SGW-63161-VA
Revision 0

Path Forward - 200-ZP-1 Remedy Implementation

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

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Approved for Public Release;
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Path Forward - 200-ZP-1 Remedy Implementation

Presented by: Mark E. Byrnes, CH2M HILL Plateau Remediation Company (CHPRC)

Presented to: Department of Energy-Richland, Environmental Protection Agency (EPA)

Date: February 7, 2019

Agenda

- Options to reduce cost
  - Nitrate treatment
- Near-term remedy implementation
  - Implement actions identified in draft Remedial Design/Remedial Action Work Plan (RD/RAWP)
  - Address remedy cost
- Long-term remedy implementation
  - Record of Decision (ROD) modification approach
- CERCLA Document Status

Cost To Date / Future Cost

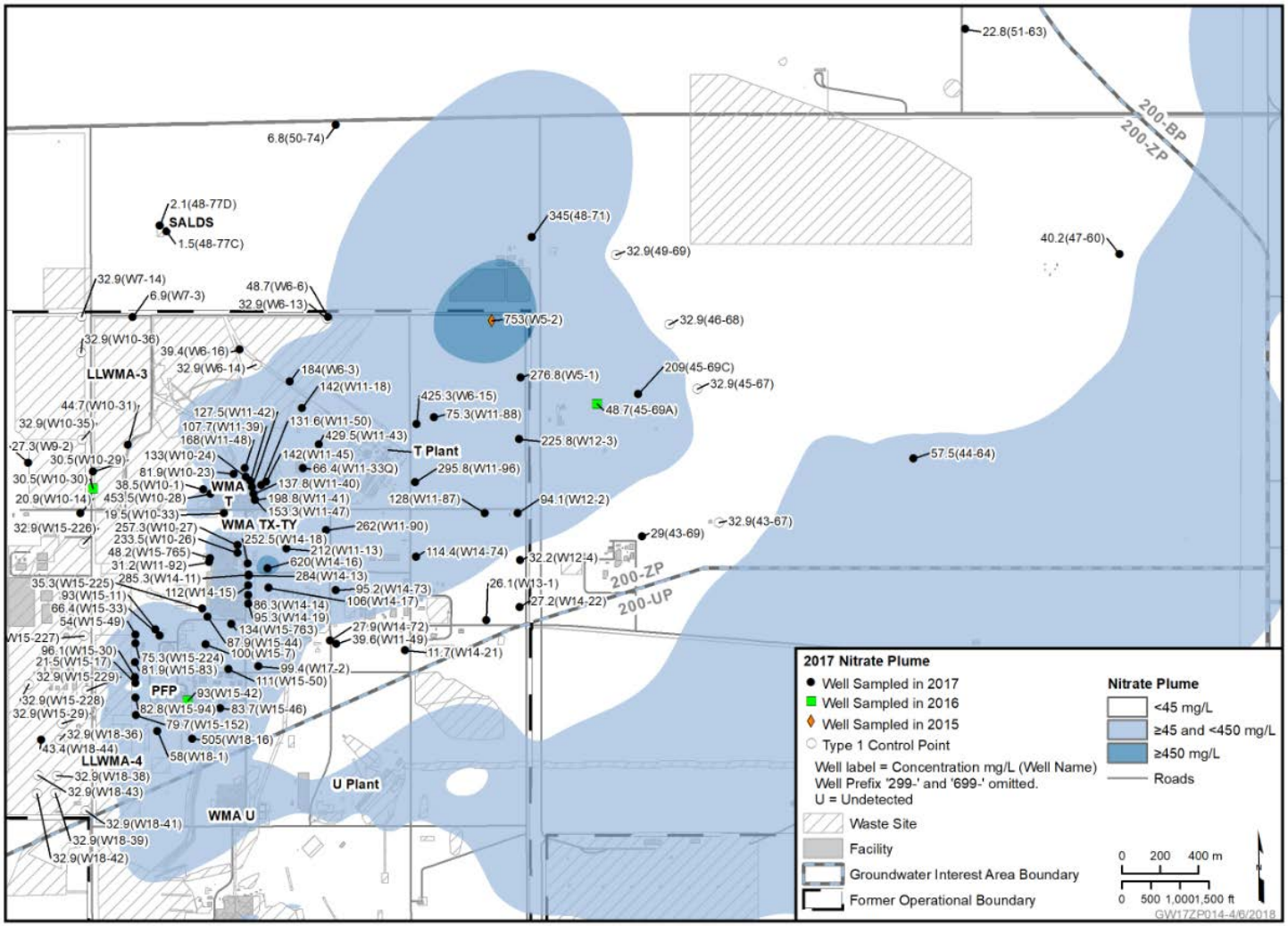
- ROD = $ 235M (*$165M to $353M*)
- Spent to-date = $ 383M (through FY17)
- Scenario 0 to-go cost*** = $ 735M ($1,118M total)*
- Scenario 0' to-go cost*** = $ 833M ($1,216M total)**

Scenario 0: Continue pumping at 1,820 gpm for original planned 25 years duration, then MNA for 100 years. Nitrate treatment stops in 2023

Scenario 0': Continue pumping at 1,820 gpm for original planned 25 years duration, then MNA for 100 years. Nitrate treatment stops in 2037

** Biological treatment stops 2023*
*** Biological treatment stops 2037*
**** Total present value*

Current Nitrate Plume Distribution



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Nitrate Treatment – Eliminate Fluidized Bed Reactor (FBRs)/MBRs

- Continue active nitrate treatment until Monitored Natural Attenuation (MNA) will achieve maximum contaminant levels (MCLs) in 125 years (2137)
  - ROD citation: *"The pump-and-treat component will be designed and implemented in combination with monitored natural attenuation to achieve cleanup levels listed in Table 11 for all COCs in 125 years."*
  - ROD includes RCRA 3020(b), provides exemption for reinjection of groundwater contaminated with hazardous constituents if the following criteria are met:
    1. Part of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 response action
    2. Groundwater treated to substantially reduce hazardous constituents prior to reinjection
    3. Response action is sufficient to protect human health and the environment
  - Establish reinjection criteria for nitrate that will achieve the MCL in 125 years
  - Document in Proposed Plan and ROD Amendment

Nitrate Treatment – Eliminate FBRs/MBRs

- Approximately 40% of our Operations & Maintenance (O&M) cost is due to operating and maintaining FBRs and MBRs for nitrate treatment
- If FBRs and Membrane Bio-Reactor (MBRs) were taken off line the table below summarizes how contaminant of concern (COCs) would be treated

	CCl4	TCE	Nitrate	Total Chromium	Hexavalent Chromium	Tc-99	Uranium	I-129	Tritium
Cleanup Levels	3.4 µg/L	1 µg/L	10,000 µg/L (Nitrate as Nitrogen)	100 µg/L	48 µg/L	900 pCi/L	30 µg/L	1 pCi/L	20,000 pCi/L
Average Influent Concentration	555 µg/L	3.32 µg/L	30,000 µg/L (Nitrate as Nitrogen)	28.6 µg/L No Treatment Needed	27.6 µg/L No Treatment Needed	1,745 pCi/L	335 µg/L	0.53 pCi/L No Treatment Needed	2,296 pCi/L
Current Treatment Method	Bioreactors + Air Strippers	Bioreactors + Air Strippers	Bioreactors	Influent Below Cleanup Levels	Influent Below Cleanup Levels	IX Resin	IX Resin	Influent Below Cleanup Level	Influent Below Cleanup Level
Future Treatment Method If MBRs/FBRs Taken Offline	Air Strippers	Air Strippers	Blending	IX Resin	IX Resin	IX Resin	IX Resin	Influent Below Cleanup Level	Influent Below Cleanup Level

CCl4 Treatment - RAO Attainment / Remedy Assessment

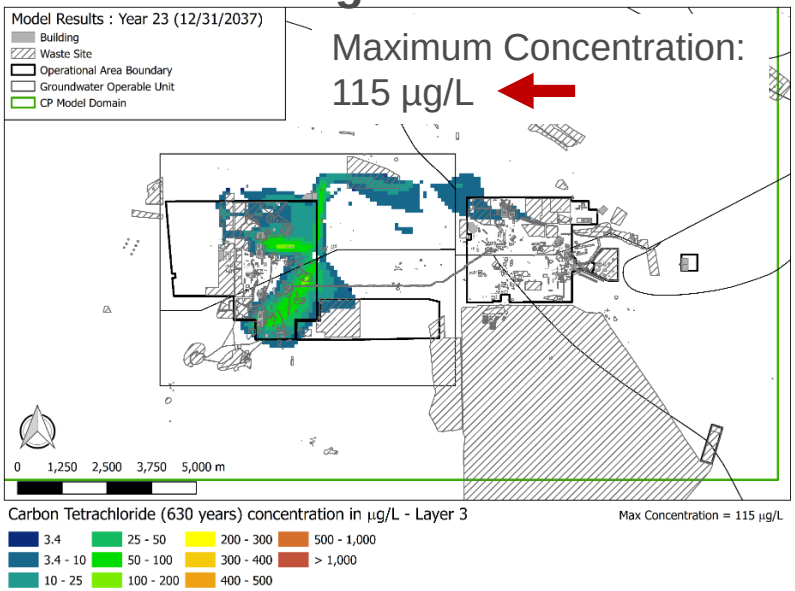
Scenario	Description	2016 Initial Capacity (gpm)	Capacity in 2023 (gpm)	Pumping Duration in Years*	Pumping Ends	Total Additional Extraction Wells	Total Additional Injection Wells	Meets 2137 Cleanup? **	Meets 2037 100 µg/L	Target Aquifer
0	Continue pumping at 1,820 gpm with 25 year duration	1,620	1,820	25	2037	42	20	No	No / No	Ringold E only
1	Continue Pumping at 1,820 gpm	1,620	1,820	83	2097	42	20	Yes	Yes / No	Ringold E and A
2	Increase Pumping to 4,070 gpm. Treat Ringold E Then A.	1,620	4,070	~40	2062	56	83	Yes	Yes / No	Ringold E and A
3	Achieve ROD Requirements	1,620	~10,000	25	2037	145	145	Yes	Yes / Yes	Ringold E and A
4	Increase Pumping To 3,070 gpm	1,620	3,070	TBD	TBD	TBD	TBD	TBD	TBD	Ringold E only

* Pumping duration since 2012.
** Based on 125 year ROD duration.

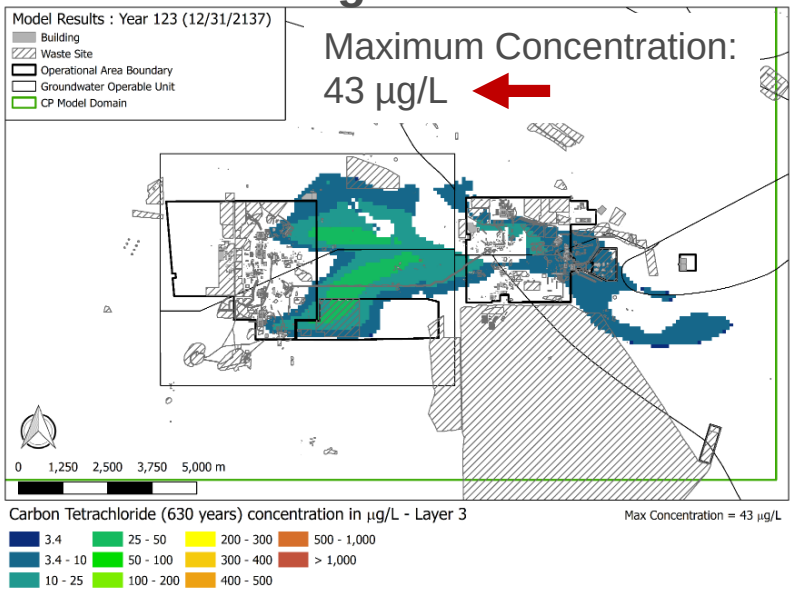
Scenario 0: 1,620 gpm through 2022, then 1,820 gpm through 2037. Extract groundwater only from Ringold E. CCl4 CUL is not met.

SCENARIO 0 CCL4 FOR YEARS 2037 and 2137 Ringold E and A

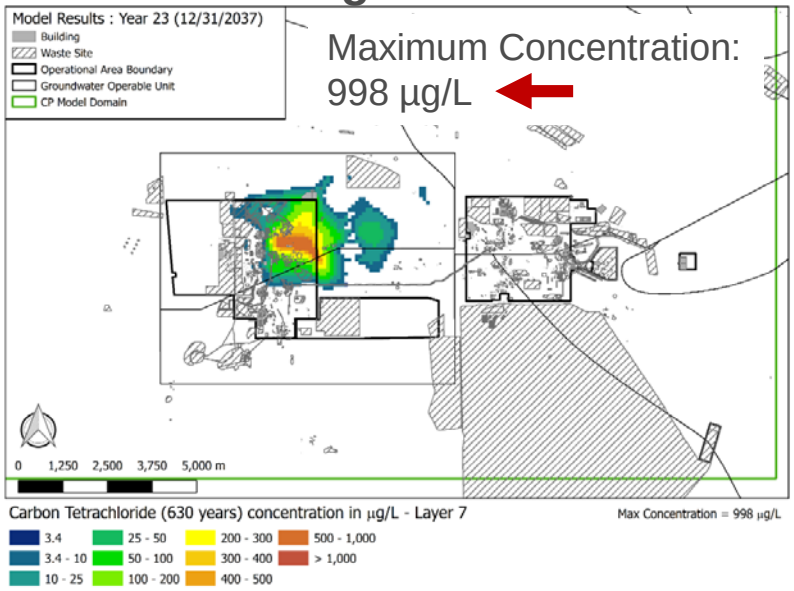
Scenario 0 Ringold E 2037



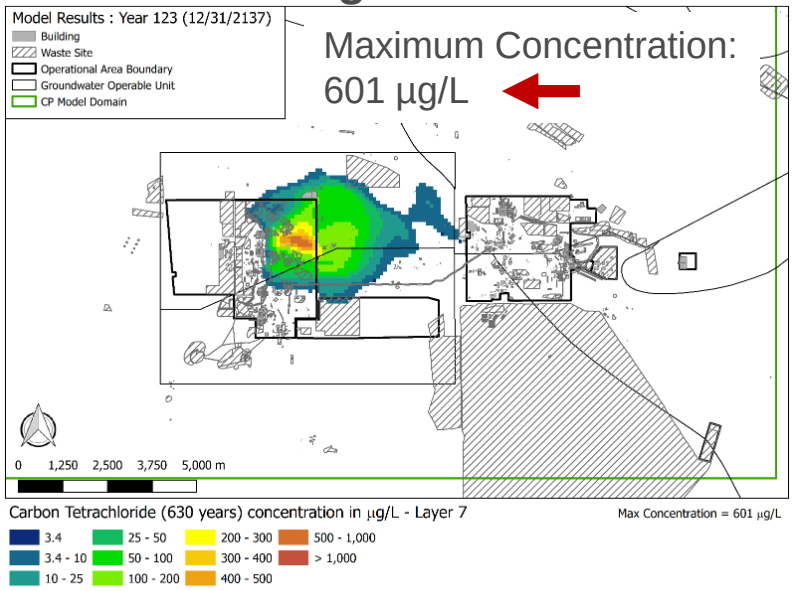
Scenario 0 Ringold E 2137



Scenario 0 Ringold A 2037



Scenario 0 Ringold A 2137



CCl4 Treatment - RAO Attainment / Remedy Assessment

Scenario	Description	2016 Initial Capacity (gpm)	Capacity in 2023 (gpm)	Pumping Duration in Years*	Pumping Ends	Total Additional Extraction Wells	Total Additional Injection Wells	Meets 2137 Cleanup? **	Meets 2037 100 µg/L	Target Aquifer
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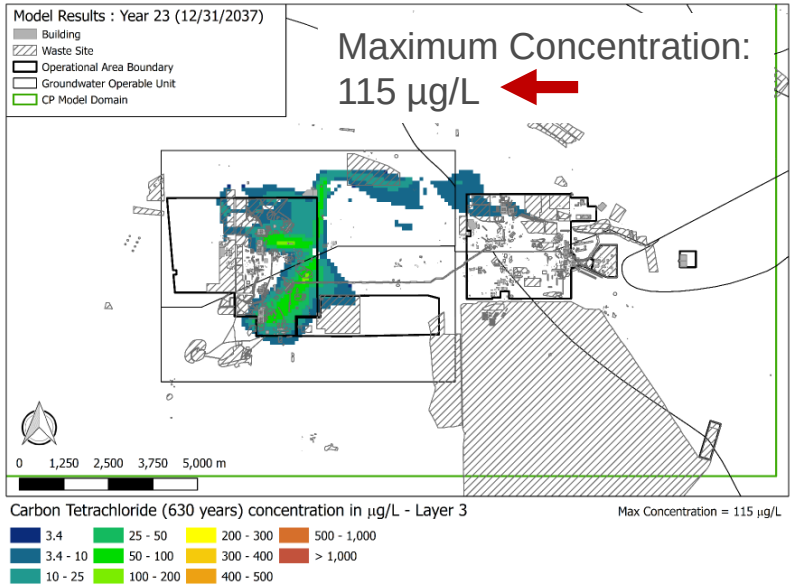
3	Achieve ROD Requirements	1,620	~10,000	25	2037	145	145	Yes	Yes / Yes	Ringold E and A
4	Increase Pumping To 3,070 gpm	1,620	3,070	TBD	TBD	TBD	TBD	TBD	TBD	Ringold E only

* Pumping duration since 2012.
** Based on 125 year ROD duration.

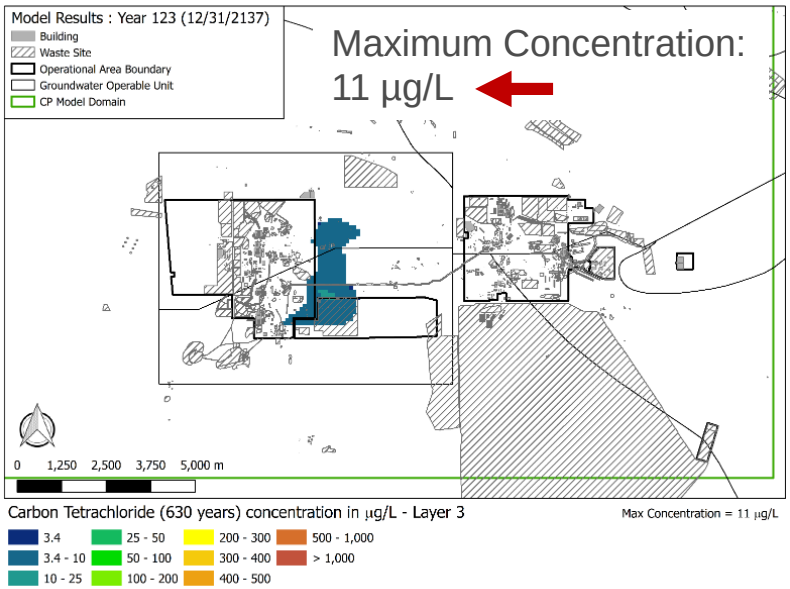
Scenario 1: 1,620 gpm through 2022, then 1,820 gpm through 2097. Extract groundwater from Ringold E then A. CCl4 CUL is met.

SCENARIO 1 CCL4 FOR YEARS 2037 and 2137 Ringold E and A

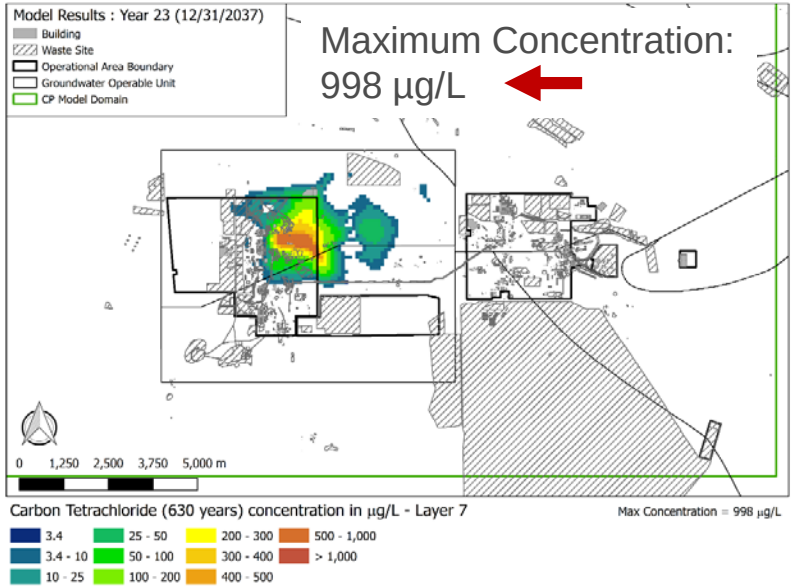
Scenario 1 Ringold E 2037



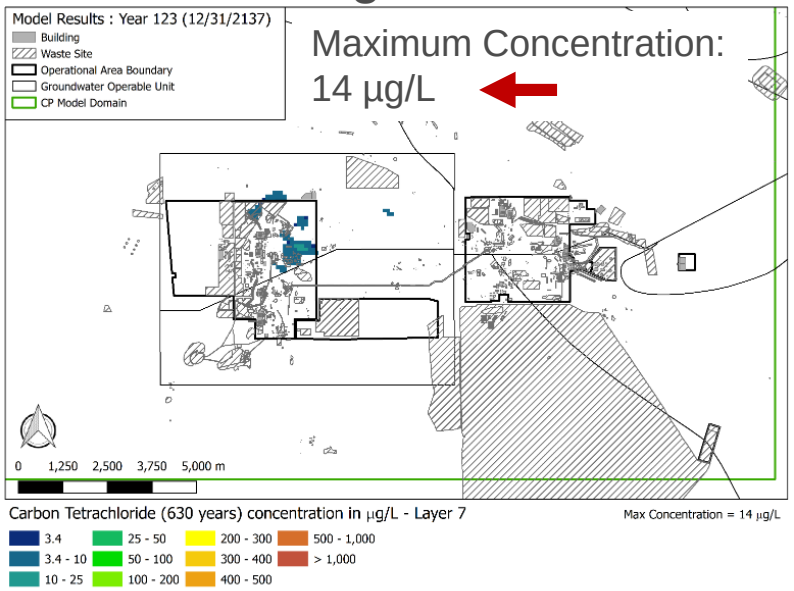
Scenario 1 Ringold E 2137



Scenario 1 Ringold A 2037



Scenario 1 Ringold A 2137



CCl4 Treatment - RAO Attainment / Remedy Assessment

Scenario	Description	2016 Initial Capacity (gpm)	Capacity in 2023 (gpm)	Pumping Duration in Years*	Pumping Ends	Total Additional Extraction Wells	Total Additional Injection Wells	Meets 2137 Cleanup? **	Meets 2037 100 µg/L	Target Aquifer
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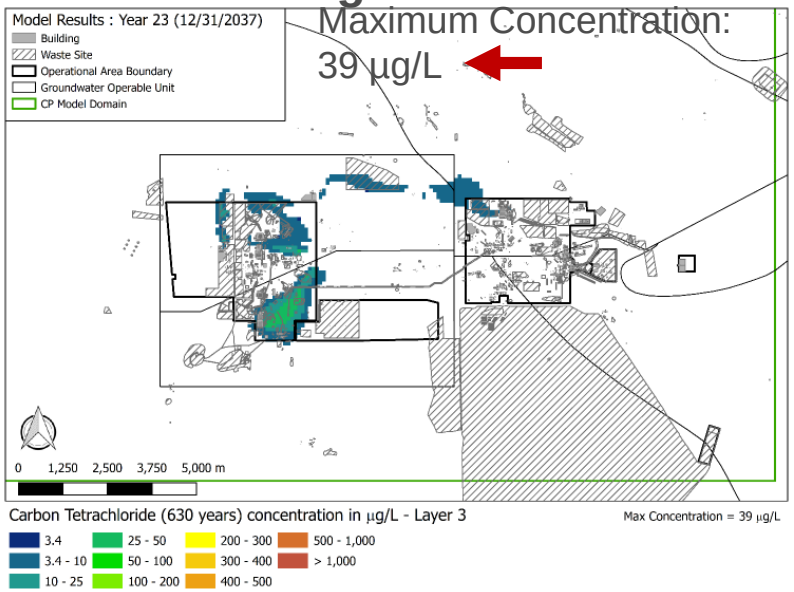
3	Achieve ROD Requirements	1,620	~10,000	25	2037	145	145	Yes	Yes / Yes	Ringold E and A
4	Increase Pumping To 3,070 gpm	1,620	3,070	TBD	TBD	TBD	TBD	TBD	TBD	Ringold E only

* Pumping duration since 2012.
** Based on 125 year ROD duration.

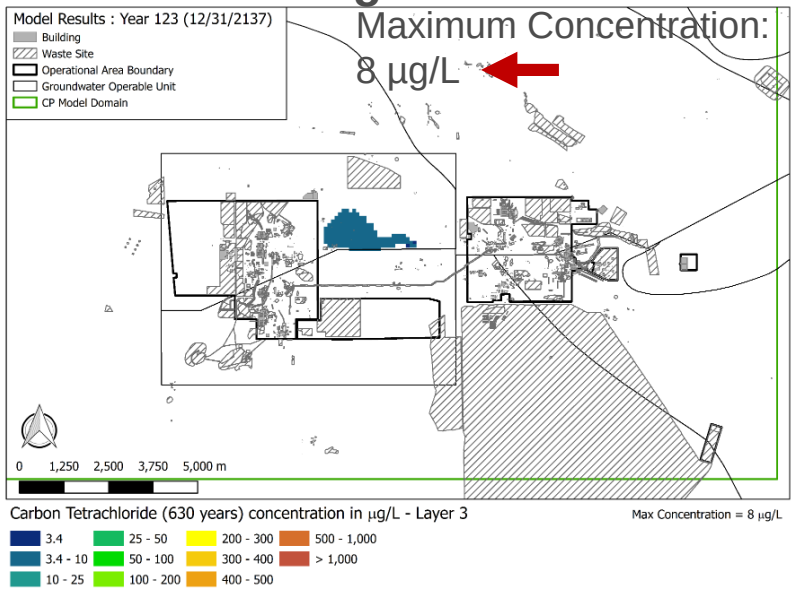
Scenario 2: 1,620 gpm through 2022 then 4,070 gpm through 2062. Extract groundwater from Ringold E then A. CCl4 CUL is met.

SCENARIO 2 CCL4 FOR YEARS 2037 and 2137 Ringold E and A

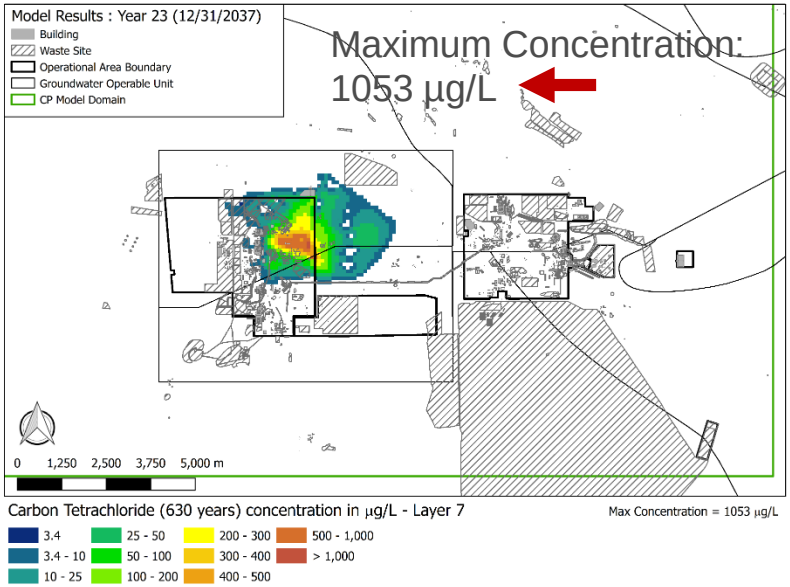
Scenario 2 Ringold E 2037



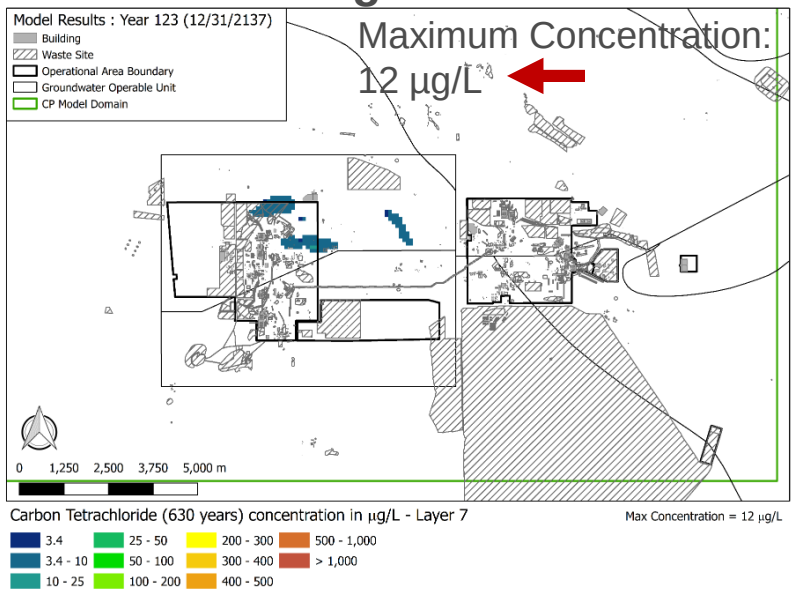
Scenario 2 Ringold E 2137



Scenario 2 Ringold A 2037



Scenario 2 Ringold A 2137



CCl4 Treatment - RAO Attainment / Remedy Assessment

Scenario	Description	2016 Initial Capacity (gpm)	Capacity in 2023 (gpm)	Pumping Duration in Years*	Pumping Ends	Total Additional Extraction Wells	Total Additional Injection Wells	Meets 2137 Cleanup? **	Meets 2037 100 µg/L	Target Aquifer
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3	Achieve ROD Requirements	1,620	~10,000	25	2037	145	145	Yes	Yes / Yes	Ringold E and A
4	Increase Pumping To 3,070 gpm	1,620	3,070	TBD	TBD	TBD	TBD	TBD	TBD	Ringold E only

* Pumping duration since 2012.

** Based on 125 year ROD duration.

CCl4 Treatment - RAO Attainment / Remedy Assessment

Scenario	Description	2016 Initial Capacity (gpm)	Capacity in 2023 (gpm)	Pumping Duration in Years*	Pumping Ends	Total Additional Extraction Wells	Total Additional Injection Wells	Meets 2137 Cleanup? **	Meets 2037 100 µg/L	Target Aquifer
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3	Achieve ROD Requirements	1,620	~10,000	25	2037	145	145	Yes	Yes / Yes	Ringold E and A
4	Increase Pumping To 3,070 gpm	1,620	3,070	TBD	TBD	TBD	TBD	TBD	TBD	Ringold E only

* Pumping duration since 2012.
** Based on 125 year ROD duration.

Scenario 4: 1,620 gpm through 2022 then 3,070 gpm through ????. Extract groundwater from Ringold E then A. CCl4 CUL is met.

If we stopped nitrate treatment we could get our CCl4 pumping rates up to 3,070 gpm

200-ZP-1 Near-Term Options

- Implement near-term actions identified in the revised RD/RAWP (under preparation)
  - Continue remediation of the Ringold E (above lower mud unit)
  - Characterize the Ringold A (below lower mud unit)
  - Complete evaluation of biotic degradation of carbon tetrachloride
  - Complete installation of disinfection system to help address injection well biofouling
  - Decide on path forward for nitrate treatment
  - Decide on timing and scope for amending the ROD
  - Continue revising the RD/RAWP, Project Management Plan (PMP), and O&M Plan
    - The RD/RAWP, PMP, and O&M Plan will be delivered for EPA review around May 2019

200-ZP-1 Near-Term Options

- Prepare Optimization Pilot Test Plan:
  - This would temporarily suspend/eliminate nitrate treatment so we could test various forms of nitrate blending
  - Not certain if an Optimization Pilot Test Plan can go against a Final ROD
- The Following Slides Present Options for a ROD Amendment Including a Schedule

Options for 200-ZP-1 ROD Modifications

ESD

- Cost
- Incorporate adaptive management approach

PP/ROD Amendment

- Above plus,
- Eliminate biological treatment

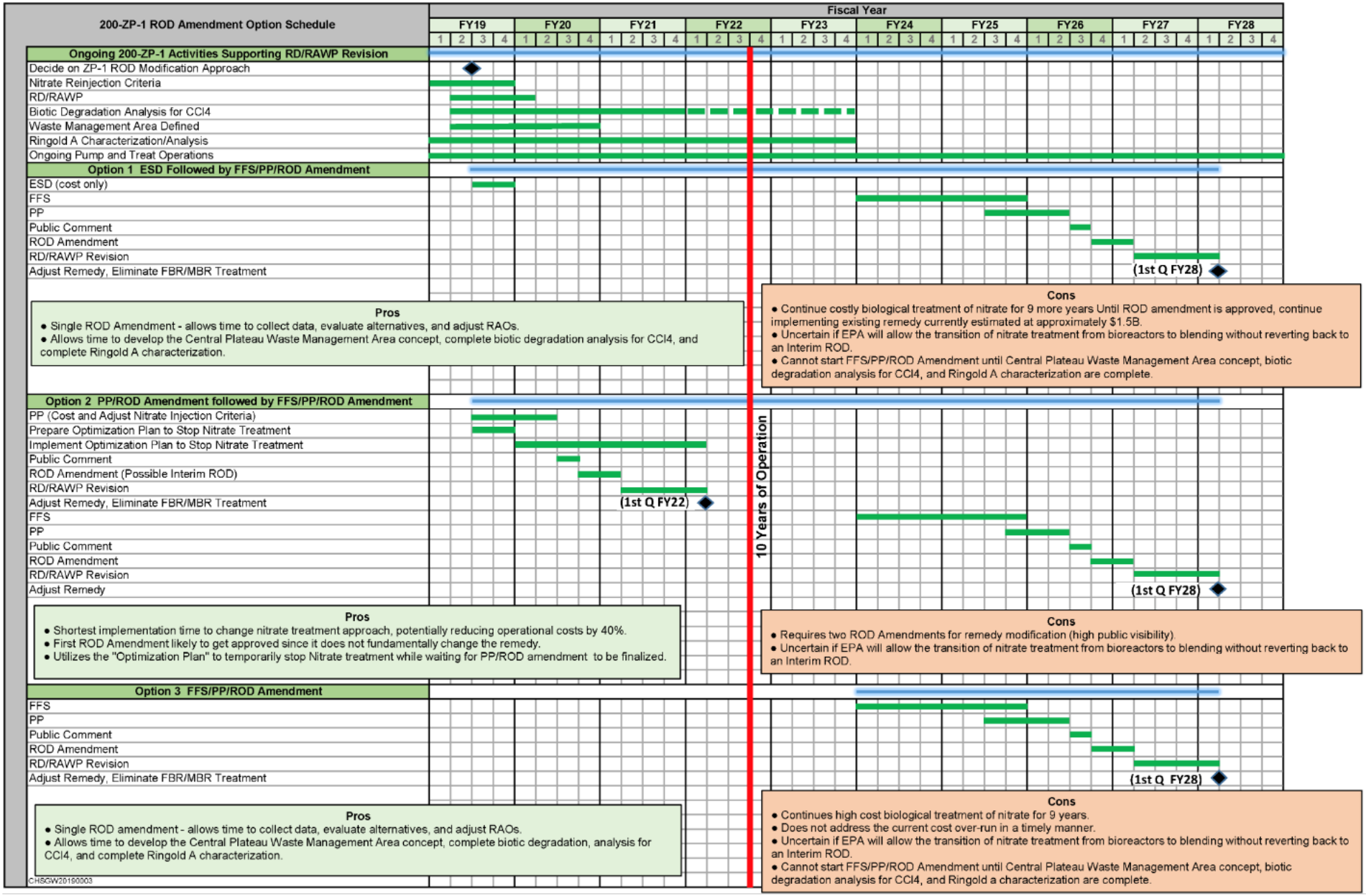
FS/PP/ROD Amendment

- Above plus,
- Modify remedy/RAOs
  - Adjust the 95% reduction for all contaminants

EPA Guidance:

- Significant Changes generally involve a change to a component of a remedy that does not fundamentally alter the overall cleanup approach.
  - Large increase in volume/cost
  - Secondary Technology: The lead agency decides to use a biological treatment method instead of air stripping (which was specified in the ROD) for ex-situ treatment of extracted groundwater. The basic pump and treat approach remains unaltered and the cleanup level specified in the ROD will be met by the alternate technology; the change is significant, but not fundamental
- Fundamental Changes involve an appreciable change or changes in the scope, performance, and/or cost or may be a number of significant changes that together have the effect of a fundamental change.
  - **Change Primary Treatment Method with Cost Decrease:** Pump and treat is the Selected Remedy for ground water. Prior to construction of a pump and treat system, interested parties collect and present ground-water information to the lead agency showing that contaminant concentrations are decreasing due to natural processes (e.g., biodegradation, dilution, adsorption, dispersion). Modeling indicates that monitored natural attenuation will achieve cleanup levels in a time frame comparable to pump and treat at substantially less cost.

A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (OSWER 9200.1-23P, July 1999)


200-ZP-1 ROD Amendment Option Schedule
Fiscal Year
FY19
FY20
FY21
FY22
FY23
FY24
FY25
FY26
FY27
FY28
Ongoing 200-ZP-1 Activities Supporting RD/RAWP Revision
Decide on ZP-1 ROD Modification Approach
Nitrate Reinjection Criteria
RD/RAWP
Biotic Degradation Analysis for CCl4
Waste Management Area Defined
Ringold A Characterization/Analysis
Ongoing Pump and Treat Operations
Option 1 ESD Followed by FFS/PP/ROD Amendment
ESD (cost only)
FFS
PP
Public Comment
ROD Amendment
RD/RAWP Revision
Adjust Remedy, Eliminate FBR/MBR Treatment
(1st Q FY28)
Pros
• Single ROD Amendment - allows time to collect data, evaluate alternatives, and adjust RAOs.
• Allows time to develop the Central Plateau Waste Management Area concept, complete biotic degradation analysis for CCl4, and complete Ringold A characterization.
Cons
• Continue costly biological treatment of nitrate for 9 more years Until ROD amendment is approved, continue implementing existing remedy currently estimated at approximately $1.5B.
• Uncertain if EPA will allow the transition of nitrate treatment from bioreactors to blending without reverting back to an Interim ROD.
• Cannot start FFS/PP/ROD Amendment until Central Plateau Waste Management Area concept, biotic degradation analysis for CCl4, and Ringold A characterization are complete.
Option 2 PP/ROD Amendment followed by FFS/PP/ROD Amendment
PP (Cost and Adjust Nitrate Injection Criteria)
Prepare Optimization Plan to Stop Nitrate Treatment
Implement Optimization Plan to Stop Nitrate Treatment
Public Comment
ROD Amendment (Possible Interim ROD)
RD/RAWP Revision
Adjust Remedy, Eliminate FBR/MBR Treatment
(1st Q FY22)
FFS
PP
Public Comment
ROD Amendment
RD/RAWP Revision
Adjust Remedy
(1st Q FY28)
10 Years of Operation
Pros
• Shortest implementation time to change nitrate treatment approach, potentially reducing operational costs by 40%.
• First ROD Amendment likely to get approved since it does not fundamentally change the remedy.
• Utilizes the "Optimization Plan" to temporarily stop Nitrate treatment while waiting for PP/ROD amendment to be finalized.
Cons
• Requires two ROD Amendments for remedy modification (high public visibility).
• Uncertain if EPA will allow the transition of nitrate treatment from bioreactors to blending without reverting back to an Interim ROD.
Option 3 FFS/PP/ROD Amendment
FFS
PP
Public Comment
ROD Amendment
RD/RAWP Revision
Adjust Remedy, Eliminate FBR/MBR Treatment
(1st Q FY28)
Pros
• Single ROD amendment - allows time to collect data, evaluate alternatives, and adjust RAOs.
• Allows time to develop the Central Plateau Waste Management Area concept, complete biotic degradation, analysis for CCl4, and complete Ringold A characterization.
Cons
• Continues high cost biological treatment of nitrate for 9 years.
• Does not address the current cost over-run in a timely manner.
• Uncertain if EPA will allow the transition of nitrate treatment from bioreactors to blending without reverting back to an Interim ROD.
• Cannot start FFS/PP/ROD Amendment until Central Plateau Waste Management Area concept, biotic degradation analysis for CCl4, and Ringold a characterization are complete.
CHSGW20190003

200-ZP-1 CERCLA Documentation Status

- Kathy Leonard will provide status on the updating of the 200-ZP-1 RD/RAWP, PMP, and O&M Plan

200-ZP-1 CERCLA Documentation Status

- Remedial Design/Remedial Action Work Plan (DOE/RL-2008-78) revisions since 2009 Rev 0
  - Updated capture 200-ZP-1 remedy design and construction
  - Updated capture optimization changes implemented over the first 5 years of operation (e.g. new wells, minor modifications to the 200 West P&T system)
  - Updated groundwater modeling discussion including Central Plateau Groundwater Model revisions
  - Updated cost and schedule information
  - Added an updated nature and extent appendix
  - Added a summary of regulatory requirements appendix

200-ZP-1 CERCLA Documentation Status (continued)

- Remedial Design/Remedial Action Work Plan (DOE/RL-2008-78) revisions since 2009 Rev 0
  - Added an appendix summarizing an evaluation of remedy performance over the first 5 years of operation (mass removed, plume capture etc.)
  - Added discussion of modeling predictions of remedy performance for the current remedy configuration against interim goals and RAOs
  - Added a summary of remedy implementation challenges (carbon tetrachloride mass distribution, hydraulic containment of “thumb area”, uncertainty in understanding of Ringold A, injection well fouling, nitrate treatment)

200-ZP-1 CERCLA Documentation Status (continued)

- Remedial Design/Remedial Action Work Plan (DOE/RL-2008-78) revisions since 2009 Rev 0
  - Provided recommendations for further study activities to address data needs and implementation challenges (e.g. Carbon tetrachloride biotic half-life study, Ringold A characterization, injection well fouling)
  - Added discussion of a proposed path forward for a phased approach to remedy modifications
- Schedule
  - Issue to RL late March/early April
  - Issue Draft to EPA in April

200-ZP-1 CERCLA Documentation Status (continued)

- Performance Monitoring Plan DOE/RL-2009-124, Rev. 3
  - Updated the routine monitoring well sampling and analysis schedule in the performance monitoring SAP (Appendices B and C) based partially on the *Redundancy Analysis for the 200-ZP-1 Groundwater Monitoring Network* (SGW-60527).
  - Updated the proposed monitoring well installation locations (Section 4.1.2 of Main Text and newly added Appendix G) based partially on the *Data Gaps Evaluation in Groundwater Monitoring at the Hanford 200-ZP-1 Groundwater Operable Unit* (SGW-60527).
  - Extensively updated the Data Quality Objectives (DQOs) for the PMP (Sections 1.4 and 4.3 of Main Text and Appendix A).

200-ZP-1 CERCLA Documentation Status (continued)

- Performance Monitoring Plan DOE/RL-2009-115 Rev. 3
  - Extensively updated the performance monitoring analysis and reporting section (Section 4.3 of Main Text) to reflect the extensive updates to the PMP DQO analytical approach.
  - Added new Appendix G as the 200-ZP-1 OU well-installation SAP that includes both monitoring wells (based partially on the data gaps evaluation) and P&T Wells (extraction and injection, based on new optimization efforts described in detail in the RD/RAWP).
- Schedule
  - Issue to RL early/mid April
  - Issue Draft to EPA late April
-

200-ZP-1 CERCLA Documentation Status (continued)

- Operations & Maintenance Plan DOE/RL-2009-124 Rev. 6
  - Extensively updated the operations and process optimization to evaluate system performance and support process optimization
  - Extensively updated the operations and maintenance section to enhance details for the pump and treat operational criteria
  - Extensively updated the transient/upset conditions criteria
  - Extensively updated the operations monitoring section which is designed to evaluate how well the treatment process functions and facilitate operation of the system

200-ZP-1 CERCLA Documentation Status (continued)

- Operations & Maintenance Plan DOE/RL-2009-124 Rev. 6
  - Extensively updated Appendix D, Sampling and Analysis Plan for the 200 West P&T outlining triggers for sample frequency, facility process data for evaluating treatment effectiveness and water quality (well foulants), incorporated mechanisms to evaluate and manage all feed streams being processed at the pump and treat facility
  - Added new Appendix E, Typical Methods for the 200 West Pump and Treat to provide routine maintenance, preventive maintenance, operation of pump and treat system components, and protection of environment, health and safety
- Schedule
  - Issue to RL early/mid April
  - Issue Draft to EPA late April