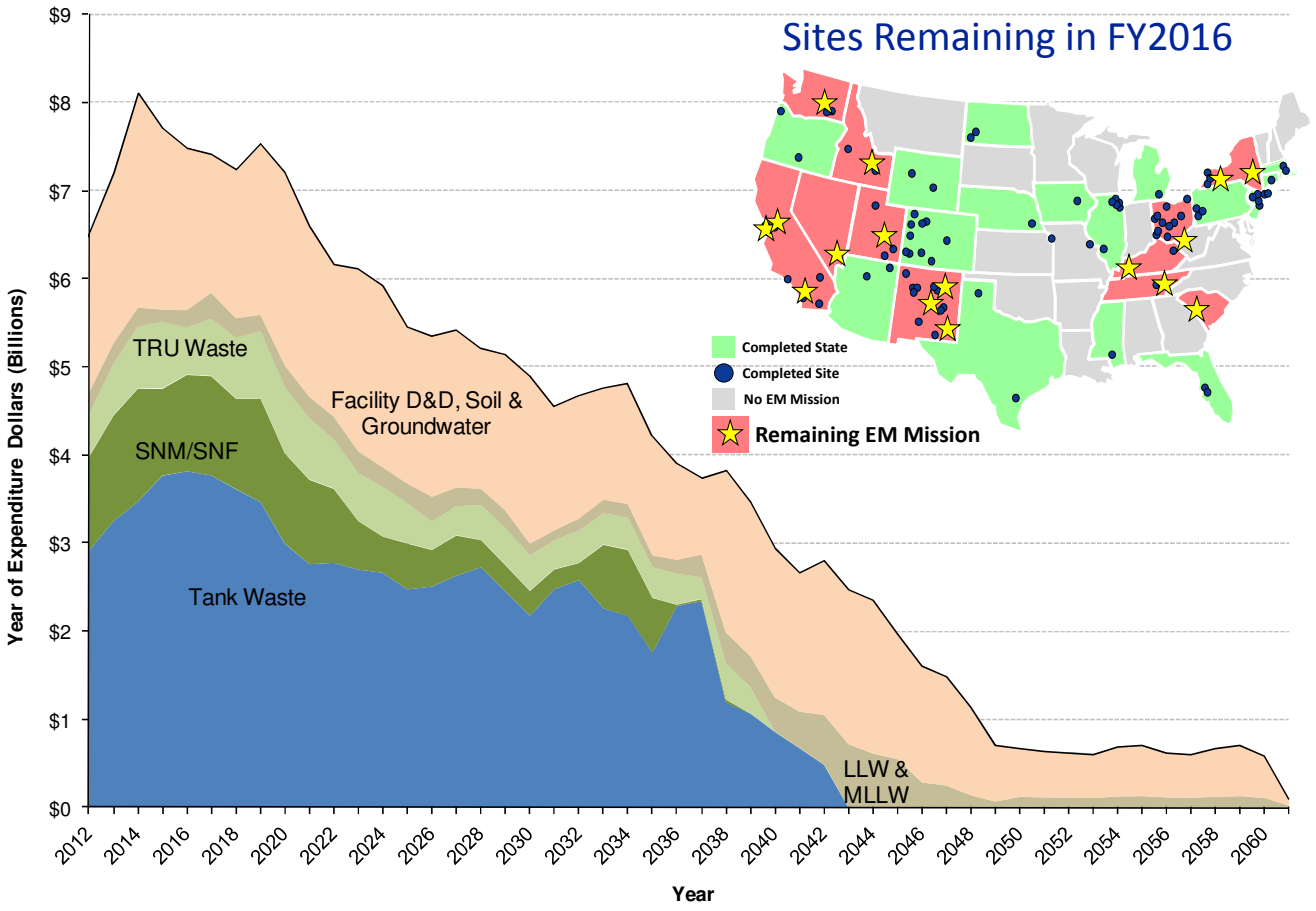
Presentation to the Interagency Performance and Risk Assessment Community of Practice Annual Technical Exchange Meeting

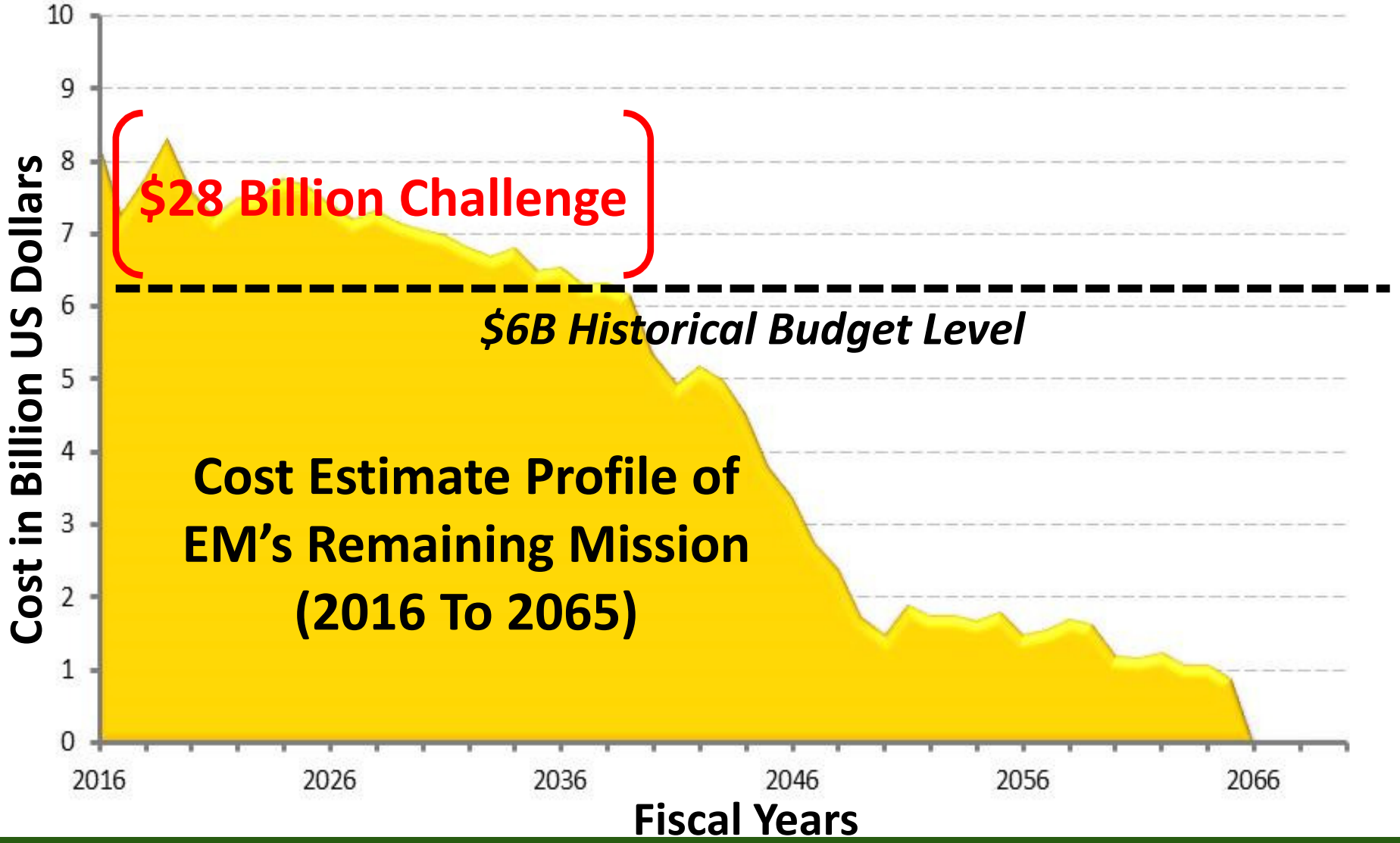
Richland, WA
December 15, 2015

DOE Environmental Cleanup Program

- Safeguards and security
- Tank waste stabilization, treatment, and disposal
- SNF & SNM disposition
- TRU and MLLW disposition
- Soil and groundwater remediation
- Facility D&D

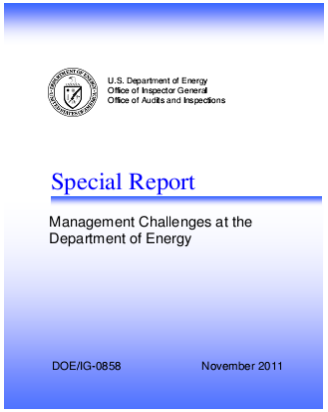


EM Challenge



Risk-Informed Decision Making Is a Management Challenge

- DOE Office of Inspector General (2011) recommended revising current remediation strategy to address environmental concerns on a national, complex-wide risk basis
  - ➢ Looking at the program holistically, fund only high risk activities that threaten health and safety or further environmental degradation
  - ➢ Reduce costs by remediating to "brownfield" rather than "greenfield" standards
  - ➢ Retain a respected outside group to rank and rate, on a national, complex-wide risk/priority (Develop National Integrated Priority List)
- 2014 Appropriations Act (i.e., 2014 “Omnibus” Bill) incorporated DOE OIG recommendations, directing the DOE to conduct independent, complex-wide risk reviews



Current Risk-Review Initiatives

The EM Program is currently the subject of two independent "risk reviews":

1. "Omnibus" Complex-Wide Risk Review
2. Hanford Site-Wide Risk Review

"Omnibus" Complex-Wide Risk Review

Omnibus Risk Review: Mandate

Consolidated Appropriations Act, 2014 (H.R. 3547, Omnibus)

"Outstanding Risks to Public Health and Safety.—The Department is directed to retain a respected outside group… to rank and rate the relative risks to public health and safety of the Department of Energy's remaining environmental cleanup liabilities. Additionally, the group should undertake an analysis of how effectively the Department of Energy identifies, programs, and executes its plans to address those risks, as well as how effectively the Defense Nuclear Facilities Safety Board identifies and elevates the nature and consequences of potential threats to public health and safety at the defense environmental cleanup sites. The group shall provide a report to the Committees on Appropriations of the House of Representatives and the Senate not later than one year after enactment of this Act."

Omnibus Risk Review: Mission

As agreed to by DOE and Congressional staff, the Omnibus Committee was charged to:

1. identify and review how specific federal policies and guidance shape DOE-EM's evaluation and use of risks to human health and safety as part of program decisions
2. review how the DNFSB identifies and elevates threats to public health and safety, and how DOE considers DNFSB concerns as part of program decisions;
3. [review] how risks to public health and safety are considered as part of state and federal regulatory compliance and priorities at DOE-EM cleanup sites;
4. [review] how DOE-EM uses human health risk and public safety input and information from a broader range of sources as part of program decisions; and
5. [review] how DOE-EM uses the range of human health risk and safety information available along with the broader range of input and constraints to balance cleanup priorities within and between cleanup sites.

NOTE: The Committee emphasized human health & safety as a recurrent theme

Omnibus Risk Review: Committee and Status

- The Omnibus Risk Review Committee comprises a group of distinguished experts, including among others:
  - ✓ Former EM Assistant Secretary Jim Rispoli
  - ✓ Former EPA Assistant Administrator Timothy Fields
  - ✓ Former NRC Commissioner George Apostolakis
  - ✓ Rutgers University Professor and Faculty Dean Michael Greenberg (Chair)

- The Congressionally-mandated Omnibus Risk Review is complete in 2015:

August 7	Omnibus Committee distributed its report to the Senate and House Appropriations Committees
September 22	Omnibus Committee briefed EPA and EM
September 26	Omnibus Committee briefed House Appropriations Committee Staff
October 26	Omnibus Committee briefed senior officials at OMB
November 10	Omnibus Committee made presentation to the Performance and Risk Assessment Community of Practice (P&RA CoP)

- The Committee is developing an epilogue to document stakeholders feedback received after the submittal of its report to Congress.

Omnibus Risk Review: Committee Recommendations

- The Omnibus committee provided 24 recommendations
  - ✓ 2 recommendations concern DNFSB
- On the remaining 22 recommendations:
  - ✓ 13 are directed to DOE
  - ✓ 5 are directed to Congress
  - ✓ 4 are proposed actions the proposed Interagency Task Force would undertake
- Summary of the Committee's recommendations can be found in the Committee presentation to the P&RA CoP, which is available on the Website: http://www.energy.gov/em/downloads/november-10-2015-webinar-congressionally-mandated-review-use-risk-informed-management

Recommendation Themes

EM developed individual responses for each Omnibus Committee recommendation and grouped the responses into four themes:

1. The True Risks of (Cleanup) Situations Must Be Understood,
2. Effective Work Processes Are Necessary to Accomplish Cleanup in a Timely and Cost Efficient Manner,
3. Cleanup Decision-making Processes Should be as Transparent as Possible, and
4. Using the Best Information to Inform Decision-making.

Omnibus Risk Review: Moving Forward

- **DOE is reviewing the Omnibus Committee recommendations.**
- **EM is working with the site offices to develop proposed responses for approval by S-1.**
- **In developing the responses, DOE affirms:**
  - ✓ The regulatory/oversight roles of EPA and the requisite States as provided in CERCLA/RCRA/Federal Facility Agreements and other regulations which govern DOE cleanup activities;
  - ✓ The importance of engaging and incorporating feedback from Federal and State regulators, Tribes, and stakeholder communities in cleanup decision-making; and
  - ✓ Departmental commitment to the 1996 Keystone Dialogue principles for environmental cleanup, the 1999 Federal Facilities Environmental Restoration Dialogue Committee (FFERDC) restatement of the Keystone Dialogue, and EPA's nine criteria for evaluating cleanup alternatives under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Federal Facilities Environmental Restoration Dialogue Committee's (FFERDC), *Final Report, Consensus Principles and Recommendations for Improving Federal Facilities Cleanup* (1996).

Hanford Site-Wide Risk Review

Hanford Site-Wide Risk Review

- DOE Deputy Under Secretary for Management requested CRESP to conduct an independent review of Hanford site-wide risks to human-health, nuclear safety, and environmental and cultural resources
- The goal of the Risk Review Project is to carry out a screening process for risks and impacts to human health and resources.
  - ➢ The results of the Risk Review Project are intended to provide the DOE, regulators, Tribal Nations and the public with a more comprehensive understanding of the remaining cleanup at the Hanford Site.
  - ➢ Intended to help inform (1) decisions on sequencing of future cleanup activities, and (2) selection, planning and execution of specific cleanup actions, including which areas at the Hanford Site should be addressed earlier for additional characterization, analysis, and remediation.
  - ➢ One of many inputs from many sources to help inform decisions.
- **Scope**: "To go" cleanup and waste management activities as of FY 2016

Hanford Risk Review: Why Now?

- A lot has been achieved at Hanford
  The 2015 Vision is approaching completion, but…
- > 50 years and > $100 Billion "to go" in Cleanup
- This is a multi-generational challenge

Hanford Risk Review: What the Project *is not*

- **The Risk Review Project is neither intended to substitute for, nor preempt any requirement imposed under applicable federal or state environmental laws or treaties or the Tri-party FFA/Consent Order**.
- **Cleanup actions considered completed by the Tri-Parties are not part of the Risk Review Project and therefore will not be evaluated.**
- **The Risk Review Project is focused on hazard and risk characterization, which is a necessary predecessor to risk management, but does not focus on risk management decisions.** The Risk Review Project considers a plausible range of cleanup actions to better understand the range of potential risks that may be caused by future cleanup actions.
- **The Risk Review is not carrying out a CERCLA risk assessment nor a Natural Resources Damage Assessment evaluation.** Evaluations of hazards, existing environmental contamination and rough order-of-magnitude estimates of risks to receptors using existing information will be the basis for developing groupings, or bins, of risk and identifying the most urgent risks to be addressed.

OFFICE OF ENVIRONMENTAL MANAGEMENT

Hanford Risk Review: Project Team

David S. Kosson[1], Charles W. Powers[1], Jennifer Salisbury, Craig H. Benson[2], Kevin G. Brown[1], Lisa Bliss[1], Joanna Burger[3], Bethany Burkhardt[1], James H. Clarke[1], Allen G. Croff[1], Lyndsey Fern Fyffe[1], Michael Gochfeld[3], Kathryn A. Higley[4], George M. Hornberger[1], Kimberly L. Jones[5], Steven L. Krahn[1], Eugene J. LeBoeuf[1], Henry S. Mayer[3], Richard B. Stewart[6], and Hamp Turner[1]

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Pacific Northwest National Laboratory assistance:

Wayne Johnson, Elizabeth Golovich, Robert Bryce, Amoret Bunn, John Cary, Mickie Chamness, Janelle Downs, Vicki Freedman, Alicia Gorton, Jeannette Hyatt*, Ellen Kennedy, George Last, Peter Lowry, Michelle Niemeyer, Mary Peterson, Christine Ross, and Michael Truex

*Savannah River National Laboratory

CRESP

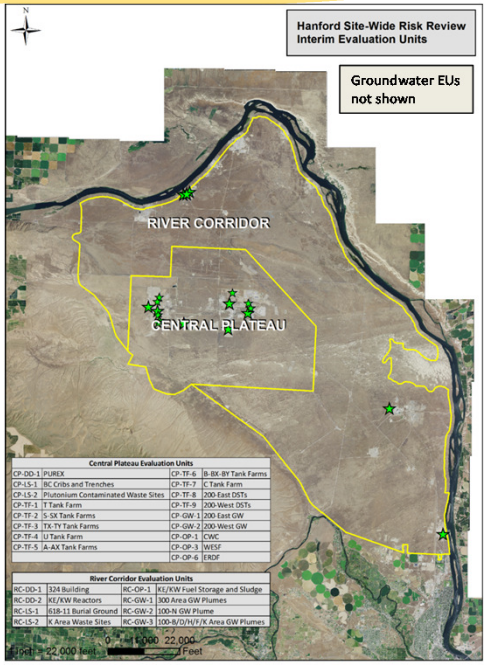
Consortium For Risk Evaluation with Stakeholder Participation

Hanford Risk Review: Overall Methodology

Grouping of all "to-go" Hanford cleanup into 60+ pieces - called **Evaluation Units (EUs)**

- Legacy Sources
- Tank Waste & Farms
- Groundwater Plumes
- D4 of Inactive Facilities
- Operating Facilities

Basic EU Characteristics include contaminant inventory, generic cleanup options and administrative status



RECEPTORS (Evaluation for each of the Receptors specifically defined)

- Human Health (workers, others)
- Groundwater
- Columbia River
- Ecological
- Cultural*

**Evaluated but not rated*

the 3 evaluation time-frames

- Active Cleanup - to 2064
- Post Cleanup ***Near-term*** - to 2164
- Post Cleanup ***Long-term*** - to 3064

Remaining contaminant inventories & barriers

An **Evaluation Template** prepared for each of the 60+ Evaluation Units (EU) -including Risk Ratings

Risk Ratings – [*not rankings*]
Not Discernable, Low, Medium, High, Very High

Interim vs. Final Report
25 vs. 60+ Completed EU Templates as data and comparative analysis to help guide Site-wide risk-informed sequencing:

- 9 vs. 9 Tank Waste and Farms EUs
- 5 vs. 5 Groundwater EUs
- 3 vs. 9 D&D EUs
- 4 vs. 21 Legacy Source Site EUs
- 4 vs. 16 Operating Facility EUs

Hanford Risk Review: General Observation

In carrying out the Risk Review Project, the team has found that ***different hazard and risk considerations are important***:

a. **To inform sequencing of cleanup activities**, *nuclear, chemical, and physical safety* (i.e., hazards, initiating events and accident scenarios) *and the threats to groundwater* and the Columbia River *are the primary risk considerations*.

b. **To inform selection, planning and execution of specific cleanup actions**, *potential risks and impacts to worker safety, ecological resources and cultural resources are the primary risk considerations*.

c. **To inform cleanup criteria** (i.e., residual contamination levels), *future land use, protection of water resources, land ownership and control, and durability of institutional and engineered controls, and legal/regulatory requirements are the primary considerations that influence future human health risk estimates*.

   Risks to human health should be considered in combination with risks to environmental and ecological resources for establishing cleanup criteria.

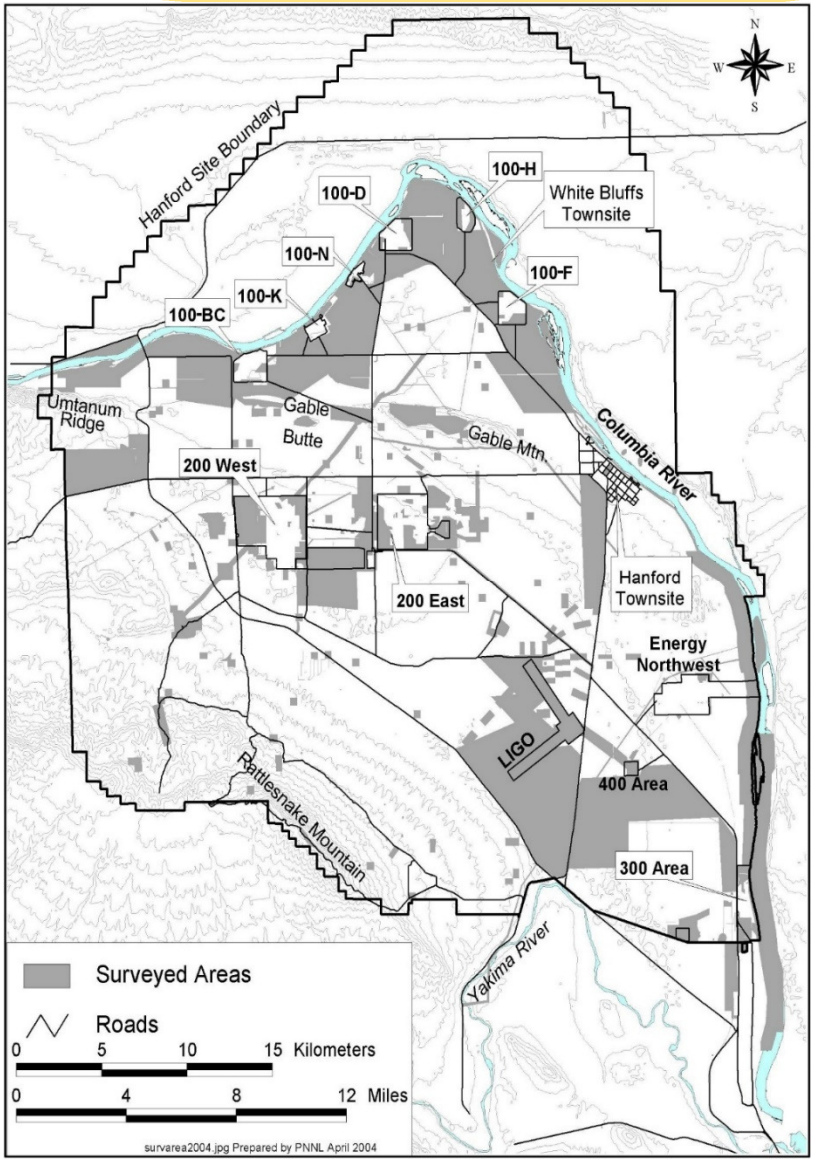
Hanford review's primary focus is on items a and b, above;
Hanford risk review will not be making recommendations on specific cleanup criteria

Hanford Risk Review: Cultural Resources

- **Native American:** Pre-contact - 10,000 years to Present
- **Historic Pre-Hanford:** 1805 to 1943
- **Manhattan Project and Cold War Era:** 1943 to 1990

Direct Impact: resource is harmed or disturbed
Indirect Impact: visual or other impacts

Unknown - uncertainty expressed (complete EU not evaluated; consultation may be necessary)
Known - known cultural resources present
None - mitigated, removed or none present



Hanford Risk Review: Risks to and from Groundwater

- Threats *to* Groundwater as a Protected Resource
  - Current groundwater contaminant plumes
  - Vadose Zone Contaminant Inventories
  - Tank wastes and other inventories in engineered systems
  - ➢ ***Groundwater Threat Metric*** (GTM) - maximum volume of water that could be contaminated by the contaminant inventory if it was in the saturated zone at the water quality standard
- Threats *from* Groundwater to the Columbia River
  - Riparian Zone – Impacted area & conc./threshold
  - Benthic Zone – Impacted river reach & conc./threshold
  - Free stream – Not discernable, dilution factor > 100 million

Hanford Risk Review: Interim Observations

1. **Address Parts of Specific Evaluation Units Earlier.**
2. **Highest Priority Group Based on Evaluation of Potential Risks to Human Health and the Environment** (*not in any specific order, for EUs completed to-date*):
   - A. **Reduction of threats posed by tank wastes.** Hydrogen gas generation, primarily related to Cs-137 and Sr-90 content of the waste, poses a threat to nuclear safety and human health through loss of tank integrity. Tank vapors may pose a threat to worker safety. Tc-99 and I-129, both being persistent and highly mobile in the subsurface pose threats to groundwater through leakage from tanks. This interim observation is consistent with the priority given by the agencies to treat low activity waste at WTP as early as possible ***if Cs-137, Tc-99 and I-129 separated from the waste are not returned to the tanks***. However, the risk profile will not be reduced significantly nor increased if Cs-137, Tc-99 and I-129 are returned to the tanks during LAW treatment.
   - B. **Reduction or elimination of risks associated with external events and natural phenomena (severe seismic events, fires, loss of power for long duration).** Facilities affected are WESF (cesium and strontium capsules), Central Waste Complex, and PUREX waste storage tunnels.
   - C. **Dependence on active controls (e.g., reliance on power, cooling water, active ventilation) to maintain safety for additional facilities with large inventories of radionuclides.** These conditions are (i) air handling ducts at WESF, and (ii) sludge at K-basins (sludge treatment project).

Hanford Risk Review: Interim Observations

3. **Cleanup Actions That Potentially May Cause Substantial Human Health Risks and therefore warrant consideration of interim actions and defered cleanup**:

   A. **Retrieval, treatment and disposal of contaminated soils underlying Building 324 and disposal of the building after grouting of the contaminated soils within the building.** Currently, no migration of soil contamination to groundwater has been indicated. As a result, approaches that allow for in-situ decay of the soil contaminants (Cs-137, Sr-90) warrant further consideration.

   •Interim risk mitigation measures should be considered (possible water main leaks, infiltration, monitoring)

   B. **Retrieval, treatment and disposal of materials from 618-11 within caissons, vertical pipe units and burial grounds** because of the characteristics of wastes (high activity, pyrophoric, poorly characterized) to be retrieved. The close proximity to the Columbia Northwest Generating Station and its workforce jeopardizes continued operations and worker safety in the event of a fire and/or release from 618-11. The current cover over the buried wastes, except the caissons and vertical pipe units, is effective in limiting water infiltration to the wastes where the cover is present. This set of conditions warrants consideration of instituting interim mitigation measures and delaying waste retrieval until closure of the generating station.

Hanford Risk Review: Interim Observations

4. **Groundwater Threats.** Many of the threats and current impacts to groundwater are being interdicted and/or treated. The greatest threats and impacts to groundwater that are not currently being addressed are from:

   A. **Groundwater Plumes Not Currently Being Actively Addressed.** Tc-99 and I-129 already in groundwater in 200 East Area (200-BP-5; EU CP-GW-1). The 200-BP-5 I-129 plume extends to the southeast (200-PO-1; EU CP-GW-1) but may be too dispersed for effective remediation other than natural attenuation.

   B. **Vadose Zone Threats to Groundwater Not Currently Being Addressed.** Tc-99, I-129 and Cr(VI) in the vadose zone associated with BC Cribs and Trenches (EU CP-LS-1) and the legacy sites associated with B-BX-BY Tank Farms (EU CP-TF-6), both located in the 200 East Area. Infiltration control, such as capping, as well as other approaches, may be effective in reducing the flux of these contaminants from the vadose zone into groundwater. Uranium currently is being extracted from perched water in B-Complex.

   C. **At 324 Building Relatively Modest Actions Could Reduce Threat.** At 324 building, the largest risk for migration of Cs-137 and Sr-90 from the soils is from breakage of a main water pipe and infiltration of precipitation and runoff in close vicinity of the building. This risk may be mitigated through water supply modifications, infiltration controls, and additional groundwater monitoring.

   D. **At 618-11 Waste Site Relatively Modest Actions Could Reduce Threat**. At 618-11, the potential for release of additional contaminants to groundwater can be mitigated by providing a cover that prevents infiltration but maintains gas venting over the caissons and vertical pipe units (currently gravel covered area).

Hanford Site-wide Risk Review: Next Steps

- An interim report on review methodologies was released on August 31, 2015 for public comment (closed Oct. 30, 2015)
- Facilitated workshop is proposed to gain broad input on priorities
  - Risk Review Project is only one of the many inputs
- Evaluation of remaining 35 Evaluation Units is proposed, to complete the final report in 2016