# Report on Annual Groundwater Monitoring, Area IV, 2014

## Santa Susana Field Laboratory
## Ventura County, California

April 2015

CDM Smith

**U. S. Department of Energy**
Energy Technology Engineering Center
4100 Guardian Street, Suite 160
Simi Valley, CA 93063

April 15, 2015

Mr. Ray Leclerc
Project Director
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95824

Subject:Report on Annual Groundwater Monitoring, Area IV, 2014
Santa Susana Field Laboratory, Ventura County, California

Dear Mr. Leclerc:

The United States Department of Energy (DOE) herby submits the "Report on Annual Groundwater Monitoring , Area IV, 2014", CDM, dated March 25, 2015. This report summarizes DOE groundwater monitoring activities conducted at the Santa Susana Field Laboratory (SSFL) located in Ventura County for the period January 1 through December 31, 2014. The Boeing Company (Boeing) and the National Aeronautics and Space Administration (NASA) have reported their data findings for 2014 in their own reports for their respective portions of SSFL.

Area IV included 29 monitoring wells and 1 on-site former water supply well that are part of the Site-Wide Monitoring Program (Sampling Program) and 67 monitoring wells and 7 seeps/spring included as part of the DOE Area IV Data Gap Evaluation. Wells with sufficient water were sampled in accordance with the Site-Wide Water Quality Sampling and Analysis Plan (Site-Wide WQSAP).

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to evaluate the information submitted. I certify that the information contained in or accompanying this submittal is true, accurate, and complete. As to those identified portion(s) of this submittal for which I cannot personally verify the accuracy, I certify that this submittal and all attachments were prepared in accordance with procedures designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those directly responsible for gathering the information, or the immediate supervisor of such person(s), the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

John Jones
DOE/ETEC Director, Santa Susana Field Laboratory

cc: Mr. Mark Malinowski
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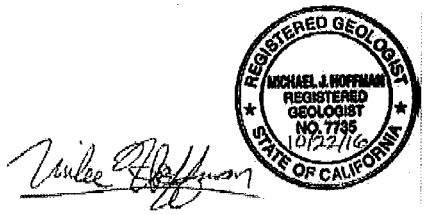
# PROFESSIONAL CERTIFICATION

## Report on Annual Groundwater Monitoring, Area IV, 2014
## January 1 through December 31, 2014
## Santa Susana Field Laboratory
## Ventura County, California

April 2015

This Annual Groundwater Monitoring Report has been prepared by a team of qualified professionals under the supervision of the senior staff whose seal and signature appears below.

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# Executive Summary

This report summarizes the United States Department of Energy (DOE) groundwater monitoring activities conducted during 2014 at Area IV within the Santa Susana Field Laboratory (SSFL) located in Ventura County, California. This is the first annual report prepared by DOE to satisfy the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) requirements to report on annual groundwater monitoring at SSFL. The annual report has been developed by CDM Federal Programs Corporation (CDM Smith) and includes water quality data collected from administrative area IV, Northern Buffer Zone, and off-site wells and seeps. For simplicity, data from these areas reported here are referred to as "Area IV." The following groundwater monitoring activities conducted within Area IV, and summarized within include the following:

- Water quality samples were collected pursuant to the Site-Wide Groundwater Monitoring Program (Haley & Aldrich 2009b, 2010c).
- There are no Regulated Unit or Post Closure Permit (PCP) monitoring program requirements for Area IV.
- Scheduled 2014 samples were collected with exceptions identified in this report.
- Water level measurements were collected in the first, second, and third quarters 2014 and groundwater elevation contours for first quarter 2014 were prepared and are presented in this report.
- Water quality samples were collected to support the Groundwater Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFI) Program and DOE Area IV Data Gap Evaluations (CDM Smith 2014a, 2014b).
- Well maintenance and equipment modifications were performed.
- Exceptions to the Site-Wide Groundwater Water Quality Sampling and Analysis Plan (WQSAP), Revision 1 are summarized in this report.

The Area IV Groundwater Data Gap Analysis (CDM Smith 2014a and 2014b) and sampling results from 2014 monitoring event indicate that the Site-Wide Groundwater WQSAP is not structured to obtain necessary data to complete the SSFL Groundwater RFI program. Recommendations for changing the WQSAP have been submitted to DTSC in the Area IV Groundwater RFI Work Plan (CDM Smith 2015).

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(Provided electronically on disc)

# List of Acronyms and Abbreviations

| | |
|---|---|
| µg/L | micrograms per liter |
| 1,1-DCA | 1,1-dichloroethane |
| 1,1-DCE | 1,1-dichloroethene |
| 1,2,3-TCP | 1,2,3-trichloropropane |
| 1,2-DCA | 1,2-dichloroethane |
| 22 CCR | Title 22 California Code of Regulations |
| Boeing | The Boeing Company |
| *cis*-1,2-DCE | *cis*-1,2-dichloroethene |
| COCs | constituents of concern |
| DOE | United States Department of Energy |
| DPH | Department of Public Health |
| DRO | diesel-range organics |
| DTSC | Department of Toxic Substances Control |
| EPA | United States Environmental Protection Agency |
| ESADA | Empire State Atomic Development Authority |
| ETEC | Energy Technology Engineering Center |
| FLUTe | Flexible Liner Underground Technologies |
| FSDF | Former Sodium Disposal Facility |
| GRO | gasoline range organics |
| GWRC | Groundwater Resources Consultants |
| HGL | HydroGeoLogic |
| KRO | kerosene-range organics |
| LUFT | Leaking Underground Fuel Tank |
| MCL | Maximum Contaminant Level |
| MDA | minimum detectable activity |
| MDL | method detection limit |
| mg/L | milligrams per liter |
| mrem/yr | millirems per year |
| MSL | mean sea level |
| MWH | MWH |
| NASA | National Aeronautics and Space Administration |
| NDMA | n-nitrosodimethylamine |
| NL | Notification Level |
| PCE | tetrachloroethene |
| pCi/L | picoCuries per liter |
| PCP | Post-Closure Permit |
| QAPP | Quality Assurance Project Plan |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| RMHF | Radioactive Materials Handling Facility |
| RI | Remedial Investigation |
| RWQCB | Regional Water Quality Control Board |
| SDWA | Safe Drinking Water Act |
| SGC | silica gel cleanup |
| SMCL | Secondary Maximum Contaminant Level |
| Sr-90 | Strontium-90 |

| | |
|---|---|
| SSFL | Santa Susana Field Laboratory |
| SWGW RBSL | site-wide groundwater risk-based screening level |
| TCE | Trichloroethene |
| TPH | total petroleum hydrocarbons |
| *trans*-1,2-DCE | *trans*-1,2-dichloroethene |
| U | Uranium |
| U-233/234 | Uranium 233/234 |
| U-238 | Uranium 238 |
| VC | vinyl chloride |
| VOC | volatile organic compound |
| WQSAP | Water Quality Sampling and Analysis Plan |

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# Section 1
# Introduction

This report summarizes the groundwater monitoring activities conducted during 2014 by the United States Department of Energy (DOE) within Area IV of the Santa Susana Field Laboratory (SSFL) located in Ventura County, California (Figure 1). Previous annual reports have reported groundwater monitoring activities performed for the entirety of SSFL including areas administered by The Boeing Company (Boeing) and the National Space and Aeronautics Administration (NASA) at administrative areas I, II, III, IV, and undeveloped land both to the north and south. Starting with this report, DOE is submitting data for wells within Area IV for which it has responsibility under the 2007 Consent Order for Corrective Action (DTSC 2007). This report describes groundwater monitoring activities that occurred from January 1, 2014 through December 31, 2014 within administrative Area IV, the Northern Buffer Zone, and off-site wells and springs located to the north and west of Area IV. For simplicity, administrative area IV, Northern Buffer Zone, and off-site wells and seeps associated with Area IV are termed "Area IV" in this report.

This report contains Area IV information only and as such has been modified to reflect regulatory compliance requirements for Area IV. The major change between previous annual reports and this report is that there are no Post-Closure Permit (PCP) Regulated Unit Monitoring Program requirements and Leaking Underground Fuel Tank (LUFT) requirements for Area IV.

Area IV groundwater monitoring activities described in this report were the result of implementation of the Site-Wide Groundwater Monitoring Program and in support of the DOE Area IV Data Gap Evaluation (CDM Smith 2014a, 2014b).

Monitoring performed in 2014 and content of this report is in compliance with the December 2010 Site-Wide Water Quality Sampling and Analysis Plan (WQSAP) (Haley & Aldrich 2010c).

## 1.1 Site Description

The SSFL is located approximately 29 miles northwest of downtown Los Angeles, California, in the southeast corner of Ventura County (Figure 1). The SSFL occupies approximately 2,850 acres of hilly terrain, with approximately 1,100 feet of topographic relief near the crest of the Simi Hills. Figure 1 shows the geographic location and property boundaries of the site, as well as surrounding areas. The site is divided into four administrative areas (Areas I, II, III, and IV) and includes undeveloped land both to the north and south (Figure 1). Most of Area I and all of Areas III and IV are owned by Boeing. The United States Environmental Protection Agency (EPA) Identification Number for Areas I and III is CAD093365435. Area II is owned by the federal government and administered by NASA along with a portion of Area I. The EPA Identification Number for Area II is CA1800090010. Boeing owns the entirety of Area IV. Ninety acres of Area IV were leased to the DOE, which also owns facilities in Area IV. The northern and southern undeveloped lands of SSFL were not used for industrial activities and are owned by Boeing.

## 1.2 Regulatory Background

Prior to submission of this annual report, groundwater sampling activities for Area IV were reported along with results from Area I, II, and III. As a result, previous annual reports were intended to fulfill the requirements of multiple regulatory programs being implemented at SSFL. These include requirements addressed in the PCP monitoring programs (Regulated Unit Programs) for Areas I, II, and III approved by the California EPA DTSC, the Site-Wide Groundwater Monitoring Program approved by DTSC, and LUFT monitoring program overseen by DTSC. There are no Regulated Unit or LUFT requirements for Area IV and thus they are not addressed in this document.

The content of this report is in compliance with the December 2010 Site-Wide WQSAP (Haley & Aldrich 2010c). The Site-Wide Groundwater Monitoring Program is prescribed by the Site-Wide WQSAP. A Draft Site-Wide WQSAP (Haley & Aldrich 2009b) was submitted to DTSC in December 2009 and implemented in the third quarter of 2010 per DTSC request. Formal implementation of the December 2010 revision to the Site-Wide WQSAP (Haley & Aldrich 2010c) occurred in the third quarter of 2011 following DTSC approval on June 6, 2011 (DTSC 2011).

## 1.3 Objectives

Area IV groundwater compliance requirements are presented in the Site-Wide Groundwater Monitoring Program. The objective of this report is to document compliance with that program. The scope of this annual report includes the following:

- Executive summary of significant findings.
- Summary of monitoring programs and activities conducted during the calendar year.
- Summary of maintenance inspections of monitored wells.
- Summary of modifications made to monitoring equipment during the calendar year, if any.
- Summary of deviations from the Site-Wide WQSAP, if any.
- Water level data, hydrographs, and groundwater elevation contour maps.
- Discussion of significant events that may influence the occurrence and movement of groundwater.
- Summary of results of laboratory analyses of water samples.
- Electronic laboratory analytical reports and sample custody documents.
- Summary of the results of statistical evaluation, if any, of water chemistry data.
- Results of quality assurance/quality control sampling and analysis and assessment of data quality including accuracy, precision, and completeness.
- Contaminant plume maps with concentrations posted for the year for specific regulated units or areas.
- Contaminant concentration versus time plots and a discussion of evident trends.

- Summary tables indicating monitoring parameter results that lie outside of historical range for each monitoring location.
- Summary of constituent concentrations at wells that exceed SSFL groundwater screening reference values.
- Summary of outstanding issues and/or follow-up work.

## 1.4 Report Organization

The remainder of this report is organized as follows:

- Section 2 provides a description of the site geology and hydrogeology
- Section 3 provides a summary of the activities performed during this reporting period
- Section 4 presents the results of field work and analytical testing
- Section 5 presents planned activities for 2015
- Section 6 presents the references

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# Section 2
# Site Geology and Hydrogeology

## 2.1 Geology

SSFL is located in the Western Transverse Ranges physiographic province of southern California. The province's geology and physiography reflect at least 70 million years of geologic history. The sedimentary rocks in the portion encompassing SSFL range from coarse grained conglomerates and sandstones to fine-grained siltstones and shale. The geologic history of the Western Transverse Ranges is complex and involves several distinct episodes of deformation involving tectonic extension, rotation, compression, and shearing. In the vicinity of SSFL, this has caused the Western Transverse Ranges to rotate more than 90 degrees clockwise. This complex geologic history is reflected in multiple fold, fault, and fracture orientations in the vicinity of SSFL.

The Chatsworth Formation underlies much of the province and is exposed across most of SSFL (Figure 2). It is a turbidic sandstone with interbedded shale, siltstone, and conglomerate approximately 6,000 feet thick and more than 65 million years old. As a result of geologic folding, the Chatsworth Formation dips moderately (typically 25 to 35 degrees) to the northwest at SSFL, along the south limb of the Simi Valley syncline. Detailed geologic mapping in the site vicinity was performed to augment published geologic maps, resulting in the subdivision of the Chatsworth Formation into upper and lower units (MWH 2009). The lower formation is exposed in southeastern SSFL and dips northwest beneath the remainder of the site. The upper Chatsworth Formation is exposed across much of the remainder of the site and has been subdivided further into stratigraphic packages consisting of coarse- and fine-grained members. Numerous steeply dipping to near-vertical faults have offset this stratigraphy. Fault gouge and fracturing, ancillary to faults, are observed at some locations.

Unconsolidated deposits at SSFL include alluvium, artificial fill, and thin soils over bedrock. The alluvium generally consists of silty sand and occurs in topographic lows and along ephemeral drainages. Areas with 5 to 30 feet of alluvium cover more than 300 acres of SSFL, or about 11 percent of the site.

## 2.2 Hydrogeology

Groundwater occurs at SSFL in alluvium and weathered and unweathered bedrock (Montgomery Watson 2000; MWH 2009). First-encountered groundwater may be observed in any of these media under water table conditions. For regulatory purposes, near-surface groundwater is defined to occur within the site's unconsolidated deposits (e.g., alluvium) and shallow weathered bedrock, whereas deep groundwater, referred to as "Chatsworth Formation groundwater," occurs in the unweathered bedrock. The near-surface groundwater may be perched or vertically continuous with deeper groundwater.

The boundaries of the mountain groundwater system encompassing SSFL include where the Simi Hills meet the floor of the Simi and San Fernando valleys, and where groundwater tends to discharge to seeps and phreatophytes along several surrounding canyons. The base of the active groundwater flow system occurs at the boundary between fresh and connate groundwater, assumed to occur at approximately sea level. The upper boundary of the mountain groundwater flow system is the

regional water table and localized perched water tables. Hydrogeologic boundaries internal to the groundwater flow system include areas of groundwater discharge to seeps and phreatophytes, pumped wells, and various boundary effects along faults and geologic contacts.

Portions of the Chatsworth Formation comprise locally transmissive aquifer units. These units generally consist of the fractured sandstone members of the upper Chatsworth Formation, many of which are several hundred feet thick. Separating the major sandstone units are a series of relatively thin shale and siltstone members that typically behave as aquitards.

The arrangement and geometry of the hydrogeologic units are controlled by geologic contacts, folding, and faulting. Faults truncate permeable zones and fractures, juxtapose different units and fold orientations, and form low-permeability boundaries and zones of enhanced fracturing. Together, these structures result in a complex three-dimensional distribution of hydrogeologic units and anisotropic permeability that influence directions and rates of groundwater flow. Major faults subdivide SSFL into several large blocks, which are further subdivided by shale beds.

The SSFL water table is a subdued reflection of the topography, which, relative to the surrounding valleys, presents as a large groundwater mound that is maintained by rainfall recharge. Distinct differences in groundwater head are observed across fine-grained units and faults that impede groundwater flow. Groundwater moves from areas of recharge toward pumping wells and downward and outward toward hill slope seeps and the surrounding lowlands. The direction of vertical flow is downward at most site locations.

Insight into the pattern of SSFL groundwater flow has been provided through the development and use of a representative three-dimensional groundwater flow model (MWH 2009).

# Section 3
# Reporting Period Activities

The reporting period for this report covers the 2014 calendar year, beginning on January 1, 2014 and ending on December 31, 2014. Work performed during the 2014 annual reporting period is presented in this section. Groundwater samples were collected in 2014 as part of the Site-Wide Groundwater Monitoring Program and to support the DOE Area IV Data Gap Evaluation.

The Site-Wide Groundwater Monitoring Program – December 2010 Site-Wide WQSAP (Haley & Aldrich 2010c) was implemented to fulfill the groundwater monitoring program specific to Area IV at SSFL. In addition to regulatory fulfillment of the Site-Wide Groundwater Monitoring Program, groundwater samples were also collected during the first quarter 2014 to support the DOE Area IV Data Gap Evaluation. The purpose of Area IV Data Gap Evaluation (CDM Smith 2014a, 2014b) sampling event was:

- Collect water levels and groundwater samples from monitoring wells not sampled as part of the Site-Wide Groundwater Monitoring Program
- Close remaining groundwater data gaps
- Provide groundwater data to support development of the Resource Conservation and Recovery Act (RCRA) Groundwater Facility Investigation (RFI) Work Plan for Area IV of the SSFL (CDM Smith 2015)

The following activities stipulated by the Site-Wide WQSAP were conducted during the reporting period:

- Measurement of groundwater levels at all accessible program wells
- Collection and submission of groundwater samples from select wells for laboratory analysis

DOE wells located in Area IV or accessible only through Area IV were not gauged during the fourth quarter 2014 per discussions between John Jones, DOE, and DTSC staff.

A list of wells present within Area IV and relative sampling program during 2014 is provided in Table 1.

Well, piezometer, and seep locations are shown on Figure 3. Site-Wide Monitoring Program locations are shown on Figure 4. Well construction details are provided in Appendix A. Figure 5 presents the Radioactive Materials Handling Facility (RMHF) and Leach Field AI-Z8 Layout and is provided to support the Strontium-90 (Sr-90) groundwater discussion.

Field groundwater monitoring activities during the first, second, and third quarter of 2014 reporting period were performed under the direction and oversight of MWH. There were no water level monitoring activities during the fourth quarter 2014. Field activities were conducted in general accordance with the Site-Wide WQSAP (Haley & Aldrich 2009b and 2010c), with exceptions described in Section 3.4. Field personnel followed the sampling and analysis requirements described in the Site-

Wide WQSAP. MWH field personnel and subcontractors followed health and safety guidelines in MWH's SSFL Health and Safety Plan (MWH 2010).

## 3.1 Modifications to Well Network and Equipment

Well maintenance activities performed during 2014 are shown in Table 2. There was no monitoring equipment modification, well installation, or well development activities performed in 2014. Well and piezometer construction details are provided in Appendix A. Flexible Liner Underground Technologies (FLUTe) multilevel system construction details also are presented in Appendix A. Monitored wells were inspected for maintenance needs during the 2014 monitoring event.

Low-flow retrofitting of site-wide wells was completed in 2011, except for the retrofit of RD-34B. A partial obstruction was noted at approximately 167 feet below the top of the casing and after multiple failed attempts to install a dedicated bladder pump, it was recommended that the well be removed from the Site-Wide Groundwater Monitoring Program (Boeing 2011).

Future investigation of the obstruction suggested that a weld seam in the well casing failed, causing the casing to partially collapse. A steel bailer was also dropped onto the obstruction repeatedly via a wireline with no change observed in the position of the obstruction, further suggesting that the obstruction is not simply an object that could be dislodged. DOE is managing this issue directly and the disposition of this well is pending resolution with DTSC.

## 3.2 Water Level Gauging

Area IV static water levels were gauged in the first, second and third quarter of 2014. Due to the ongoing drought and lack of rainfall, and number of dry wells observed during the third quarter event, DOE recommended suspension of water level measurements until after the winter 2014-15 rainy season.

Static water levels were gauged at all accessible program wells. Depths to water were measured from the top of each well casing. Conditions of the well (e.g., loose caps, damaged casing) were recorded in field logs. Wells were gauged using an electronic water-level meter. Portions of the cable and meter or probe that were in contact with groundwater were decontaminated before use at each well. Water levels were obtained first quarter 2014 (January 13 through March 25, 2014), second quarter 2014, and third quarter 2014 and are summarized in Table 3. A total of 104 wells were scheduled for gauging during first quarter 2014. The following 35 locations were not gauged for reasons described in Table 3: ES-31, OS-05, PZ-051, PZ-052, PZ-055, PZ-097, PZ-098, PZ-100, PZ-102, PZ-110, PZ-111, PZ-112, PZ-113, PZ-114, PZ-115, PZ-124, PZ-150, PZ-151, PZ-160, PZ-161, RD-22, RD-23, RD-33A, RD-50, RD-57, RD-64, RD-74, RS-11, RS-16, RS-18, RS-23, RS-24, RS-25, RS-27 and RS-30.

Low-flow well retrofits performed in 2011 and resulting changes in measuring point elevations are presented in Table 4 (Haley & Aldrich 2010b, 2011).

## 3.3 Groundwater Sampling and Analysis

Area IV monitoring wells are scheduled to be sampled annually in accordance with the Site-Wide WQSAP. In Area IV, the Site-Wide Groundwater Monitoring Program includes 30 wells for sampling and analysis and 66 locations for water level monitoring. The Site-Wide Groundwater Monitoring Program wells are presented in Table 1 and shown on Figure 4. The monitoring frequency of the Site-Wide Program decreased from semi-annual in 2010 to annual beginning in 2013.

To address groundwater characterization needs per the Area IV Data Gap Evaluation (CDM Smith 2014a, 2014b), 66 groundwater samples were collected from January 21 through March 28, 2014 for the first quarter 2014: 25 samples under the Site-Wide WQSAP (Haley & Aldrich 2009b and 2010c), and 41 samples addressing data gap needs. No water samples were scheduled for collection in the second, third, or fourth quarters per the Site-Wide WQSAP.

Groundwater field parameters collected during purging prior to sample collection are presented in Table 5. Groundwater samples analyzed in 2014 per the Site-Wide WQSAP (Haley & Aldrich 2009b and 2010c), Groundwater RFI, and Area IV Data Gap Evaluation are presented in Table 6. The analytical methods are presented in Table 7.

Since third quarter 2010, radiochemistry analyses (except for tritium) have been performed using an approach described in EPA's Area IV Radiological Study Quality Assurance Project Plan (QAPP) for Groundwater, Surface Water, and Sediment (HydroGeoLogic [HGL] 2010). This approach involves filtering at the laboratory followed by separate analysis of the liquid filtrate and the solid residue captured by the filter. Each of the results has its own associated error and minimum detectable activity (MDA).

### 3.3.1 Other Monitoring

Sixty-seven monitoring wells and seven seeps and springs were scheduled for sampling as part of the Area IV Data Gap Evaluation as presented in Table 1. Due to deviations discussed in Section 3.4, only 41 locations were sampled for the Groundwater Data Gap Evaluation during the 2014 reporting period. Analyses for radionuclides identified in prior wells sample results by EPA or MWH were also performed during this period.

## 3.4 Deviations from Water Quality Sampling and Analysis Plans

Exceptions to the Site-Wide WQSAP are presented in Table 8. Exceptions include wells not sampled due to lack of water present, wells containing insufficient water for sampling, well or equipment damage/malfunction, or access restrictions; incomplete analyses; stabilization parameters not collected at fixed intervals; initial purge volume not met before stabilization parameters collected; sample rate differing from purge rate; and QAPP requirements not met. No exceptions other than those listed in Table 8 occurred for Area IV wells in 2014.

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# Section 4
# Monitoring Results

This section provides a review of Area IV 2014 groundwater levels, and groundwater quality results and trends. Historical data were summarized in previous reports by Groundwater Resources Consultants (GWRC 2000), Haley & Aldrich (2001 through 2009a, 2010a) and MWH (2011a, 2011b, 2012, 2013, 2014). Groundwater screening reference values used to evaluate results are presented in Table 9. First time detections are presented in Table 10. New maximum concentrations for Area IV results are presented in Table 11.

## 4.1 Groundwater Elevations and Flow Conditions

Water level elevations for 2014 are presented in Table 3. Discrete depth-interval water level data from FLUTe-equipped wells were not collected. All pressure transducers present in FLUTe wells have failed. Water level hydrographs are provided in Appendix C. Occurrence and movement of groundwater at Area IV is influenced by precipitation. There were no groundwater extraction events that are believed to influence the presence or movement of groundwater in Area IV. Annual precipitation data are presented in Appendix B.

Figure 6 presents contours of first-encountered, non-perched groundwater elevations, as determined from water levels measured during the first quarter of 2014. Wells and piezometers that typically monitor perched groundwater were identified in the Groundwater Remedial Investigation (RI) Report (MWH 2009). Additional information that helped constrain the contouring included topography, the approximate elevations of identified seeps and springs, historical water level data for wells and piezometers not gauged during the first quarter of 2014, and the understanding that groundwater level discontinuities coincide with certain fault segments and other geologic structures. In the case of well clusters, water levels from the shallowest wells were used. The data represent water levels primarily within the Chatsworth Formation, but include levels in younger deposits where the zone of saturation is continuous with the underlying formations. Area IV wells were not gauged during the fourth quarter 2014.

Non-perched groundwater elevations measured in SSFL monitoring wells during the first quarter of 2014 ranged from a low of approximately 1,386 feet above mean sea level (MSL) at well SP-900C to a high of about 1,798 feet above MSL at well RD-17 (Table 3, Figure 6). Groundwater levels in Chatsworth Formation wells were generally lower during the first quarter 2014 than during the first quarter 2013 (MWH 2014; Appendix C), in part because of lower than average precipitation during the 2013-2014 water year (Appendix B).

The groundwater elevation contour map is provided to satisfy, in part, the requirements of Title 22 California Code of Regulations (22 CCR), section 66264.97 for determining groundwater flow rates and directions. A groundwater elevation contour map can be used in simple hydrogeologic settings to depict variations in the elevation of the water table surface, which can in turn be used to interpret apparent relative directions of groundwater flow. However, the groundwater elevation contours depicted in Figure 6 are not used to infer groundwater flow directions or rates of groundwater movement due to the hydrogeologic complexities at SSFL as described in Section 2.2, the groundwater elevation contours depicted in Figure 6 are not used to infer groundwater flow directions or rates of

groundwater movement. Estimates of groundwater flow rates and three-dimensional groundwater flow directions from areas within SSFL were made and are presented in the draft groundwater RFI report (MWH 2009).

## 4.2 Groundwater Quality

Laboratory analytical results for groundwater samples are tabulated in Tables 12 through 17. Time series plots of analytical data for constituents of concern (COCs) identified in the Site-Wide Groundwater Monitoring Program (Haley & Aldrich 2010c) are provided in Appendix D. Time series plots of analytical data presented in Appendix D include results through 2014 for principle COCs and constituents monitored under the Site-Wide Groundwater Monitoring Program (Haley & Aldrich 2010c). Area IV COCs time series plots for trichloroethene (TCE), perchlorate, and tritium are presented. Plots are not presented for COCs ammonia, xylenes, and total petroleum hydrocarbons (TPH); radiochemistry, and metals, constituents, which are specific to the Area IV data requirements per the Site-Wide Groundwater Monitoring Program. Obvious new trends of chemical concentrations in groundwater during 2014 were not visually evident in these time series plots.

Constituents detected for the first time in groundwater sampled from individual locations are presented in Table 10. Constituents previously detected in groundwater sampled from a particular location and reported at new maximum concentrations are presented in Table 11. Aside from these exceptions, the analytical results were within historical ranges (GWRC 2000; Haley & Aldrich 2001 through 2009a, 2010a; MWH 2003, 2011a, 2011b, 2012, 2013, 2014).

Groundwater chemical concentration data from the 2014 reporting period are posted on chemical extent maps showing areas of impacted groundwater for 14 chemicals on Figures 7 through 20. These chemicals were selected for mapping because they are COCs in the Site-Wide Groundwater Monitoring Program, and were selected for presentation on chemical extent maps in the Groundwater RI Report (MWH 2009).

### 4.2.1 Quality Assurance and Quality Control

Laboratory analytical reports for the 2014 reporting period are provided in Appendix E and the quality assurance assessment is presented in Appendix F. Per the Site-Wide WQSAP (Haley & Aldrich 2009b and 2010c) , the quality assurance assessment provides an assessment of data quality including accuracy, precision, and completeness. The quality assurance assessment also includes results of the data validation process, and a summary of the field sampling and analytical program, data management review procedure, and data verification process.

### 4.2.2 Groundwater Screening Reference Values

The groundwater sampling results for individual chemicals are compared for discussion purposes to the following screening values, listed in approximate descending order of importance and/or relevance:

- Site-specific values developed by DTSC (i.e., groundwater comparison concentrations for metals) (listed as SSFL Comparison in report tables);
- Isotope-specific activity limits for individual beta/photon emitters based on the effective dose equivalent of 4 millirems per year (mrem/yr) (Federal Register 2000);

- Primary Maximum Contaminant Levels (MCLs) established by the EPA and promulgated by the Safe Drinking Water Act (SDWA), and by the California Department of Public Health (DPH) promulgated by 22 CCR, sections 64431 through 64449 and 64672 (Regional Water Quality Control Board [RWQCB] 2008; DPH 2008) (listed as Primary MCL and Cal MCL in report tables);
- Notification Levels (NL)/Advisory Levels established by the California DPH (RWQCB 2008; DPH 2010);
- Secondary Maximum Contaminant Levels (SMCLs), which address aesthetics such as taste and odor (RWQCB 2008; DPH 2006) (listed as Secondary MCL in report tables);
- Taste and Odor Threshold (RWQCB 2008) (listed as Taste/Odor in report tables); and
- Site-specific values developed for SSFL using risk assessment procedures assuming direct ingestion of groundwater (listed as SWGW RBSL [site-wide groundwater risk-based screening level] in report tables).

For chemicals with more than one screening value, the lower value is used to be more conservative. When EPA and California DPH values for MCLs differ, the lower value is used. In cases where the SMCL is lower than the Primary MCL, the SMCL is used.

The methodology used to develop the risk-based screening values for chemicals that are not metallic elements and where there are no agency-published values is described in a technical memorandum included in Appendix 7-C of the Groundwater RI Report (MWH 2009). Groundwater screening reference values are presented in Table 9.

### 4.2.3 Areas of Impacted Groundwater

Chemical concentration data from the 2014 reporting period are posted on chemical extent maps showing areas of impacted groundwater for 14 chemicals on Figures 7 through 20. These chemicals were selected for mapping because they are COCs in the Site-Wide Groundwater Monitoring Program, generally exhibit more than solitary spatially isolated detects, and were presented on chemical extent maps in the Groundwater RI Report (MWH 2009) that were based on a comprehensive site-wide evaluation of their extent in groundwater.

Maps of impacted groundwater were presented in the draft groundwater RFI report for chemicals that exceeded screening values at five or more locations between the third quarter 2007 and the second quarter 2008, and chemicals that exceeded screening values at five or more locations historically (through second quarter 2008), but for which there is little or no recent data. Chemicals with concentrations historically exceeding screening values at five or more locations but having adequate sampling coverage in recent data to indicate the chemical is no longer present at concentrations above the screening value (e.g., 1,1,1-trichloroethane, chloroform, and benzene) were not included. Chemicals that are common laboratory contaminants (e.g., methylene chloride and bis (2-ethylhexyl) phthalate) and those that are naturally occurring and for which there is no known site-related anthropogenic source (e.g., sulfate) were also not included, even if they had concentrations exceeding screening values at five or more locations.

The chemical extent maps in the draft groundwater RFI report were developed based on a comprehensive site-wide evaluation of the historical groundwater data, and serve as a baseline from which to evaluate whether the more recent monitoring results differently constrain the chemical

extent boundaries. These chemicals generally have more than solitary spatially isolated detects where their spatial distribution warrants preparation of a plume map.

The 2014 analytical results were evaluated to identify any additional chemicals for which a chemical extent map was warranted according to the criteria used in the Groundwater RI Report. No additional chemicals were identified for generation of a chemical extent map.

Areas of impacted groundwater from the groundwater RFI report form the basis of those shown in the chemical extent maps in this report. Adjustments to the areas of impacted groundwater are made each year as new data are collected. The chemical extent boundaries for each chemical are defined by the groundwater screening reference values listed in Table 9. The maximum concentrations at each location from samples collected in 2014 are posted for each chemical and the locations are color-coded to indicate whether the result exceeded the screening value, was detected below the screening value, or was not detected. For locations that were not sampled in 2014, the most recent historical result is posted along with the date the sample was collected.

Isoconcentration lines equal to screening values for selected chemicals in groundwater are depicted in Figures 7 through 20 and are based on both current and historical sampling results as well as professional judgment, particularly for chemicals that are transformation or daughter products from either the biological or abiotic decay of a parent (e.g., *cis*-1,2-dichloroethene [*cis*-1,2-DCE] produced from the biological transformation of TCE. The screening-value isoconcentration lines represent the interpreted map-view extent of impacted groundwater based on all available data, not just the most recent reporting period.

The areas of impacted groundwater for each of the chemicals plotted have been adjusted based on the 2014 results as follows:

### *Trichloroethene (Figure 7)*

- The 'Former Sodium Disposal Facility/Empire State Atomic Development Authority (FSDF/ESADA)' area of impacted groundwater has been separated from the 'Building 4100/Building 4056 Landfill' area of impacted groundwater. TCE concentrations detected above the TCE screening level include wells RD-21 (140 micrograms per liter (µg/L), RD-23 (160 µg/L), RD-64 (45 µg/L), and RD-65 (68 µg/L). The 'FSDF/ESADA' area of impacted groundwater represents recent well data, groundwater flow paths, and geologic structures/morphology.

- The 'Building 4100/Building 4056 Landfill' area of impacted groundwater includes RD-07 and RD-91. TCE was reported in RD-07 and RD-91 above its screening level in the 2014 samples. TCE was reported in RD-07 at an estimated concentration (J) of 52 J and 57 µg/L in 2013 and 2014, respectively. RD-91 was last sampled for TCE in May 2009 and was reported at a concentration of 270 µg/L. In 2014, TCE concentration was reported in RD-91 at 200 µg/L.

- The 'DOE LF3' area of impacted groundwater includes PZ-104 and PZ-105. This plume has been separated from the western wing of the 'Central' area of the impacted groundwater.

### *Tetrachloroethene (Figure 8)*

No adjustments to the areas of impacted groundwater for tetrachloroethene (PCE) were required based on 2014 results.

### *cis-1,2-Dichloroethene (Figure 9)*

- The HMSA RFI Site plume was extended on the west because the PZ-120 exceeded the *cis*-1,2-DCE screening value of 6 µg/L.
- The 'FSDF/ESADA' area of impacted groundwater was reduced due to concentrations below the screening value for *cis*-1,2-DCE in monitoring wells RD-21 (1.7 µg/L) and RD-65 (3.7 µg/L). *Cis*-1,2-DCE was reported in RD-23 and RD-64 at a concentration of 55 and 120 µg/L, respectively.

### *trans-1,2-Dichloroethene (Figure 10)*

No adjustments to the areas of impacted groundwater for *trans*-1,2-dichloroethene (*trans*-1,2-DCE) were required based on 2014 results.

### *Vinyl Chloride (Figure 11)*

No adjustments to the areas of impacted groundwater for vinyl chloride (VC) were required based on 2014 results.

### *1,1-Dichloroethene (Figure 12)*

- The impacted groundwater area located between SNAP, DOE LF2, and RMHF area was reduced on the west due to decreased concentrations of 1,1-dichloroethene (1,1-DCE) at RD-88 to levels below the screening value.

### *1,2-Dichloroethane (Figure 13)*

No adjustments to the areas of impacted groundwater for 1,2-dichloroethane (1,2-DCA) were required based on 2014 results.

### *1,1-Dichloroethane (Figure 14)*

No adjustments to the areas of impacted groundwater for 1,1-dichloroethane (1,1-DCA) were required based on 2014 results.

### *1,4-Dioxane (Figure 15)*

The screening value for 1,4-dioxane has been lowered from 3 µg/L to 1 µg/L since the draft groundwater RFI report (MWH 2009) was prepared. Delineated areas of groundwater impacted by 1,4-dioxane in the draft groundwater RFI report used the old screening value, whereas the adjusted chemical extent boundaries in the 2010, 2011, 2012, 2013, and current Annual Reports (MWH 2011a, 2012, 2013) use the new screening value.

- The 'FSDF/ESADA' area of impacted groundwater was reduced due to concentrations below the screening value for 1,4-dioxane in monitoring wells RD-65 (0.46 µg/L). 1,4-dioxane was reported in R6-64 at a concentration of 2.1 µg/L in 2013 and 1.8 µg/L in 2014.

### *Carbon Tetrachloride (Figure 16)*

No adjustments to the areas of impacted groundwater for carbon tetrachloride were required based on 2014 results.

### *1,2,3-Trichloropropane*

There are no areas in Area IV with 1,2,3-trichloropropane (1,2,3-TCP) impacted groundwater.

*Formaldehyde*

Areas of impacted groundwater for formaldehyde are not present in Area IV.

*Total Petroleum Hydrocarbons C4-C30 (Figure 17)*

- The area of impacted groundwater in the vicinity of the 'FSDF/ESADA' RFI Sites was decreased to the south due 2014 results being below screening value for RD-65 (<100 µg/L for TPH C12-C30 and < 100 mg/L for TPH C4-C12).
- The area of impacted groundwater in the vicinity of the B065 Landfill RFI Site was removed due to decreased concentrations of TPH below the screening value in RD-20, RD-29, and RD-96 (<10, 27 J, and <100 µg/L).
- A new area of impacted groundwater in the vicinity of the DOE LF3 RFI Site was added due to exceedance of the screening value for TPH at PZ-105 at concentration of 190 J µg/L (C8-C30). PZ-105 was last sampled in 2009 and TPH was <88 µg/L (C8-C30).

*N-Nitrosodimethylamine*

There are no areas of impacted groundwater for n-nitrosodimethylamine (NDMA) located in Area IV.

*Perchlorate (Figure 18)*

No adjustments to the areas of impacted groundwater for perchlorate were required based on 2014 results.

*Nitrate as $NO_3$ (Figure 19)*

The 'B100 Trench' area of impacted groundwater was removed due to decreased concentrations of nitrate at RD-91 to levels below the screening value [45 milligrams per liter (mg/L)]. Prior to this recent result, RD-91 was last sampled for nitrate in April 2004 and was detected above the screening value at a concentration of 47 mg/L.

*Fluoride*

The area in the vicinity and south of the SNAP area of impacted groundwater was removed due to decreased concentration of fluoride to a level below the screening value (0.8 mg/L) at PZ-109. In PZ-109, fluoride was detected above the screening value in 2008 and 2009. In 2014, fluoride was detected at 0.42 mg/L in PZ-109. Fluoride was not detected above the screening value in any Area IV well. Since fluoride was not detected above the screening value in Area IV, a fluoride figure is not required or developed for the annual report.

### 4.2.4 Analytical Results

During the 2014 reporting period, analytes in groundwater samples collected at the SSFL were not detected or were detected at concentrations consistent with historical concentrations, with exceptions identified in Tables 10 and 11. These exceptions generally lie within the following categories:

- First-time detection and first-time analysis; results of analyses performed for the first time are indicated by an asterisk in Table 10.
- First-time detection near the method detection limit (MDL) or MDA and: 1) only a recent sampling history (small total number of analyses for that constituent); 2) the constituent is a common field or laboratory contaminant; or 3) the constituent is a naturally-occurring compound.

- First-time detection and lower MDL or MDA compared to historical results.
- First-time detection at a well in an area of impacted groundwater, and the constituent is a daughter product of another constituent known to be present at that location, or is otherwise consistent with other compounds previously detected at that location.
- First-time detection or new maximum concentration is consistent with data from other nearby wells.
- New maximum concentration only slightly exceeds previous maximum, and a clear increasing trend is not apparent.
- The particular hydrocarbon chain reporting range for a first-time or new TPH detection varies from the hydrocarbon chain reporting range of previous TPH analyses.
- Detection not repeatable in consecutive sampling events, or not consistent between primary, duplicate, and split sample results.
- Combinations of the above.

The few cases for which there are insufficient historical data to provide further context for the recent results, or that otherwise warrant further discussion, are presented below, with on-site detections (excluding radiochemical constituents) discussed in Section 4.2.4.1. Off-site detections (excluding radiochemical constituents) are discussed in Section 4.2.4.2. Radiochemistry results are discussed in Section 4.2.5. Follow-up discussion of 2013 results highlighted in the 2013 annual report (MWH 2014) discussed in Section 4.2.6.

#### 4.2.4.1 On-Site Detects

Constituent concentrations (except for radiochemical constituents that are discussed separately in Section 4.2.5) detected in groundwater samples collected from on-site wells in 2014 that were inconsistent with historical data fell within the categories listed in Section 4.2.4 and were unremarkable, with the following exceptions:

- Cadmium (dissolved) was reported for the first time at monitoring well PZ-109 in the first quarter 2014 at a concentration of 0.017 mg/L, which is above the SSFL Comparison groundwater screening reference value of 0.0002 mg/L. PZ-109 was sampled in first quarter 2014 in support of DOE Area IV Data Gap Evaluation, and is not monitored under the current site-wide groundwater monitoring program.
- *Cis*-1,2-DCE was reported at a new maximum estimated concentration of 14 J µg/L at monitoring well PZ-120 in the first quarter 2014 and above the California MCL of 6 µg/L. *Cis*-1,2-DCE was last reported in 2013 at a concentration of 4.9 µg/L in PZ-120. PZ-120 was sampled in first quarter 2014 in support of DOE Area IV Data Gap Evaluation, and is not monitored under the current site-wide groundwater monitoring program.
- Cobalt (dissolved) was reported for the first time at well cluster SP-T02A, SP-T02B, SP-T02C, and SP-T02D at concentrations of 0.007, 0.0098, 0.016, and 0.016 mg/L, respectively. The SSFL Comparison groundwater screening reference value for cobalt is 0.0019 mg/L. The SP-T02 seep cluster wells were sampled as part of the seep monitoring program, and are not monitored under the current site-wide groundwater monitoring program.

- Gasoline range organics (GRO) were reported for the first time at monitoring well RD-23 (FLUTe port 3) in the first quarter 2014 at an estimated concentration of 86 J µg/L for C6-C12 range, which is above the Taste/Odor Threshold of 0.005 µg/L. RD-23 was sampled in first quarter 2014 in support of DOE Area IV Data Gap Evaluation, and is not monitored under the site-wide groundwater monitoring program. Water level monitoring is performed at RD-23 as part of the site-wide groundwater monitoring program.

- Nitrate-$NO_3$ was detected for the first time at monitoring well RD-93 in the first quarter 2014 at an estimated concentration of 44 J mg/L, which is below the California MCL of 45 mg/L. RD-93 was sampled in first quarter 2014 in support of DOE Area IV Data Gap Evaluation, and is not part of the site-wide groundwater monitoring program. Water level monitoring is performed at RD-93 as part of the site-wide groundwater monitoring program.

- Toluene was detected at seep cluster wells SP-T02A, SP-T02B, and SP-TO2C in first quarter 2014 at estimated concentrations of 0.75 J, 0.35 J, and 0.44 J µg/L, respectively. These concentrations are all below the California MCL of 150 µg/L. These were the only detections of volatile organic compounds (VOCs) in what are the first available validated VOC analysis results at these wells. These seep cluster wells are located in the northwestern undeveloped land near well RD-94. The SP-T02 seep cluster wells are not associated with a natural seep, but their construction and installation methodology are identical to other seep cluster wells at SSFL. Low-level toluene detections have been common among the seep cluster wells installed to date, and the toluene is thought to be sourced from one of the well installation or construction materials, though such source has not yet been specifically identified.

- TCE was detected at a new estimated maximum concentration of 90 J µg/L at monitoring well PZ-120 in the first quarter 2014 and above the Primary MCL of 5 µg/L. TCE was previously analyzed at PZ-120 nine times and detected at concentrations ranging from 5 to 53 µg/L. PZ-120 was sampled in first quarter 2014 in support of DOE Area IV Data Gap Evaluation, and is not monitored under the site-wide groundwater monitoring programs.

#### 4.2.4.2 Off-Site Detections

Constituent concentrations (except for radiochemical constituents discussed in Section 4.2.5) detected in groundwater samples collected from off-site wells in 2014 that were inconsistent with historical data fell within the categories listed in Section 4.2.4 and were unremarkable, or are discussed in more detail below:

- Cobalt (dissolved) was detected for the first time at seep cluster well SP-900B and SP-900C at concentrations of 0.013 and 0.12 mg/L, respectively. The SSFL Comparison groundwater screening reference value for cobalt is 0.0019 mg/L. The SP-900 seep cluster wells were sampled in first quarter 2014 in support of DOE Area IV Data Gap Evaluation, and are not monitored under the site-wide groundwater monitoring programs.

- Toluene was detected at seep cluster well SP-900C in first quarter 2014 at an estimated concentration of 0.25 J, µg/L and below the California MCL of 150 µg/L. This was the only detection of VOCs in what are the first available validated VOC analysis results at this well. SP-900C is located off-site near the northwestern portion of Area IV. Low-level toluene detections have been common among the seep cluster wells installed to date, and the toluene is thought to be sourced from one of the well installation or construction materials, though such source has not yet been specifically identified. The SP-900 seep cluster wells were sampled in

first quarter 2014 in support of DOE Area IV Data Gap Evaluation, and are not monitored under the site-wide groundwater monitoring programs.

### 4.2.5 Radiochemistry Results

Radiochemistry analyses were performed for samples collected during the 2014 reporting period under the Site-Wide Program and Area IV Data Gap Evaluation sampling. Radiochemistry analysis results for 2014 are presented in Table 16, and discussed further below.

Beginning in third quarter 2010, radiochemistry analyses (except for tritium) of Site-Wide Program and other groundwater samples were performed using a new approach described in EPA's Area IV Radiochemistry Study QAPP (HGL 2010). In short, this approach involves filtering at the laboratory followed by separate analysis of the liquid filtrate and the solid residue captured by the filter. Each of the results has its own associated error and MDA. This approach was incorporated into the 2010 Site-Wide WQSAP (Haley & Aldrich 2010c).

Radiochemistry constituents detected for the first time in groundwater at individual locations are presented in Table 10 and constituents previously detected in groundwater at a particular location but reported at a new maximum concentration are presented in Table 11. Because of the limited history of particulate results, a particulate detection was considered new if the constituent was never detected in historical particulate, dissolved or total results, and was considered a new maximum if the constituent was detected at a higher activity than the previous maximum activity reported in historical particulate, dissolved, or total results. Comparison of radiochemistry results using the new approach (with separate analysis of liquid filtrate [dissolved] and solid residue [particulate]) to historical results may not be representative, especially for the particulate results. Any new detections or new maximums discussed below may be due, at least in part, to the change in sample preparation and analysis methodology first implemented in third quarter 2010, or to the comparison with historical data using other methods.

Radiochemical constituent activity levels detected in groundwater samples in 2014 that were inconsistent with historical data fell within the categories listed in Section 4.2.4 and were unremarkable, or are discussed in more detail below:

- Dissolved gross alpha was reported at a new maximum in on-site groundwater monitoring well RD-96 in first quarter 2014 at a value of 17 ± 2.6 picoCuries per liter (pCi/L), which is above the Primary MCL of 15 pCi/L. Particulate gross alpha was not detected at RD-96. Adjusted dissolved gross alpha activity (adjusted for naturally occurring uranium) was less than zero pCi/L indicating the dissolved gross alpha result is associated with naturally occurring uranium, the presence of which is consistent with other results throughout SSFL. RD-96 is scheduled for annual Site-Wide Program sampling for gross beta activity, and continued sampling and analysis will provide further context for this result.
- Uranium (U) isotopes were reported for the first time at monitoring well PZ-105 in first quarter 2014 at activities estimated at 10 ± 2.3 pCi/L with an MDA of 0.36 pCi/L for dissolved U and 0.29 J ± 0.21 pCi/L with an MDA of 0.21 pCi/L for particulate U. Dissolved U was not reported above the California MCL of 20 pCi/L. The particulate result is from a solid sample from the filter paper and is not representative of water quality. The particulate result was J-flagged by data validators due to a high recovery U-232 tracers; thus the results for primary sample should be considered to be biased high. PZ-105 was sampled in first quarter 2014 in support of DOE

Area IV Data Gap Evaluation, and is not monitored under the site-wide groundwater monitoring programs.

- Strontium-90 (Sr-90) was reported for the first time at monitoring well RS-28 in first quarter 2014 at estimated activity of 2.5 ± 0.47 pCi/L with an MDA of 0.75 pCi/L for dissolved Sr-90 and 13 ± 0.77 pCi/L with an MDA of 0.78 pCi/L for particulate Sr-90. Dissolved Sr-90 was not detected above the primary MCL of 8 pCi/L. This well had been welded shut by Boeing in 2008 and had not been sampled since then. The particulate result is from a solid sample from the filter paper and is not representative of water quality.

One new figure has been developed for this Area IV annual report. The extent of tritium in groundwater is presented in Figure 20.

### 4.2.6 2013 Results Follow-up

This section evaluates whether or not sampling and analyses performed during the current year is sufficient to resolve documented follow-up sampling issues from the previous annual report, and assesses the need for changes to the groundwater monitoring programs.

#### 4.2.6.1 2013 On-Site Detects

There were no on-site results highlighted in the 2013 annual report (MWH 2014) requiring follow-up in Area IV. Revisions to the Site-Wide Monitoring Program are discussed in Section 5.

#### 4.2.6.2 2013 Off-site Detects

There were no off-site results highlighted in the 2013 annual report (MWH 2014) requiring follow-up in Area IV. Revisions to the Site-Wide Monitoring Program are discussed in Section 5.

#### 4.2.6.3 2013 Radiochemistry Results

There were no radiochemistry results highlighted in the 2013 annual report (MWH 2014) requiring follow-up in Area IV. Revisions to the Site-Wide Monitoring Program are discussed in Section 5.

# Section 5
# 2015 Planned Activities

The next sampling event will occur during the first quarter 2015. The monitoring frequency for the Site-Wide Program will be quarterly for water level monitoring and annual for sampling and analysis, with sampling performed in the first calendar quarter.

Silica gel cleanup (SGC) will continue to be included in the sample preparation procedures for groundwater samples undergoing TPH analysis for diesel-range organics (DRO) or kerosene-range organics (KRO).

Data collected under the Site-Wide Program included in this report indicate that the program is not providing effective monitoring of groundwater conditions at Area IV. Key wells identified during the Data Gap Analysis have not been sampled recently, but are proposed for sampling in 2015. It has been recognized that additional characterization near the RMHF leachfield is warranted. In the Draft RFI Groundwater Work Plan, Area IV (CDM Smith 2015) a candidate well has been proposed to define the lateral extent of Sr-90 and TCE from the leach field and groundwater flow direction. The proposed candidate well location is shown on Figure 5.

In addition to collecting Site-Wide Program data, groundwater was collected from Area IV wells under the Area IV Data Gap Evaluation. The combination of the site-wide and data gap groundwater data collected in 2014 have been used to update the current groundwater site conditions within Area IV. Not all wells scheduled for sampling in 2014 were sampled, in most cases because of lack of water available for sampling in Area IV wells. As a result, the current groundwater condition could not be determined and the historic data must be used to represent the extent of COCs in groundwater.

Follow-up groundwater sampling work is discussed below.

## 5.1 Outstanding Issues and/or Follow-Up Work

Low-flow retrofitting of site-wide wells was completed in 2011, with the exception of site-wide well RD-34B due to a partial obstruction in the well present at about 167 feet below the top of the casing. Following multiple attempts to remove the obstruction, a recommendation to remove the well from the Site-Wide Monitoring Program was advanced (Boeing 2011). Resolution of the issue is pending DTSC response.

Groundwater data collected in 2014 was used to develop the Draft RFI Groundwater Work Plan, Area IV (CDM Smith 2015). In the draft work plan, water quality sampling analysis plan update recommendations were presented. While this plan is being reviewed by DTSC, Table 18 presents DOE's proposed groundwater sampling for 2015 in Area IV. The table includes Site-Wide Monitoring Program wells as well as DOE data gap wells. Current drought conditions existing at the site have been considered in development of this list.

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# Section 6
# References


Boeing. 2011. RD-34B. E-mail from Michael O. Bower (The Boeing Company) to Mr. Tom Seckington, Department of Toxic Substances Control. November 5.

CDM Smith, 2014a. SSFL Area IV Characterization Status Meeting, DOE, DTSC, CDM; February 19.

CDM Smith, 2014b. DTSC GW Meeting, DOE, DTSC, CDM; March 20.

CDM Smith. 2015. Draft RCRA Facility Investigation (RFI) Groundwater Work Plan, Area IV, Santa Susana Field Laboratory, Ventura County, California, January.

DPH (California Department of Public Health). 2006. "Article 16. Secondary Drinking Water Standards." http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Recentlyadoptedregulations/R-2103-finalregtext.pdf, updated May 2.

DPH. 2008. "Maximum Contaminant Levels and Regulatory Dates for Drinking Water, U.S. EPA vs California." http://www.cdph.ca.gov/certlic/drinkingwater/Documents/DWdocuments/EPAandCDPH-1128-2008.pdf. Updated November.

DPH. 2010. "Drinking Water Notification Levels and Response Levels: An Overview." http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Notificationlevels/NotificationLevels.pdf . Updated December 14.

DTSC. 2007. Consent Order for Corrective Action, Docket No. P3-07/08-003, In the Matter of Santa Susana Field Laboratory, Simi Hills, Ventura County, California. August.

DTSC. 2011. Approval of the Site-Wide Water Quality Sampling and Analysis Plan. Letter to Michael Bower, The Boeing Company. June 6.

Federal Register. 2000. "Environmental Protection Agency, 40 CFR Parts 141, and 142, National Primary Drinking Water Regulations; Radionuclides; Proposed Rule." Federal Register Volume 65, Number 78, pp 21605 – 21614, Table II-3. April 21.

GWRC (Groundwater Resources Consultants, Inc.). 2000. Annual Groundwater Monitoring Report. Santa Susana Field Laboratory, 1999, Boeing North American, Inc., Rocketdyne Propulsion & Power, Ventura County, California. February 28.

Haley & Aldrich. 2001. Report on Annual Groundwater Monitoring, 2000. Susana Field Laboratory, Simi Hills, Ventura County, California. February 28.

Haley & Aldrich. 2002a. Report on Annual Groundwater Monitoring, 2000. Susana Field Laboratory, Simi Hills, Ventura County, California. February 28.

Haley & Aldrich. 2002b. Report on Appendix IX Groundwater Monitoring, 2001, Santa Susana Field Laboratory, Ventura County, California. 22 March 2002.

Haley & Aldrich. 2003a. Report on Annual Groundwater Monitoring, 2002, Santa Susana Field Laboratory, Ventura County, California. 28 February 2003.

Haley & Aldrich. 2003b. Addendum to Report on Annual Groundwater Monitoring, 2002, Santa Susana Field Laboratory, Ventura County, California. 4 March 2003.

Haley & Aldrich. 2004. Report on Annual Groundwater Monitoring, 2003, Santa Susana Field Laboratory, Ventura County, California. 27 February 2004.

Haley & Aldrich. 2005. Report on Annual Groundwater Monitoring, 2004, Santa Susana Field Laboratory, Ventura County, California. 28 February 2005.

Haley & Aldrich. 2006. Report on Annual Groundwater Monitoring, 2005, Santa Susana Field Laboratory, Ventura County, California. 28 February 2006.

Haley & Aldrich. 2007. Report on Annual Groundwater Monitoring, 2006, Santa Susana Field Laboratory, Ventura County, California. 28 February 2007.

Haley & Aldrich. 2008. Report on Annual Groundwater Monitoring, 2007, Santa Susana Field Laboratory, Ventura County, California. 28 February 2008.

Haley & Aldrich. 2009a. Report on Annual Groundwater Monitoring, 2008, Santa Susana Field Laboratory, Ventura County, California. 28 February 2009.

Haley & Aldrich. 2009b. Draft Site-Wide Water Quality Sampling and Analysis Plan, Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Revision 1, File No. 20080/M489. December.

Haley & Aldrich. 2010a. Report on Annual Groundwater Monitoring, 2009. Susana Field Laboratory, Simi Hills, Ventura County, California. February 26.

Haley & Aldrich. 2010b. Regulated Unit Water Quality Sampling and Analysis Plan, Areas I and III, Post-Closure Permit PC-94/95-3-02, Santa Susana Field Laboratory, Ventura County, California, April 2010.

Haley & Aldrich. 2010c. Site-Wide Water Quality Sampling and Analysis Plan, Revision 1, Santa Susana Field Laboratory, Ventura County, California. December.

Haley & Aldrich. 2011. Site-Wide Low-Flow Implementation Summary, Santa Susana Field Laboratory, Ventura County, California. December.

HGL (HydroGeoLogic, Inc.). 2010. Quality Assurance Project Plan for Groundwater, Surface Water, and Sediment, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California, Prepared for U.S. Environmental Protection Agency Region 9, EPA AES Contract Number EP-S7-05-05, Task Order Number 0038, August 11

Montgomery Watson. 2000. Conceptual Site Model, Movement of TCE in the Chatsworth Formation, 2000.

MWH. 2003. Susana Field Laboratory, Near-Surface Groundwater Characterization Report, Santa Susana Field Laboratory, Ventura County, California. November.

MWH. 2009. Draft Site-Wide Groundwater Remedial Investigation Report, Santa Susana Field Laboratory, Ventura County, California, December.

MWH. 2010. Health and Safety Plan, Revision 4, RCRA Corrective Action Program Activities, Santa Susana Field Laboratory, Ventura County, California. April.

MWH. 2011a. Report on Annual Groundwater Monitoring, 2010, Santa Susana Field Laboratory, Ventura County, California. March.

MWH. 2011b. Addendum to Report on Annual Groundwater Monitoring, 2010, Santa Susana Field Laboratory, Ventura County, California. April.

MWH. 2012. Report on Annual Groundwater Monitoring, 2011, Santa Susana Field Laboratory, Ventura County, California. February.

MWH. 2013. Report on Annual Groundwater Monitoring, 2012, Santa Susana Field Laboratory, Ventura County, California. February.

MWH. 2014. Report on Annual Groundwater Monitoring, 2013, Santa Susana Field Laboratory, Ventura County, California. January.

RWQCB (Regional Water Quality Control Board). Central Valley Region, 2008. A Compilation of Water Quality Goals, prepared by Jon D. Marshack, D.Env. July.

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# Appendix A

# Monitoring Well and Piezometer Construction Data

(Provided electronically on disc)

Table A-1 Well Construction Data

Table A-2(A, B) Construction Details of Piezometer Monitoring System

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# Appendix B

# Precipitation Data

(Provided electronically on disc)

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# Appendix C

# Water Level Hydrographs

(Provided electronically on disc)

**List of Hydrographs**

**FSDF/ESADA**
RD-21
RS-54

**B4100 Trench**
RD-20

**Bldg 56 Landfill**
RD-07

**B4057/59/626**
PZ-109

**HMSA/PDU**
PZ-120
RD-29

**Tritium Plume**
RD-90
RD-95

**RMHF**
RD-30
RD-63

**OCY**
RD-14

**Bldg 65 Metals Clarifier**
PZ-104
PZ-105

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# Appendix D

# Time Series Plots of Analytical Data

(Provided electronically on disc)

Time series plots for trichloroethene (TCE), perchlorate, and tritium are presented in this Appendix. Only primary sample results for the following wells are presented in the plots.

**TCE**

| FSDF/ESADA | Bldg 56 Landfill | B4057/59/626 |
|---|---|---|
| RD-21 | RD-07 | PZ-109 |
| RD-23 | | |
| RD-33A | | |
| RD-54A | | |
| RD-54B | | |
| RD-54C | | |
| RD-64 | | |
| RD-65 | | |
| RS-18 | | |
| RS-54 | | |

| RMHF | HMSA/PDU | OCY |
|---|---|---|
| RD-30 | PZ-108 | RD-14 |
| RD-34A | PZ-120 | |
| RD-34B | | |
| RD-63 | | |
| RD-98 | | |
| RS-28 | | |

| Bldg 65 Metals Clarifier | Southeast Drum Storage |
|---|---|
| PZ-005 | PZ-051 |
| PZ-104 | PZ-052 |
| PZ-105 | |

| Pond Dredge Area | Bldg 4100/4009 |
|---|---|
| RD-13 | RD-91 |

**Perchlorate**

FSDF/ESADA
RD-21
RD-54A
RS-18
RS-54

**Tritium Plume**
RD-34A
RD-88
RD-90
RD-93
RD-94
RD-95

# Appendix E

# Laboratory Analytical Reports

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# Appendix F

# Quality Assurance Assessment

(Provided electronically on disc)

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