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Semiannual Progress Report for Corrective Measures Evaluation/Corrective Measures Implementation for Consolidated Unit 16-021(c)-99

Prepared by the Environmental Programs Directorate

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EXECUTIVE SUMMARY

Significant achievements accomplished during this reporting period included completion of field activities for the CdV-16-4ip interim measure source-removal testing for RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) in groundwater; completion of the Technical Area 16 geophysics study; and initiation of drilling activities for several monitoring wells. These wells will provide valuable information for the hydrogeologic conceptual model and will include perched-intermediate wells CdV-9-1(i) and R-63i and regional aquifer well R-47.

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1.0 INTRODUCTION

This report serves as both the 2013–2014 summary report for the Technical Area 16 (TA-16) permeable reactive barrier (PRB) and associated corrective measures implementation (CMI) projects and the semiannual progress report for the corrective measures evaluation (CME)/CMI for Consolidated Unit 16-021(c)-99. It summarizes activities Los Alamos National Laboratory (LANL or Laboratory) completed from April to September of fiscal year (FY) 2014 on the CME/CMI for Consolidated Unit 16-021(c)-99, the TA-16 260 Outfall. Activities outlined in the 1998 corrective measures study (CMS) plan (LANL 1998, 062413; LANL 1999, 064873), approved by the New Mexico Environment Department (NMED) Hazardous Waste Bureau on September 8, 1999 (NMED 1999, 093666), and other related activities are described herein.

2.0 SURFACE CMI

2.1 Best Management Practices

Inspection of best management practices (BMPs) associated with Consolidated Unit 16-021(c)-99 is completed under the Individual Storm Water Permit, pursuant to the requirements of National Pollutant Discharge Elimination System (NPDES) Permit No. NM0030759 (hereafter, the Individual Permit), as authorized by the U.S. Environmental Protection Agency (EPA). Current BMPs, called controls in the Individual Permit, include a low-permeability cap consisting of a 20-in.-thick crushed tuff/bentonite cap installed on top of the former settling pond, five earthen berms and one rock check dam installed to control run-on/runoff, riprap within the former channel to control runoff, and established vegetation to control erosion from the site. Controls are inspected annually and following a significant rain event of 0.25 in. or greater within 30 min, as measured at rain gage 257, per the Individual Permit.

In the period from April to September 2014, six significant rain events were recorded at rain gage E257. No BMP maintenance or repairs resulted from the four inspections conducted. Per the Individual Permit, if several storms exceeding the intensity threshold occur over a period not to exceed 15 d from the first event, a single inspection is sufficient to achieve compliance (hence the number of events differs from the number of inspections). The 2014 annual inspection will be completed in October 2014. Inspection results will be reported in the "Storm Water Individual Permit Annual Report, Reporting Period: January 1–December 31, 2014," which will be submitted to the EPA Region 6 Enforcement Division as well as to the NMED Surface Water Quality Bureau on or before March 1, 2015.

2.2 Hydrogeologic Investigations

Hydrogeologic investigations include periodic water sampling as outlined in the 1998 Resource Conservation and Recovery Act facility investigation report (LANL 1998, 059891) as well as continuing investigations delineated in the 1998 CMS plan (LANL 1998, 062413). The current groundwater sampling program, conducted per the Laboratory's Interim Facility-Wide Groundwater Monitoring Plan (LANL 2013, 241962), includes semiannual sampling at Martin and Burning Ground Springs. SWSC Spring was added to the fourth quarter sampling campaign to collect data to support the initiative to begin operation of the granulated activated carbon (GAC) springs treatment units (discussed in more detail below).

Two groundwater sampling campaigns were conducted in the Cañon de Valle watershed in May and June 2014 and in August 2014. Data from the sampling campaigns will be included in the upcoming periodic monitoring reports.

Recently reconfigured monitoring wells CdV-16-4ip, CdV-R-37-2, and CdV-R-15-3 were sampled on May 16, 2014. From August 5 to August 14, 2014, all TA-16 260 monitoring group wells were sampled, except for FLC-16-25280, which was dry, and MSC-16-06295, which was destroyed during the storms on September 12 and 13, 2013.

The September 2013 storms produced a total of 5.39 in. of precipitation at the TA-06 weather station. This flood caused geomorphic changes to Cañon de Valle and Water Canyon that were assessed in fall 2013 and spring 2014. Wells 16-25280 and CdV-16-1(i) were damaged but not destroyed. This damage is described in the "September 2013 Storm and Flood Assessment Report" (LANL 2013, 251021).

One year earlier, floods in July, August, and October 2012 impacted both Cañon de Valle and Water Canyon, causing localized scouring in parts of the canyons and sediment deposition in downgradient areas. A follow-up study focused on the effects of floods on the geomorphology and sediment chemistry following the 2012 monsoon season. The results are summarized in the "Results of 2012 Sediment Monitoring in the Water Canyon and Cañon de Valle Watershed" (LANL 2013, 241083). The study showed very low concentrations of key chemicals of potential concern, consistent with, or less than, pre-fire concentrations and less than residential and recreational soil screening levels.

2.3 2014 CMI Activities

The Cañon de Valle pilot PRB remains nonoperational because of post–Las Conchas fire flooding, which destroyed the capture wall for the PRB. Continued risks of flooding preclude reinstalling the PRB at this time. The current location of the PRB is not feasible for reinstalling the barrier because of the deep scouring of the alluvial sediment in that area.

The carbon-filtration treatment systems at the springs remain in place but are not operational because a permit has not been issued. On July 25, 2014, the project manager led a tour for DOE and NMED Groundwater Bureau and Surface Water Bureau personnel of the CdV-16-4ip well site, Burning Ground Spring, SWSC Spring, Martin Spring, and the location of the former Cañon de Valle PRB. Discussions were held regarding the regulatory path forward to begin operation of the GAC treatment systems installed at Burning Ground Spring, SWSC Spring, and Martin Spring. NMED personnel informed the Laboratory that it will need to contact EPA Region 6 to determine if discharge from treatment units installed at the springs require an NPDES permit.

3.0 SUBSURFACE CME

3.1 CME for Deep Groundwater

The primary work accomplished during this reporting period consisted of preparation activities for the geophysics study and RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) source-removal testing activities at CdV-16-4ip.

- **Geophysics Study:** The "Work Plan for Direct Current Resistivity Profiling in Cañon de Valle" (LANL 2012, 215111) was submitted to NMED in April 2012 and approved by NMED on May 18, 2012 (NMED 2012, 520404). In May and June of 2014, the Cañon de Valle electrical resistivity geophysical investigation was conducted at the site (LANL 2014, 259157). Activities included acquiring, modeling (in both two- and three-dimensions), and interpreting six lines of electrical resistivity within and next to Cañon de Valle at Los Alamos National Laboratory (LANL or the Laboratory). Three lines were run parallel to the canyon and were over 5000 ft in length. The remaining three lines were placed perpendicular to the canyon to help tie the features

together. The main objective of the study was to map the electrical structure of the vadose zone in the vicinity of Cañon de Valle (LANL 2012, 215111). Of particular interest was the identification of low resistivity regions indicative of increased moisture content, clay-rich zones associated with groundwater pathways, or changes in geologic lithology or perched water.

The results of the geophysics study were not inconsistent with the current conceptual model for Cañon de Valle area. However, the spatial resolution of the direct current electrical resistivity geophysical survey decreases with increasing depth, and it was not possible to resolve lower vadose zone features of hydrogeological interest such as perched groundwater zones or significant lithological boundaries (e.g., perching horizons).

- **CdV-16-4ip Source-Removal Testing for RDX in Groundwater:** Interim measures source-removal testing was conducted at deep perched-intermediate well CdV-16-4ip in accordance with the "Interim Measures Work Plan for Source-Removal Testing at Well CdV-16-4ip" (LANL 2013, 239235), as approved with modifications by NMED in its letter dated April 30, 2013 (NMED 2013, 522441). The testing consisted of a 60-d extended pumping test and recovery monitoring at well CdV-16-4ip. The primary objectives of the work were to determine whether source removal from this zone can be conducted to limit potential migration of RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) and other constituents to the underlying regional aquifer and to determine if long-term pumping in the perched-intermediate zone is a viable source-removal option. An additional objective included refining the conceptual model regarding the spatial extent and hydraulic characteristics of deep perched-intermediate groundwater.

  A total of 472,684 gal. (1789 m^3) of water was pumped during the test. Concentrations of RDX in the pumped water ranged from approximately 143 µg/L to approximately 170 µg/L, trending upward during the test. The pumped water was treated using a GAC treatment system, and a total of 0.27 kg (0.6 lb) of RDX was removed through treatment during the 2 mo of pumping at CdV-16-4ip.

  Based on the test results, it was determined that long-term pumping at CdV-16-4ip with the sole objective of removing mass from the deep perched groundwater is not cost-effective because of the relatively low yield of this well (3 gallons per minute) and the limited mass of RDX that would be produced. The extended source-removal test at CdV-16-4ip has demonstrated that long-term pumping at the well would remove RDX from the deep perched-intermediate aquifer at TA-16 at a rate of approximately 1 kg/yr (2.3 lb/yr).

Other work accomplished concerning the CME for deep groundwater from April 2014 to September 2014 includes the following.

- **Monitoring Well Installation:** Four new wells are planned for TA-16, including two wells currently in the process of being drilled and completed. These wells will provide valuable information for the hydrogeologic conceptual model and will include perched-intermediate wells CdV-9-1(i) and R-63i and regional aquifer wells R-47 and R-58. Details regarding these wells are summarized below.
  - ❖ Monitoring well CdV-9-1(i) (LANL 2013, 239226), which is planned to be drilled during the first quarter of FY2015, will be located north of Cañon de Valle, approximately 0.15 mi northeast of CdV-9-1(i) (Figure 3.1-1). Data from this well will be used to refine the understanding of the northern portion of RDX-contaminated groundwater in the deep perched zone. Drilling preparation is underway for this well.

- ❖ Monitoring well R-63i (LANL 2013, 235924) is currently being drilled near existing well R-63 (Figure 3.1-1). Data from R-63i will be used to constrain the shape of the lower deep intermediate aquifer to better understand the deep perched groundwater flow direction in this area and to further constrain the extent of RDX and volatile organic compound contamination in deep perched groundwater. No long-term pumping test is planned for monitoring well R-63i at this time.
- ❖ Regional monitoring well R-47 (LANL 2012, 232340) is currently being drilled north of Cañon de Valle (Figure 3.1-1) to better define the RDX distribution within the regional aquifer north of Cañon de Valle and to monitor for high explosives and other contaminants in the aquifer downgradient of the 260 Outfall and beneath infiltration pathways associated with Cañon de Valle and deep perched groundwater in the area. No deep perched groundwater was observed during drilling of R-47.
- ❖ Regional well R-58 (LANL 2012, 212117) will be drilled north of S-Site Canyon (Figure 3.1-1). Data from R-58 will be used to monitor for contaminants downgradient of potential contaminant breakthrough locations for S-Site and Fishladder Canyons and may provide information on the perched-intermediate zone in that area. The installation date for this well is pending DOE and NMED prioritization for work to be completed in FY2015.

- **Tracer Deployment:** On March 14, 2014, an extension request was submitted to NMED requesting an extension from the March 31, 2014, date to deploy tracers at Consolidated Unit 16-021(c)-99 to a new date of December 31, 2014. It is anticipated that before December 31, 2014, an additional extension request will be submitted with a revised date, based on technical need, NMED priorities, funding constraints, and adequate time to complete the work. This additional time may allow the Laboratory to obtain sufficient data from planned new wells to evaluate whether a tracer is still appropriate.

4.0 REGULATORY, PUBLIC AND STAKEHOLDER INVOLVEMENT

On July 25, 2014, the Laboratory project manager led a tour for DOE and NMED Groundwater Bureau and Surface Water Bureau personnel to the CdV-16-4ip well site, Burning Ground Spring, SWSC Spring, Martin Spring, and the location of the former Cañon de Valle PRB. Additional details are discussed in section 2.3.

No public meetings or meetings with stakeholders were held between April 2014 and September 2014.

5.0 PROBLEMS ENCOUNTERED/ACTIONS TO RECTIFY PROBLEMS

The hydrologic system in Cañon de Valle was strongly perturbed by the August 2011 flooding because of severe damage to the watershed caused by the Las Conchas wildfire. As a result, baseline contaminant levels within the canyon system need to continue to be reevaluated. Two long-term alluvial wells were destroyed in this flooding, and the PRB capture wall was severely damaged. The TA-16 storm filters in springs have not been turned on because of issues with the NPDES permit. However, meetings with NMED to address a path forward for the alluvial system are planned and will be scheduled in the future.

6.0 WORK PLANNED FOR THE NEAR FUTURE

6.1 Surface CMI

6.1.1 BMPs

- Continue to inspect existing BMPs following significant precipitation events

6.1.2 Hydrogeologic Investigations

- Check for the presence and levels of water in the Cañon de Valle alluvial system
- Evaluate geomorphic changes in Cañon de Valle resulting from post–Las Conchas fire storm events in FY2013
- Continue precipitation monitoring

6.1.3 Surface CMI Activities

- Meet with NMED personnel to review spring RDX data and to determine a path forward for the PRB and storm filters
- Monitor the bentonite cap in the TA-16 260 Outfall pond

6.2 Subsurface CME

- Complete installation of CME intermediate and regional aquifer wells R-63i, R-47, CdV-9-1(i), and R-58
- Conduct extended cross-hole pumping test at CdV-9-1(i) to evaluate the hydraulic connection between this well and other nearby wells completed in the deep perched groundwater and to measure hydraulic parameters at this location

6.3 Public and Stakeholder Involvement

- Continue discussions with NMED personnel regarding the optimal path forward for both surface CMI and groundwater CME

7.0 RECOMMENDATIONS

Key recommendations for the TA-16 260 Outfall subsurface CME and surface CMI for future FYs include the following:

- Activities relevant to the groundwater CME should be given priority in light of recent observations in deep groundwater associated with the TA-16 260 CME. These observations include increasing RDX) concentrations in R-18 and high (>200 µg/L) RDX concentrations in the upper screen of CdV-16-4ip.
- The crucial next steps for the groundwater CME focus on the drilling of new wells, and further collection of hydrologic data through additional cross-hole testing.

- These drilling activities are important precursors to both the groundwater CME report and any interim actions that may be deemed necessary to minimize high explosives migration into regional groundwater.
- The Laboratory believes decisions to replace the pilot PRB or destroyed alluvial wells should be deferred until 2015, at the earliest. Experience following the Cerro Grande and other fires within the region suggests large floods are likely for up to 3 yr following severe burning in a watershed's headwaters. Nearby alluvial wells with similar concentrations and trends can provide continued alluvial groundwater monitoring for the TA-16 260 monitoring group.
- The use of the storm filters currently located at several TA-16 springs continues to be strongly recommended. This action would be a useful interim measure pending future decisions on the fate of the PRB. These springs currently provide a large fraction of the mass-flux of RDX within the canyon system. In the absence of the PRB, these storm filters may remove a large percentage of the flux of RDX in the alluvial waters within Cañon de Valle.
- The results of the source-removal testing program activities for CdV-16-4ip should be used along with geochemical and hydraulic data from new wells R-63i, CdV-9-1(i), R-47, and R-58 to refine the conceptual model of the nature and extent of contamination at TA-16. The refined conceptual model will be used to further evaluate the potential for source-removal and other remedial strategies for the deep perched-intermediate zone.
- With NMED concurrence, the Laboratory recommends combining the surface CMI and groundwater CME efforts into one technical and regulatory approach. This approach will be presented in a CME report, to be delivered following completion of drilling, data collection, aquifer testing, and data analysis activities described herein.

8.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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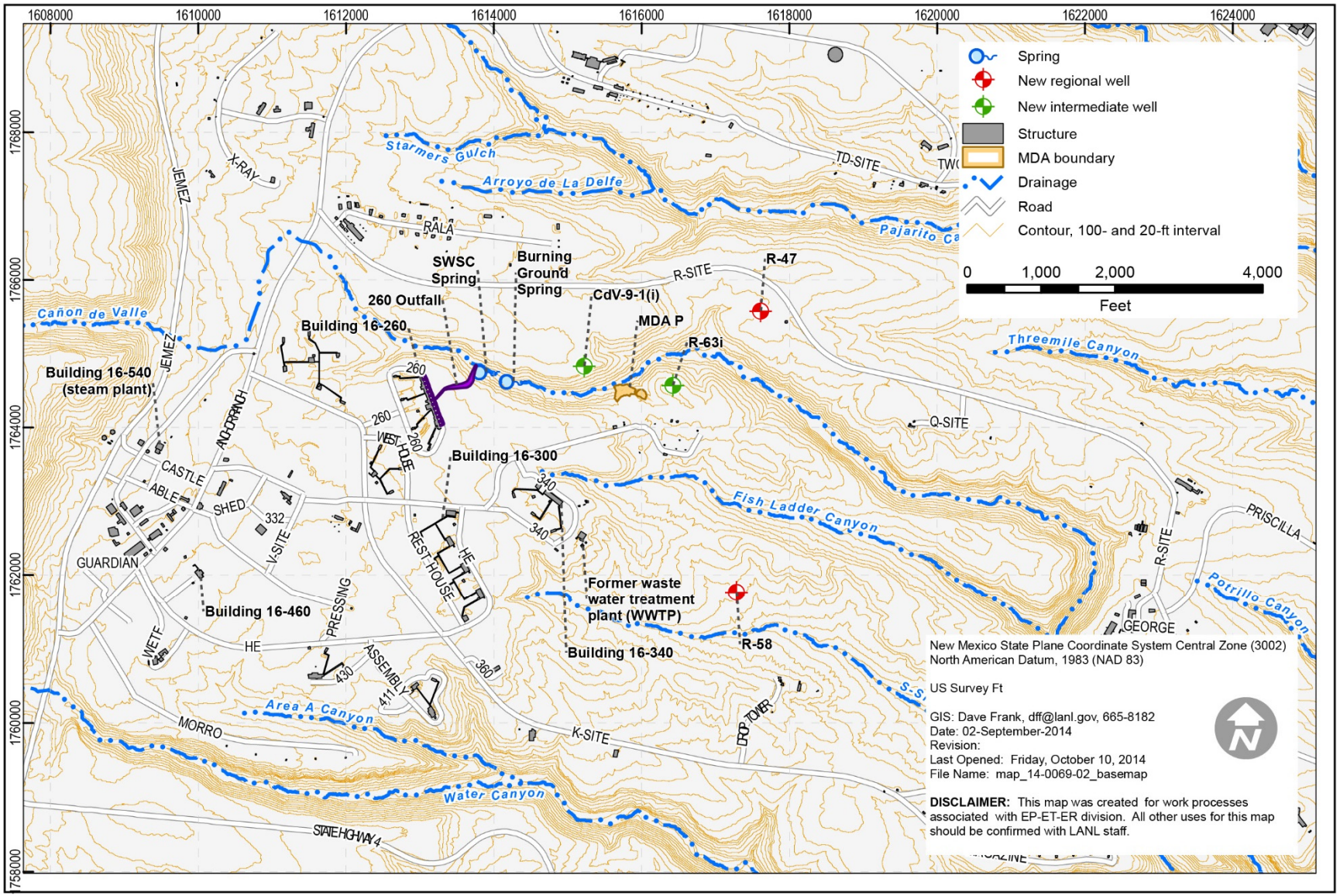

Figure 3.1-1 Locations of wells CdV-9-1(i), R-63i, R-47, and R-58