



New Mexico Environment Department

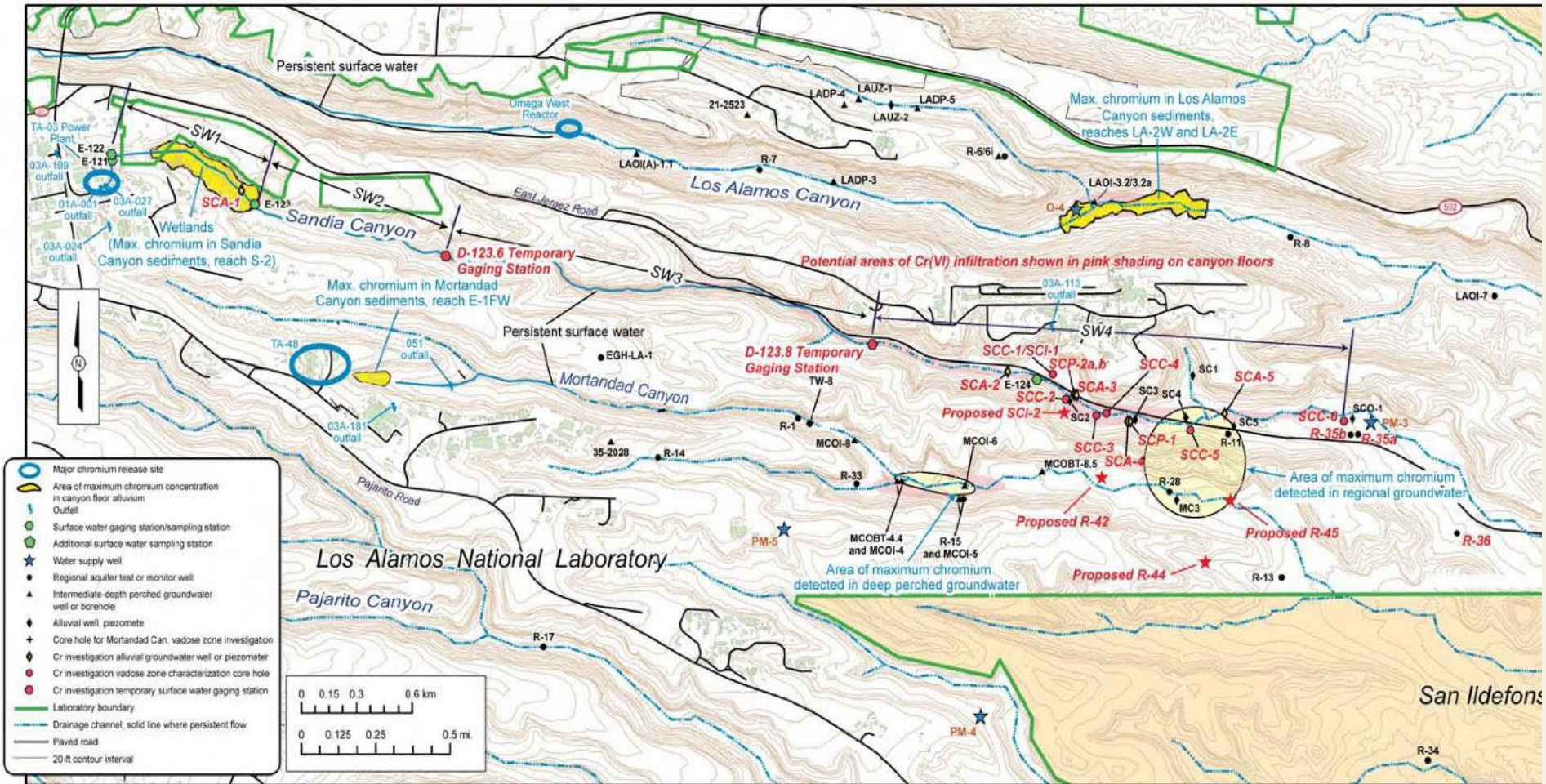
Los Alamos National Laboratory Chromium Plume Cleanup Updates

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May 1, 2024
Los Alamos County Board of Public Utilities Meeting



Source Areas and Affected Canyons





Overview of Plume Control IM

- Three Workplans
- Two Consent Orders
- First workplan: April 2013
 - ▣ Extraction/mass recovery
 - ▣ Found to be feasible with CrEX-1 (2014)
- Second workplan: May 2015
 - ▣ Migration control
- Third workplan: April 2018
 - ▣ Leading assumption that Cr(VI) in top 50 ft
 - ▣ Metrics and reporting
 - ▣ 3-yr performance timeline monitored with semi-annual and annual reports



Overview of IM Performance

- Assumption not valid
 - ▣ Contamination found deeper, 100 ft below the water table
- Plume depth not characterized
 - ▣ Additional wells needed to bound contamination
 - ▣ Planned wells will characterize the deeper unit (Tcar)
 - ▣ Due to lack of deep plume characterization and concentration trends at R-70, NMED supports Los Alamos County's decision to temporarily turn off PM-3
- No clear hydraulic control due to injection
- Unfavorable responses
 - ▣ Increasing concentrations and unpredicted movement of water
- NMED Issued Numerous Technical Comments
 - ▣ The overarching assumption for the original workplans is not valid and a new workplan was required



Unfavorable Response to IM Operation

- Concentrations are also increasing consistent with IM operation in R-61
 - Cause for the increasing trend is currently unknown
 - DOE stated potentially could be result of CrEX-2 drawing water from a high concentration zone
 - DOE stated in February 2023 that additional investigation or modifications to the IM may be necessary if the trends reaches concentrations above regulatory standard
- Water table maps
 - Do not indicate clear mounding from injection well network
 - As indicated by a cone of recharge that is similar in shape but the reverse of a cone of depression surrounding a pumping well
 - Shows clear cone of depression from extraction wells, indicating that extraction provides partial hydraulic control
- Tracer results
 - Indicate flow direction away from the extraction well network
 - Non-detection of tracers cause uncertainty in water movement from injection wells
 - Concern for potential uncharacterized preferential pathways



Chromium IM Workplan

- Chromium Interim Measures and Characterization Work Plan (IMWP) was delivered to HWB in September 2022 as Milestone #2 in the FY 2022 Consent Order Appendix B
 - ▣ Worked together with DOE to identify characterization activities necessary to move towards final remedy
- NMED reviewed the IMWP and delivered comments in a Notice of Disapproval (NOD)
 - ▣ NMED required that the document revision include alternative location(s) for injection outside the plume contamination boundary
 - ▣ NMED agrees with extraction, but DOE must find an alternative location for injection of treated water to continue IM operations
 - ▣ Goal is to be able to move to the determination of a final remedy after completing the data gap activities in the IMWP
- A revised document is due this summer



Current Assessment

- Since analyzing the R-45 screen 2 concentration increases in early 2021, NMED has encouraged DOE to propose alternate injection locations
- NMED supports enhancing and expanding the injection/extraction well network under the Interim Measures while data gap activities are completed.
 - Phased IM has been successfully implemented on this project since 2005
 - Started with accelerated characterization of the source, including the vadose zone and potential contamination pathways
 - When characterization with monitoring wells demonstrated potential for offsite migration to Pueblo de San Ildefonso, IM focused was phased to focus on plume control
 - When injection well concentration exceeded 270ppb, IM operation was modified
 - Now that unfavorable responses are seen, IM operations must be modified again in new IMWP
 - This phased interim measure was also successfully implemented at the Kirtland Air Force Base groundwater plume



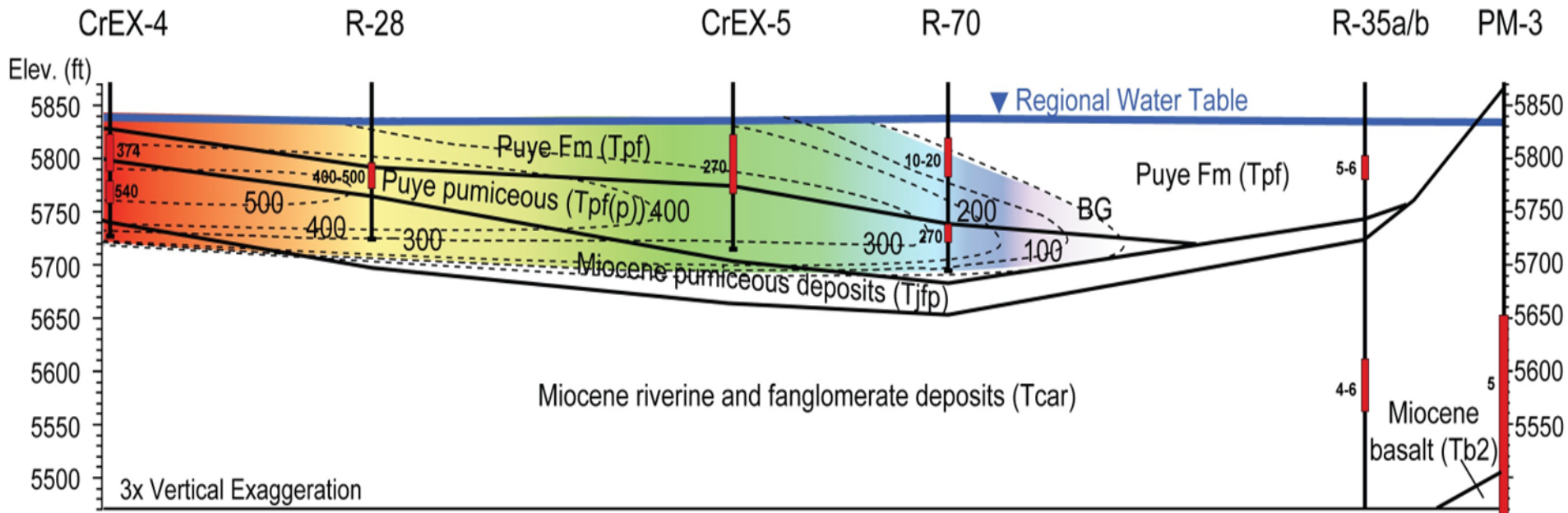
Current Assessment

- DOE contends that the alternative injection location will be proposed in a Corrective Measures Evaluation (CME)
 - Pump and treat as the remediation technology
 - Adaptive Management Strategy to refine the remedy
- NMED is responsible for ensuring that the selected remedy is protective and can achieve final remedy objectives in a reasonable time frame
 - Public comment period is a requirement of the final remedy selection, but NMED encourages incorporating regular public facilitation as part of the IMWP
- NMED needs data to better characterize nature & extent of the plume.
 - Cannot ensure that a final remedy pump and treat system will contain the plume without understanding the extent of contamination, both laterally and vertically



Hydrogeologic Cross Section

- Water Table is in the Puye Formation
- Chromium concentrations exceeding regulatory limits have been detected in the Puye Formation, Puye Pumiceous, and Miocene Pumiceous
- Monitoring wells are not currently available to characterize potential contamination in the TCar





Drilling Concerns

- Failure during installation of R-73 paused drilling in July 2022
 - Designed and approved as a dual screen well
 - Angled dual screen with upper screen in the Pumiceous Puye and the lower screen in the Chamita Formation
 - 14" steel driving casing separated as the casing was being lifted during well installation after drilling into the Chamita Formation
 - Encountered issues with flowing sand with heaving conditions when drilling into the T-Car
 - Causal analysis indicated that N3B should provide directions for drilling methods and tooling techniques that are better suited to flowing sand formations
 - Analysis of the welding indicated lack of integrity at the casing separation point
 - Causal analysis indicated the recommended corrective actions
 - Specify welder qualifications and weld inspection requirements, including requiring documentation
 - Specify requirements for visual check of casing weld integrity (outside and inside) during casing installation
 - Specify requirements for visual inspection of carbon steel casing prior to welding (integrity, trimming and beveling)
 - R-73 had to be plugged and abandoned after allowing a potential conduit for migration of contamination until P&A was completed



Drilling Concerns

- Office of the State Engineer (OSE) brought up concerns for dual screen wells and the methods used to seal wells
 - Concerns for vertical hydraulic communication between the two screens in completed dual screen wells
 - Concerns with dual screen wells penetrating through a contaminated hydrogeologic layer into a different unit with no known contamination
 - Concerns with the use of bentonite as an annular seal where multiple hydrogeologic units will be penetrated and contamination is present
 - NMOSE regulations does not allow bentonite to be used as annual seal in contaminated zones
 - Requires contamination to be sealed with an OSE approved sealant (portland cement or other sealant meeting NMAC 19.27.4.30 requirements)
 - Artesian well design and applications are required in the plume area
 - Requires a cement borehole seal between hydrogeologic units, as defined by NMOSE

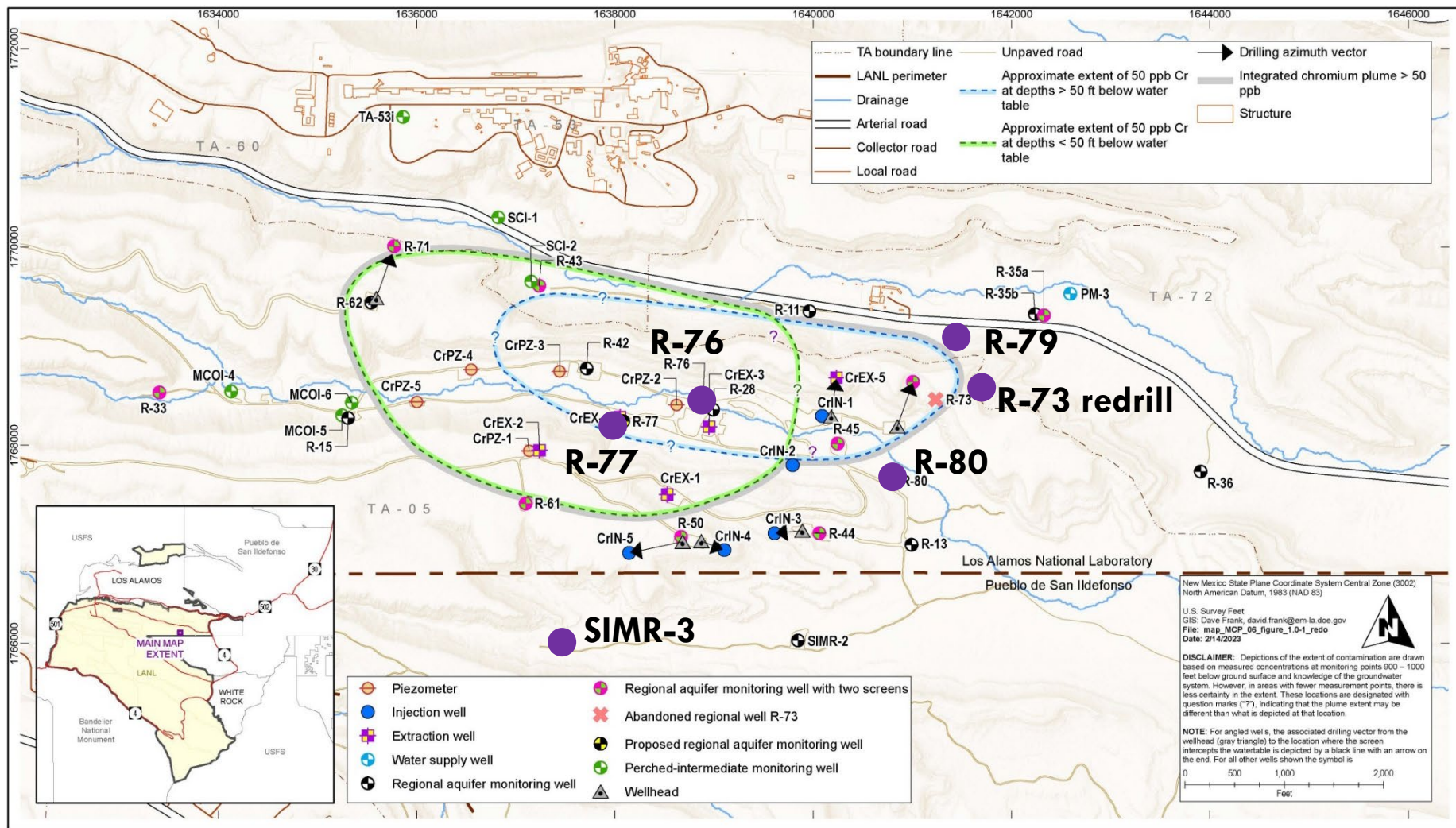


Drilling Concerns

- ❑ OSE stated that District 6 will not approve well permits using drilling and well construction methodology that is known to have been unsuccessful in previous wells
- ❑ Currently OSE is not approving dual screen well designs in the chromium plume area
 - ▣ Impacting the timeline to accomplish the characterization wells required for the submission of a CME
- ❑ OSE is not approving the use of bentonite as a seal where contamination is present
 - ▣ Requires the use of cement, or other OSE approved sealant, as a seal
- ❑ First approved permit application since R-73 failure was R-76
 - ▣ Began drilling in September 2023
 - ▣ Construction was halted when deviations from the permit occurred without an approved variance in November 2023
 - ▣ Variance request was approved by OSE on April 4th
 - ▣ Expected back in the field soon to free drive casing and complete the well



Planned Data Gap Wells





DP-1835 Notice of Violation

- DOE responded to the Notice of Non-Compliance with a letter in May 2022
 - Stated there has been no demonstration that a significant increase in concentration and that there is not demonstration that such increase is attributable to a discharge
- NMED issued a Notice of Violation in June 2022 requiring the submission of a corrective action plan
 - Utilizing civil penalties with the failure to comply within 30 days
- DOE complied and submitted an Action Plan in September 2022
 - Perform qualitative and quantitative analyses for the cause of R-45 S2 increases and predicted trends
 - Simulation plan for identifying alternative extraction and injection rates to decrease R-45 S2 concentrations
 - Install two additional monitoring wells, R-79 and R-80, downgradient of injection
 - Continue monitoring plume movement using existing network



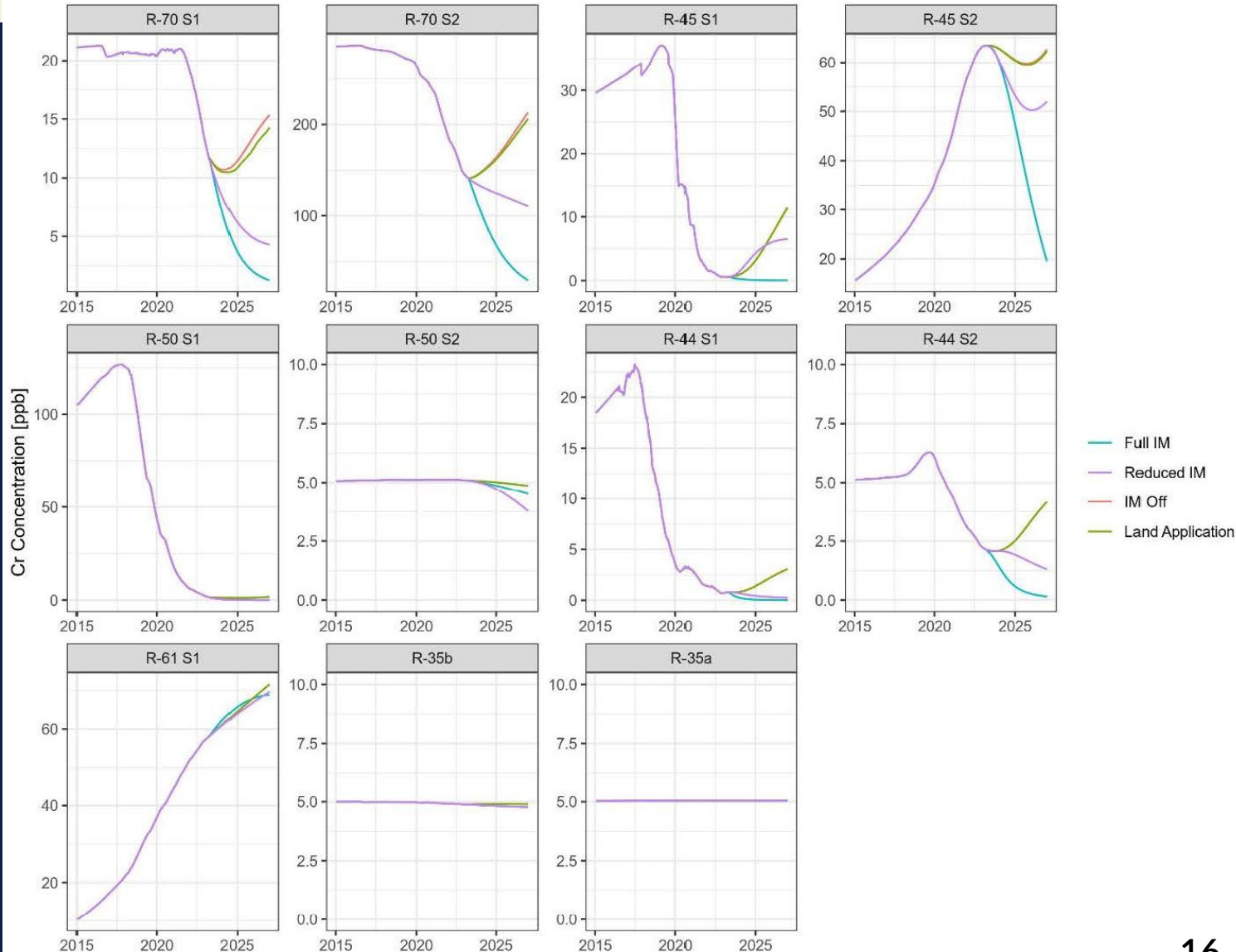
GWQB Notice to Cease Injection

- GWQB issued a Corrective Plan Response and Further Action Required letter in December 2022
- Stated that the proposed actions were acceptable, but had deficiencies
 - Did not identify the actions to control the cause of contamination migration
 - Did not identify actions to prevent further migration of the contamination plume
- NMED required additional corrective actions with the cessation of all injection activities by April 2023
 - Until completion of proposed corrective actions
 - Until DOE can definitively prove that further migration is not occurring



Model Prediction during IM Shutdown

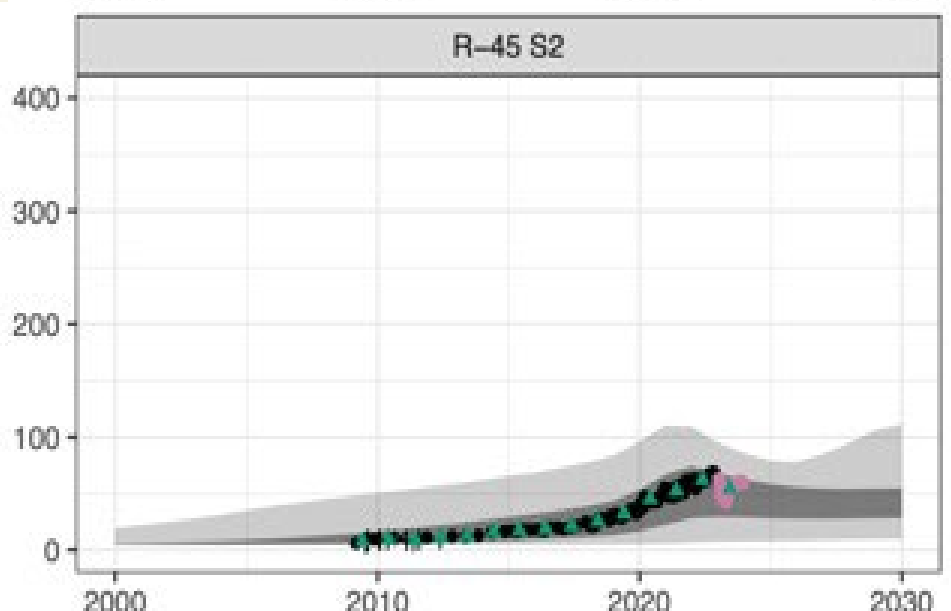
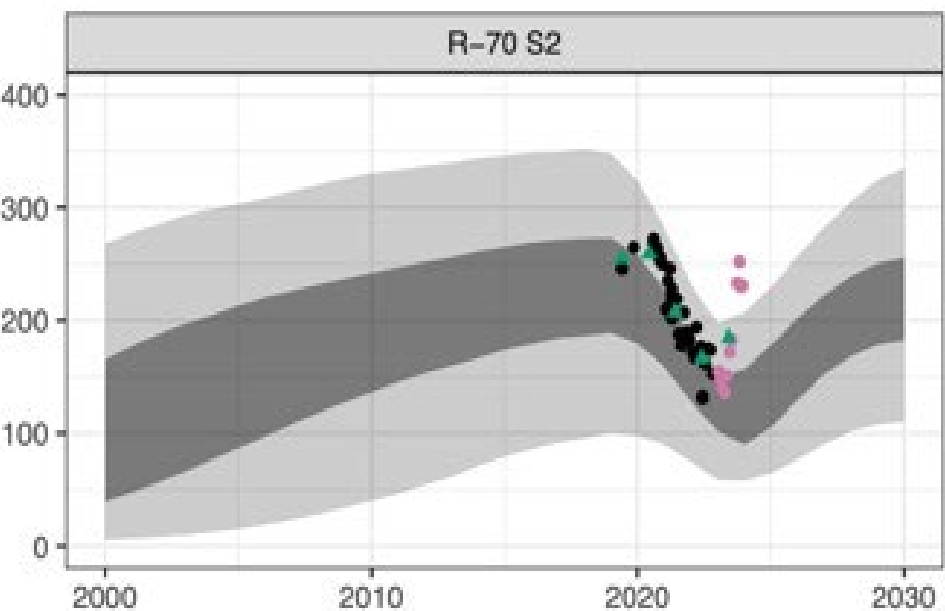
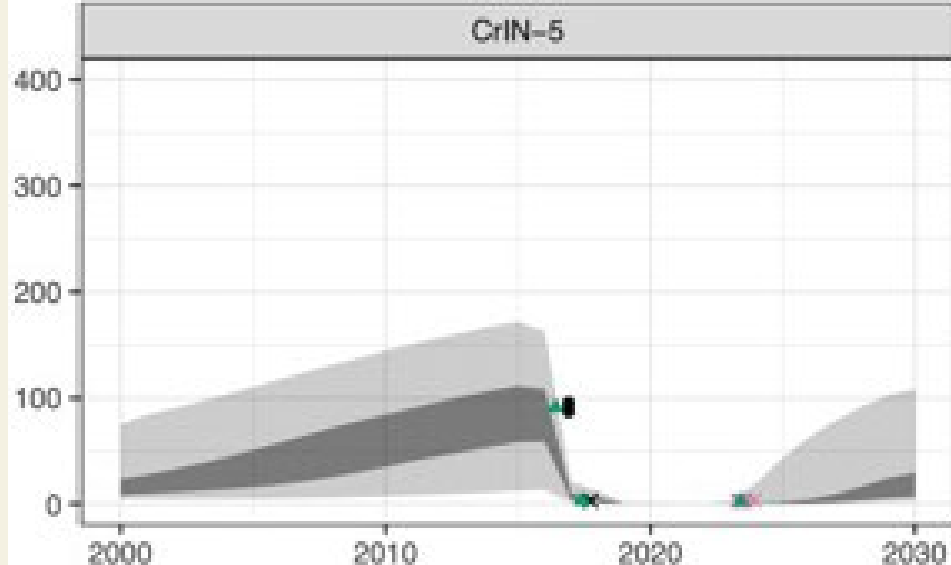
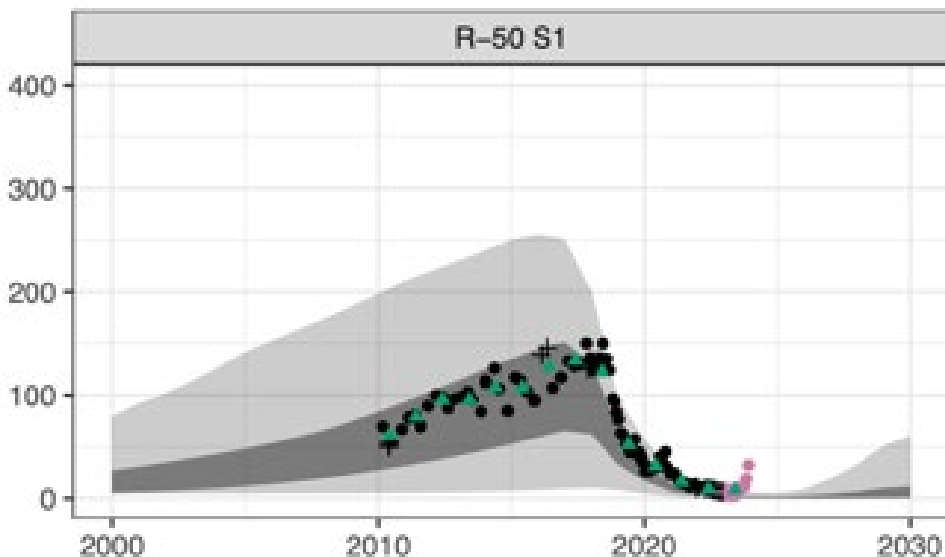
- December 2022 model predictions for concentration responses to different operational scenarios
- IM off does not reflect the rapid rebound in R-50 S1
- R-70 S2 is not above 200ppb until after 2025, occurred in September 2023
- R-61 does not exceed 70ppb until after 2025, occurred January 2024







Rebounds After Cessation





NMED Partial Operation Concessions

- At a meeting held on August 15, 2023, DOE shared concerns regarding increases in percentage of chromium concentration since the IM shut down for the first time
- To facilitate active remediation and alleviate concerns with increasing concentration trends, NMED sent a letter on September 6, 2023 that proposed acceptable corrective actions that would allow for partial restart of the IM
 - One-year temporary recommencement with the following actions proposed in a Corrective Action Plan
 - DOE must install an alternative disposal location for the treated water outside the boundary of the plume that can dispose of the full volume of water extracted
 - Install SIMR-3, a monitoring well on Pueblo de San Ildefonso land
 - Install previously proposed characterization well R-80
 - Would allow for temporary operation while protective measures are implemented that satisfy NMED concerns



NMED Partial Operation Concessions

- DOE responded in a letter dated December 5, 2023
 - Discussed the urgent need to resume operation of the IM and the potential contamination risk to the regional aquifer under Pueblo de San Ildefonso from a prolonged shutdown
 - Agreed to participate in an Independent Technical Review to provide insight on the impasse
 - Does not agree with NMED's offer and the conditions for partial operation
 - Requested NMED approval to resume partial operation of the IM during the Independent Technical Review
 - Include the use of injection wells CrIN-2, CrIN-3, CrIN-4 and CrIN-5



NMED Partial Operation Concessions

- NMED responded with a letter on February 6, 2024 proposing another compromise
 - Reiterated the need for immediate action and the potential risks to groundwater safety, including contamination risk to Pueblo de San Ildefonso, if action is not taken
 - Discussed that DOE action is needed prior to the completion of the mutually agreed upon independent review
 - Acceptable Corrective Actions
 - A temporary two-year recommencement of injection
 - Installation of alternative disposal location outside the plume boundary that can dispose of the water extracted from two extraction wells
 - Install SIMR-3, a monitoring well on Pueblo de San Ildefonso land
 - Install previously proposed characterization well R-80



NMED Partial Operation Concessions

- DOE responded in a letter dated April 10, 2024
 - Does not agree to the conditions, stating that they are not
 - Protective of the regional aquifer
 - Does not consider the purpose and design of the IM
 - Consistent with the purpose of an IM under the 2016 Compliance Order on Consent
 - Does not agree to an alternative disposal location
 - Stated NMED provided “arbitrary conditions without scientific basis”
 - Again, requested partial operations of CrIN-3, CrIN-4 and CrIN-5 with consideration to restarting CrIN-2
 - Stated it is premature to stipulate resumption of the IM given the ongoing expert review



Independent Technical Review

- Following the recommendation from the Radioactive and Hazardous Materials Committee, DOE and NMED agreed to participate in an Independent Technical Review
 - ▣ IRT is composed of members proposed by both parties
 - EM-LA included members affiliated with DOE or the Network of National Laboratories for Environmental Management and Stewardship
 - NMED included members from academia, private industry and EPA Region 6
- IRT began meeting and has participated in a site visit



Independent Technical Review

- IRT is tasked with providing recommendations towards a path forward focusing on key issues:
 - ▣ The ability of the IM to hydraulically control the plume
 - ▣ State of modeling and the applicability of the model to inform regulatory decisions
 - ▣ NMED's proposed corrective actions and conditions
 - Including alternative disposal location(s)
 - ▣ Readiness to begin evaluating and proposing final remedy alternatives
 - ▣ Monitoring well design
 - dual screen wells and bentonite as a sealant
- Review will include a technical assessment and identification of data gaps



Summary

- **Urge accelerated characterization efforts**
 - Better evaluate the nature and extent of contamination
 - Characterize key aquifer properties to inform a CME
- **Expand remediation under interim measures**
 - Propose alternative injection location(s) to satisfy state concerns
 - Expand the pump-and-treat system
- **NMED continues to encourage extraction and treatment of the contamination while the independent technical review is underway**
 - Rebounds in chromium concentrations since the cessation far exceed the responses projected by the FEHM model
 - Along the southern boundary, R-50 S1 and CrIN-5 show concerning rebounds
 - Along the eastern boundary, R-45 S2, CrEX-5 and R-70 S2 continue to show increasing concerning trends



Questions?