

## NRC Responsibilities and Review Process for Phase 1 Decommissioning Plan

### The 1980 West Valley Demonstration Project Act Defines NRC Responsibilities

#### Prescribe Cleanup Criteria

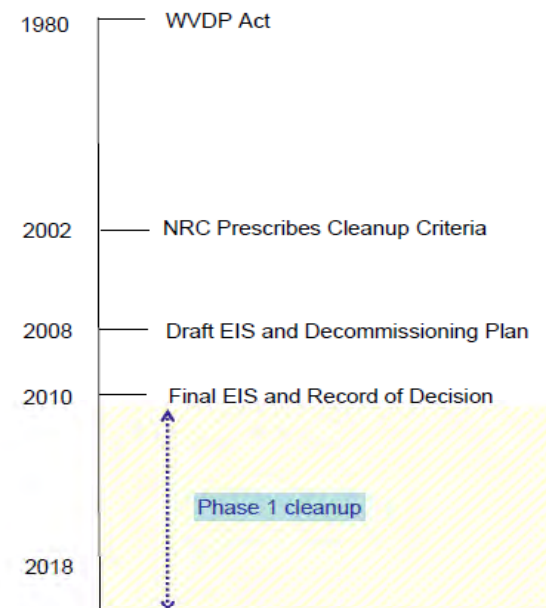
- NRC prescribed the License Termination Rule (10 CFR part 20, subpart E) as the cleanup criteria in 2002

#### Informal Review and Consultation

- NRC informal review and consultation for Phase 1 DP
  - Completeness review (3/2009)
  - Technical review (12/2009)
  - Technical evaluation report (early 2010)

#### Monitoring

- NRC monitoring of Phase 1 cleanup
  - In-process monitoring during DOE remediation
  - Review of DOE Final Status Survey Report (FSSR)
  - Independent confirmatory survey, as needed



Conceptual Decommissioning Timeline

#### Next Steps

- Review of Information Collected During the Ongoing Assessment Period
- Core Team Input on Phase 2 Decision
- Collaboration on Supplemental EIS (if needed), and
- Review and Action on Phase 2 Decommissioning Plan

## NRC Stakeholder Interactions Related to West Valley Demonstration Project Phase 1 Decommissioning Plan

### NRC's Decommissioning Plan (DP) Review is Open to Public

- Interactions tied to 1980 West Valley Demonstration Project Act
- In 2000, NRC established guidelines for interactions

### Meetings on Phase 1 DP

- Seven meetings conducted
- All meeting noticed and open to public
- Meeting notices posted on NRC public website  
<http://www.nrc.gov/public-involve/public-meetings/index.cfm>

### Documents on Phase 1 DP

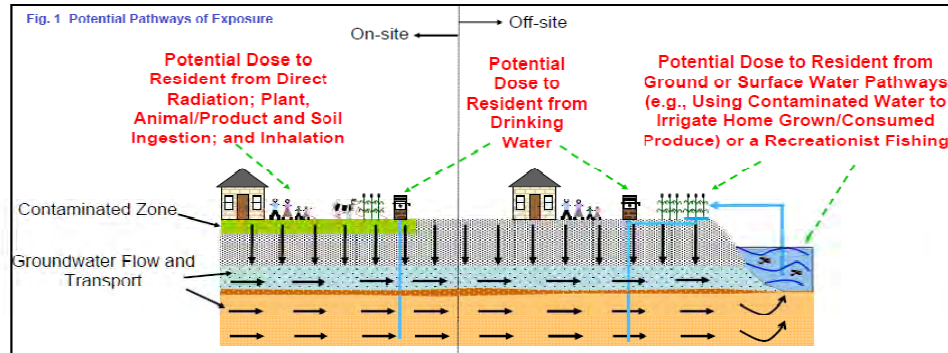
- Documents related to NRC review publicly available:
  - DOE Phase 1 DP
  - Stakeholder correspondence
  - NRC request for additional information (RAI)
  - DOE RAI response
  - NRC technical evaluation report

### NRC Considers Stakeholder Comments

- Correspondence received from seven stakeholders
- Over 100 comments received
- Comments informed staff review, and many incorporated into NRC's RAI



## Development of Derived Concentration Guideline Levels (DCGLs)



### What are DCGLs?

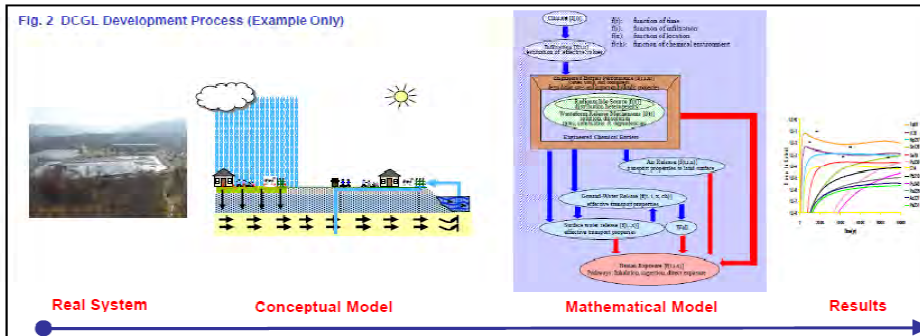
- Derived Concentration Guideline Levels or (DCGLs) are clean-up levels used to guide remediation of a contaminated site
- DCGLs are concentration limits for each radionuclide expected to be present at the site

### How are DCGLs derived?

- Considers all the different ways contamination could move through the environment (see figure above), and
- How a member of the public could be exposed to radioactivity based on reasonable land use assumptions such as gardening or recreational fishing (see figure above)
- All pathways dose assessment performed over a 1000 year compliance period (see figure below)

### What questions were raised during the review?

- Clarification was needed on how assumptions used to derive DCGLs would be verified in the field (e.g., source size)
- Additional information was needed on how DOE would verify the site had been sufficiently cleaned following remediation
- Additional justification was needed to support parameter values selected in dose assessment
- Additional information was needed to support the assumption that the cistern drilling scenario evaluated by DOE would lead to the most restrictive DCGLs compared to other potential scenarios (e.g., erosion, natural gas drilling, worker, surface water usage)



## Conceptual Model Uncertainty: Groundwater Dependent Pathways

### How did DOE derive clean-up levels?

- DOE considered potential dose to a farmer who grows crops on contaminated land.
- Contamination is assumed to be brought to the surface from construction of a cistern or large diameter well.

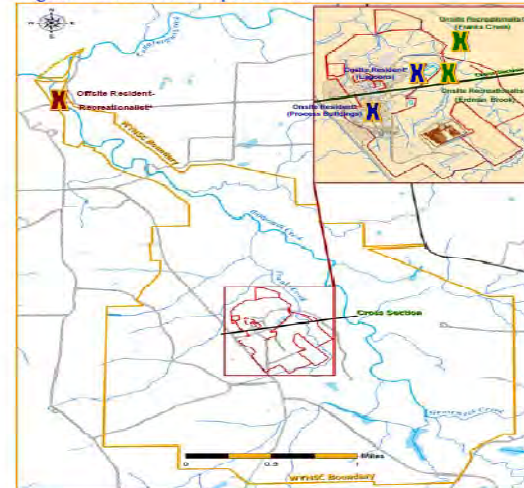
### Questions raised during NRC's review:

- What other scenarios could lead to potential exposure to a member of the public?
- How does residual subsurface contamination move through the environment at West Valley?
- How could contamination from multiple sources coalesce in ground and surface water?
- What are the potential pathways of exposure to members of the public at on-site and off-site locations?

### NRC staff performs independent modeling and calculations during its reviews:

- Modeling and calculations were conducted to evaluate the potential groundwater pathway risk posed by residual contamination located at the bottom of the excavations.

Figure 1 Potential Receptor Locations



Potential Receptors	Pathways of Exposure						
	External	Inhalation	Soil Ingestion	Plant	Animal	Fish	
<b>X</b> Onsite* (Resident)							
<b>X</b> Onsite* (Recreationalist)	X	X	X				
<b>X</b> Offsite* (Resident & Recreationalist)	X	X	X	X	X	X	

\*The designations onsite and offsite pertain to the DOE project premises.

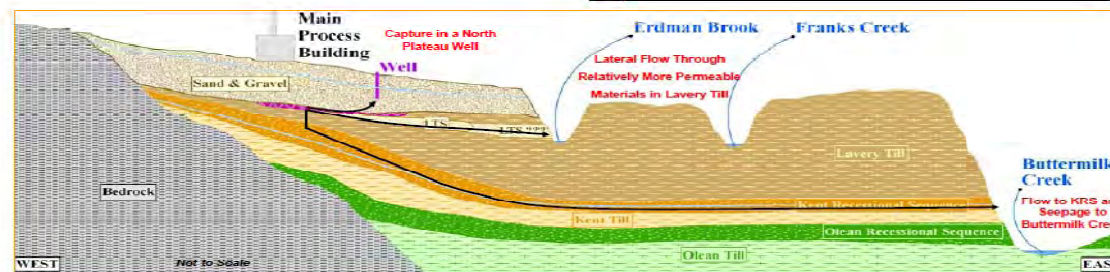


Figure 2 Cross Section Showing Potential Pathways of Exposure Through Ground and Surface Water

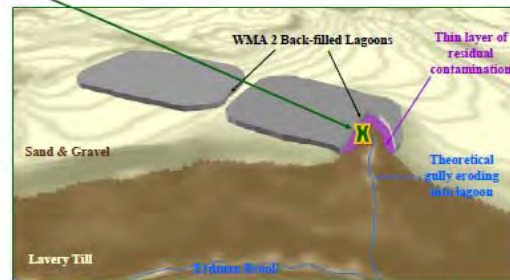
## Conceptual Model Uncertainty: Erosion Scenarios

### How did DOE derive clean-up levels?

- DOE considered potential dose to a farmer who grows crops on contaminated land
- Contamination is assumed to be brought to the surface from construction of a cistern or large diameter well



Potential Receptor Locations



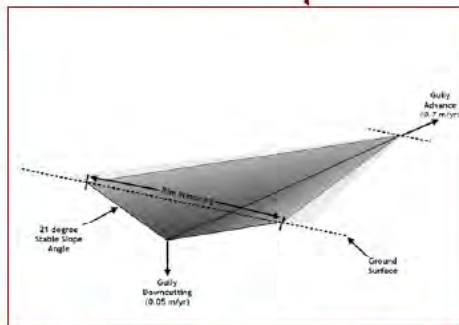
Conceptual Model Used to Estimate Dose Impacts to Onsite Recreational Receptor



Example of Gully Advancement on Site Streams

### Questions raised during NRC's review:

- How can erosional processes lead to exposure to potential receptors?
- What erosional processes dominate the potential risk to receptors?
- What are the differences in potential pathways of exposure to onsite and offsite receptors?
- How can uncertainty in erosion predictions be reduced, constrained, or adequately managed?



Model Used to Estimate Dose Impacts to Offsite Residential Receptor

### NRC staff performs independent modeling and calculations during its reviews.

#### Onsite\* Recreational Receptor:

Assumed a 100 to 1000 m<sup>2</sup> exposure area representing exposed surface of lavery till from stream widening or gully advancement

Pathways include:

1. External dose
2. Inhalation
3. Incidental Soil Ingestion

#### Offsite\* Resident-Recreational Receptor:

Eroded contamination assumed to all be dissolved in aqueous phase for subsequent uptake at downstream receptor location (e.g., contaminated surface water used for drinking water and irrigation).

All pathways listed above plus plant, animal, and drinking water ingestion pathways

\*The designations onsite and offsite pertain to the DOE project premises.

## Conceptual Design Of Engineered Hydraulic Barrier Walls

### What are Engineered Barriers?

- Constructed containment systems that control movement of groundwater (vertical barriers) or infiltration of surface runoff and rain (caps)

### What is the Purpose?

- Facilitate subsurface excavation
- Prevent recontamination of excavation area from contaminated groundwater

### What are the Preliminary Designs?

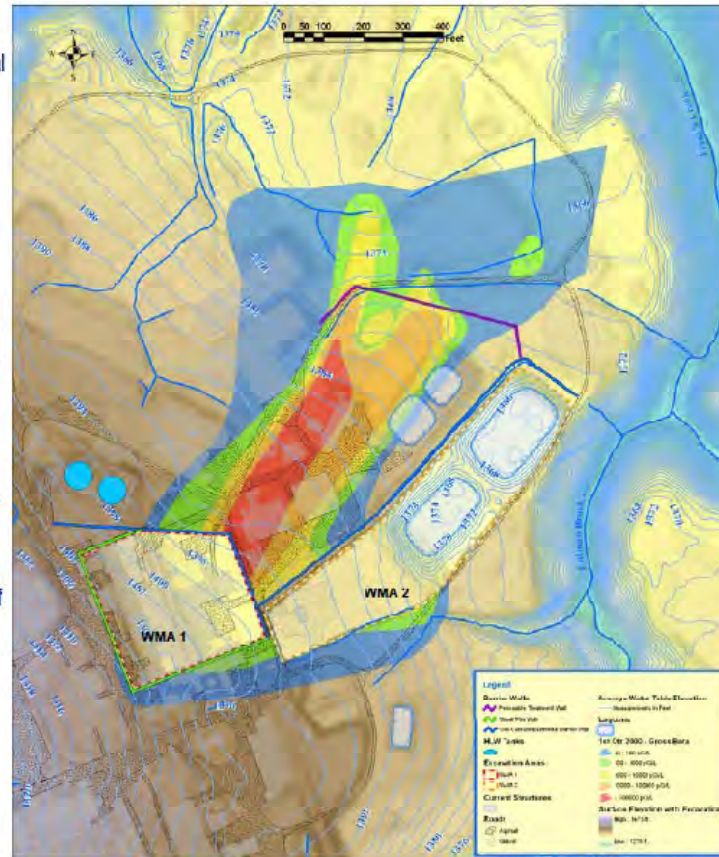
- Two vertical soil-cement-bentonite walls
- Approximately 750 ft long, 2-13 ft wide, and up to 50 ft deep at WMA 1
- Approximately 1,100 ft long, and up to 20 ft deep at WMA 2
- 6.0 E-06 cm/s as maximum permeability
- At least 2 ft into the Lavery till

### What are the Risk Significant Aspects of NRC's Review?

- Recontamination
- Worker safety issues
- Potential adverse impacts on other systems and future cleanup options

### How Would the Performance of an Engineered Barrier be Evaluated?

- Hydraulic head monitoring (nested piezometers and monitoring wells)
- Groundwater modeling
- Groundwater quality monitoring



## ALARA Evaluation

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### What is ALARA?

- ALARA is the principle of reducing exposures to radiation when it is **reasonable** or practical to do so—to As Low As Reasonably Achievable, or ALARA.
- ALARA evaluations usually address two aspects of what is **reasonable** : (1) typical good practices that are done to reduce exposures and (2) comparison of costs and benefits of alternative actions.
- The NRC criteria for decommissioning (for unrestricted use, applicable to Phase 1) include requirements for ALARA.

### Review Areas for NRC's Review of DOE's ALARA Evaluation:

- Has a quantitative cost-benefit analysis been performed?
  - Have appropriate benefits and costs been addressed?
  - Have benefits and costs been evaluated for the 1000-year compliance period?
- Have typical good practice efforts for remediation been considered?

### Open Issues on ALARA:

- The NRC staff has requested additional information on the ALARA evaluation that DOE submitted in its Decommissioning Plan.
  - DOE should discuss good practice efforts for ALARA that are part of cleanup activities.
  - In the cost-benefit part of its ALARA evaluation, DOE applied a discount rate to adjust the value of future benefits to a present value (today's dollars) of the benefit. DOE should consider lower discount rates or no discounting for assessing worth of future benefits, which include averted doses (i.e., the reduction in potential future doses, due to remediation).
  - DOE should explain reasoning for presenting a preliminary ALARA analysis with a planned additional, complete ALARA analysis during Phase 1.

## Overview of Site Decommissioning and the Radiation Survey and Site Investigation Process

### Areas Reviewed by the NRC Health Physics Team:

Radiological Status of the Facility  
Planned Decommissioning Activities  
Facility Radiation Surveys

Environmental Radioactivity Data  
Details of DCGL Development and Integrated Dose Analysis

### What are the principal steps in the Radiation Survey and Site Investigation Process?

- Site Identification
- Historical Site Assessment
- Characterization Survey
- Remedial Action Support Survey
- Final Status Survey



Figure 1: NRC/ORISE performing confirmatory surveys

### Six Survey Types Used For Compliance with the Radiological Criteria for Unrestricted Release:

- Background Survey
- Scoping Survey
- Characterization Survey
- Remedial Action Support Survey
- Final Status Survey
- Confirmatory Survey

### What role does the NRC play in Site Decommissioning and in the Radiation Survey and Site Investigation Process?

#### What is the purpose of all these surveys?

- Determine radiological condition of the site
- Ensure that remediation processes are successful
- In process verification of survey results by NRC personnel
- Independent confirmation of WVDP Final Status Survey



Figure 2: NRC/ORISE performing confirmatory surveys

#### Decommissioning Plan

- NRC reviews and comments on the Decommissioning Plan per the West Valley Demonstration Project Act and DOE-NRC Memorandum of Understanding

#### Characterization Surveys

- NRC reviews characterization surveys to ensure the radiological condition of the site is sufficiently established to permit planning for site remediation
- NRC may elect to perform independent surveys and split sampling analyses to verify performance

#### Remedial Action Support Surveys

- NRC reviews remedial action survey plans to ensure that they are adequate to determine when remediation actions have been successful, so that a Final Status Survey may begin
- NRC staff may provide oversight during the remedial action process through monitoring and in-process split sampling analyses of remediated areas

#### Final Status Survey Design

- Final Status Survey design is provided as a part of the Decommissioning Plan
- NRC staff determines if the Final Status Survey design is adequate to demonstrate compliance with the NRC cleanup criteria for unrestricted release

#### Final Status Survey

- During the implementation of the Final Status Survey NRC staff may provide oversight through in-process monitoring and split sampling analyses

#### Confirmatory Survey

- The confirmatory survey is performed by the NRC (or its contractor) to provide data to substantiate the results of the Final Status Survey

#### Final Status Survey Report

- NRC staff will review the Final Status Survey report to determine if the survey results demonstrate that the site meets the radiological criteria for unrestricted release



## Perspectives on Radiation Dose

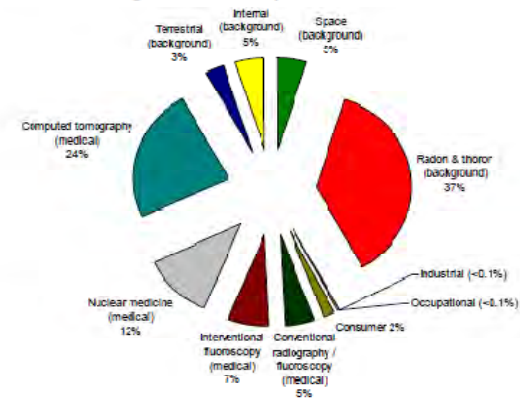
What is radioactivity? Where does radiation come from? What is radiation exposure? What is radiation dose?

### Measuring Radiation

There are four different, but interrelated, units for measuring radioactivity, exposure, absorbed dose, and dose equivalent. These can be remembered by the acronym **R-E-A-D**

- **Radioactivity** refers to the amount of ionizing radiation released by a material.
- **Exposure** describes the amount of radiation traveling through the air. Many radiation monitors measure exposure.
- **Absorbed dose** describes the amount of radiation absorbed by an object or person (that is, the amount of energy that radioactive sources deposit in materials through which they pass).
- **Dose equivalent (or effective dose)** combines the amount of radiation absorbed and the medical effects of that type of radiation. Units for dose equivalent are the roentgen equivalent man (rem) and sievert (Sv), and biological dose equivalents are commonly measured in 1/1000th of a rem (known as a millirem or mrem).

### How much radiation do you receive? Ionizing Radiation Exposure to the Public



The above chart is taken from the National Council on Radiation Protection and Measurements (NCRP) Report No. 160, "Ionizing Radiation Exposure of the Population of the United States," 2009.

### Comparison of Doses Received by the Public to the NRC Cleanup Criteria for Site Decommissioning/Unrestricted Release

Description	mrem	Source
Living near a nuclear power station (annual)	<1	EPA
Cosmic radiation living at sea level (annual)	24	EPA
<b>NRC cleanup criteria for site decommissioning/unrestricted release (annual)</b>	<b>25</b>	<b>NRC</b>
Cosmic radioactivity (annual)	27	EPA
Terrestrial radioactivity (annual)	28	EPA
Natural radioactivity in the body (annual)	40	EPA
Cosmic radiation living in Denver (annual)	50	EPA
NRC annual dose limit for the public (due to operations from licensed nuclear facilities)	100	NRC
Average occupational dose received by U.S. commercial radiation workers in 1980	110	NCRP 101
Average dose to airline flight crew member, from cosmic radiation and transport of radioactive materials by air (annual)	170	NCRP 101
Radon in average home (annual)	200	EPA
Average dose to people in the U.S. from all sources of background radiation (annual)	310	NCRP 160
Limit for occupational exposure of radiation workers set by the U.S. NRC and DOE (annual)	5000	NRC, DOE

Calculate your annual dose estimate from the handout or: <http://www.nrc.gov/about-nrc/radiation/around-us/calculator.html>

## NRC Region 1 Monitoring Activities for the DOE West Valley Demonstration Project



*Discussion on Tank & Vault Drying project*

- Monitoring visits up to four times/year
- Conducted during various site operations
- Coordinated with NRC Project Manager
- Results communicated with DOE, New York State agencies, and WVES
- Results documented in written reports



*Discussing the North Plateau Groundwater Plume mitigation project*



*Discussing Tank 8D-4 waste in the STS operating aisle*



*Discussing the Tank & Vault Drying project*



*Surveying out of radiological buffer area*