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Revision 0

200-ZP-1 Optimization Study Update

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

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Approved for Public Release;
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200-ZP-1 Optimization Study Update

Presented by: M. E. Byrnes, CH2M HILL Plateau Remediation Company

Presented to: U.S. Department of Energy-Richland (DOE/RL) and United States Environmental Protection Agency (EPA)

Date: September 8, 2020

Agenda

- Update on optimization study:
  - Recent changes to the 200 West Pump and Treat (P&T)
  - Operational sampling results
  - Performance monitoring sampling results
  - COVID-19 impacts on the 200 West P&T
  - Rebound study results
  - Status of Draft A Optimization Study Sampling and Analysis Plan (SAP)
- COVID-19 impacts on Ringold A characterization
- Status of Operations and Maintenance (O&M) Plan
- Ringold A hydraulic test plan
- Path forward

Optimization Study − Recent Changes to 200 West P&T

- Flow changes:
  - Extraction wells in 200 East (BP-5 and DV-1) and the PFP work zone were shut down during the partial stop work on March 23, 2020. Resulting flow was 1,640 gal/min.
  - Flow was restored to 2,500 gal/min on July 29, 2020.
  - Rebound study complete on all extraction wells (except YE-29).
- Operations Acceptance Test (OAT) for the 16 in. bypass line was completed August 13, 2020; no issues were identified.
- Third air stripping tower:
  - Contract awarded September 2019.
  - Delivered August 24, 2020.
- BP-5/PO-1 Ion Exchange (IX) system:
  - Contract awarded September 2019.
  - Expected to be delivered October 29, 2020.
- Layup activities are progressing.
- No other changes made to the facility during FY 2020 due to impacts from COVID-19.

Optimization Study - Operational Sampling Results

Air emissions:

- Washington State updated Toxic Air Pollutants table of ASIL, SQER, and de minimis values in Washington Administrative Code (WAC) 173-460-150 on December 23, 2019:
  - Latest model version (ECF-200W-17-0206) was found to be bounding for toxic air pollutants.
  - Changes updated the list and removed some constituents.

	ASIL ($\mu g/m^3$)	SQER (lb/day)	De minimis (lb/day)
CCl_4			
Pre-2020	0.0238	4.57	0.228
2020	0.17	27	1.4
Chloroform			
Pre-2020	0.0435	8.35	0.417
2020	0.043	7.1	0.35

Optimization Study - Operational Sampling Results

Air emissions (cont.):

- Integrated mass balance for upgrade to 3,750 gal/min is being finalized.
- Draft new source review shows CCl_4 and chloroform are not bounded by previous model.
- Radiological release calculations were updated in 2018:
  - Driven by a procedure update for potential-to-emit calculations.
  - Used conservative concentrations from beginning of plant startup.
- Integrated mass balance estimates lower; should be bounding:

	Uranium	I-129	Tritium	Tc-99
Previous ECF (pCi/L)	577.43	2.18	9,250	14,875
IMB estimate (pCi/L)	59.7	0.343	2,409	938.6

Optimization Study - Operational Sampling Results

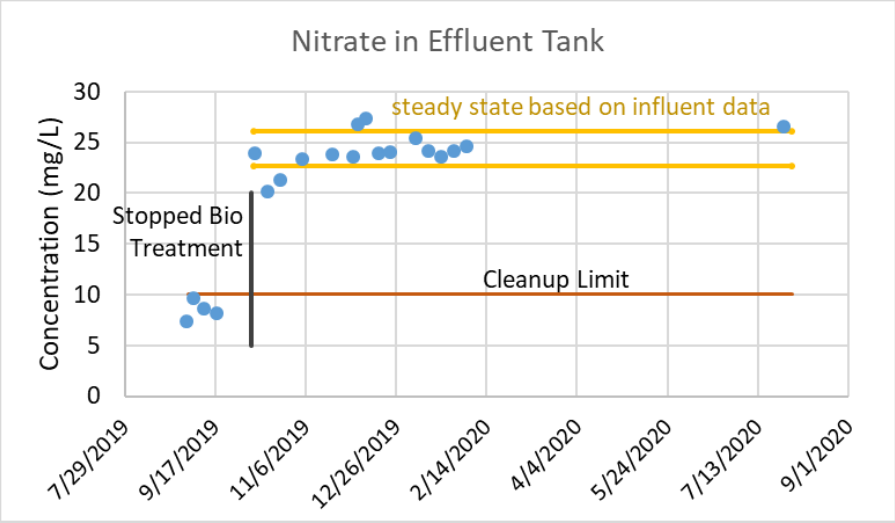
Air emissions (cont.):

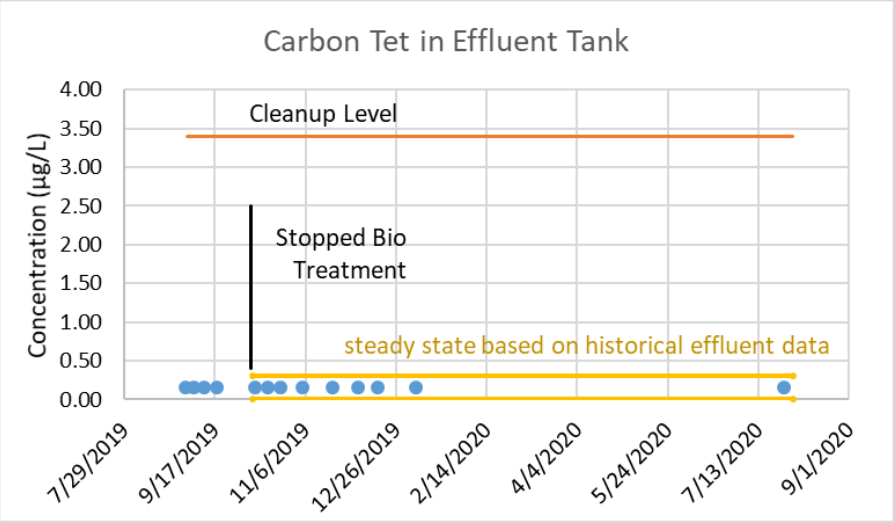
- Air model for toxic air pollutants to be updated in Fiscal Year (FY) 2021:
  - Prepare for increase to 3,750 gal/min.
  - Address ASIL, SQER, and de minimis changes to Washington Administrative Code (WAC) 173-460-150.
  - Address recent changes to Hanford Site ambient air boundary.
  - Address updated meteorological information for model.

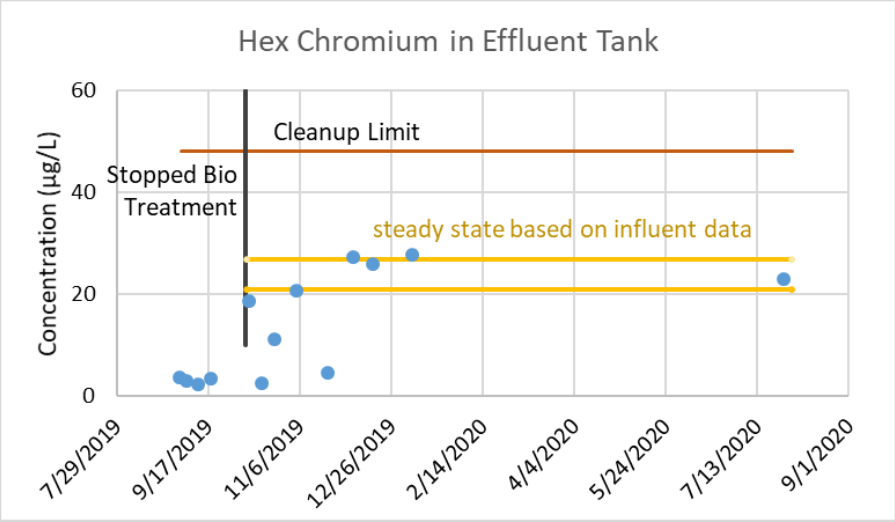
Optimization Study - Operational Sampling Results

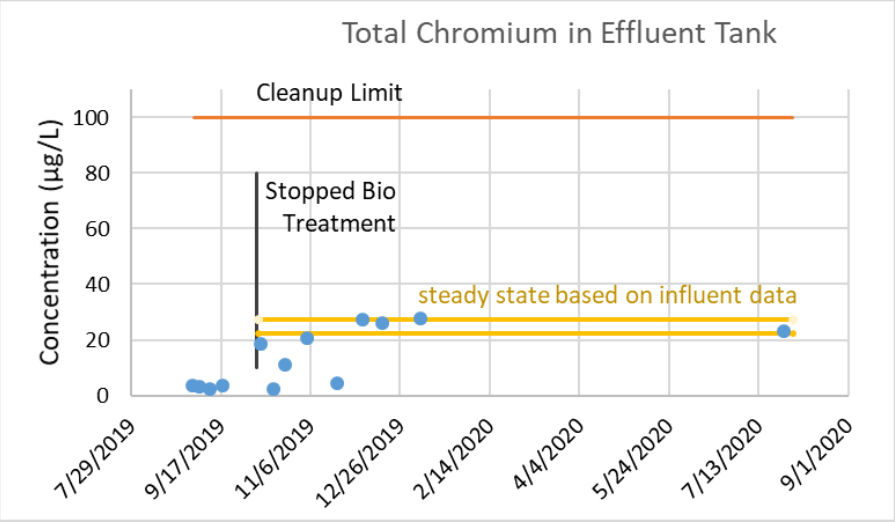
- The next few slides provide an update on the 200 West P&T influent and effluent concentrations for many of the Contaminants of Concern (COCs) (including total chromium and Cr[VI]) to show that effluent concentrations continue to remain well below the cleanup level (except for nitrate).
- The following slides provide clarification for EPA regarding why Cr(VI) is not currently being treated.

Optimization Study – Operational Sampling Results



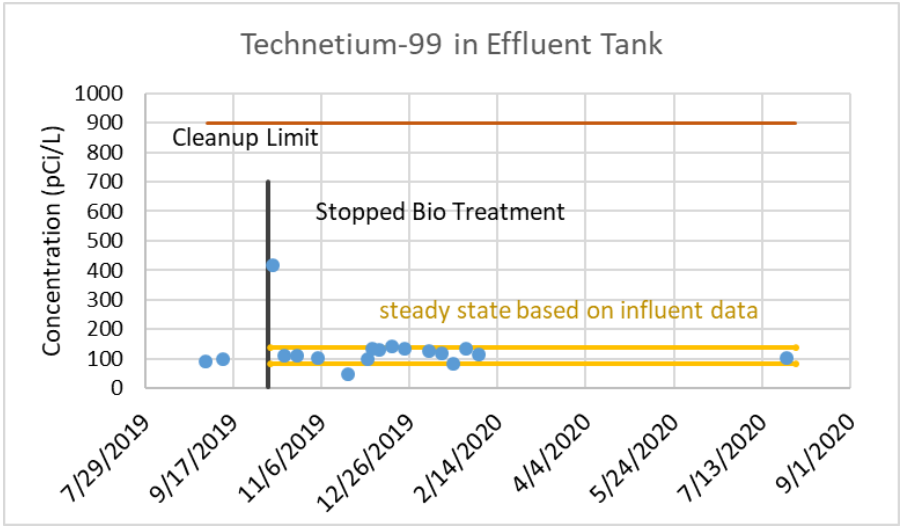


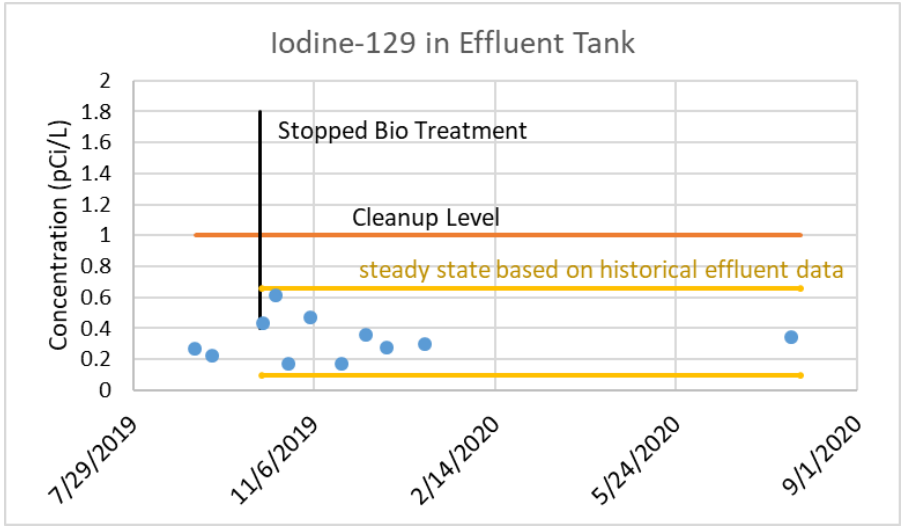


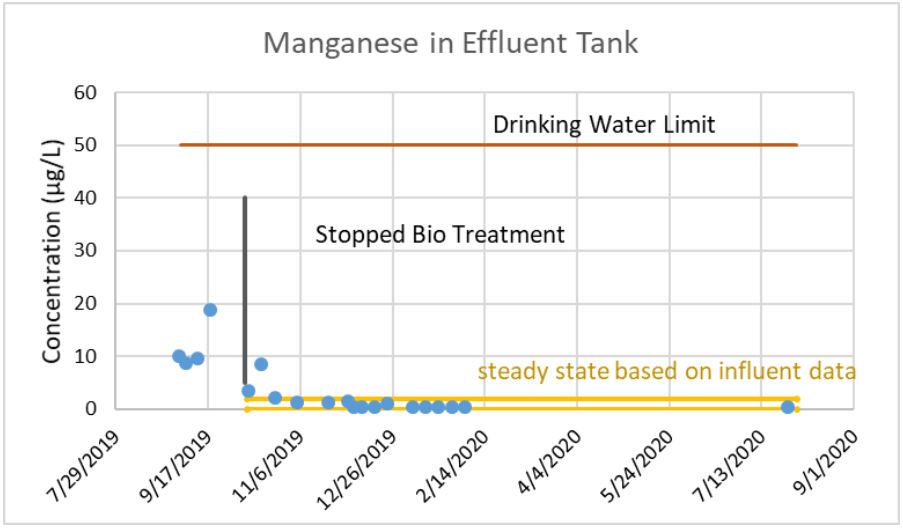


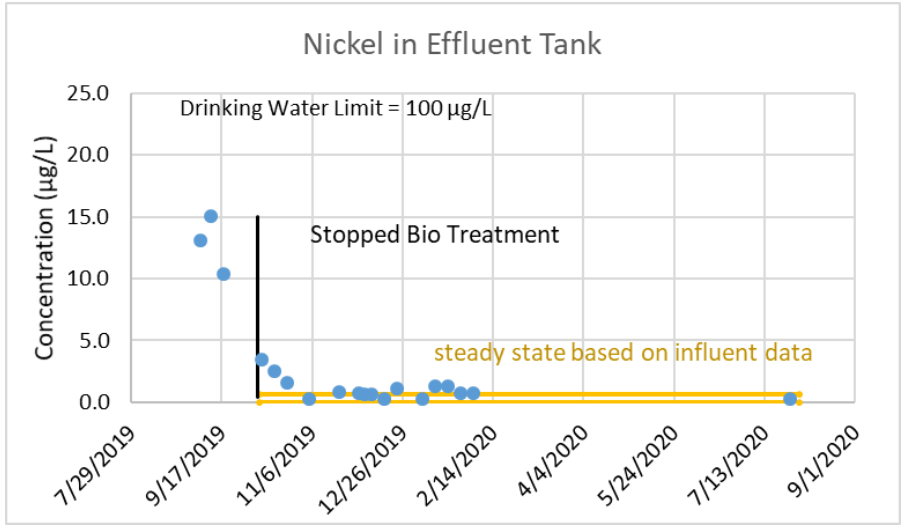
No samples available from March 2020 through June 2020 due to COVID-19 work restrictions.

Optimization Study - Operational Sampling Results









No samples available from March 2020 through June 2020 due to COVID-19 work restrictions.

Optimization Study – Operational Monitoring Results

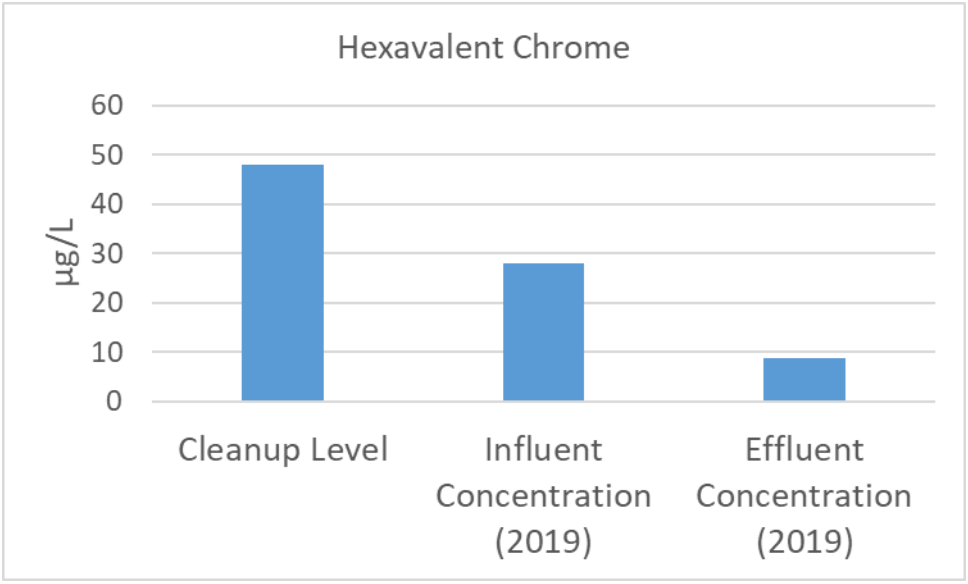
- The following slides discuss the Cr(VI) treatment approach during the optimization study:
  - What did we expect for chromium treatment?
  - What are we actually seeing for chromium treatment?
  - Discuss Cr(VI) aquifer concentrations at wells and mass removal.
- The intent of the following slides is to develop consensus on the Cr(VI) approach during the optimization study.

Optimization Study – Operational Monitoring Results

- Biological treatment at the 200 West P&T was focused on nitrate and CCl_4. Cr(VI) treatment was secondary.

  From Table 1-1 of the functional design criteria document for 200-ZP-1* in reference to Cr(VI): “No treatment required due to low influent levels.”

- When we suspended biological treatment, we expected a decrease in Cr(VI) treatment to near no treatment:
  - Expected effluent Cr(VI) to increase to influent tank concentrations (28 µg/L versus cleanup level of 48 µg/L).
- This was different than with nitrate, which we knew would leave the plant exceeding the cleanup level.



*SGW-40043, *200 West Area Pump And Treat System Functional Design Criteria*, August 2011.

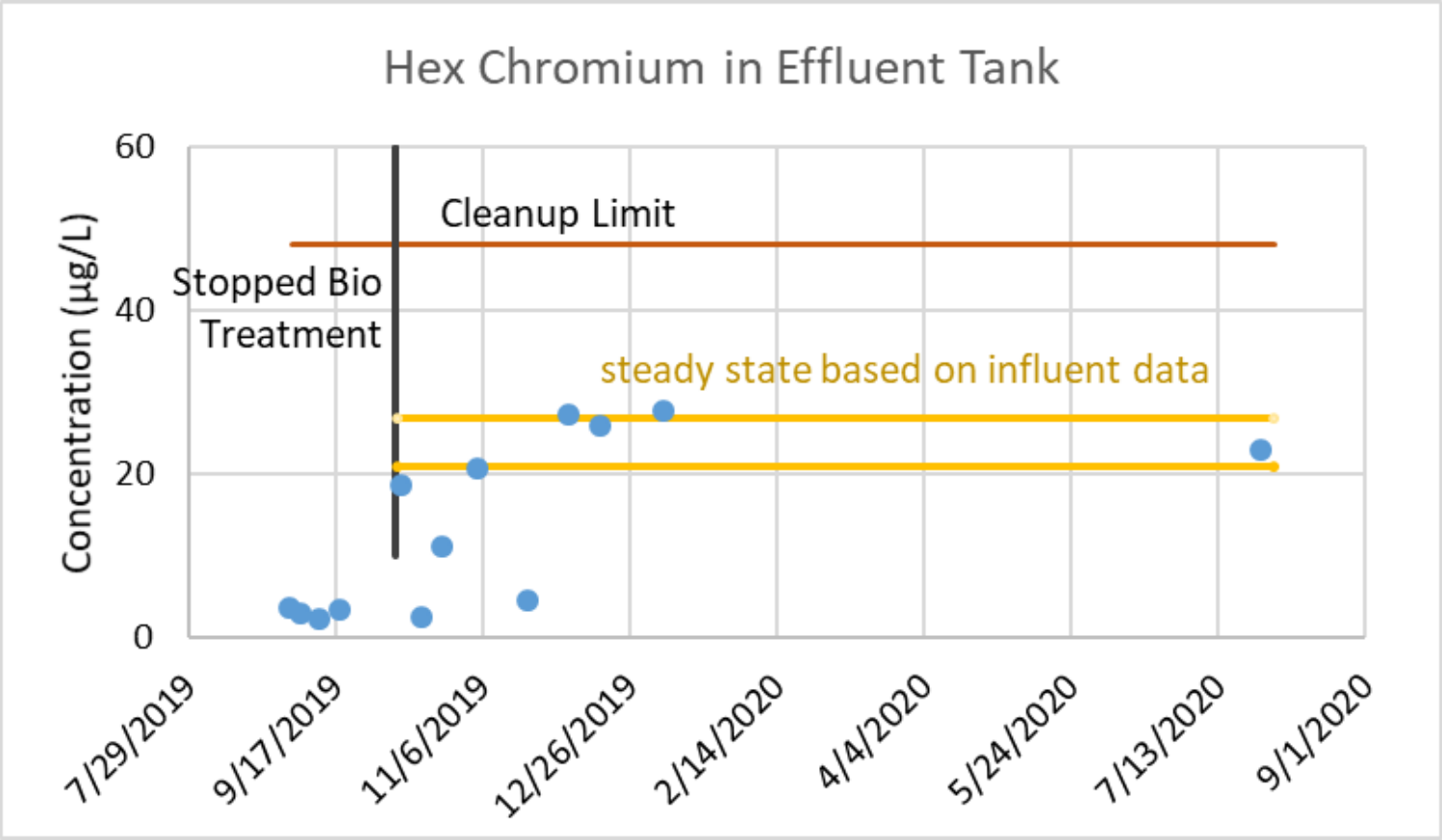
Optimization Study Plan Anticipated Cr(VI) Treatment Unnecessary

- If Fluidized Bed Reactor (FBRs)/Membrane Bio-Reactor (MBRs) were taken offline, the table below summarizes how 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/ GAC	Bioreactors + Air Strippers/ GAC	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/ GAC	Air Strippers/ GAC	Blending*	Influent Below Cleanup Levels	Influent Below Cleanup Levels	IX Resin	IX Resin	Influent Below Cleanup Level	Influent Below Cleanup Level

Note: From briefing on July 30, 2019, to EPA and RL entitled “200-ZP-1 Optimization Study Plan Update”; and Table 3 in DOE/RL-2019-38, Rev. 0, *200-ZP-1 Operable Unit Optimization Study Plan*.

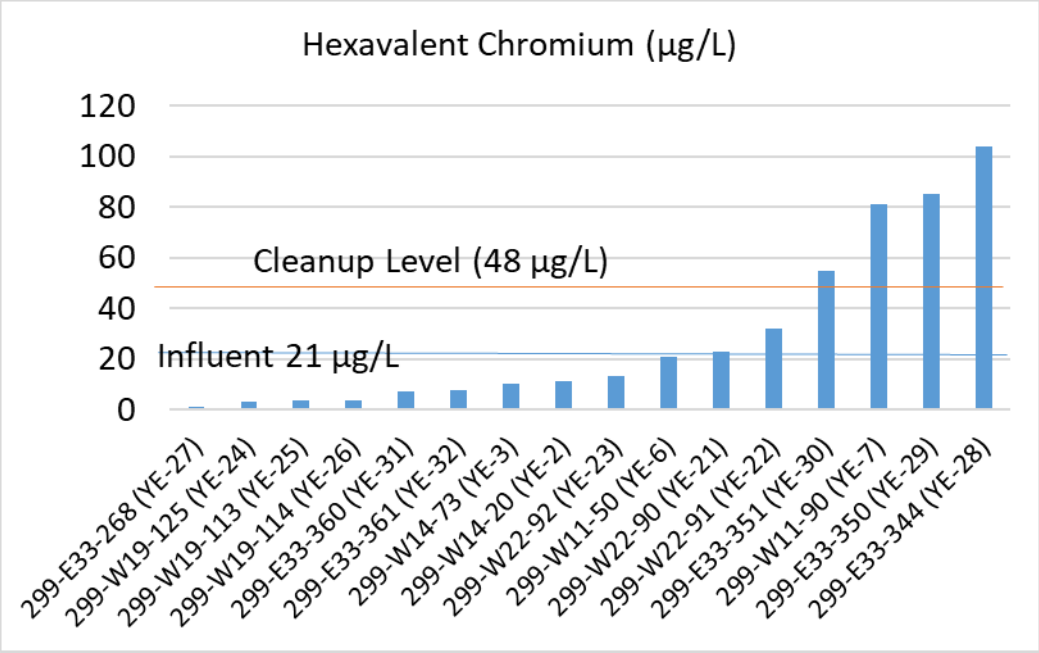
Data Have Confirmed Anticipated Trends for Cr(VI)



Note: Monthly averages presented in tabular form in quarterly updates. Most recent briefing was on August 5, 2020, and included data through the 2nd quarter of 2020.

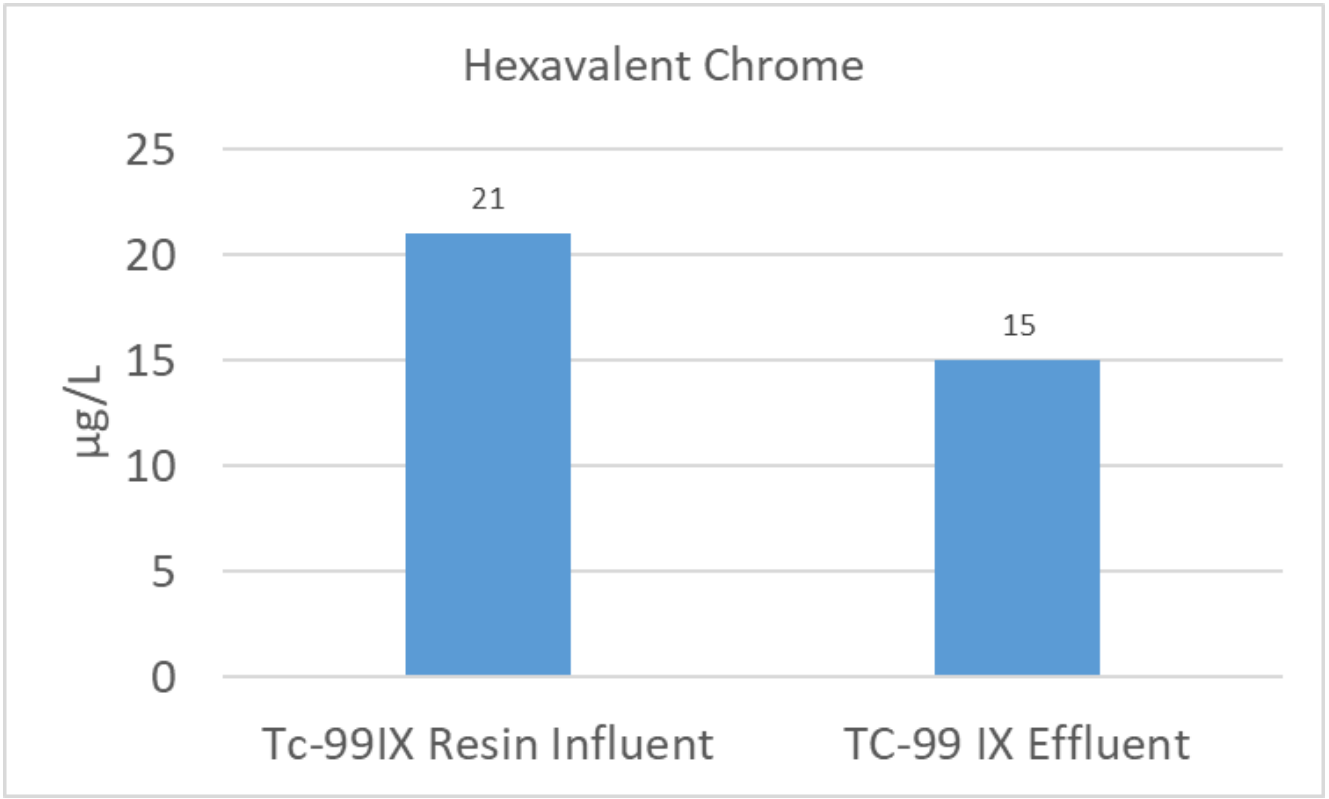
“Rad” Extraction Wells Have Varying Cr(VI) Content

- A total of 12 of 16 “Rad” wells have Cr(VI) less than the cleanup level.
- Blended influent 21 µg/L, well below the cleanup level of 48 µg/L.

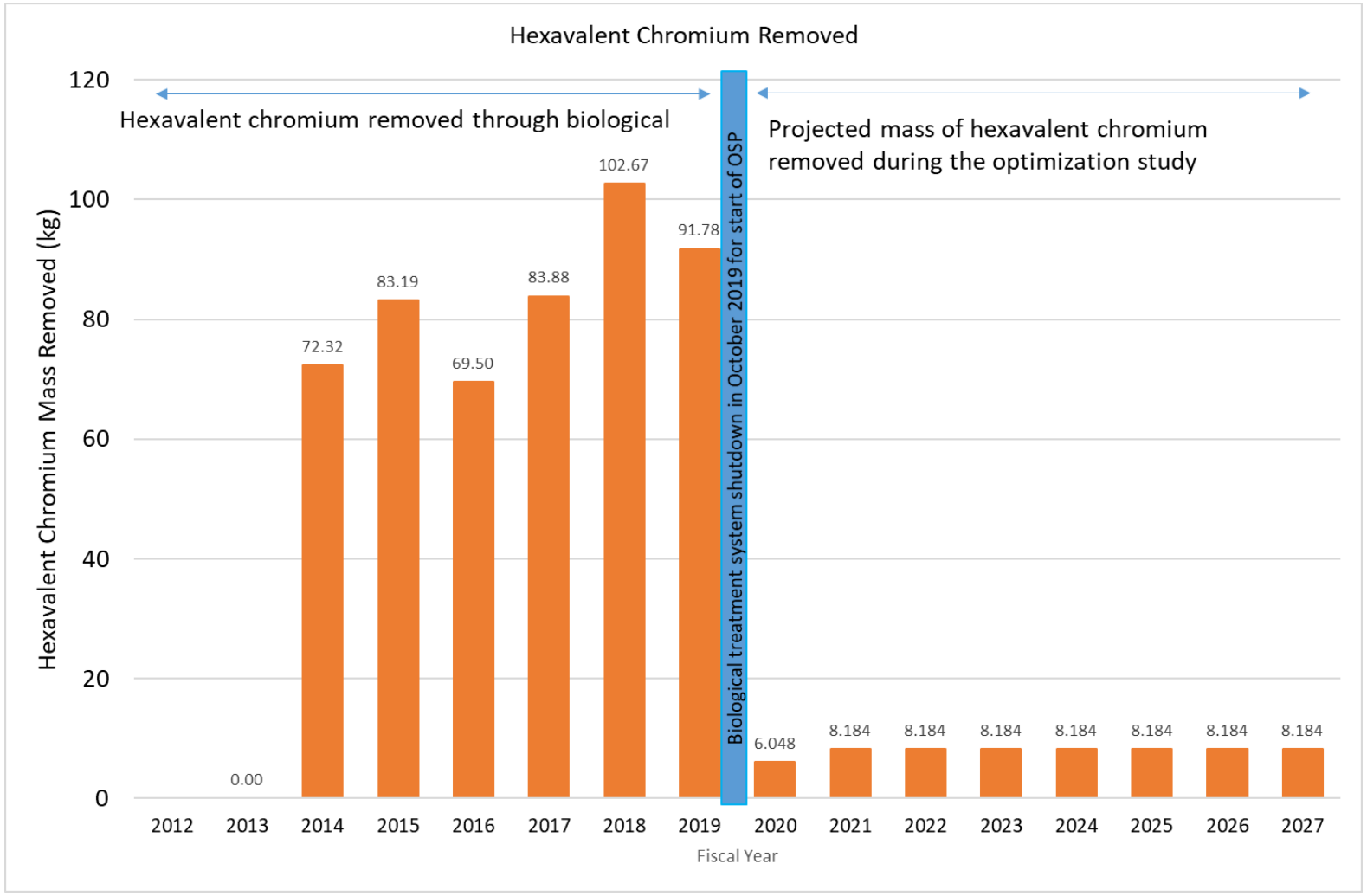


“Rad” Wells Receive Treatment for Cr(VI) by IX

- Cr(VI) treatment by IX is nominal and secondary to Tc-99.

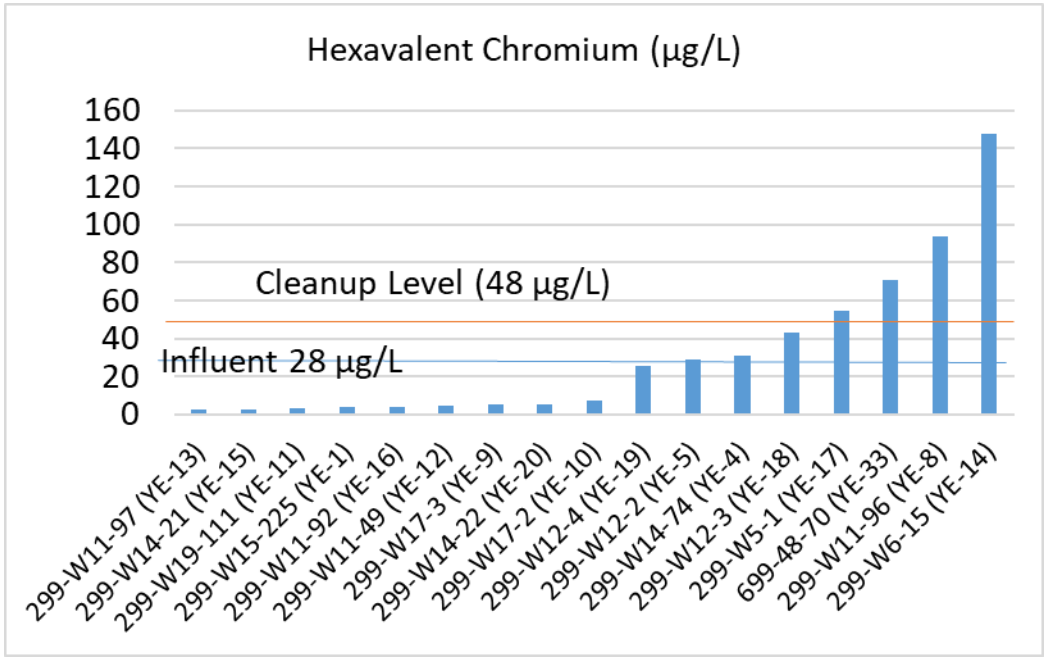


Mass Removal of Cr(VI) Continues at Reduced Rate



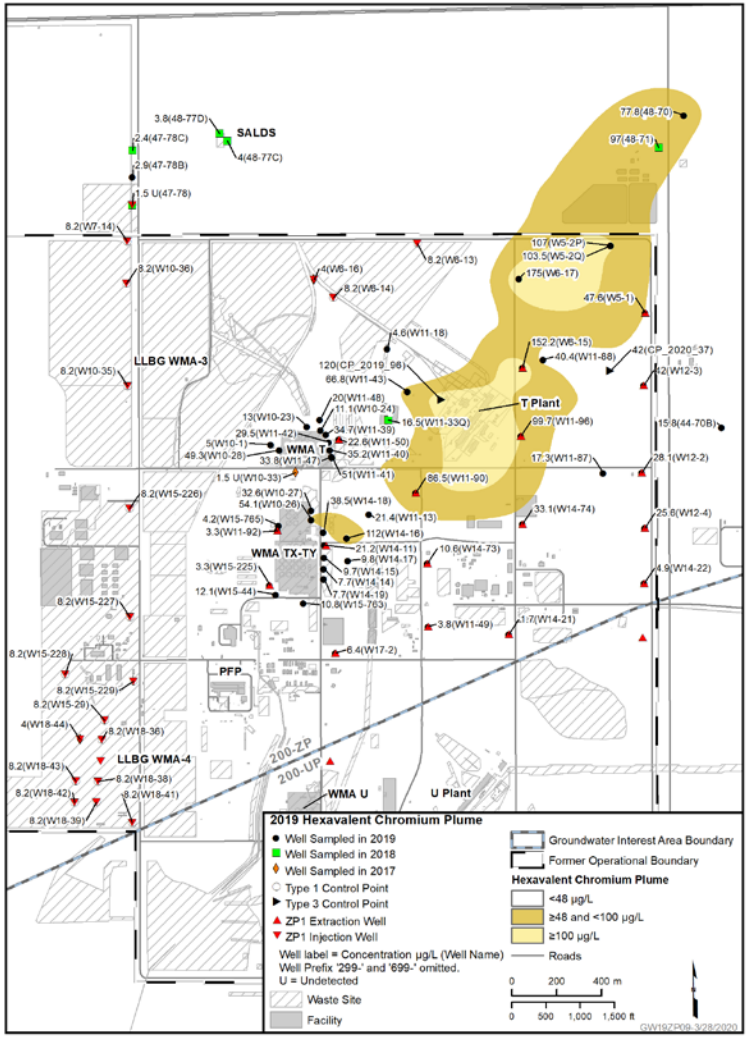
“Non-Rad” Extraction Wells Also Have Varying Cr(VI) Content

- A total of 13 of 17 “Non-Rad” wells have chromium less than the cleanup level.
- Blended influent 28 µg/L, well below the cleanup level of 48 µg/L.

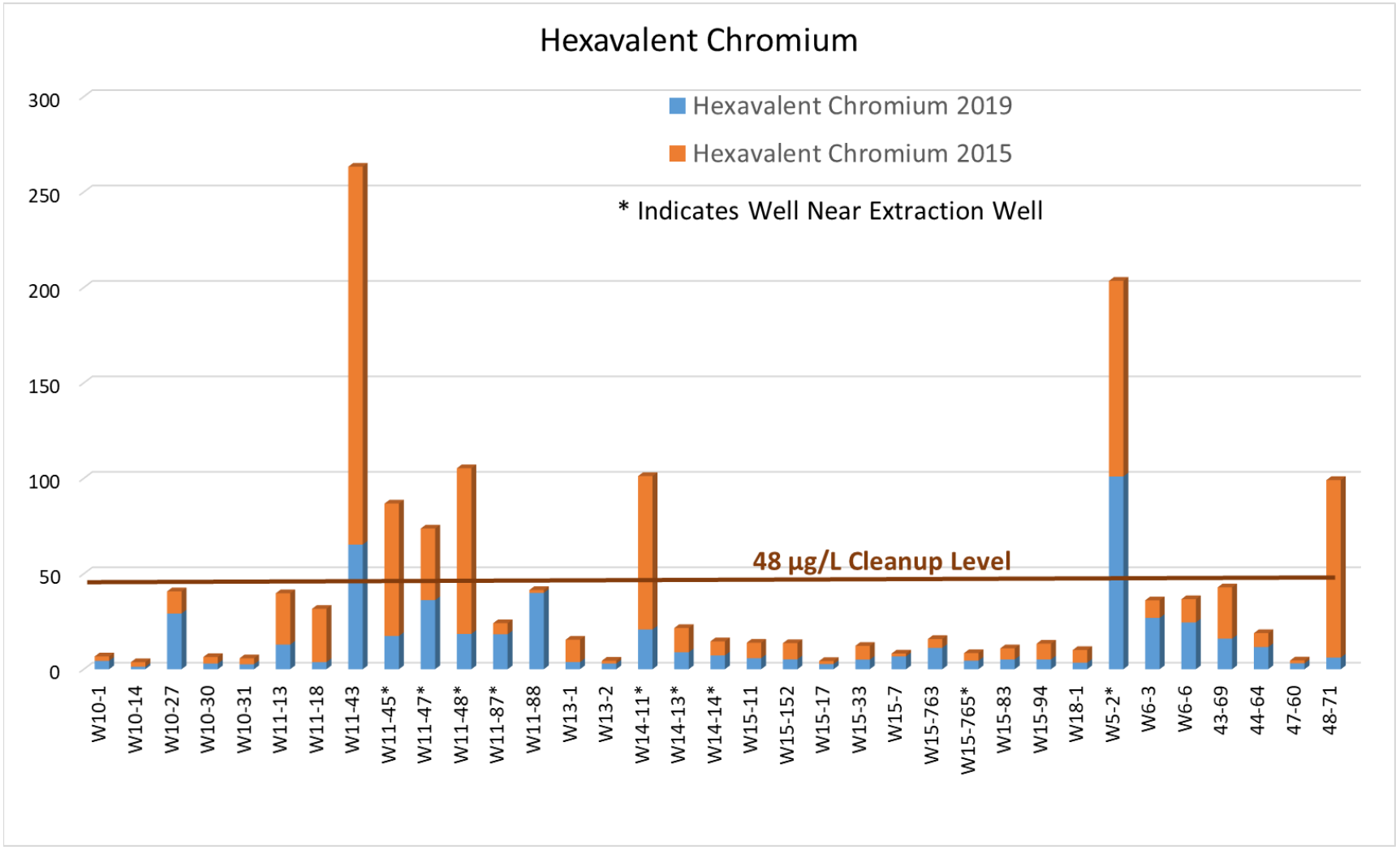


Plume Maps Show Extent of Cr(VI)

- While there is currently no strong indication for a continuing source, we will further evaluate the available evidence during FY 2021.



Monitoring Wells Show Decreasing Trend in Cr(VI)



Technical Recommendations Regarding Cr(VI)

- Monitor Cr(VI) during optimization study with IX treatment only:
  - Verify continued compliance with cleanup level.
  - Refine Cr(VI) plumes and track changes.
  - Continue tracking mass removal by IX.
- Prepare recommendations for Cr(VI) treatment post-optimization test.

Technical Recommendations Regarding Cr(VI)

- Maintain focus of optimization test:
  - Accelerate and optimize CCl_4 treatment.
  - Monitor nitrate to define plumes and determine effectiveness of natural attenuation.
- Meet the RAOs for all the other COCs, including Cr(VI).

Recommended Next Steps Regarding Cr(VI)

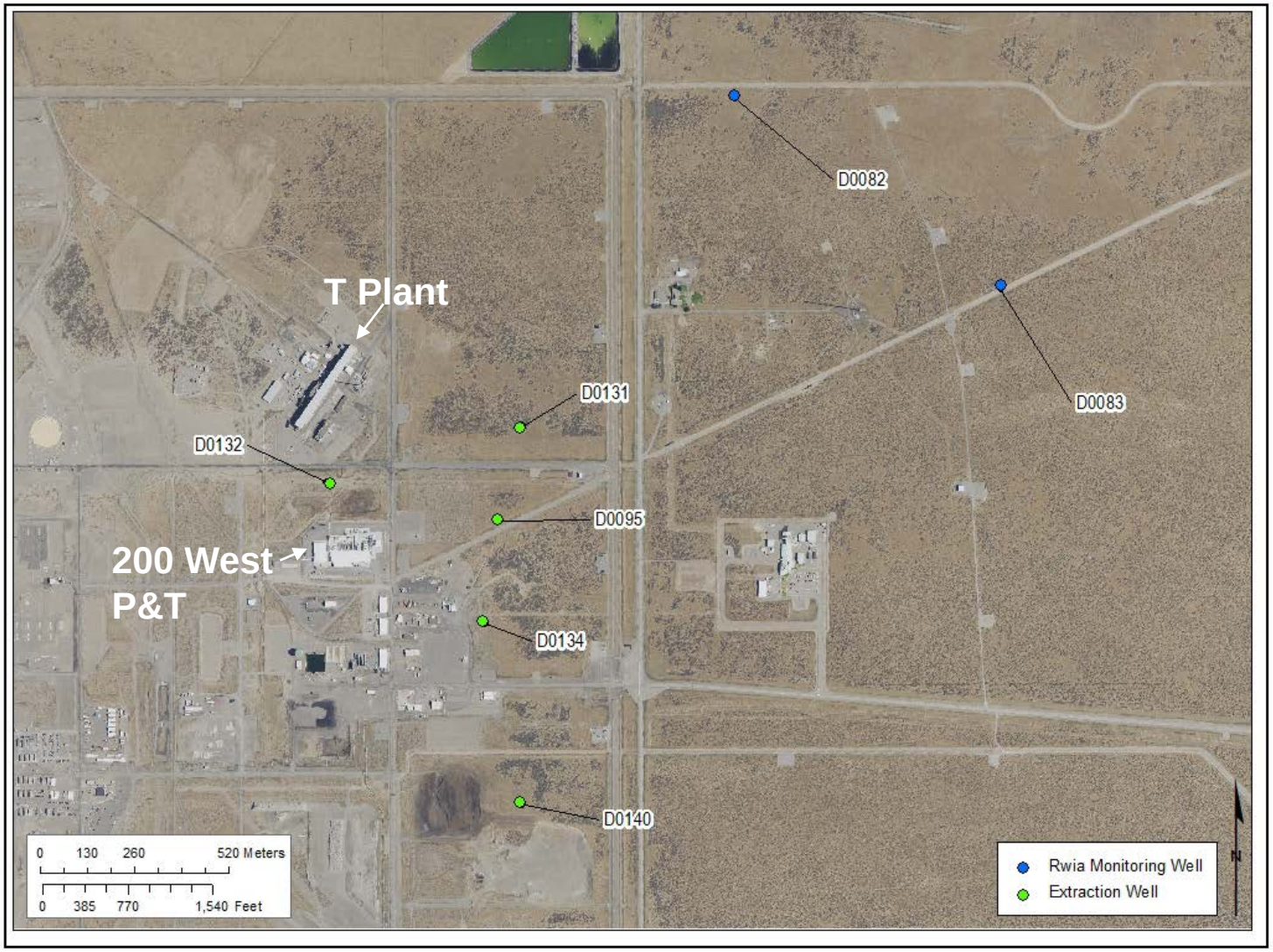
- Confirm we have consensus with recommended approach for Cr(VI) during the optimization study.
- Document concurrence with approach.
- Open discussion on the form of documentation:
  - Email?
  - Tri-Party Agreement Change Notice (TPA-CN)?
  - Other?

Optimization Study – COVID-19 Impacts On 200 West P&T

Extraction well drilling delays:

- COVID-19 shutdown began on 3/17/2020; phased restart of drilling began on 7/6/2020.
- Five Extraction wells
  - D0095 – Drilling began 1/27/20
    - Currently drilled 292 ft of 524 ft
  - D0132 – Drilling began 2/18/20
    - Currently drilled 323 ft of 538 ft
  - D0131 – Drilling began 7/22/20
    - Currently drilled 225 ft of 507 ft
  - D0134 – Drilling began 7/29/20
    - Currently drilled 118 ft of 535 ft
  - D0140 – Drilling began 8/5/20
    - Currently drilled 115 ft of 540 ft

Optimization Study – COVID-19 Impacts On 200 West P&T – Drilling Delays



Optimization Study – COVID-19 Impacts On 200 West P&T – Routine Sampling Delays

- Agreed with DOE-RL and regulatory agencies to report sampling delays or missed trips monthly in table format.
- The first “delayed or missed sample” tables will be reported for July and August 2020 on September 10 and then for each month thereafter in the first 10 days of the following month.
- No delayed or missed samples will be removed from the schedule without consulting DOE-RL and the regulatory agencies.
- A summary of missed samples due to work delays for March through June 2020 will be prepared and submitted with the August sample tables.

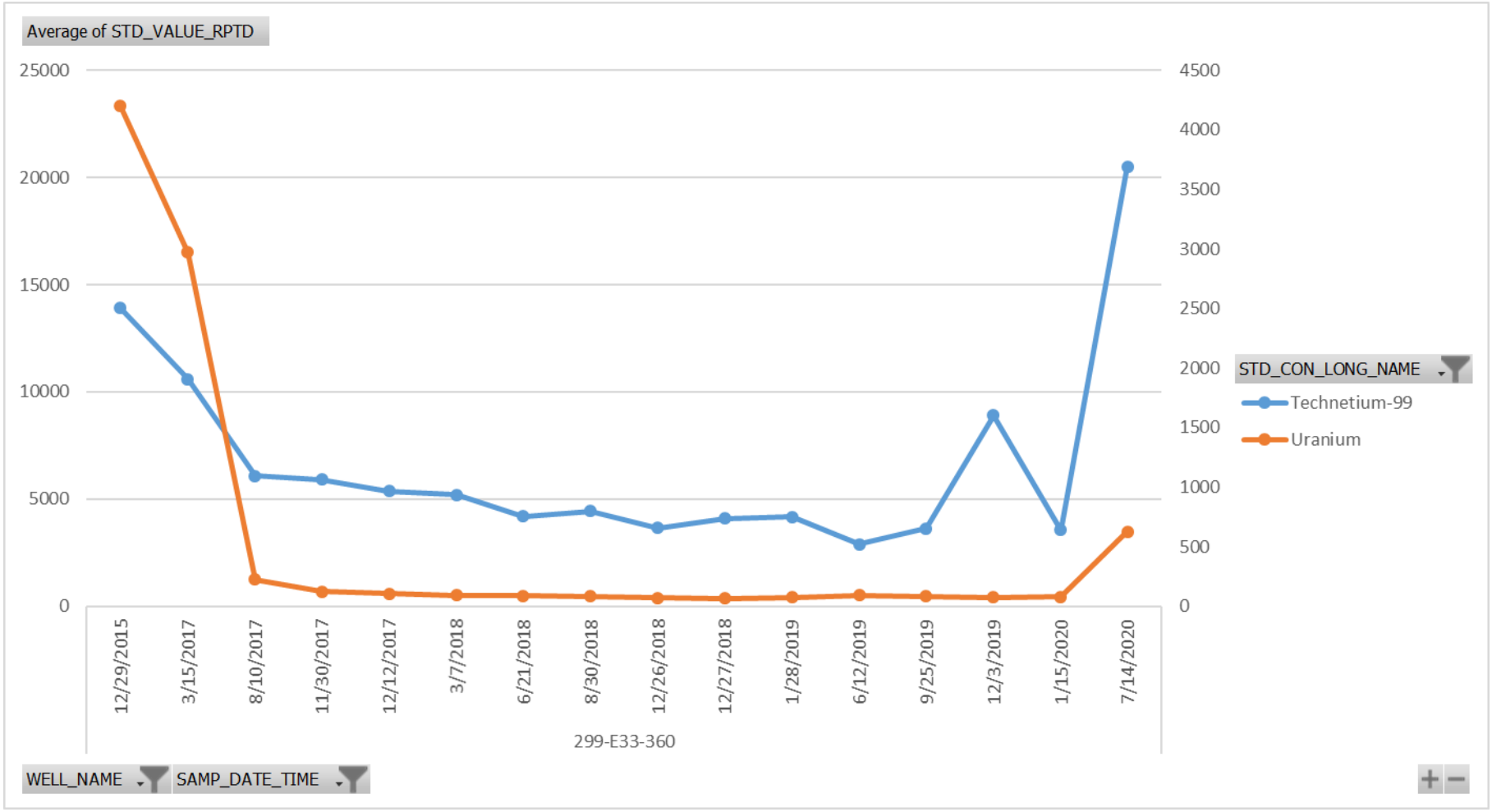
Optimization Study – Rebound Study Results

- Constituents of interest analyzed for rebound after extraction well restart:

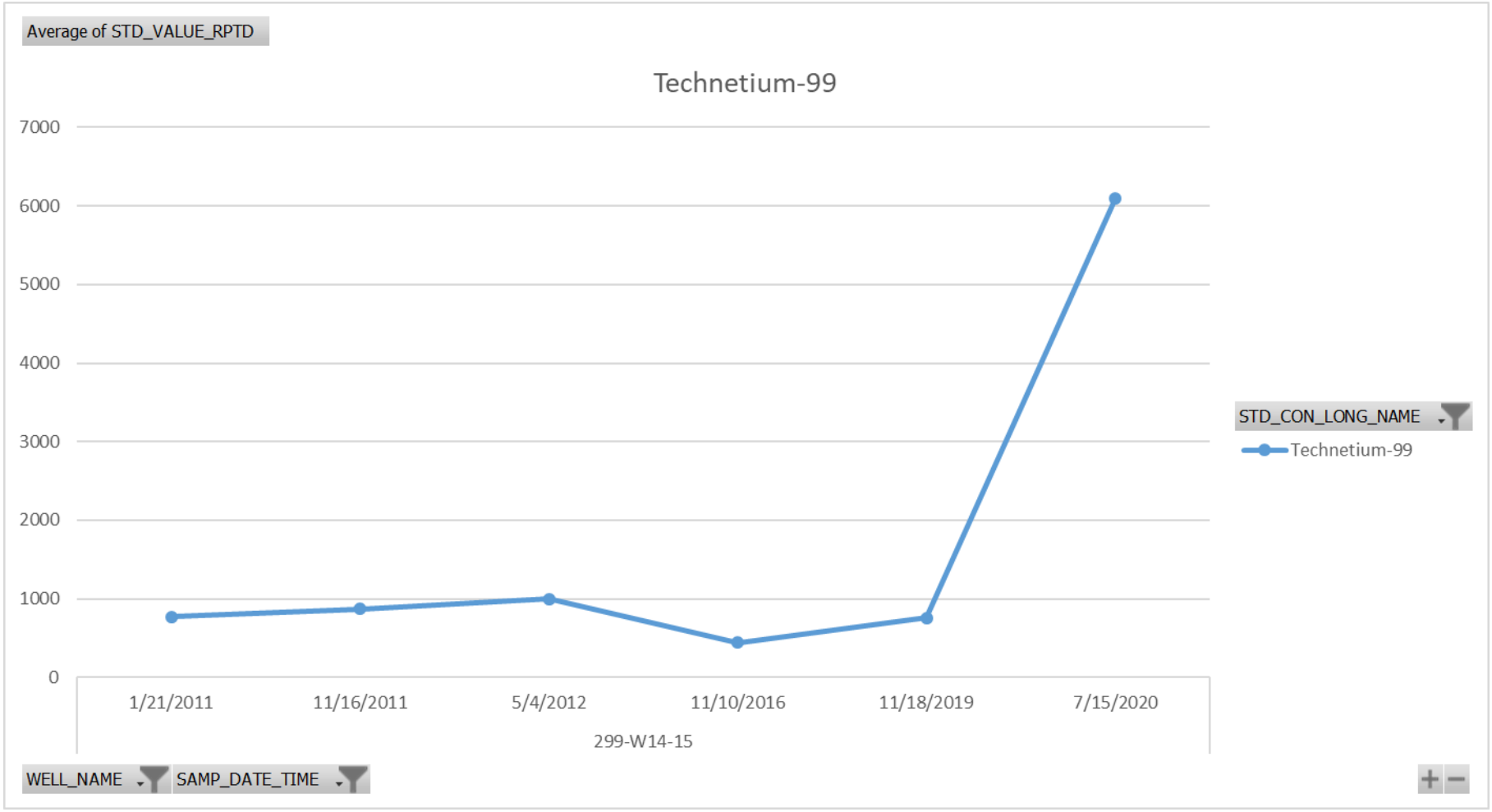
Well Name	Well Use	Carbon tetrachloride	Chromium	Hexavalent Chromium	Nitrate	Technetium-99	Uranium
299-E33-16	MW		X	X	X	X	X
299-E33-20	MW		X		X	X	X
299-E33-31	MW		X		X	X	X
299-E33-337	MW		X		X	X	X
299-E33-338	MW		X		X	X	X
299-E33-342	MW				X	X	X
299-E33-344	EW	X	X	X	X	X	X
299-E33-351	EW	X	X	X	X	X	X
299-E33-360	EW	X	X	X	X	X	X
299-E33-361	EW	X	X	X	X	X	X
299-E33-44	MW		X		X	X	X
299-E33-47	MW		X		X	X	X
299-W10-27	MW		X	X	X	X	X
299-W11-45	MW	X			X	X	
299-W11-47	MW	X			X	X	
299-W11-49	EW			X			
299-W11-92	EW	X	X	X	X	X	X
299-W14-15	MW		X	X	X	X	X
299-W14-18	MW		X	X	X	X	X
299-W14-20	EW	X	X	X	X	X	X
299-W15-225	EW	X	X	X	X	X	X
299-W15-44	MW		X	X	X	X	X
299-W15-765	MW		X	X	X	X	X
299-W17-2	EW	X	X	X	X	X	X
299-W17-3	EW	X	X	X	X	X	X

Note: Yellow-highlighted cells identify potential rebound of constituent in sampled well.

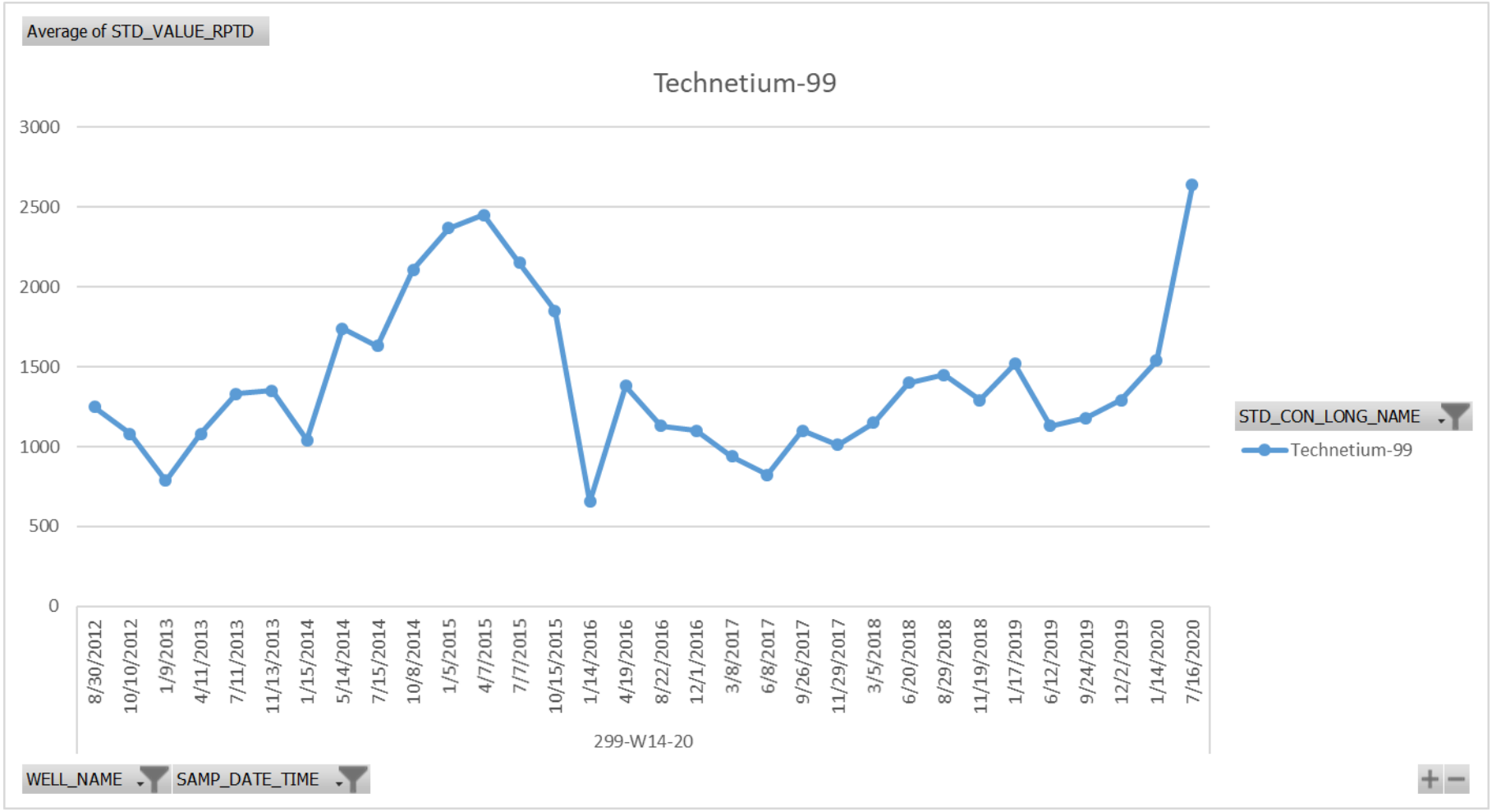
Optimization Study – Rebound Study Results



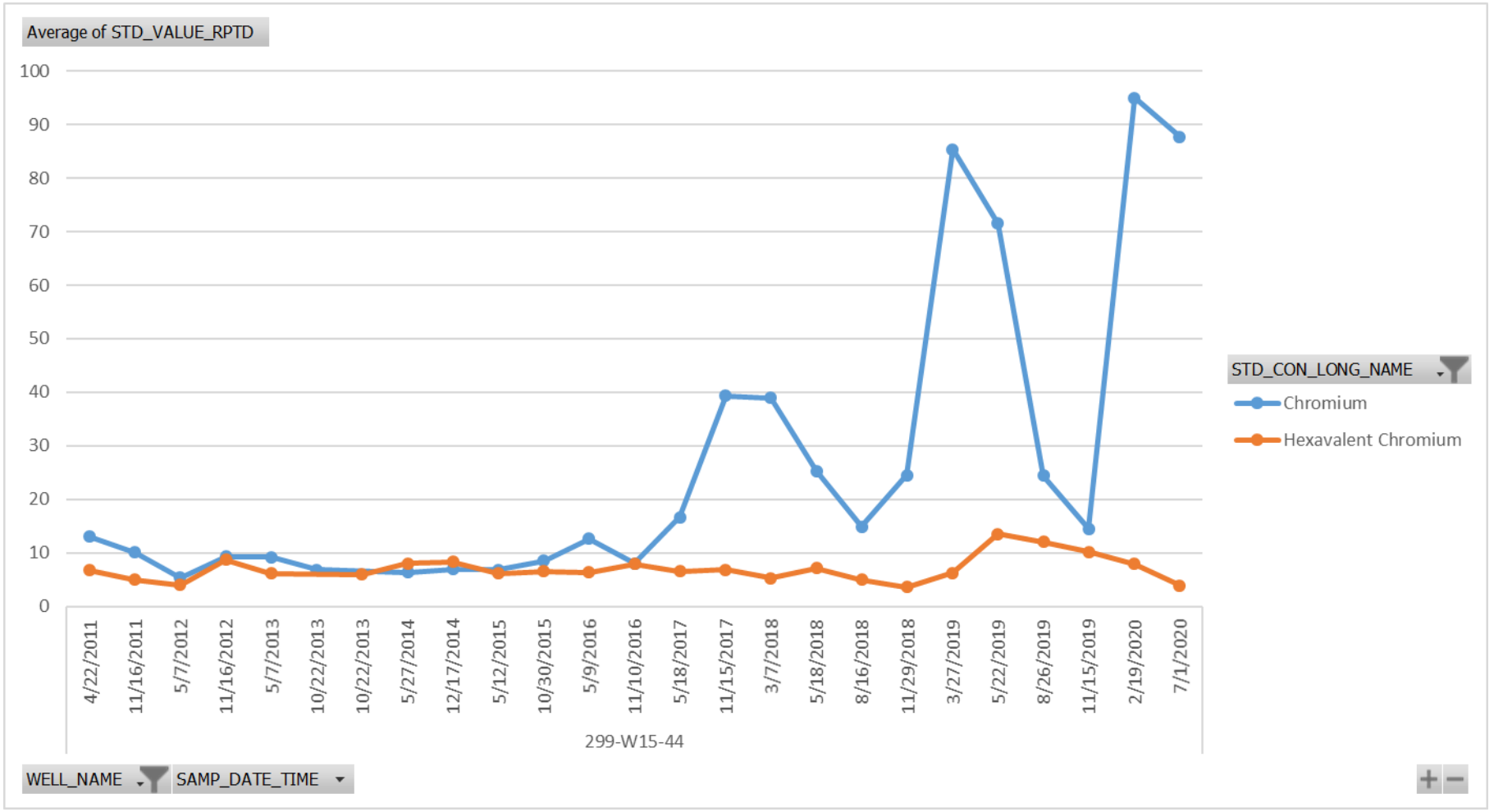
Optimization Study – Rebound Study Results



Optimization Study – Rebound Study Results



Optimization Study – Rebound Study Results



Optimization Study – Status on Draft A Optimization Study SAP

- DOE/RL-2019-76, Draft A, *200-ZP-1 Operable Unit Optimization Study Sampling and Analysis Plan*, will be delivered to EPA in the next few weeks for their review.
- The FY 2021 baseline has an activity to perform a comprehensive plume evaluation. This evaluation will develop a strategy to optimize the recovery of COCs other than those identified in the Optimization Study SAP (e.g.,Tc-99, uranium, and Cr[VI]) .
  - This will evaluate evidence for potential continuing sources.

COVID-19 Impacts on Ringold A Characterization

- COVID-19 shutdown began on 3/17/2020; phased restart of drilling began on 7/6/2020.
- Two Rwia Monitoring wells (D0082 and D0083)
  - D0082 – Drilling began 7/13/20
    - Currently drilled 148.5 ft of 431 ft
  - D0083 – Drilling began 8/25/20
    - Currently drilled 64.5 ft of 464 ft

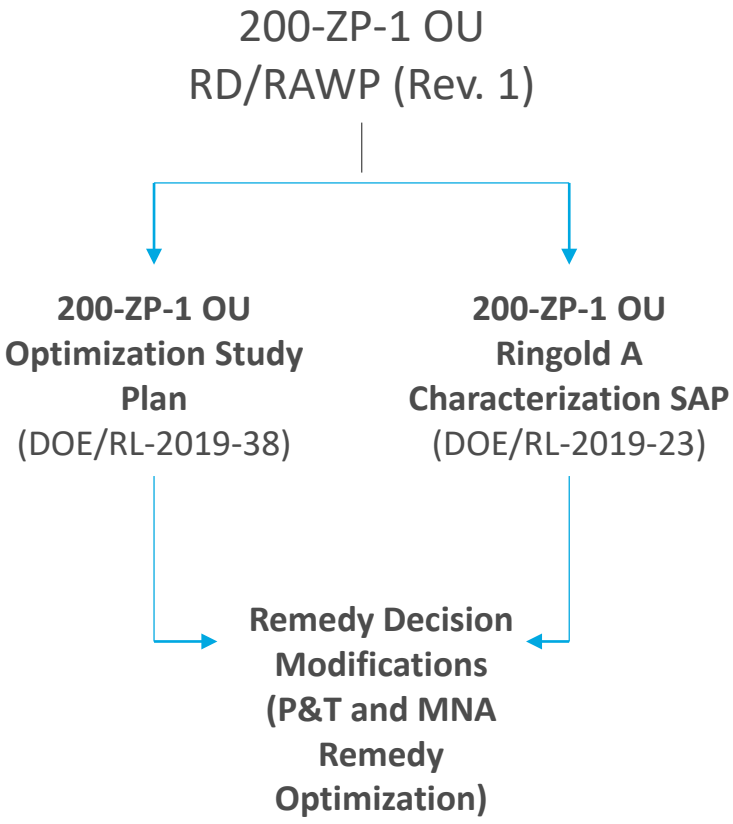
Status on 200-ZP-1 O&M Plan

- CHPRC received RL's latest comments on the 200-ZP-1 O&M Plan on August 6, 2020. We are currently in the process of addressing these and will then prepare the Draft A document.

Ringold A Hydraulic Test Plan

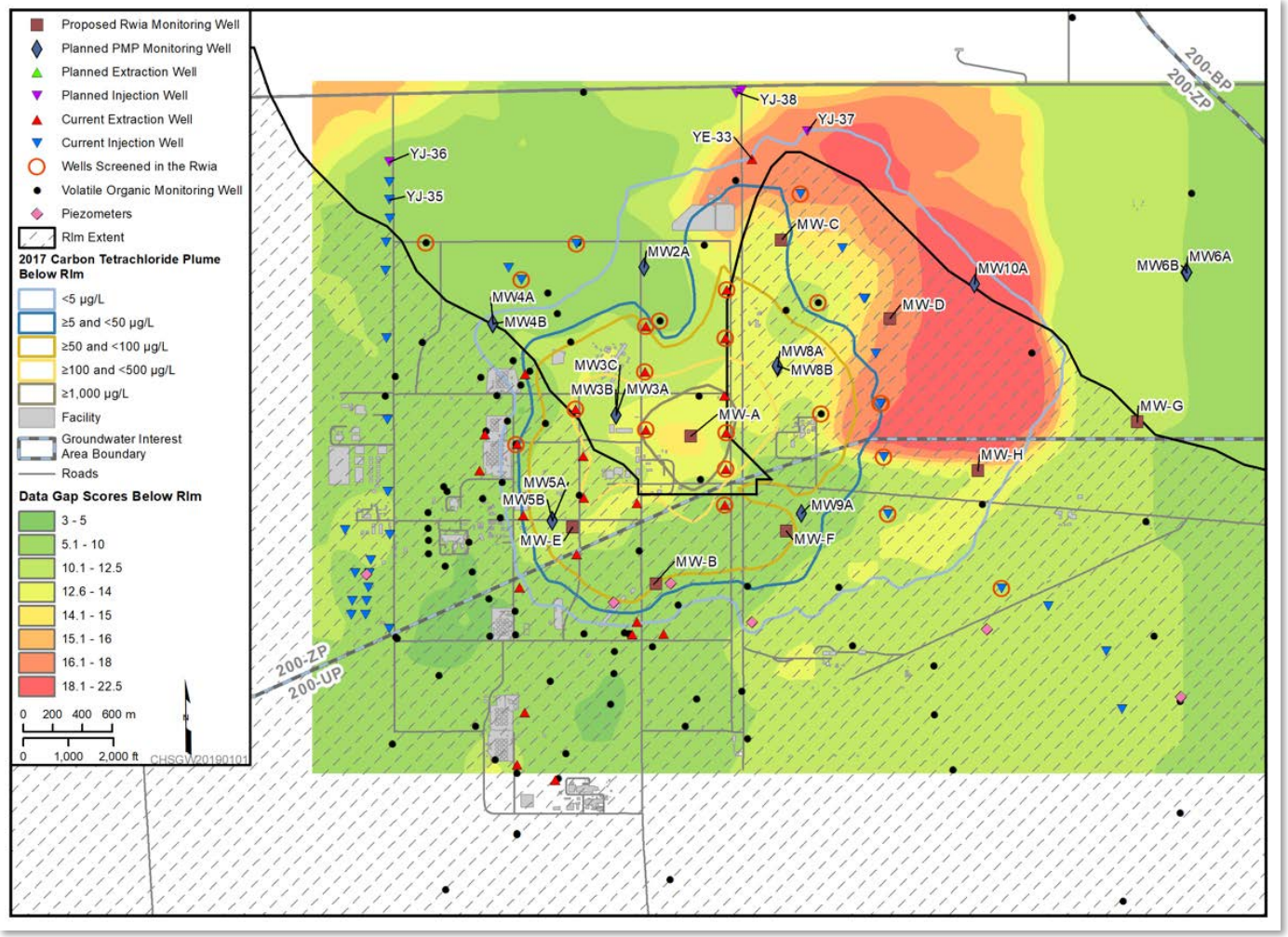
- Ringold A SAP (DOE/RL-2019-23) was developed to address data gaps critical for 200-ZP-1 remedy implementation:
  - Nature and extent of contaminants
  - Geologic framework of Ringold A
  - **Hydraulic properties for contaminant F&T modeling**

"Data collection efforts for hydraulic properties will mostly be specified and conducted under a separate hydraulic test plan that will be developed following the issuance of this SAP. Although not detailed in this SAP, development of the hydraulic testing plan and completion of the associated hydraulic testing work is a required task under this SAP."



Ringold A Hydraulic Test Plan

- 12 new monitoring wells will be installed from FY 2020 and FY 2022:
  - 8 wells (MW-A through MW-H) for Phase 1
  - 4 wells (MW-I through MW-L) for Phase 2
- SGW-61350, *Data Gaps Evaluation in Groundwater Monitoring at the Hanford 200-ZP-1 Groundwater Operable Unit* (2019)



Ringold A Hydraulic Test Plan – Objectives/Scope

1. Define large-scale **transmissivity** and **storage** properties to support Fate and Transport (F&T) modeling.
2. Define the **vertical profile of hydraulic conductivity** for the Rwia associated with major zones of different transmissivity to support F&T modeling.
3. Define the **vertical hydraulic conductivity** (leakage factor) to support F&T modeling.
4. Define the **effective porosity** of the Rwia within the observed/interpreted plume migration pathways to support F&T modeling.

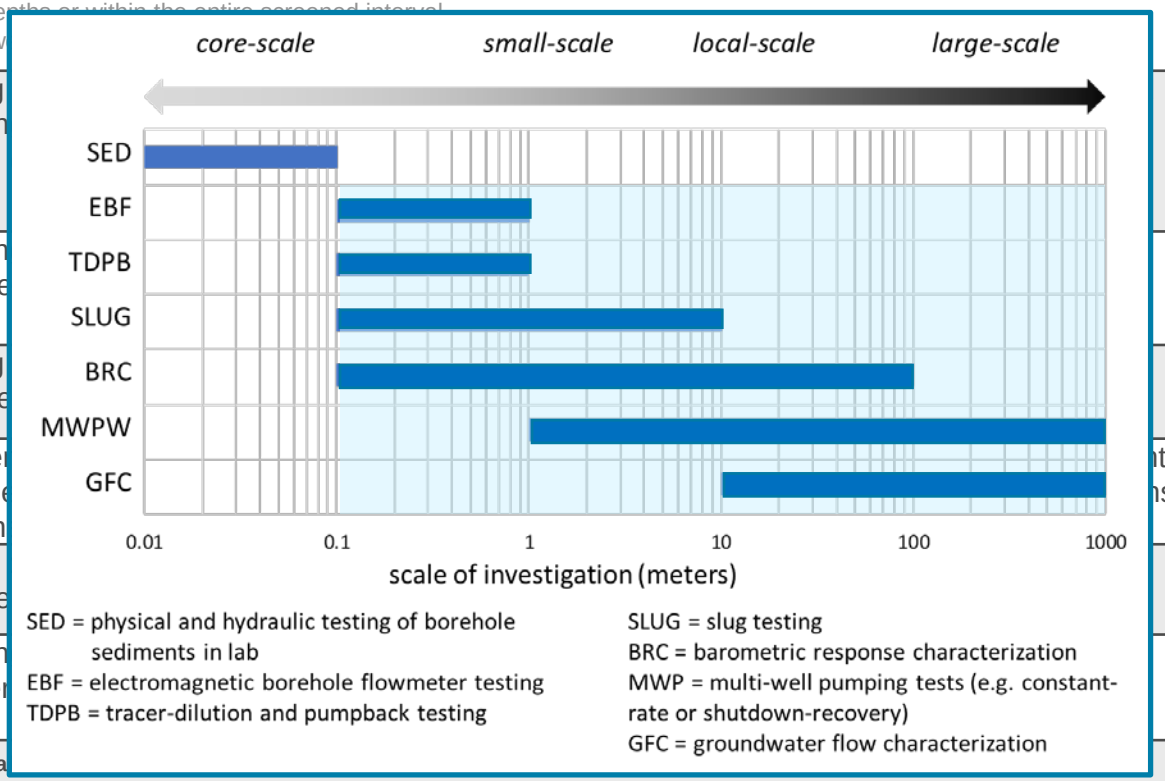
The hydraulic test plan will:

- Provide the technical basis for selection and implementation of hydraulic testing methods.
- Include high-level information that will guide the development of field test instruction documents for each testing activity.
- Minimize impact to P&T operations and continuing progress toward RAOs.

Ringold A Hydraulic Test Plan − Selected Testing Methods and Scope

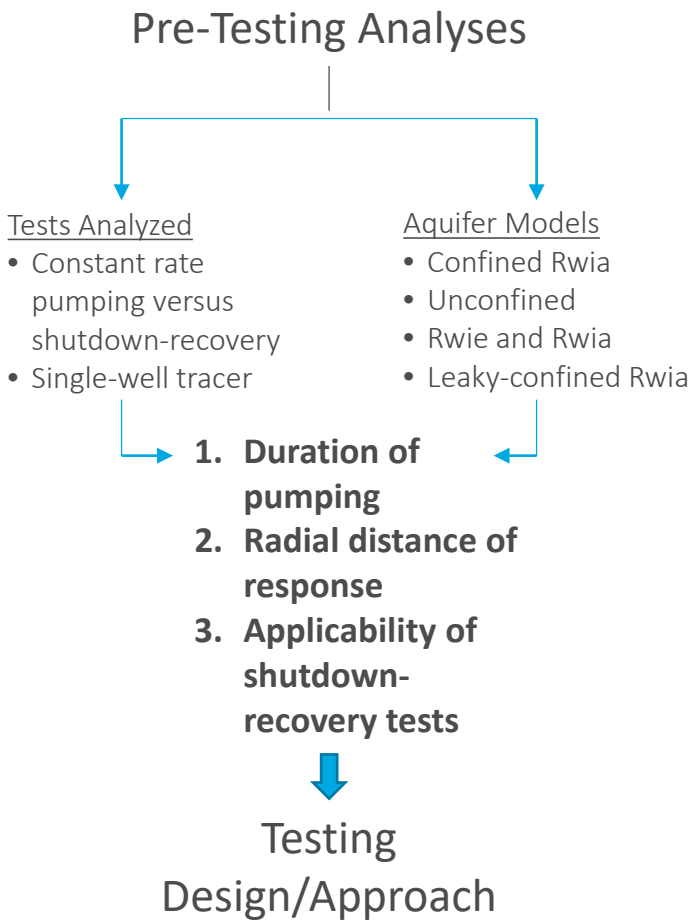
Aquifer Hydraulic Testing

Testing Type		Approach	Resulting Information
Sediment core sample testing		Laboratory analysis of physical and hydraulic properties	Core-scale measurements of particle-size distribution, moisture content, bulk density, particle density, n_t, and K_v
Slug testing		Multi-stress level slug tests conducted at selected well locations Can be performed during drilling or after construction at discrete de… or within the entire screened interval following w…	Localized K_h and T
Shutdown-recovery variant form of the constant-rate pumping test		Pumping monitorin pumping wells	
Single-well tracer testing	Dilution testing	Monitorin within the	
	Pump-back testing	Pumping within the	
EBF testing		Measure screen de condition	…t …ns
Groundwater flow characterization		Analysis automate	
Barometric response characterization		Monitorin characte…	



K_h = horizontal hydraulic conductivity; K_v = vertica…
storativity; S_y = specific yield
V_a = advective groundwater velocity within the aquifer (also known as the ambient linear or seepage velocity)
V_w = groundwater velocity through the wellbore

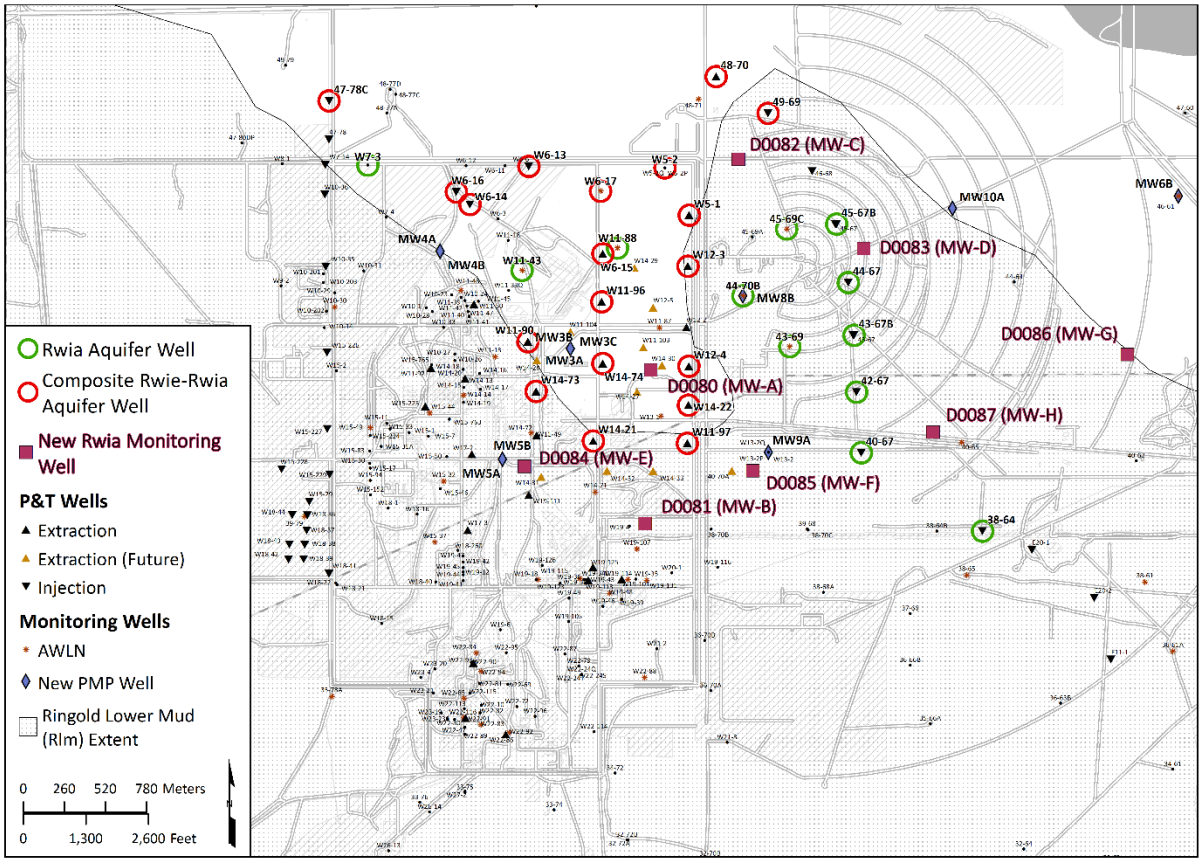
Ringold A Hydraulic Test Plan – Pre-Testing Analyses



- Pumping duration:
  - Fully confined and unconfined conditions (~2 to 6 months).
  - >12 months to distinguish between confined and slightly leaky-confined; could identify highly leaky-confined conditions within several months.
- Radius of influence:
  - Wells within ~400 m are usable, but P&T impacts can be expected.
- Shutdown-recovery tests:
  - Involves shutting off flow to a P&T "stress" well while others remain running at (near) constant rate.
  - Less impact to P&T operations.
  - Requirements:
    - Pre-test stabilization period (up to 3 months).
    - Similar test durations and radius of influence as constant-rate pumping tests.
- Single-well tracer tests can investigate a relatively small aquifer volume (~1 m) but can provide near-field estimated of groundwater flow and effective porosity.

Ringold A Hydraulic Test Plan – Testing Approach

- Use existing P&T extraction and injection wells as the pumping wells for the shutdown-recovery pumping tests to:
  - Minimize disruptions to P&T operations.
  - Eliminate the need for temporary storage, handling, and disposal of purge water generated during testing.
- There is no need to shut down all extraction wells to perform recovery tests.
- Develop and implement a phased approach based on well availability and data gaps.

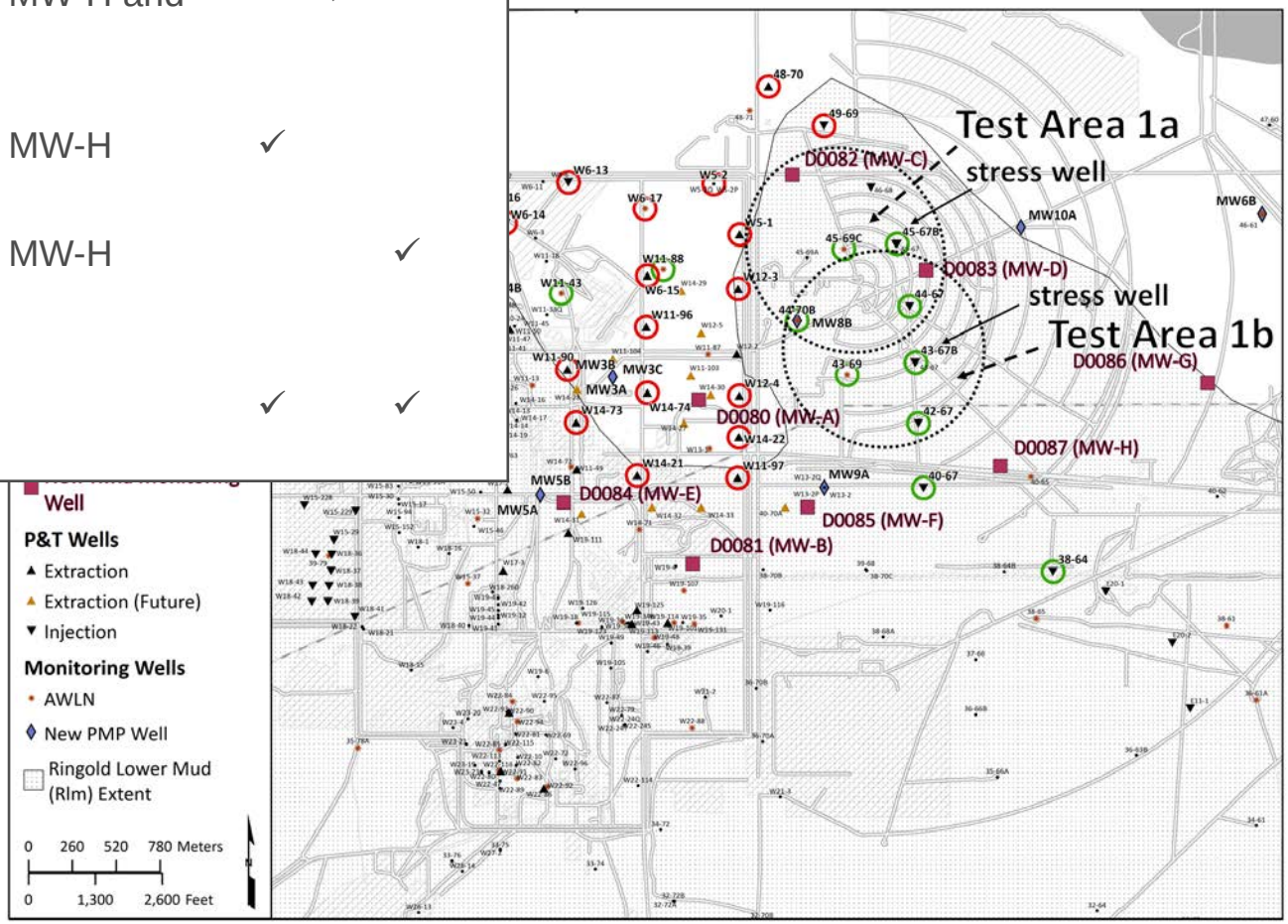


Ringold A Hydraulic Test Plan – Phase 1 – Ringold A Aquifer Testing

Test Method	Locations	Objectives 1	2	3	4
Electromagnetic borehole flowmeter testing	MW-A through MW-H and 2 stress wells		✓		
Post-completion slug testing	MW-A through MW-H	✓			
AWLN stations, barometric monitoring	MW-A through MW-H			✓	
Shutdown-recovery tests	2 areas	✓		✓	

SAP objectives:

1. Large-scale T and S in Rwia
2. Vertical profile of K in Rwia
3. Leakage factor
4. Effective porosity in Rwia

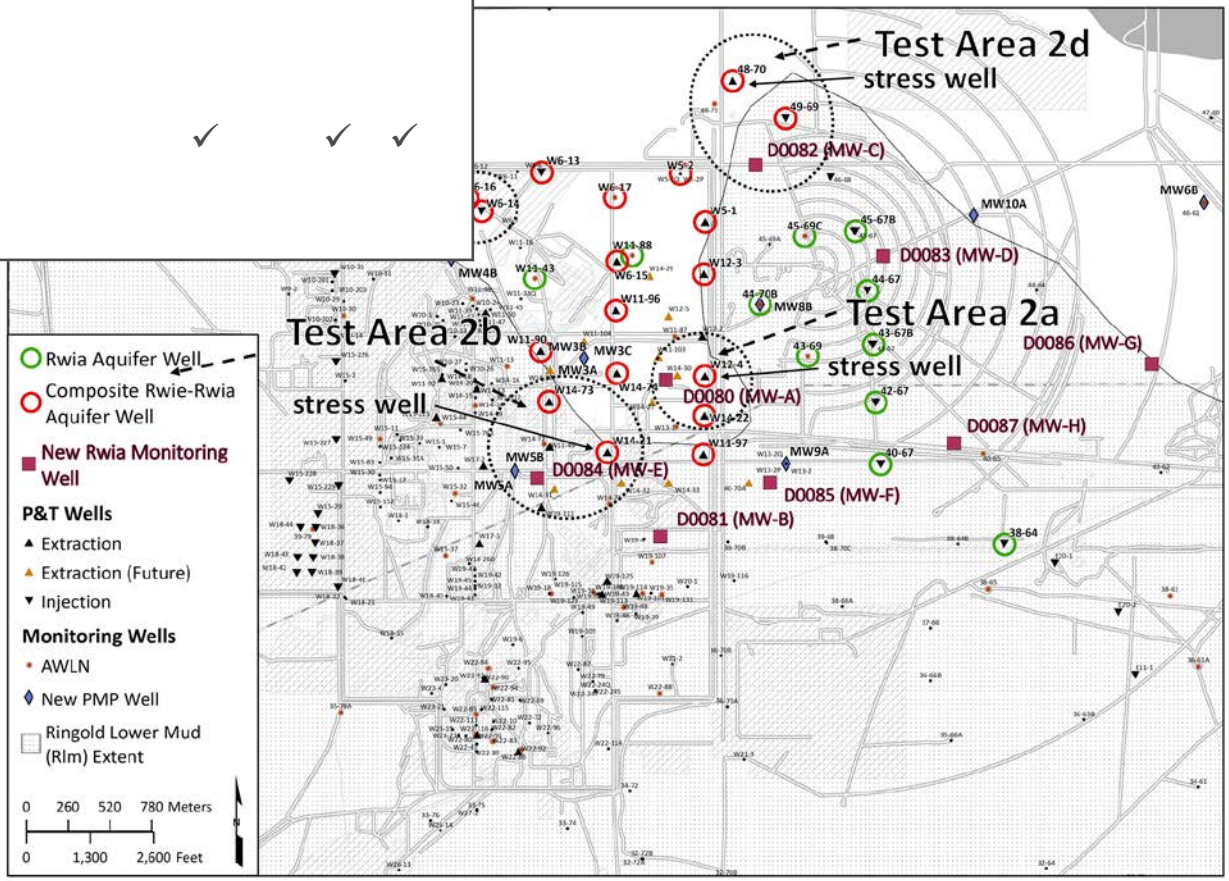


Ringold A Hydraulic Test Plan – Phase 2 – Rwie-Rwia Composite Aquifer Testing

Test Method	Locations	Objectives 1	2	3	4
Electromagnetic borehole flowmeter testing	4 stress wells		✓		
Shutdown-recovery tests	4 areas	✓		✓	✓

SAP objectives:

1. Large-scale T and S in Rwia
2. Vertical profile of K in Rwia
3. Leakage factor
4. Effective porosity in Rwia

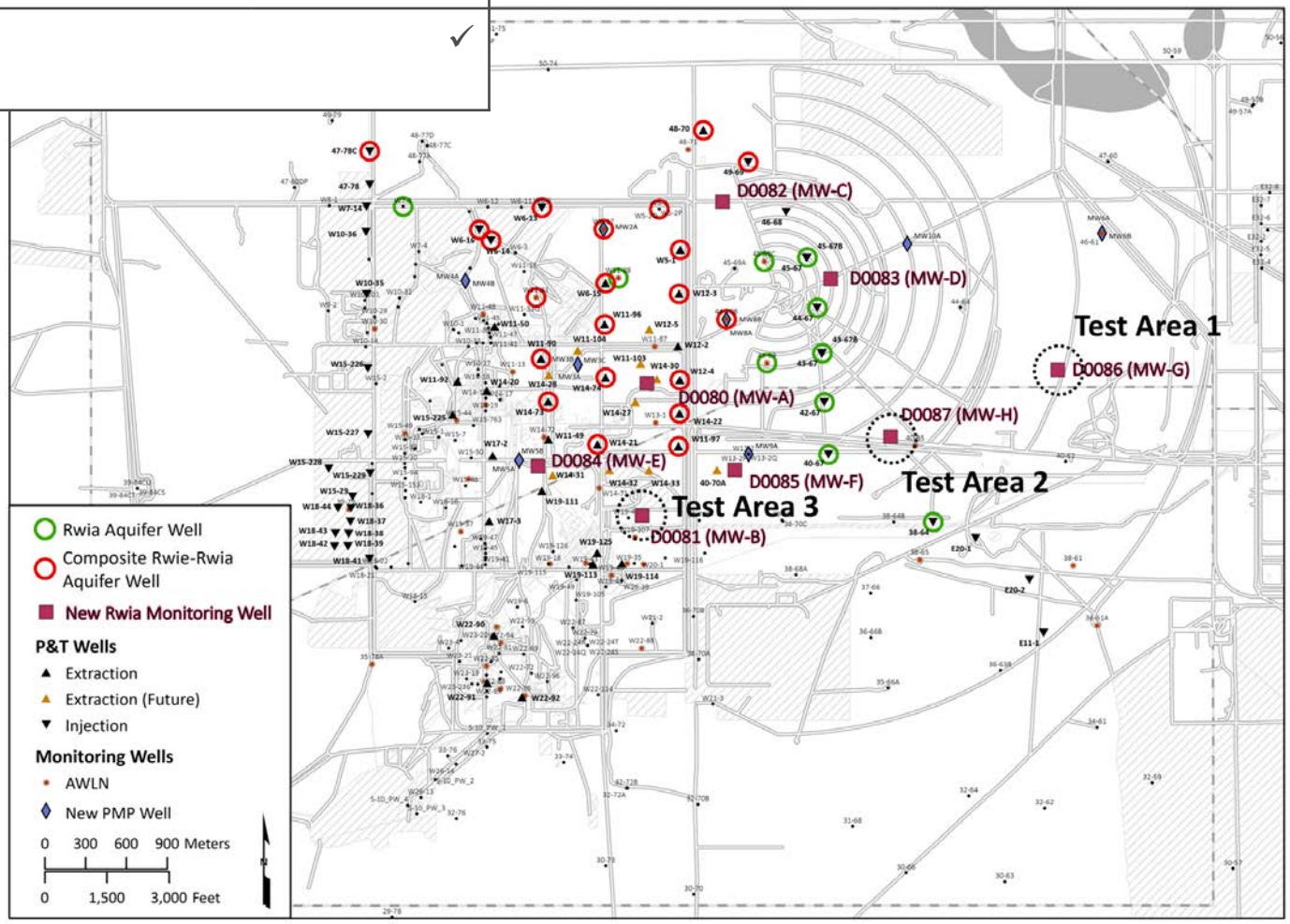


Ringold A Hydraulic Test Plan – Phase 3 – Rwia Single Tracer Testing

Test Method	Locations	Objectives 1	2	3	4
Single-well tracer testing	3 areas				✓

SAP objectives:

1. Large-scale T and S in Rwia
2. Vertical profile of K in Rwia
3. Leakage factor
4. Effective porosity in Rwia



Ringold A Hydraulic Test Plan Status/Next Steps

- Decisional draft was submitted to DOE-RL for review:
  - Final test plan will be shared with EPA, and a separate more detailed summary presentation can be provided if requested.
- Following finalization of the test plan, field test instructions will be prepared for each testing activity depending on the schedule of well installations:
  - If test objectives or conceptual site models for the 200-ZP-1 test area change significantly during the multi-year hydraulic testing activities, the testing plan may be modified accordingly.
- The test plan activities will require close coordination with the P&T operations staff.

Path Forward

- Deliver Optimization Study SAP to EPA for review in the next few weeks.
- Continue implementing interim optimization study sampling:
  - May need TPA-CN approved by EPA to extend interim optimization study sampling, depending on how long EPA needs for SAP review.
- Continue drilling new extraction wells and Ringold A characterization monitoring wells.
- Address DOE-RL comments on O&M Plan and prepare Draft A.
- Continue performing groundwater modeling to evaluate additional ways to optimize recovery of all COCs (including Tc-99, uranium, and Cr[VI]).
- Continue monitoring for continuing sources as part of the Central Plateau (CP) comprehensive plume evaluation.
- Begin implementation of Ringold A hydraulic test plan.