EMID-700698

**DEPARTMENT OF ENERGY**
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

RECEIVED
DEC 04 2019
NMED Hazardous Waste Bureau

DEC 04 2019

EMLA-2020-1150-02-001

Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the Supplemental Work Plan for Pilot-Scale Amendments Testing for Chromium in Groundwater beneath Mortandad Canyon, Revision 1

Enclosed please find two hard copies with electronic files of the "Supplemental Work Plan for Pilot-Scale Amendments Testing for Chromium in Groundwater beneath Mortandad Canyon, Revision 1." The work plan has been revised to switch Figures 3.2-1 and 3.2-2 per a comment received from the New Mexico Environment Department via email on November 6, 2019.

If you have any questions, please contact Danny Katzman at (505) 309-1371 (danny.katzman@em-la.doe.gov) or Cheryl Rodriguez at (505) 257-7941 (cheryl.rodriguez@em.doe.gov).

Sincerely,

For: Stephen [signature]

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosures:

1. Two hard copies with electronic files – Supplemental Work Plan for Pilot-Scale Amendments Testing for Chromium in Groundwater beneath Mortandad Canyon, Revision 1 (EM2019-0455)

CC (letter and enclosure[s] emailed):
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo, NM
Dino Chavarria, Santa Clara Pueblo, NM
Neelam Dhawan, NMED
Steve Yanicak, NMED-DOE-OB
William Alexander, N3B
Emily Day, N3B
Erich Evered, N3B

Mark Everett, N3B
Jeannette Hyatt, N3B
Danny Katzman, N3B
Kim Lebak, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
Frazer Lockhart, N3B
Elizabeth Lowes, N3B
Pamela Maestas, N3B
Glenn Morgan, N3B
Bruce Robinson, N3B
Thomas McCrory, EM-LA
David Nickless, EM-LA
Cheryl Rodriguez, EM-LA
Hai Shen, EM-LA
emla.docs@em.doe.gov
N3Brecords@em-la.doe.gov
Public Reading Room (EPRR)
PRS Website

December 2019
EM2019-0455

# Supplemental Work Plan for Pilot-Scale Amendments Testing for Chromium in Groundwater beneath Mortandad Canyon, Revision 1

EM2019-0455

# Supplemental Work Plan for Pilot-Scale Amendments Testing for Chromium in Groundwater beneath Mortandad Canyon, Revision 1

December 2019

Responsible program director:

| Printed Name | Signature | Title | Organization | Date |
|---|---|---|---|---|
| Bruce Robinson | | Program Director | Water Program | 11/26/19 |

Responsible N3B representative:

| Printed Name | Signature | Title | Organization | Date |
|---|---|---|---|---|
| Erich Evered | | Program Manager | N3B Environmental Remediation Program | 11/26/2019 |

Responsible DOE EM-LA representative:

| Printed Name | Signature | Title | Organization | Date |
|---|---|---|---|---|
| Arturo Q. Duran | For: | Compliance and Permitting Manager | Office of Quality and Regulatory Compliance | 12/04/2019 |

## CONTENTS



### Figures



### Tables

## 1.0 INTRODUCTION

This supplemental pilot-scale amendments testing work plan presents additional activities that will be conducted to meet the objectives of an ongoing study presented in the “Pilot-Scale Amendments Testing Work Plan for Chromium in Groundwater beneath Mortandad Canyon” (hereafter referred to as the Work Plan) submitted to the New Mexico Environment Department (NMED) in July 2017 and approved with direction by NMED on July 31, 2017 (LANL 2017, 602505; NMED 2017, 602546). This work plan fulfills the NMED requirement stated in its June 26, 2019, letter for submission of a supplemental Phase 1 (pilot-scale) work plan by September 26, 2019 (NMED 2019, 700492). Amendment solutions were deployed into monitoring wells R-42 (sodium dithionite) and R-28 (molasses) in August and September 2017, respectively (Figure 1.0-1). Sampling has been conducted at R-42 with R-42 pumping and under non-pumping conditions using varying purge volumes ranging from 50 gal. to 1000 gal. Sampling at R-28 has been conducted exclusively without any pumping from R-28 using purge volumes ranging from 50 gal. to 1000 gal. Results, data evaluation, and progressive interpretations of data collected to date have been presented in six quarterly reports submitted to the NMED (LANL 2018, 602862; LANL 2018, 603031; N3B 2018, 700032; N3B 2018, 700108; N3B 2019, 700214; N3B 2019, 700420). The data indicate that chromium breakthrough has not been observed at either well since deployment of their respective amendments. The activities presented in this work plan build on data collected to date and are intended to facilitate completion of the pilot amendments study.

## 2.0 OBJECTIVES AND STATUS

The overarching objective of the pilot amendments study as presented in the Work Plan is to evaluate the feasibility of in situ treatability of hexavalent chromium [i.e., reduction of Cr(VI) to Cr(III)] in the regional aquifer beneath Mortandad Canyon.] Sampling data collected from R-42 and R-28 since amendment deployment have gone from initially elevated concentrations of approximately 800 µg/L and 400 µg/L, respectively, to very low concentrations of Cr(VI) well below the New Mexico groundwater standard of 50 µg/L, indicative of strong and persistent reducing conditions in the aquifer around these wells (N3B 2019, 700420).

Additional objectives of the pilot amendments study include an evaluation of (1) the reduction capacity induced by different amendments, (2) the volume of the treated zone relative to the volume of injected amendment solution, and (3) any potential adverse conditions that may occur within the aquifer as a result of the amendments.

The data collection activities necessary to address these remaining objectives are still underway. The activities largely rely on continuing to monitor for rebound of chromium concentrations approaching pre-deployment concentrations and to characterize the overall geochemistry of groundwater and hydrology associated with the induced treatment zones in the aquifer. Recent observations from R-42 and R-28, however, suggest a decrease in specific capacity in both wells and biofouling in R-28. Both of these conditions could affect the quality of the current data-collection activities and also adversely affect the duration that may be necessary to complete the study.

Hexavalent chromium concentrations (measured as total chromium) in R-42 remain at levels below 10 µg/L indicating that conditions in the aquifer surrounding R-42 have sufficiently reducing conditions to reduce and immobilize Cr(VI). The pH in R-42 is approximately 7.0 standard units (SU), which is lower than pre-deployment values that were closer to 8.0 SU. The persistence of these lower pH values is indicative of a continued influence from geochemical reactions following the dithionite deployment.

The hexavalent chromium concentrations at R-28 have most recently also been in the 10 µg/L range. The pH has recently increased to above 5.5, indicating diminishing levels of organic acids and the significant longevity of the Cr(VI)-reducing conditions generated by the injected molasses. In R-28, uncertainties remain regarding to what degree the observed Cr(VI)-reducing conditions are related to near-well conditions versus conditions further into the aquifer but still within the radius of influence induced by the initial molasses injection.

## 3.0 APPROACH

To better determine whether decreases in specific capacity observed at both wells is because of conditions in the well or the filter pack or in the aquifer, each of the wells will be redeveloped using mechanical methods. Following redevelopment, dilution tracer tests will be conducted in a manner consistent with pre-amendment dilution tests to generate data that may provide insights into aquifer conditions associated with the amendments testing and resultant geochemical conditions.

### 3.1 Redevelopment

Each of R-42 and R-28 have experienced reductions in specific capacity during the period since amendment deployment, as discussed in the Sixth Quarterly Report (N3B 2019, 700420). Tables 3.1-1 and 3.1-2 show the estimated changes in specific capacity for R-42 and R-28, respectively. Redevelopment will be conducted in those wells to address conditions that may have developed within the well and in the filter pack as a result of addition of amendments. If reductions in specific capacity are associated with conditions further into the aquifer within the treatment zone that was established with amendments, redevelopment will not likely correct the condition. Inability to correct the decrease in specific capacity could also indicate that a reduction in porosity or permeability has occurred associated with some aspect of the amendment testing.

R-28 and R-42 will both be redeveloped using physical and mechanical means. The current sampling systems will be removed and video logs will be collected before redevelopment activities take place. Video logging will provide insights into the conditions within the screened intervals and may help guide specifics of the redevelopment phase.

Each screen interval will first be brushed with a stiff-bristled water-well brush followed by surging with a tight-fitting surge block. Following the surging activity, each well will be bailed until water clarity visibly improves and minimal solids are returned from the well sumps. A submersible pump will be installed in each well for the final step of redevelopment. Pumping within each well screen will be conducted in 2-ft steps throughout the entire screen interval before positioning the pump within 5 ft of the top of each screen and purging while collecting water-quality parameters. Purging will continue until turbidity is less than 5 nephelometric turbidity units and other parameters are stable. Finally, the pump will be lowered to the bottom of the well and used to purge for 5 min to evacuate the water in the sump space. Each well will be video logged again upon completing redevelopment activities and before reinstalling the sampling systems. The sampling systems will be reinstalled with the various components located at depths selected to optimize the dilution tracer testing described below.

### 3.2 Borehole Dilution Tracer Tests at R-42 and R-28

The planned redevelopment activities at R-42 and R-28 offer an opportunity to conduct dilution tracer tests at these locations to assess local flow velocity changes since the last successful dilution tracer tests were conducted in both wells in 2014, prior to deployment of amendments. In principle, local flow velocity changes relative to 2014 estimates can be attributed to the effects of the 2017 amendment additions on aquifer permeability near the two wells. This will help satisfy one of the objectives of the amendments tests; namely, to assess the effects of the amendments on aquifer permeability, which is important because significant decreases in local permeability caused by amendments could result in the diversion of natural flow around amendment-treated zones, thus decreasing the effectiveness of the amendments in reducing Cr(VI).

A dilution tracer test was conducted in R-42 in January 2018 to assess local permeability changes caused by the dithionite amendment deployed at R-42 in 2017, but the test yielded inconclusive results because the equipment configuration in R-42 was not ideal for a comparison to the test results from 2014. A similar test was not conducted at R-28 because R-28 has the same non-optimal equipment configuration as R-42. Figure 3.2-1 shows the configuration that will be used for a dilution tracer test, which was effectively the configuration in R-42 and R-28 during the 2014 dilution tracer tests. It is also the target configuration in both wells after the pending redevelopment. In this case, the return flow from the transducer tube is discharged above the top of the screened interval, where it is forced to move downward through the screened interval toward the pump intake situated below the bottom of the screened interval. As long as the pumping and return flow rates are equal, the rate of decline in tracer concentrations in the circulation flow loop will be a direct reflection of the volumetric flushing rate through the screened interval caused by natural flow through the screen. The configuration of Figure 3.2-1 minimizes the chances that the flow discharge from the circulation return line will be pushed into the aquifer or that the pump will draw water from the aquifer.

Figure 3.2-2 shows the equipment configuration in R-42 during the 2018 dilution tracer test (the current configuration in R-28 is effectively the same), as well as a depiction of flow patterns in the screened interval during the test (while the pump was circulating water). The fact that the transducer tube used for tracer injection and water circulation was discharging about halfway down the screened interval resulted in effective tracer monitoring of only the lower half of the screened interval. More importantly, it also apparently resulted in the injection of a small amount of discharge flow from the transducer tube directly into the aquifer rather than exclusively into the well casing. Because the pumping and return flow rates were equal during the test, the injection of some of the return flow into the aquifer had to be balanced by the withdrawal of some water from the aquifer. The net effect was an apparent flushing rate of the screened interval that was much faster than would have been observed if the interval had been flushed only by natural cross flow.

Figure 3.2-3 shows the results of the 2014 and 2018 dilution tracer tests in R-42. The expectation was that the decline in log tracer concentrations would be slower after the August 2017 dithionite amendment addition (reflecting a slower natural flow rate through the well) because the specific capacity of R-42 had decreased after the dithionite addition (LANL 2018, 603031); however, it is apparent that the deduced flow velocity through the R-42 well was significantly greater in 2018 than in 2014, which is consistent with the enhanced flushing-rate scenario depicted in Figure 3.3-2 due to the equipment configuration only accessing the lower half of the screen interval. Figure 3.3-2 also shows that after the water in R-42 stopped being continuously circulated, the tracer concentration initially increased before resuming its decline at a much lower rate than during the circulation period. The fact that tracer concentrations initially increased after circulation stopped is an indication that some of the tracer was driven upgradient into the aquifer while circulation was occurring during the test.

The dilution tracer tests conducted in R-42 and R-28 after redevelopment should provide a more direct comparison with the 2014 borehole dilution tracer tests because redevelopment should improve the hydraulics in the well screen and filter pack to pre-amendment conditions and because the configuration of the system used for the dilution test will be more directly comparable to the 2014 configuration. The well redevelopment effort should reduce the potential confounding influence of well screen and/or filter pack fouling caused by the amendments, which could result in apparent decreases in permeability that are not representative of changes in porosity or permeability in the aquifer but only reflect conditions within the wells themselves. The dilution tracer test comparisons will still only reflect permeability changes very near R-42 and R-28, so they should be considered only one line of evidence in assessing the effects of the amendments on local aquifer permeability. Other lines of evidence were discussed in the Sixth Quarterly Amendments Report (N3B 2019, 700420) as part of the estimates of Cr(VI) mass reduced in the amendments tests. It was concluded in that report that the natural flow rates (and, by inference, aquifer permeabilities) in the vicinity of R-42 and R-28 appeared to have decreased by approximately a factor of 2 in both wells after the amendment deployments (with significant uncertainty in both of these estimates). The dilution tracer tests after well rehabilitation would help refine these estimates.

An additional opportunity afforded by the borehole dilution tracer tests in R-42 and R-28 after the well redevelopment is the possibility of assessing the influence of nearby interim measure extraction wells on the flows through R-42 and R-28 (CrEX-4 for R-42 and CrEX-3 for R-28). To provide a valid comparison with the 2014 dilution tracer tests, the tests should be conducted without nearby extraction wells being pumped; however, once a slope is established in a plot of log-concentration versus time, a flow rate can be estimated and the test objectives will be met. If a nearby extraction well is then turned on, it could result in a change in the slope of log-concentration versus time, which would imply a change in the flow rate flushing the observation well as a result of the nearby extraction well being pumped. This change could, in principle, be either an increase or a decrease, with the latter implying that the extraction well is inducing flow in a different direction than natural flow through the observation well (likely at an oblique angle), effectively slowing the flushing rate of the well. The concept is illustrated schematically in Figure 3.2-4. There is a high probability that no definitive change in slope will be observed given the distances between the extraction wells and R-42 and R-28, but even this result would be informative. Based on the results of the 2014 dilution tracer tests, it is recommended that CrEX-4 not be turned on until at least 60 hr after the start of the dilution test in R-42 and CrEX-3 not be turned on until at least 36 hr after the start of the dilution test at R-28; however, in both cases, the decision would need to rely on quick-turnaround tracer analyses before making a decision on when within the period of declining dilution tracer concentrations to turn on the extraction wells. Quick turnaround tracer analyses will also be conducted to inform how long to run the dilution test sampling.

The use of tracers and the specific tracers that would be used will require approval from NMED’s Groundwater Quality Bureau (GWQB). That process has historically involved submittal of a notice of intent to discharge and a no-permit required determination from the GWQB.

## 3.3 Monitoring and Sampling

The current monitoring approach for R-42 and R-28 includes monthly samples collected for constituents including metals, and general inorganics (including nitrate, nitrite, total organic carbon, dissolved organic carbon, and perchlorate). Samples are collected after 50 and 350 gal. of purging. This sampling approach will continue until the time of well redevelopment. Following redevelopment, the same sampling protocol will be applied for direct comparison of data to the period prior to redevelopment. Data will be shared and discussed in technical team meetings with NMED, and the sampling protocol will be adjusted as necessary and in consultation with NMED to meet the data collection objectives.

The dilution tests will involve sampling at a high frequency (multiple times per day) to characterize the dilution rate for each of the wells. The sampling necessary to characterize the dilution curve is expected to occur over a period of approximately one week as was the case shown for R-42 in 2014 (Figure 3.2-2).

## 4.0 SCHEDULE

The activities presented in this work plan, including redevelopment, dilution testing, and the ongoing and follow-on monitoring, will be presented in subsequent reports on the pilot-scale amendments testing. Presently, there is a report scheduled for submittal to NMED in December 2019 and a presumed final report scheduled for submittal to NMED in June 2020. The results of the activities conducted under this work plan are expected to primarily be presented in the June 2020 report. Status of the activities will be provided in the December 2019 report. It is also proposed that the reporting schedule be adjusted from quarterly to semiannual with the December 2019 and June 2020 reports fulfilling the remainder of the reporting requirement for the tests at R-42 and R-28.

## 5.0 REFERENCES AND MAP DATA SOURCES

### 5.1 References

*The following reference list includes documents cited in this supplemental work plan. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Los Alamos National Laboratory's (LANL or the Laboratory) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by Newport News Nuclear BWXT-Los Alamos, LLC (N3B) (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.*

LANL (Los Alamos National Laboratory), July 2017. "Pilot-Scale Amendments Testing Work Plan for Chromium in Groundwater beneath Mortandad Canyon," Los Alamos National Laboratory document LA-UR-17-25406, Los Alamos, New Mexico. (LANL 2017, 602505)

LANL (Los Alamos National Laboratory), January 2018. "Quarterly Report on Pilot-Scale Amendments Testing for Chromium in Groundwater beneath Mortandad Canyon," Los Alamos National Laboratory document LA-UR-18-20467, Los Alamos, New Mexico. (LANL 2018, 602862)

LANL (Los Alamos National Laboratory), April 2018. "Second Quarterly Report on Pilot-Scale Amendments Testing for Chromium in Groundwater Beneath Mortandad Canyon," Los Alamos National Laboratory document LA-UR-18-23418, Los Alamos, New Mexico. (LANL 2018, 603031)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), July 2018. "Third Quarterly Report on Pilot-Scale Amendments Testing for Chromium in Groundwater Beneath Mortandad Canyon," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2018-0019, Los Alamos, New Mexico. (N3B 2018, 700032)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), October 2018. "Fourth Quarterly Report on Pilot-Scale Amendments Testing for Chromium in Groundwater Beneath Mortandad Canyon," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2018-0069, Los Alamos, New Mexico. (N3B 2018, 700108)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), January 2019. "Fifth Quarterly Report on Pilot-Scale Amendments Testing for Chromium in Groundwater Beneath Mortandad Canyon," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2019-0011, Los Alamos, New Mexico. (N3B 2019, 700214)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), April 2019. “Sixth Quarterly Report on Pilot-Scale Amendments Testing for Chromium in Groundwater Beneath Mortandad Canyon,” Newport News Nuclear BWXT-Los Alamos, LLC, document EM2019-0133, Los Alamos, New Mexico. (N3B 2019, 700420)

NMED (New Mexico Environment Department), July 31, 2017. “Approval, Pilot-Scale Amendments Testing Work Plan for Chromium in Groundwater beneath Mortandad Canyon,” New Mexico Environment Department letter to D. Hintze (DOE-EM) and B. Robinson (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2017, 602546)

NMED (New Mexico Environment Department), June 26, 2019. “Approval, Request for Extension of Phase 2 Pilot Amendment Testing Work Plan, Fiscal Year 2019 Milestone #10,” New Mexico Environment Department letter to D. Hintze (EM-LA) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2019, 700492)

### 5.2 Map Data Sources

Structures; County of Los Alamos, Information Services; as published 29 October 2007.

Drainage; County of Los Alamos, Information Services; as published 16 May 2006.

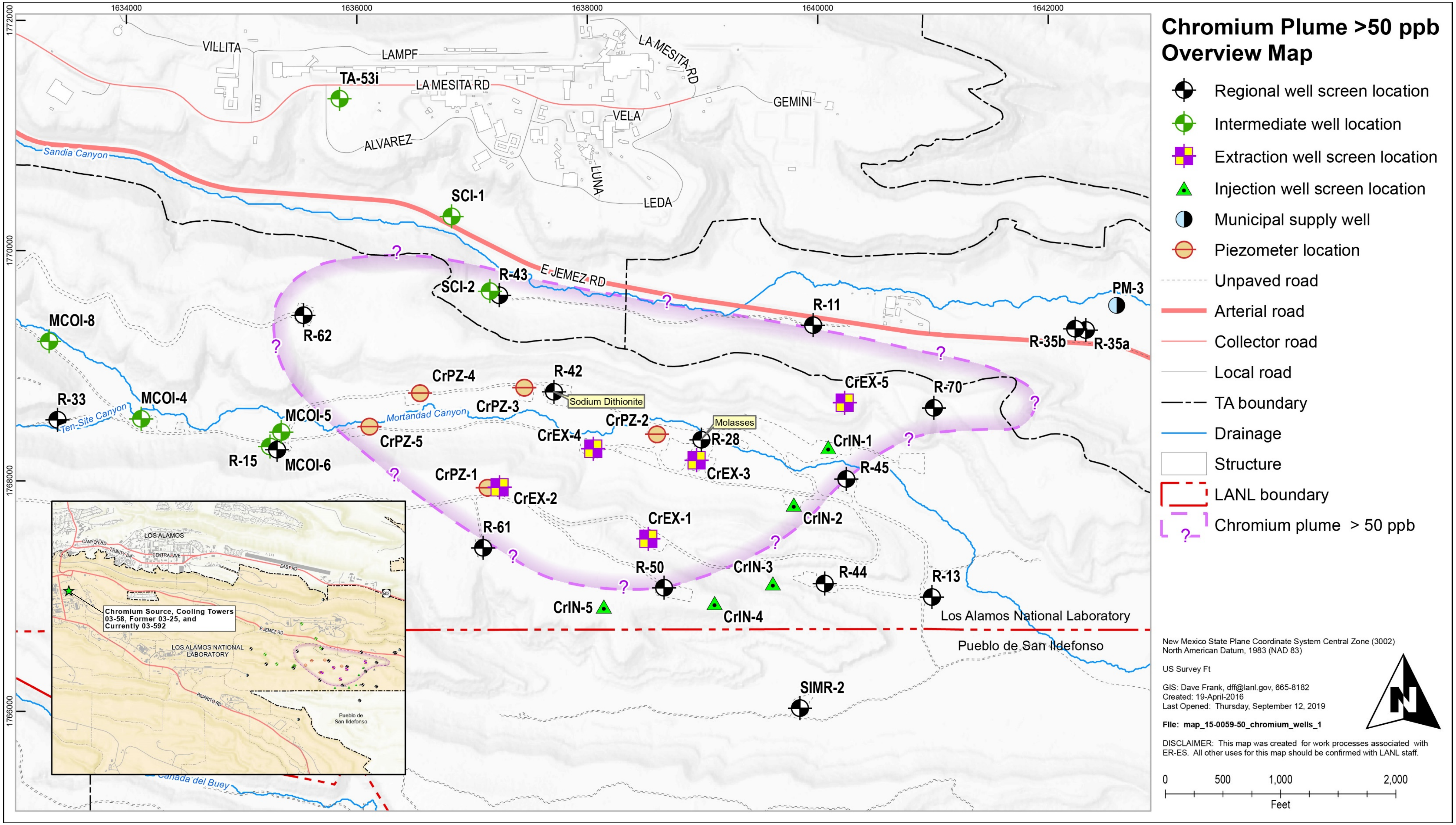
Road Centerlines for the County of Los Alamos; County of Los Alamos, Information Services; as published 04 March 2009.

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 13 August 2010.

Chromium Plume; Los Alamos National Laboratory, ER-ES, As published, LANL Geodatabase\em.GISEMPRD1.sde\EM.chromium\EM.chromium_plume; 2019

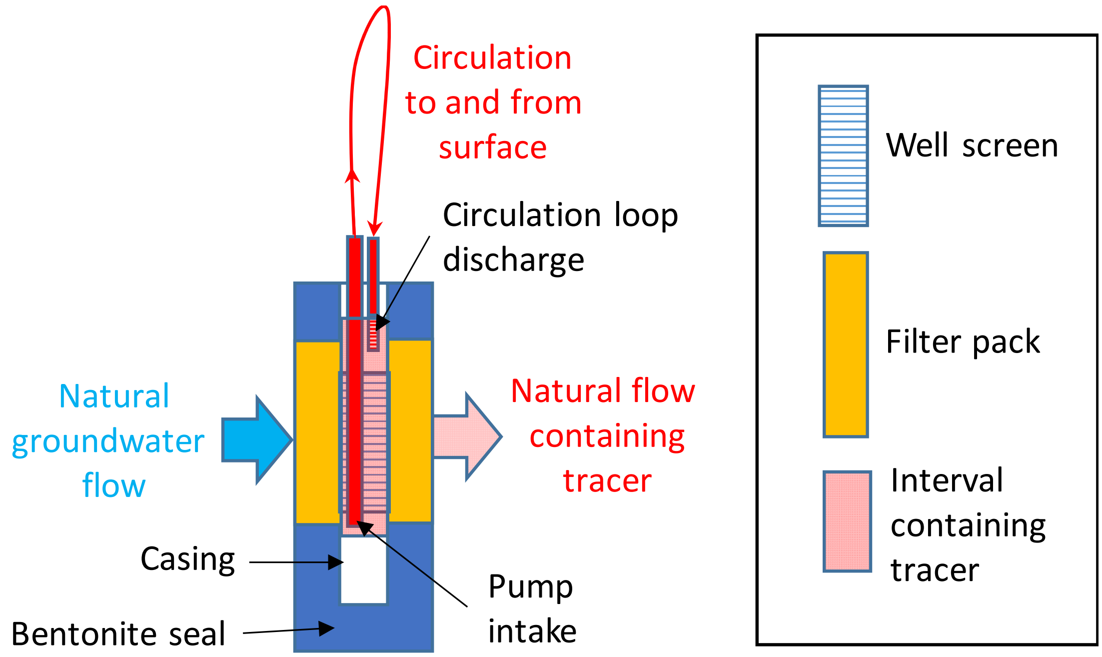
Well Point features; Los Alamos National Laboratory, ER-ES, As published, LANL GeodatabaseDatabase Connections\em.GISEMPRD1.sde\EM.chromium\EM.chromium_associated_wells; 2019

Unpaved Roads; Los Alamos National Laboratory, ER-ES, As published, LANL GeodatabaseDatabase Connections\em.GISEMPRD1.sde\EM.chromium\EM.mortandad_unpaved_pads_roads; 2019



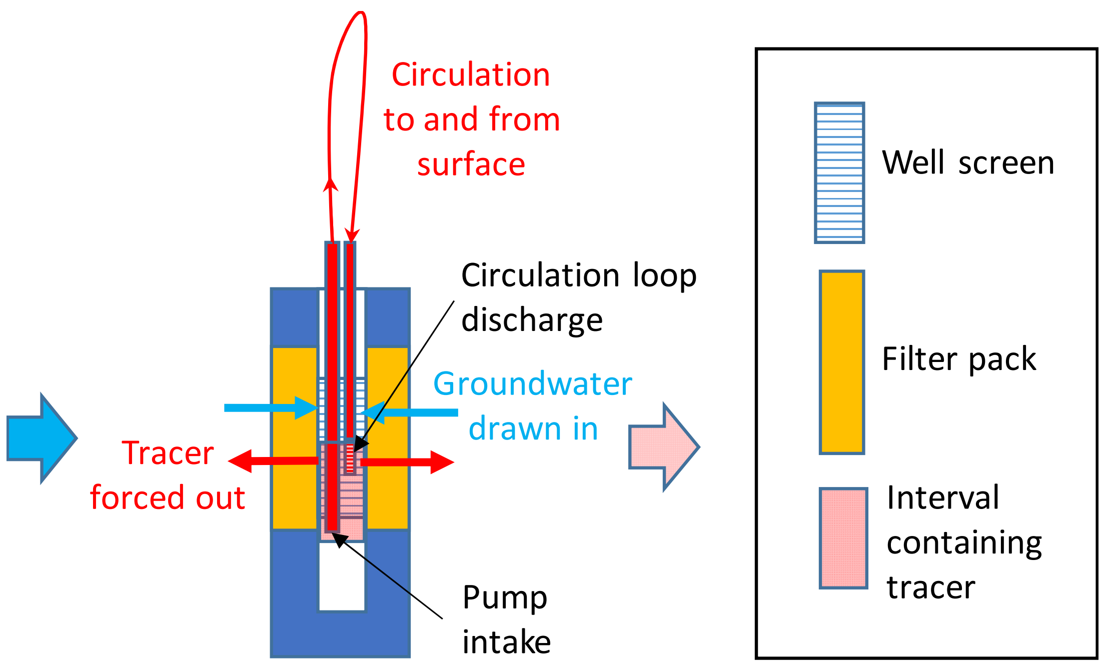

Note: Map also shows locations of the two wells involved in the pilot-scale amendments tests.

**Figure 1.0-1 General site map showing extent of chromium plume as expressed by the approximation of the 50 µg/L extent of contamination**



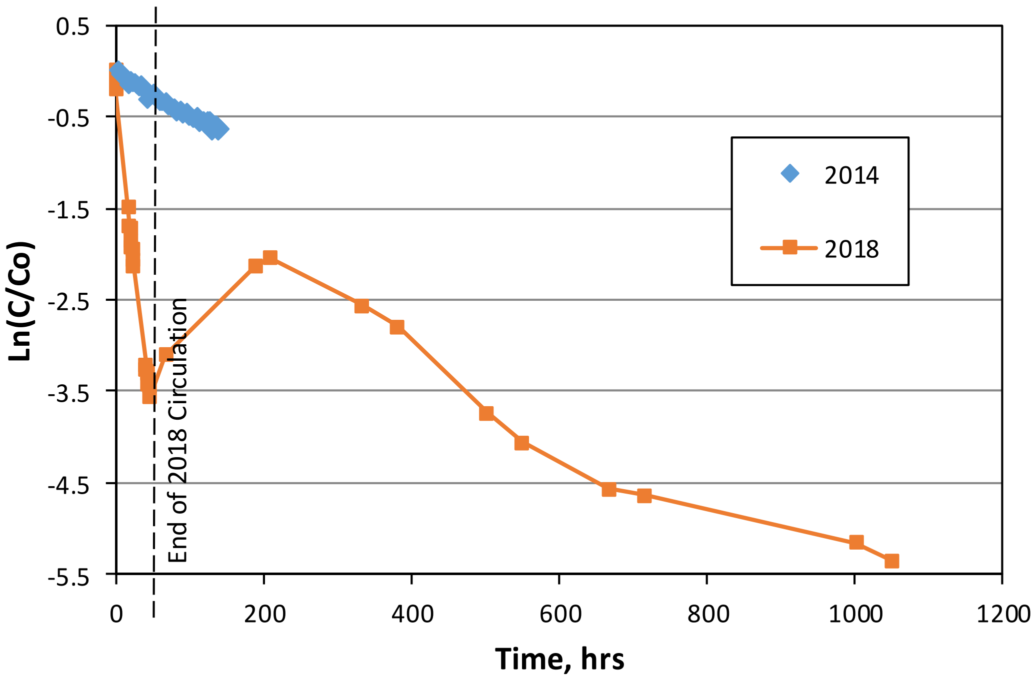

Notes: Tracer and return flow are discharged within the well screen, which results in monitoring of only the lower part of the screen and increases the chances of direct injection of tracer and return flow into the aquifer, resulting in more rapid removal of tracer than would occur as a result of natural cross-flow through the well screen.

**Figure 3.2-1 Proper downhole configuration for a dilution tracer test**




Notes: Tracer and return flow are discharged in casing above the top of the well screen, and the pump intake is set below the bottom of the well screen. The induced flow is thus constrained to be vertical, and the tracer is flushed from the circulation loop only by natural cross-flow through the well screen. This was the configuration in R-42 and R-28 during the dilution tracer tests conducted in 2014.

**Figure 3.2-2 Downhole configuration in R-42 during dilution tracer test in 2018**




Note: The much greater apparent flow rate (steeper slope) during circulation in 2018 and the initial increase in tracer concentrations after circulation ended in 2018 are both consistent with the flow conditions depicted in Figure 3.2-2.

**Figure 3.2-3 Tracer concentration histories (natural log of concentration divided by initial concentration) in 2014 and 2018 dilution tracer tests in R-42**

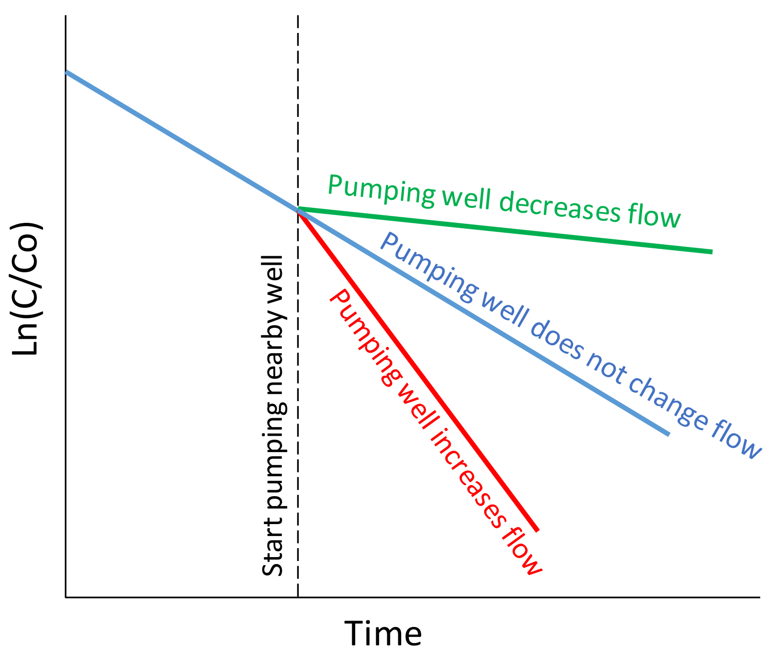



**Figure 3.2-4 Schematic depiction of possible log tracer concentration trends in a dilution tracer test when a nearby extraction well is turned on part way through the test**

**Table 3.1-1**
**R-42 Specific Capacity Estimates from Various Tests Conducted Before and After Amendment Deployment**

| Event | Period | Pumping Rate (gpm) | Average Drawdown (ft) | Specific Capacity (gpm/ft) |
|---|---|---|---|---|
| Test-1 | 2009-11-14 to 2009-11-15 | 5.5 | 7.0 | 0.8 |
| Pre-Amendment Deployment 1 | 2013-06-17 to 2013-07-07 | 7.1 | 2.6 | 2.7 |
| Pre-Amendment Deployment 2 | 2013-07-11 to 2013-08-21 | 7.1 | 7.4 | 1.0 |
| Pre-Amendment Deployment 3 | 2014-04-21 to 2014-04-29 | 7.5 | 7.4 | 1.0 |
| Post-Amendment Deployment 1 | 2018-10-22 to 2018-10-26 | 2.9 | 5.4 | 0.5 |
| Post-Amendment Deployment 2 | 2018-10-29 to 2018-10-30 | 2.9 | 6.6 | 0.4 |

**Table 3.1-2**
**R-28 Specific Capacity Estimates from Various Tests Conducted Before and After Amendment Deployment**

| Event | Period | Pumping Rate (gpm) | Average Drawdown (ft) | Specific Capacity (gpm/ft) |
|---|---|---|---|---|
| Test-1 | 2004-02-05 to 2004-02-06 | 9.45 | 0.8 | 11.8 |
| Test-2 | 2004-03-07 to 2004-03-08 | 12.9 | 1.0 | 13.3 |
| Pre-Amendment Deployment 1 | 2013-09-07 to 2013-11-22 | 28.7 | 2.5 | 11.6 |
| Pre-Amendment Deployment 2 | 2014-05-30 | 26.5 | 2.1 | 12.6 |
| Pre-Amendment Deployment 3 | 2014-05-31 to 2014-06-03 | 26.5 | 2.2 | 12.1 |
| Post-Amendment Deployment 1 | 2018-10-22 to 2018-10-26 | 2.6 | 1.1 | 2.4 |
| Post-Amendment Deployment 2 | 2018-10-29 to 2018-10-30 | 2.6 | 0.7 | 3.8 |
| Post-Amendment Deployment 3 | 2018-11-01 to 2018-11-02 | 2.6 | 0.7 | 3.9 |