THE HANFORD SITE

Cumulative Impact Evaluation

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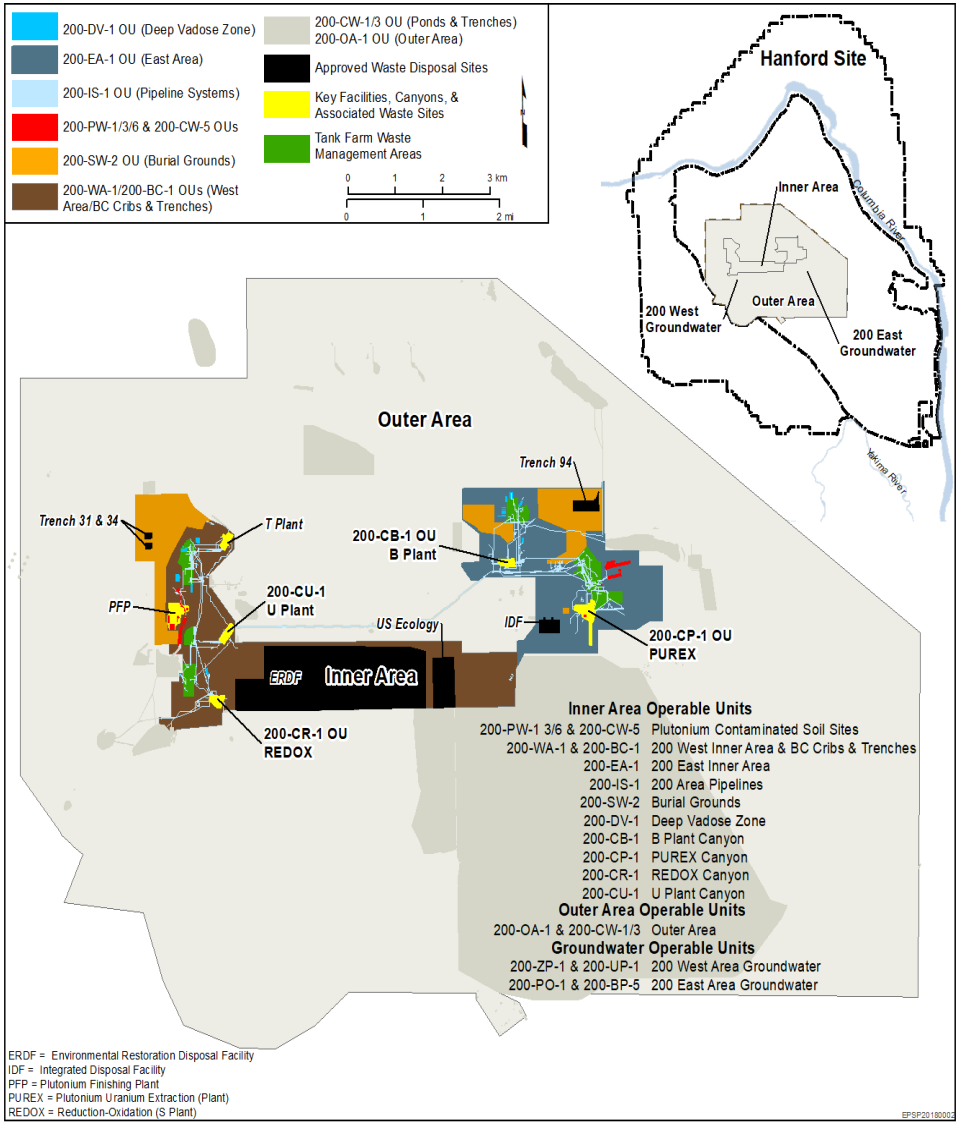
Presented to: Hanford Advisory Board River and Plateau Committee

September 19, 2019

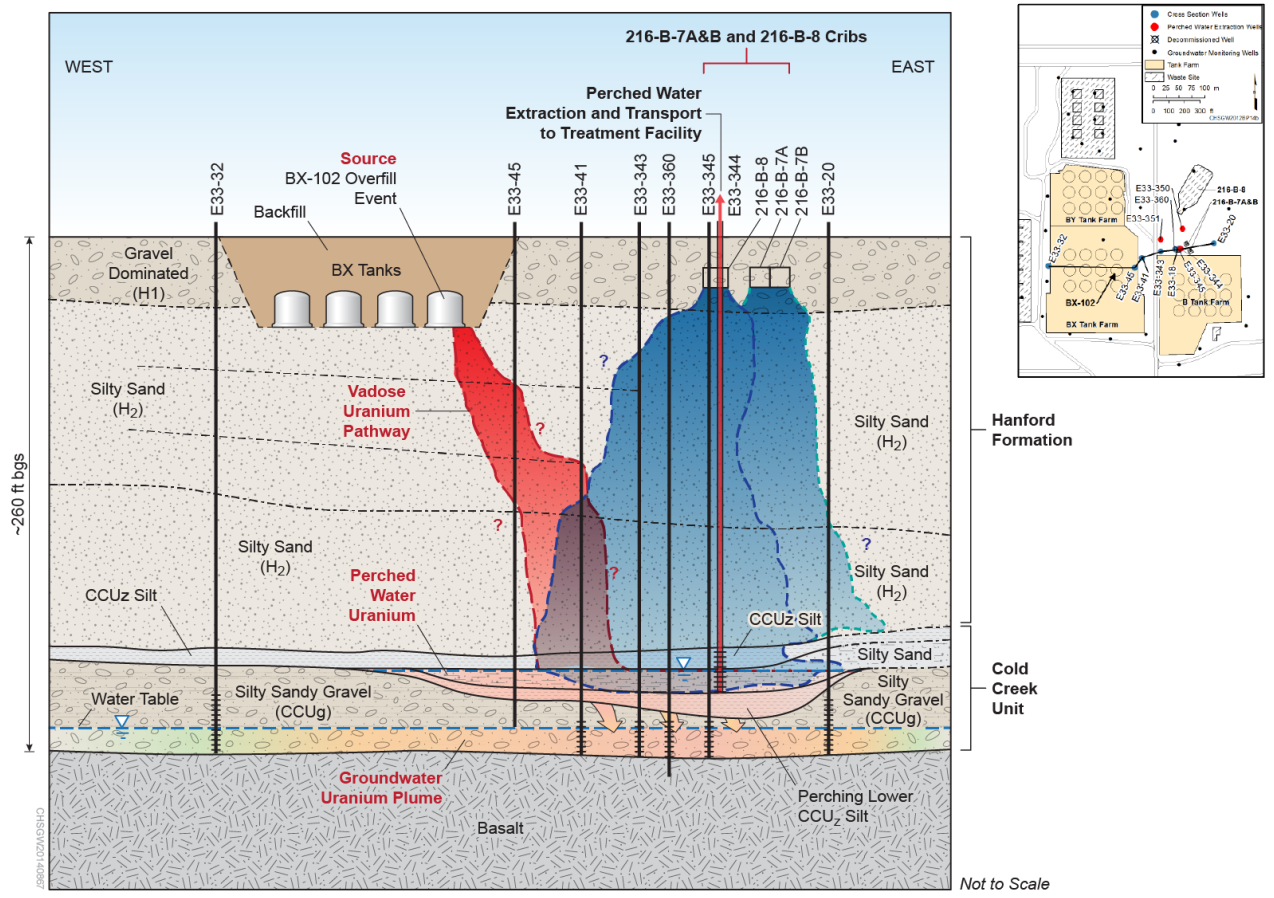
Overview

- Cumulative Impact Evaluation (CIE) vision and development
- Framing questions and answers
- Current work and future activities



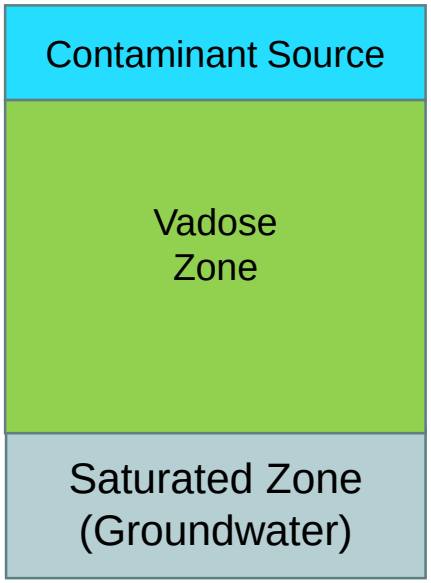
Cumulative Impact Evaluation

Comingled contaminant plumes in soil and groundwater drive the need to understand cumulative impacts



Cumulative Impact Evaluation Thesis Statement

The CIE will be a dynamic set of tools that will support remediation and closure decisions across the Central Plateau and will enable an integrated evaluation of various alternatives.



Why Cumulative Impact Evaluation Is Needed

- Need to evaluate impacts of remedial actions, corrective measures, and closure actions using consistent approaches and under a common framework
- Situations across the Hanford Site where discharges to one waste site or a tank farm impacted movement of contaminants under a nearby waste site include:
  - 200 West Example: U Plant area
  - 200 East Example: B Complex
- Comingling of contamination from multiple waste sites and tank farms in groundwater is well documented

Example Application for Use of Cumulative Impact Evaluation (1)

- CIE does not supplant the regulatory decision-making process:
  - CIE is a decision-support tool
  - Normal Tri-Party Agreement process will be followed for *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) and *Resource Conservation and Recovery Act* (RCRA) decisions
- Any application of the CIE within a decision document will be fully documented and subject to agencies' review
- Individual modules can be used in the CERCLA/RCRA decision process

Example Application for Use of Cumulative Impact Evaluation (2)

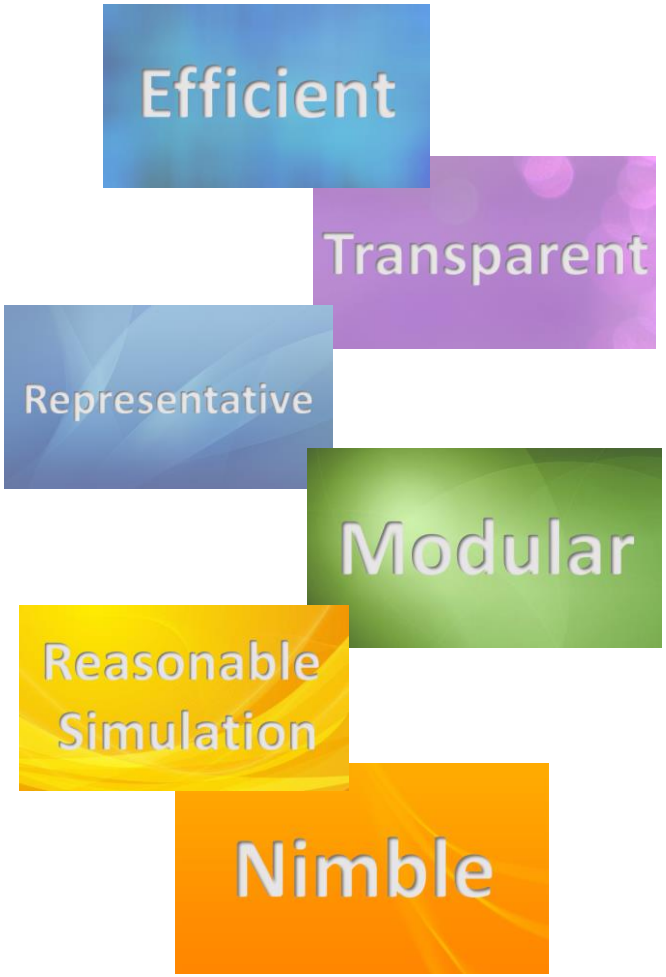
- Cap Design for Waste Management Area (WMA) C: size of cap can impact contaminants in groundwater and/or remedy performance for pump-and-treat (P&T) systems
- Understand the impact of changing conditions:
  - Sensitivity to changing hydraulic parameters based on updated information
  - A tank leak assessment may be updated for WMA S/SX:
    - Understanding performance of P&T systems
    - Inform decisions about potential changes to groundwater monitoring network
- Detailed evaluation of alternatives within feasibility studies and corrective measures studies

Scope of (Initial) Cumulative Impact Evaluation

- Inventory
  - Soil Inventory Model (SIM) for liquid disposal sites; updated as CERCLA decisions are made
  - Inventory estimates for other sources (e.g., WMA C); updated as tank waste retrieval efforts are undertaken
  - Solid waste disposal sites (Waste Information Data System, [WIDS])
- Vadose Zone – Implemented in Subsurface Transport Over Multiple Phases (STOMP) (3-D models)
- Groundwater – Implemented in MODFLOW and MT3DMS
- During the (initial) CIE development, the models will evaluate contaminant fate and transport for 1,000 years

Cumulative Impact Evaluation Vision

- CIE provides a sitewide context for individual site cleanup decisions:
  - Enables evaluation of cumulative impacts to groundwater from alternative closure and remediation decisions for source areas and groundwater
  - Focuses on remedial and closure actions timeframe (100 to 200 years), but will evaluate groundwater conditions up to 1,000 years
- CIE product is a set of fate and transport models in the unsaturated and saturated zones, with supporting databases and automated tools to allow information to flow efficiently and prepare graphical/tabular results



Cumulative Impact Evaluation Development

- Establish foundation – technical approach document
- Procure, install and test new computing system
- Identify soil inventory
- Complete model development, documentation and quality assurance
- Develop integrated computational framework to “knit” models together

Cumulative Impact Evaluation Updates

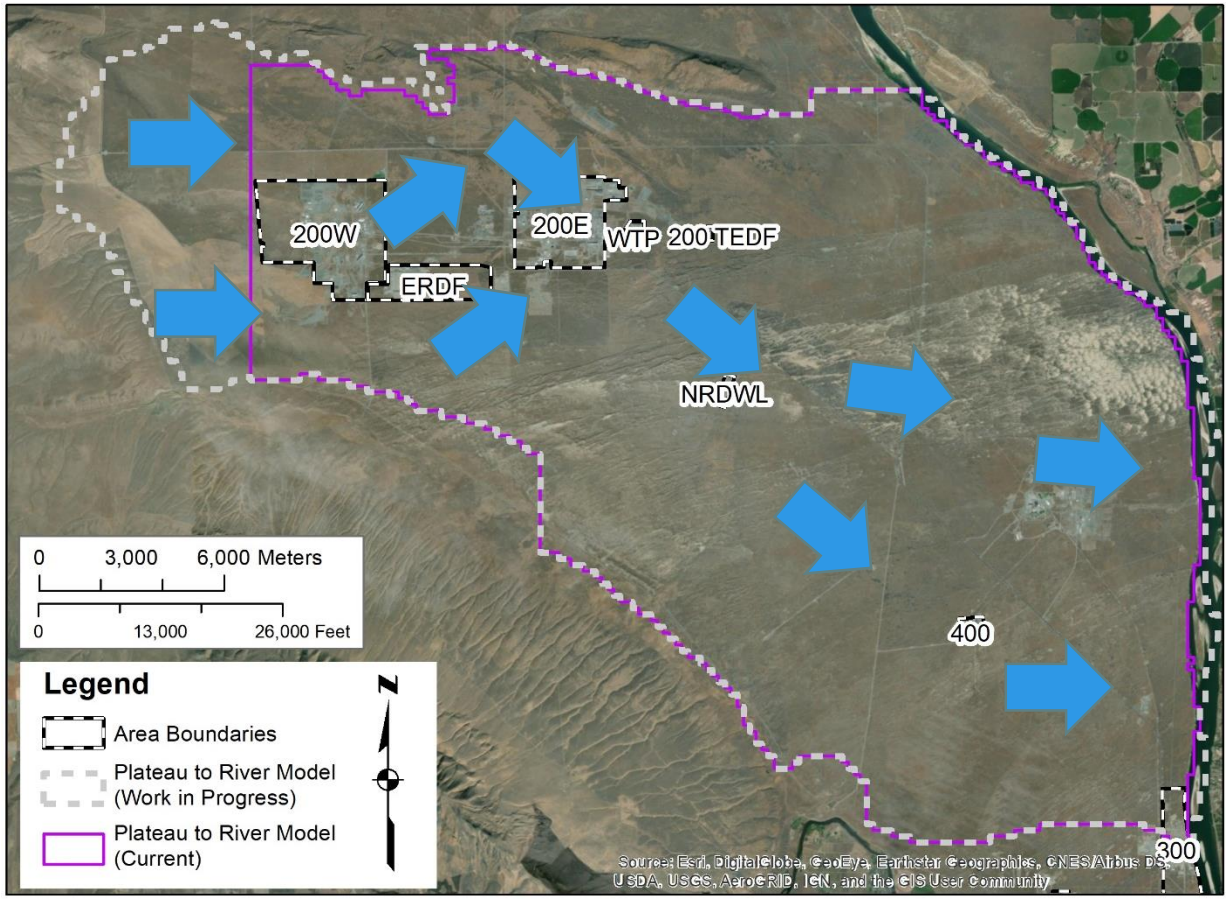
- Maintenance Plan described in the Technical Approach Document (Chapter 6)
- All databases and models will be periodically updated as additional information is obtained from P&T operations, groundwater and vadose zone characterization activities, and other information is obtained from tank farms, waste sites, and groundwater
- Future versions of the CIE can also expand any of the following elements, as needed:
  - Timeframe
  - Range of end-state conditions for source units and groundwater

Overview of Cumulative Impact Evaluation and Composite Analysis

	Cumulative Impact Evaluation (CIE)	Composite Analysis (CA)
Objective	supports cleanup decisions	supports waste disposal and closure decisions
Regulatory Framework	CERCLA, RCRA – supports the decision making process for remedy selection, corrective measures, and closure actions	AEA – as implemented in DOE O 435.1 requirements for protection of public and the environment from radiological waste disposal
Sources	evaluate cumulative impact of significant sources of hazardous chemicals and radionuclides	evaluates cumulative impact of significant radiological sources
Timeframe	align to remedial decision timeframes – typically 100 to 1,000 years	1,000 years post-closure, with evaluation to 10,000 years

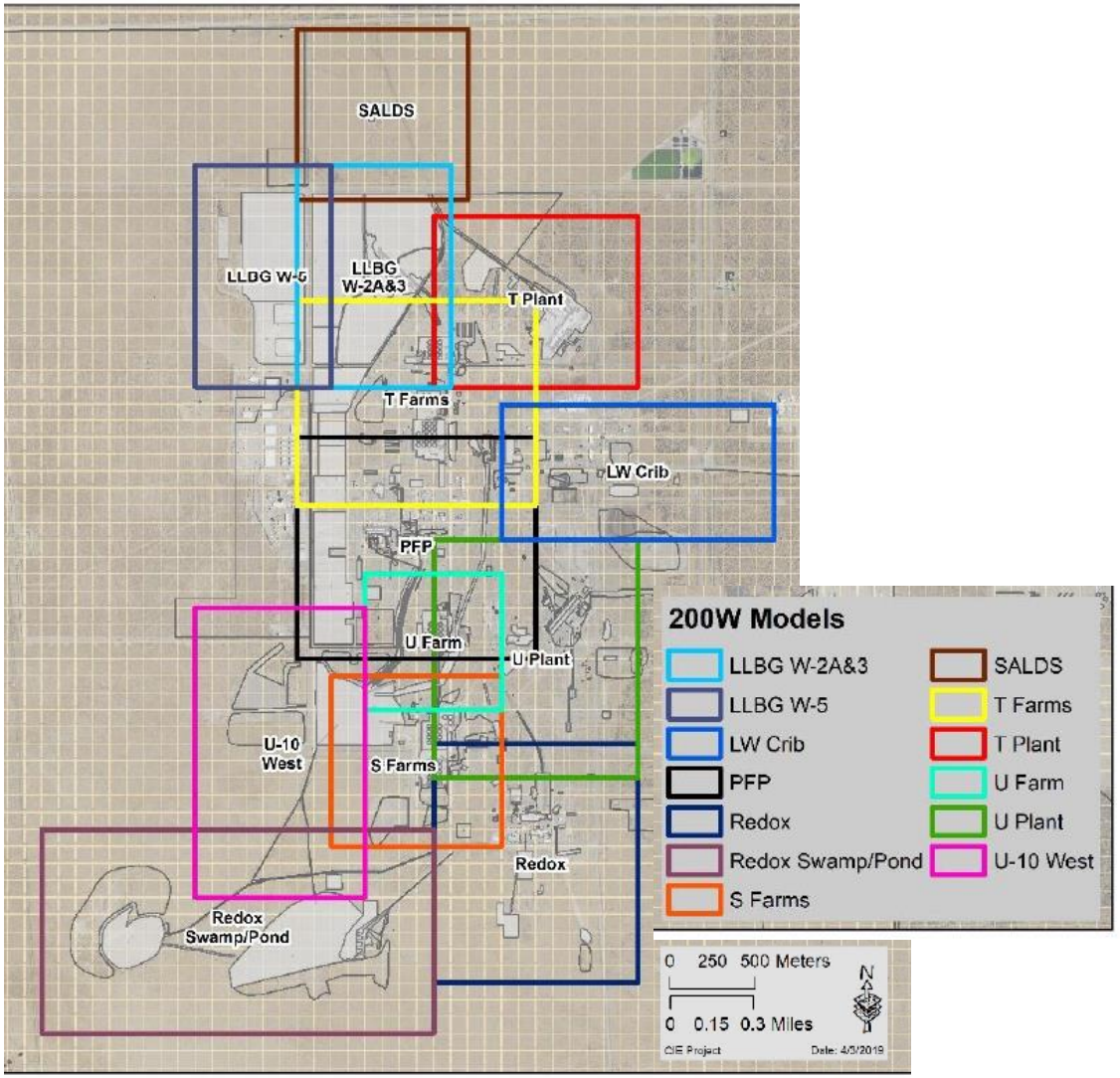
Plateau to River Model Domain

- The CIE will evaluate contaminant fate and transport from the central plateau to the Columbia River
- **Model Calibration**: 1940 to present (water levels and selected contaminant plumes)
- **Model Updates**: will be performed as additional information about water levels and gradients, contaminant plumes, hydrostratigraphy, and aquifer parameters become available

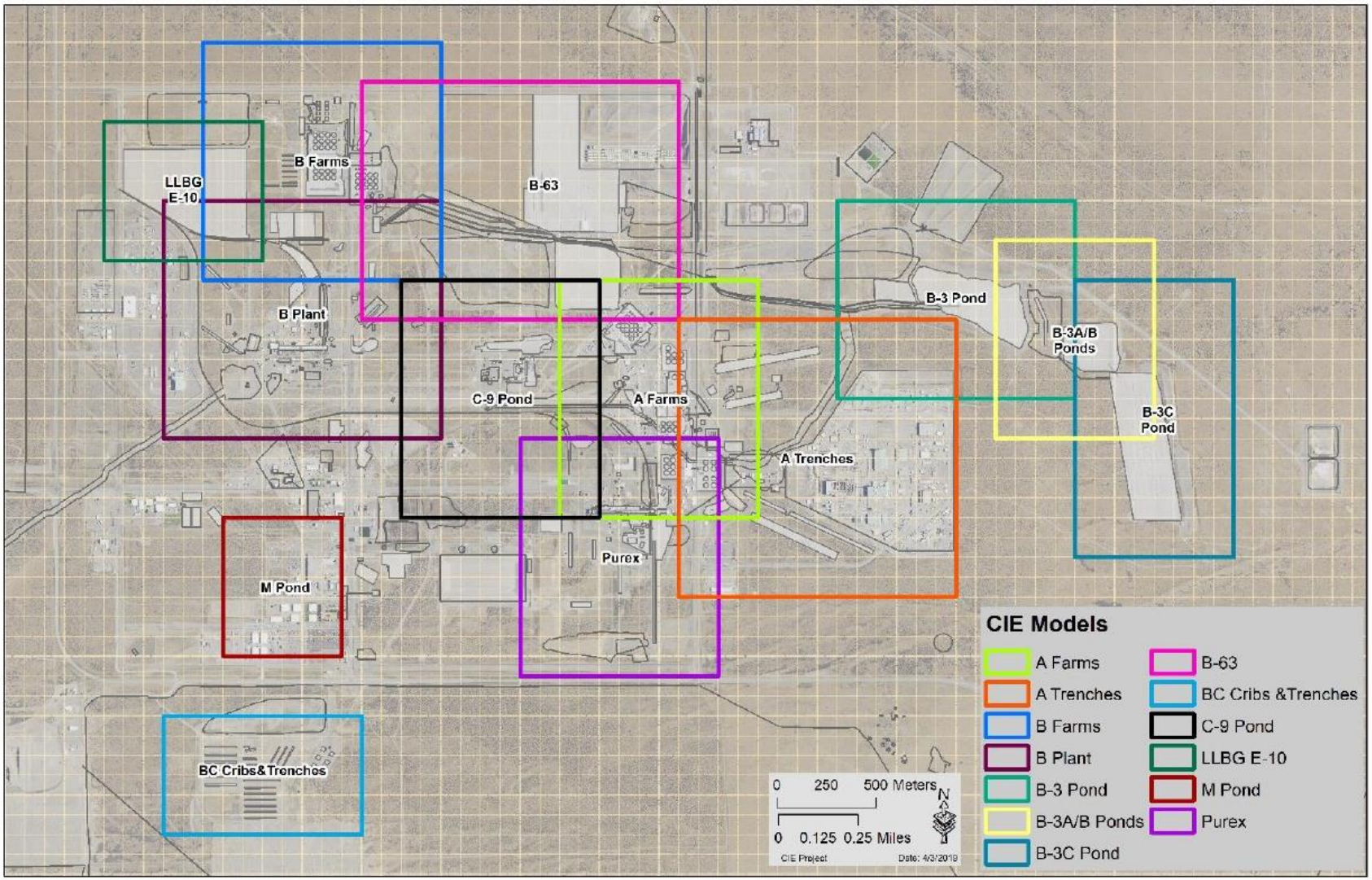


Vadose Zone Models in the 200 West Area

- Vadose zone models are constructed for areas that do not have existing models (e.g., WMA C, IDF, ERDF)
- Models cover areas where potential comingling for liquid discharges could take place in the vadose zone
- 200 West: 13 models
- 200 East: 13 models

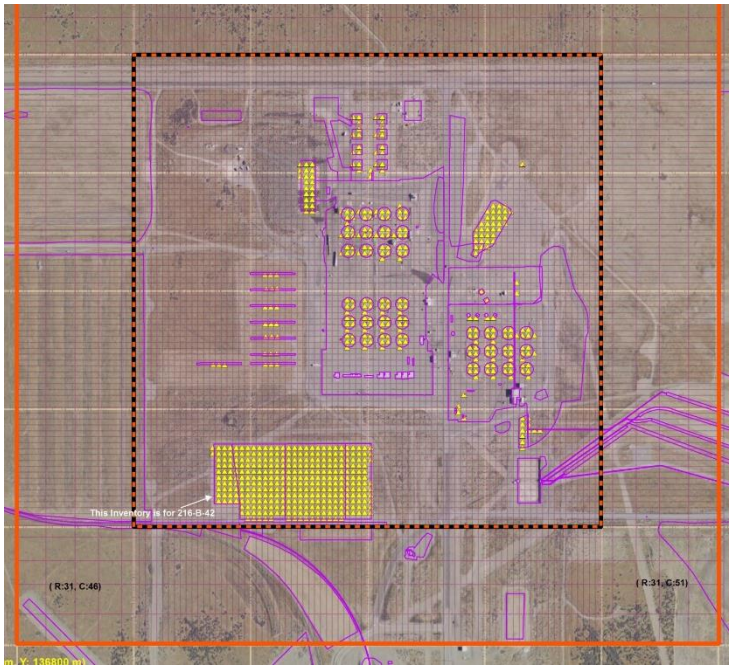


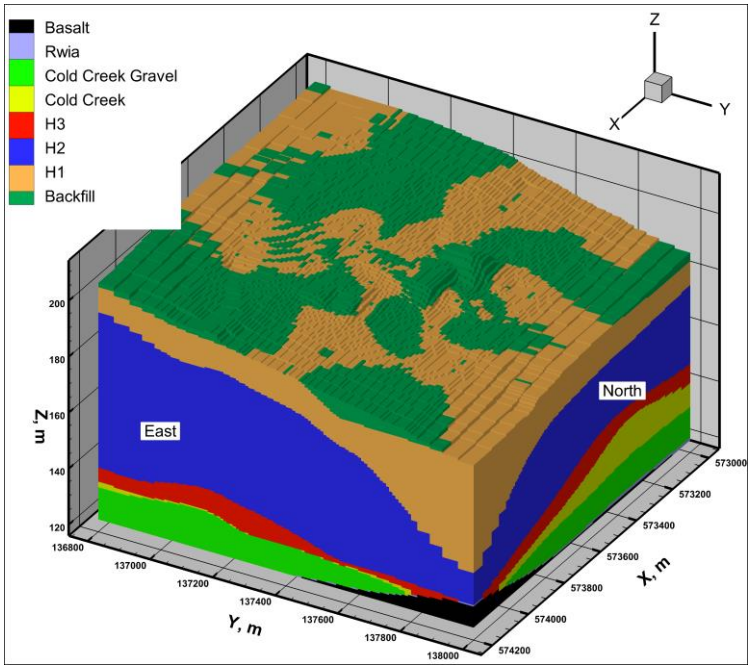
Vadose Zone Models in the 200 East Area



Vadose Zone Models

- Multi-site models to address comingling
- Complex models requiring significant computational resources (super computers)





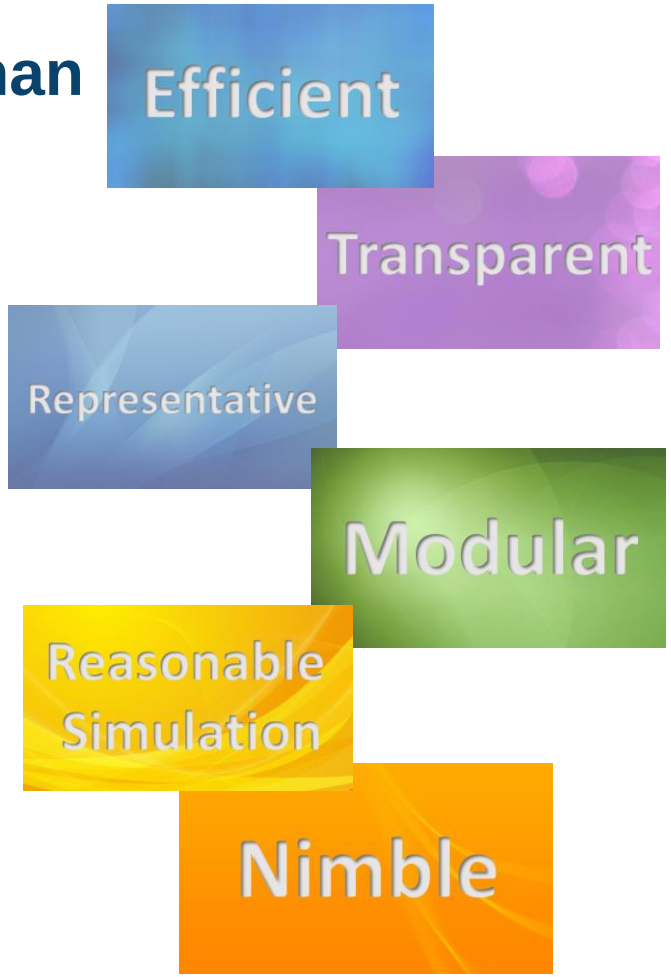
Framing Questions

- Q1: Will the CIE be flexible to allow communication with flow models other than Plateau to River (P2R)?
- Q2: What is the mechanism for determining which waste sites are included?
- Q3: Will the CIE account for contaminant plumes from other sources that may comingle with Hanford plumes?
- Q4: How will the CIE be used while individual waste source flow models have not been completed?

Framing Questions

Q1. Will the CIE be flexible to allow communication flow models other than P2R?

- "Modular" attribute allows different parts of the CIE to be replaced with other tools as needed
- Any groundwater fate and transport model can be used, if necessary



Framing Questions

Q2: What is the mechanism for determining which waste sites are included?

- Liquid Waste Disposal Waste Sites:
  - 386 sites in the 200 Area were evaluated in SIM (version 2)
  - Past leaks, unplanned releases, disposal to cribs, trenches, ponds, etc.
  - SIM (version 2) is used to provide estimates of liquid discharges (volumes) and contaminant mass or activity (kilograms or curies)
  - Screening process considered both liquid volume and contaminant mass (or activity):
    - WIDS: disposal sites and unplanned releases
    - Field and Jones (2005)* and updates: tank and ancillary equipment leaks

* RPP-23045, *Tank Farm Vadose Zone Contamination Volume Estimates*

Framing Questions

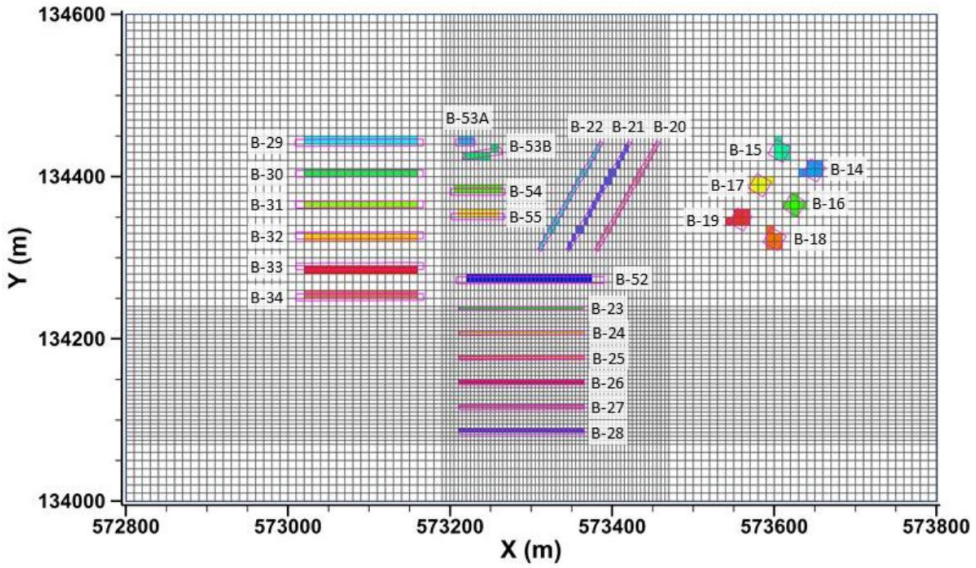
Q3: Will the CIE account for contaminant plumes from other sources that may comingle with Hanford plumes?

- The CIE will evaluate contaminant fate and transport from the central plateau to the Columbia River
- For central plateau plumes, no known non-Hanford contamination has comingled with central plateau sources, except the following:
  - Contamination from US Ecology has already comingled with 200-UP-1 plumes (hexavalent chromium) and is addressed through the 200-UP-1 CERCLA process
  - Future contributions from US Ecology are evaluated in the CIE (and the composite analysis)
  - Upgradient nitrate contamination is taken into account

Framing Questions

Q4: How will the CIE be used while individual waste source flow models have not been completed?

- Waste sites are grouped into few 3-D vadose zone models
- CIE will develop an initial set of tools based on available information
- Areas with existing models (e.g., WMA C, ERDF, IDF) will use these existing models – no new models will be developed
- As waste sites and WMAs obtain additional information and develop remediation and/or closure plans, CIE tools will be updated or replaced, as appropriate



Grid Size Resolution and Source Allocations for the BC Cribs Area

2018 Completed Work

- Conducted four scoping workshops on technical approach with DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology):
  - CIE framework (March 1, 2018)
  - Source inventory and release models (May 22, 2018)
  - Geologic and vadose zone models (September 18, 2018)
  - Saturated zone models and reporting (November 13, 2018)
- Topic-specific workshops were also conducted in 2018 and 2019 (e.g., SIM-v2, hydrostratigraphic 3-D model)
- Regulators, Tribes, and stakeholder input on WMA-C vadose zone models and ZP-1/UP-1/BP-5/PO-1 groundwater models informed the model development process

2019 Completed Work

- Completed Draft A of DOE/RL-2018-69, *Cumulative Impacts Evaluation Technical Approach Document*
- Ecology submitted comments on August 8, 2019
- EPA provided partial comments from U.S. Geological Survey
- Procure, install, and test new computing system (GAIA)

Next Steps

- Independent Peer Review Panel (October 2019)
- Finalize CIE Technical Approach Document (issue Rev. 0)
- Finalize (first-cut) CIE models (fiscal years 2020 and 2021):
  - Inventory estimates (soil inventory model, other)
  - Release models
  - STOMP (vadose zone)
  - MODFLOW/MT3DMS (groundwater)
  - Integrated computational framework
  - Documentation and quality assurance
- Ready to support central plateau remedy decision-making process around calendar year 2022

Summary

- Closely spaced waste sites result in comingled plumes in soil and groundwater
- We must understand the effect remedial actions may have in order to make the most informed decisions
- The CIE is the tool to perform this analysis

Feedback and Questions?