Comprehensive Final Report

2011 SITEWIDE FIVE-YEAR REVIEW REPORT

Motorola 52nd Street Superfund Site
Phoenix, Arizona

Prepared by:

Arizona Department of Environmental Quality

U.S. Environmental Protection Agency

URS Corporation

Task Assignment No. EV10-0074
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REPORT CERTIFICATION AND APPROVALS

2011 SITEWIDE FIVE-YEAR REVIEW
Motorola 52nd Street Superfund Site
Phoenix, Arizona

September 30, 2011

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ACC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
AOC	Administrative Order on Consent
APS	Arizona Public Service
ARAR	Applicable or Relevant and Appropriate Requirement
ARS	Arizona Revised Statutes
AS	air sparge
ASRAC	Arizona Superfund Response Action Contract
ATP	Acid Treatment Plant
ATSDR	Agency for Toxic Substance and Disease Registry
bgs	below ground surface
BSVE	Biologically-Enhanced Soil Vapor Extraction
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAG	Community Advisory Group
CIG	Community Informational Group
CIP	Community Involvement Plan
CO	Consent Order
COC	chemical of concern
COP	City of Phoenix
COS	City of Scottsdale
CRA	Conestoga-Rovers & Associates
D	Deep Zone
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense non-aqueous phase liquid
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
EW	East Washington
FLUTe	Flexible Liner Underground Technologies
Freescale	Freescale Semiconductor, Inc.
FRI	Focused Remedial Investigation
FS	Feasibility Study
ft	feet
GAC	granular activated carbon
GES	Groundwater Extraction System
GPI	Gutierrez-Palmenberg, Inc.

gpm	gallons per minute
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HHSLs	human health screening levels
Honeywell	Honeywell International
HP	horsepower
HSU	Hydrostratiographic Unit
IGWTP	Integrated Groundwater Treatment Plant
LAU	Lower Alluvial Unit
lb	pound
LNAPL	light non-aqueous phase liquid
LOD	Letter of Determination
LUST	leaking underground storage tank
M	Intermediate Zone
MAU	Middle Alluvial Unit
MCL	Maximum Contaminant Level
µg/L	micrograms per liter
mg/L	milligrams per liter
Motorola	Motorola, Inc.
NCP	National Contingency Plan
NFA	No Further Action
NPL	National Priorities List
O&M	operation and maintenance
OCC	Old Crosscut Canal
OU	operable unit
PCE	tetrachloroethene
PNI	Phoenix Newspaper, Inc.
PQGWWP	Poor Quality Groundwater Withdraw Permit
PRC	Phoenix Revitalization Corporation
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
PTP	Pilot Treatment Plant
PVC	polyvinyl chloride
RAA	Remedial Alternatives Analysis
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RI	Remedial Investigation
RO/DI	reverse osmosis/deionized water
ROD	Record of Decision
RP	Responsible Party
RSL	Regional Screening Level

S	Shallow Zone
SGHHSLs	Soil Gas Human Health Screening Levels
Shaw	Shaw Environmental Inc.
Site	Motorola 52nd Street Superfund Site
SRLs	Soil Remediation Levels
SRP	Salt River Project
SVE	soil vapor extraction
SWPL	Southwest Parking Lot
TAG	Technical Assistance Grant
TBC	To Be Considered
TCA	trichloroethane
TCE	trichloroethene
TCZ	Target Capture Zone
TDS	total dissolved solids
TI	Technical Impracticability
TTO	Total Toxic Organics
UAO	Unilateral Administrative Order
UAU	Upper Alluvial Unit
UPRR	Union Pacific Railroad
URS	URS Corporation
UST	underground storage tank
UV	ultraviolet
VC	vinyl chloride
VI	vapor intrusion
VOC	volatile organic compound
WQARF	Water Quality Assurance Revolving Fund
WSRV	West Salt River Valley

EXECUTIVE SUMMARY

The OU1 and OU2 interim remedies implemented at the Motorola 52nd Street Superfund Site (the Site) in Phoenix, Arizona both include groundwater extraction and treatment facilities designed to capture volatile organic compound (VOC) contamination within their respective boundaries while a final remedy addressing the aquifer at the Site is developed. The OU1 interim remedy also includes a soil clean up component implemented at the former Motorola 52nd Street Facility.

Operable Unit 1

Status of Interim Remedial Actions. During the current Five-Year Review Period (August 2006 through October 2010), the following activities were conducted in OU1:

- Extraction of groundwater from source areas located at the former Motorola 52nd Street Facility and a well extraction network located at the Old Crosscut Canal (OCC), treatment of extracted groundwater at the Integrated Groundwater Treatment Plant (IGWTP), and use of the treated groundwater by ON Semiconductor, Inc. (the current operator of the former Motorola 52nd Street Facility). Approximately 533 million gallons of groundwater containing approximately 3,211 pounds as trichloroethylene (TCE) of VOCs were processed.

- Expansion of the well monitoring network.

- Initiation of the Bedrock Extraction Pilot Study to evaluate long-term extraction of groundwater from impacted bedrock underlying the former Motorola 52nd Street Facility.

- Agreement between the United States Environmental Protection Agency (EPA) and Freescale Semiconductor, Inc. (which is currently responsible for addressing Site contamination on Motorola's behalf) to conduct an assessment of the vapor intrusion to indoor air pathway of VOC contamination within the boundaries of OU1.

- Evaluation of alternative end uses for OU1 treated groundwater (the current end user, ON Semiconductor, intends to suspend manufacturing operations and will have no use for the water).

Groundwater monitoring data collected during the review period from OU1 indicate that the OCC extraction network is effectively decreasing TCE concentrations in the vicinity of the groundwater extraction wells and in the alluvial groundwater plume west of the OCC. These results support the conclusion that the extent of the contaminant plume is likely contracting

downgradient of the extraction system and the migration of contamination into OU2 is being mitigated.

Issues Raised During the Five-Year Review. On the basis of data reviewed, inspections of Site groundwater treatment facilities, and interviews conducted with project stakeholders, the OU1 interim groundwater remedy appears to be achieving the primary goal of the remedial action (as defined by applicable decision documents) which is containment of VOC-contaminated groundwater in the alluvial aquifer. However, the review did indicate a number of outstanding interim remedy issues and noted concerns. These include:

- In OU1, one component of the interim remedy that is not assessed as being complete is the soil cleanup activities conducted at the Courtyard/50th Street area. Further, no soil cleanup or soil gas investigation of the Acid Treatment Plant (ATP) area has been conducted to date. The status of these required components of the Letter of Determination (LOD) and Record of Decision (ROD) raises uncertainty regarding the current protectiveness of the interim remedy.

- Although vapor intrusion (VI) is not specifically identified in either the OU1 LOD or the ROD, this potential contaminant pathway will need to be evaluated in both the Courtyard/50th Street and ATP areas to ensure that no risk associated with the VI to indoor air pathway exists. On November 15, 2002, Southwest Parking Lot (SWPL) soil cleanup activities achieved a determination of No Further Action from the Arizona Department of Environmental Quality (ADEQ) because data collected from the SWPL met treatment goals; however, updated data are needed to evaluate whether contaminant pathways such as VI to indoor air pose unacceptable risks in this region of the former 52nd Street Facility should current or future regular occupation of these areas/structures occur.

- Issues that may impact future protectiveness at OU1 include: (1) the presence of dense non-aqueous phase liquid (DNAPL) in bedrock at and near the former Motorola 52nd Street Facility that continues to serve as an ongoing source of groundwater contamination, (2) the phase-out of manufacturing operations at ON Semiconductor requiring a new end use for water treated at the IGWTP, (3) the continued lowering of the groundwater table which impacts groundwater extraction rates and renders the remedy less efficient with the potential to affect future containment, and (4) the age and condition of the IGWTP equipment and the high level of complexity required to maintain treatment effectiveness.

- Issues noted with the OU1 interim remedy that do not affect protectiveness include: (1) the introduction of uncertainty into capture zone analyses, and (2) an insufficient level of detail

presented in IGTWP reporting to promote a comprehensive evaluation of treatment system effectiveness and demonstrate compliance with regulatory requirements.

TABLE ES-1
ISSUES AND RECOMMENDATIONS - OU1 INTERIM REMEDY
2011 Site Wide Five-Year Review – Motorola 52nd Street Superfund Site

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Issue	Affects Protectiveness (Y/N) [b]	
			Current	Future
1	Issue 4	DNAPL present in bedrock at and near the former Motorola 52nd Street Facility continues to serve as an ongoing source of groundwater contamination upgradient of the OCC extraction system. Without addressing this issue, the required duration of OU1 Interim Remedy operation could suggest future remedy failure.	N	Y
2	Not Applicable	ON Semiconductor is phasing out manufacturing operations at the former Motorola 52nd Street Facility and requires that a new beneficial end-use for groundwater treated at the IGWTP be implemented. If a decision document modifying the end use in the ROD/LOD is not implemented by the time the facility ceases accepting the treated groundwater, the interim remedy will not function as intended by the ROD/LOD in the future.	N	Y
3	Not Applicable	Due in part to the ongoing lowering of the groundwater table, extracted groundwater rates have declined since initial OU implementation rendering the Interim Remedy less efficient than originally intended by decision documents. This decrease in efficiency has the potential to affect future remedy effectiveness, particularly with respect to groundwater plume containment.	N	Y
4	Issue 14, 15, and 17	The age and condition of IGWTP equipment, as well as the high level of operational complexity required to maintain effectiveness of the system, may lead to future operational issues and a decline in Operation and Maintenance adequacy. Specific potential concerns observed during the site inspection include: – Treatment of only 30 to 40% of the original design flow – Relatively high per unit cost for treatment – Non-functional sump controls for the pipeline double-containment system – Removal of two liquid-phase carbon units from service for treatment of scale and recycling of descaling/scale prevention solution in process operations – Signs of environmental exposure/weathering of equipment and process areas – Insufficient detail in maintenance documentation	N	Y
5	Issue 8 and 9	The soil vapor extraction operations identified in the ROD/LOD have ceased; the effectiveness of completed soil cleanup activities has not been adequately evaluated. No soil cleanup in the ATP area (as required by the ROD/LOD) has been conducted.	Y	Y

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Issue	Affects Protectiveness (Y/N) [b]	
			Current	Future
6	Issue 11	Given current developments in the evaluation of vapor intrusion to indoor air, the extent to which this potential contaminant pathway affects nearby residents and site workers during interim remedy implementation has not been adequately evaluated to date.	Y	Y

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Recommendations	Party Responsible	Oversight Agency	Milestone Date	Issue Affects Protectiveness (Y/N) [b]	
						Current	Future
1	Issue 4	Continue review and investigation of approaches to mitigate the impact of DNAPL present in bedrock at and near the former Motorola 52nd Street Facility.	Freescale	ADEQ	July 2013	N	Y
2	Not Applicable	Select a demonstrated beneficial end use for groundwater treated at the IGWTP and implement a decision document modifying the end use defined in the ROD/LOD.	Freescale	ADEQ	November 2014	N	Y
3	Not Applicable	Where increased groundwater extraction could potentially promote increased containment of contamination, take measures to increase groundwater extraction.	Freescale	ADEQ	December 2014	N	Y
4	Issue 14, 15, and 17	Conduct an engineering review of IGWTP operations to improve efficiency and better document operations. The review should focus on reducing operational complexity where appropriate, identifying where documentation could be more specific, and assessing the remaining service life of equipment, including process monitoring/controls.	Freescale	ADEQ	November 2014	N	Y
5	Issue 8 and 9	Conduct additional studies/investigations to demonstrate compliance of completed soil cleanup activities with appropriate remediation criteria (e.g., SRLs) and assess whether additional soil cleanup at the Motorola Facility areas is required. These activities may be conducted with planned work to evaluate soil gas and the VI to indoor air contaminant pathways at the former facility.	Freescale	ADEQ	December 2014	Y	Y

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Recommendations	Party Responsible	Oversight Agency	Milestone Date	Issue Affects Protectiveness (Y/N) [b]	
						Current	Future
6	Issue 11	Evaluate the VI to indoor air contaminant pathway in the residential neighborhood between the former Motorola 52nd Street Facility and the OCC. Conduct additional VI studies/investigations at the former facility.	Freescale	EPA	December 2014	Y	Y

Notes:

[a] For current issues that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-1 for a description of the issue and status summary.

[b] Protectiveness is assessed based on whether the remedy is functioning as intended by the ROD/LOD, whether the exposure assessment performed at the time of remedy selection is still valid, and whether there is any other information that could call into question the protectiveness of the remedy (i.e., result in unacceptable risks to potential receptors of contamination).

Assessment of OU1 Interim Remedy Protectiveness. A protectiveness determination of the interim remedy at Motorola 52nd Street Superfund Site OU1 cannot be made at this time until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation on the former Motorola facility. It is expected that this investigation will be completed no later than the next Five-Year Review. When the investigation is complete, a protectiveness determination will be made. This five year review also identified other issues that may affect long term protectiveness: the presence of DNAPL in the bedrock at the Motorola facility; the need for a new beneficial end-use for groundwater treated at the IGWTP; declining groundwater levels that may affect extraction rates; and the age and condition of IGWTP equipment that may lead to future operational issues.

A number of issues were identified during the Five-Year Review that may impact whether the OU1 interim remedy is protective in the long-term. To address issues with the potential to impact long-term protection, the following actions need to be taken:

- Continue review and investigation of approaches to mitigate the impact of DNAPL present in bedrock at and near the former Motorola 52nd Street Facility.

- Select a demonstrated beneficial end use for groundwater treated at the IGWTP and issue a decision document modifying the end use defined in the ROD/LOD.

- Where increased groundwater extraction could potentially promote increased containment of contamination, take measures to increase groundwater extraction.

- Conduct an engineering review of IGWTP operations to improve efficiency and better document operations.

Operable Unit 2

Status of Interim Remedial Actions. During the current Five-Year Review Period, the following activities were conducted in OU2:

- Extraction of groundwater from three wells located just west of Interstate 10, treatment of the extracted groundwater at the 20th Street Groundwater Treatment Facility, and discharge of treated groundwater to the Salt River Project Grand Canal. Approximately 3,690 million gallons of groundwater containing approximately 3,742 pounds of VOCs were processed.

– Expansion of the well monitoring network.

– Establishment of a mixing zone to evaluate the discharge to the Grand Canal of boron present in the extracted groundwater.

Groundwater monitoring data collected during the review period from OU2 indicate that the TCE plume width continues to decrease downgradient of the extraction system from north to south. The plume narrowing is observed in all three hydrostratiographic subunits of the OU2 area, with the deepest unit demonstrating the least change in TCE concentrations over time.

Issues Raised During the Five-Year Review. On the basis of data reviewed, inspections of Site groundwater treatment facilities, and interviews conducted with project stakeholders, the OU2 interim groundwater remedy appears to be achieving the primary goal of the remedial action (as defined by applicable decision documents) which is containment of VOC-contaminated groundwater in the alluvial aquifer. However, the review did indicate a number of outstanding interim remedy issues and noted concerns. These include:

– In OU2, future protectiveness may be impacted by a long-term issue with capture in an area southeast of the OU2 extraction system; there is contamination upgradient of this system that exceeds Arizona Aquifer Water Quality Standards and is expected to travel along a flow path outside the current limit of capture. The lack of a comprehensive framework for the assessment of the vapor intrusion to indoor air pathway in OU2 could also affect protectiveness if this pathway is complete.

– Issues noted with the OU2 interim remedy that do not affect protectiveness include: (1) the introduction of uncertainty into capture zone analyses, (2) a limited assessment in remedy reporting regarding whether concentrations of contaminated groundwater within the alluvial aquifer upgradient of the OU2 extraction system are decreasing, (3) treatment facility labeling.

TABLE ES-2
ISSUES AND RECOMMENDATIONS - OU2 INTERIM REMEDY
2011 Site Wide Five-Year Review – Motorola 52nd Street Superfund Site

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Issues	Affects Protectiveness (Y/N) [b]	
			Current	Future
1	Not Applicable	A possible long term issue with capture is indicated for an area southeast of the OU2 GES; in this region, there is contamination upgradient of the OU2 GES that exceeds the AWQS and is expected to travel along a flow path outside the limit of capture. Without action to address this issue, the interim remedy will likely fail to capture this contamination in the future.	N	Y
2	Issue 11	Given current developments in the evaluation of vapor intrusion to indoor air, the lack of a comprehensive framework for the assessment of the vapor intrusion to indoor air pathway in OU2 remains an issue.	Y	Y

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Recommendations	Party Responsible	Oversight Agency	Milestone Date	Issue Affects Protectiveness (Y/N) [b]	
						Current	Future
1	Not Applicable	Develop a work plan to address contamination southeast of the OU2 GES that has the potential to migrate west and outside the limit of capture in the future.	Freescale and Honeywell	ADEQ/EPA	June 2013	N	Y
2	Issue 11	Develop a comprehensive approach to evaluate the vapor intrusion to indoor air contaminant pathway for the OU2 area.	EPA	EPA	December 2014	Y	Y

Notes:

[a] For current issues that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-1 for a description of the issue and status summary.

[b] Protectiveness is assessed based on whether the remedy is functioning as intended by the ROD/LOD, whether the exposure assessment performed at the time of remedy selection is still valid, and whether there is any other information that could call into question the protectiveness of the remedy (i.e., result in unacceptable risks to potential receptors of contamination).

Assessment of OU2 Interim Remedy Protectiveness. A protectiveness determination of the interim remedy at Motorola 52nd Street Superfund Site OU2 can not be made at this time until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation within the OU2 area. It is expected that this investigation will be completed no later than the next Five-Year Review. When the investigation is complete, a protectiveness determination will be made. The interim remedy provides hydraulic containment across the width and depth of the VOC plume in groundwater near I-10. However, because of the potential for the plume to migrate west and outside the current capture zone, a long-term protectiveness statement can not be made.

FIVE-YEAR REVIEW SUMMARY FORM

SITE INFORMATION

Site Name *(from WasteLAN)*: Motorola 52nd Street Superfund Site

EPA ID *(from WasteLAN)*: AZD009004177

Region: EPA Region 9	**State:** Arizona	**City/County:** Phoenix

SITE STATUS

NPL Status: ☒ Final ☐ Deleted ☐ Other (specify):

Remediation Status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete

Multiple Ous? * ☒ YES ☐ NO **Construction Completion Date:** Interim Remedy

Has site been put into reuse: ☒ YES ☐ NO

REVIEW STATUS

Lead Agency: ☐ EPA ☒ State ☐ Tribe ☐ Other Federal Agency (specify:

Author Name: Wendy Flood c/o ADEQ

Author Title: Project Manager	**Author Affiliation:** ADEQ Consultant

Review Period: ** August 2006 to October 2010

Date(s) of Site Inspection: December 1 & 2, 2010

Type of Review:

☒ Post-SARA ☐ Pre-SARA
☐ Non-NPL Remedial Action Site ☐ NPL-Removal only
☐ Regional Discretion ☒ NPL State/Tribe-lead

Review Number: ☐ 1 (first) ☐ 2 (second) ☐ 3 (third) ☒ Other (specify): OU1 - 4th, OU2 - 3rd

Triggering Action:

☐ Actual RA Onsite Construction at OU # ☐ Actual RA Start at OU #
☐ Construction Completion ☒ Previous Five-Year Review Report
☐ Other (specify):

Triggering Action Date (*from WasteLAN*): September 28, 2006

Due Date (*five years after triggering action date*): September 28, 2011

*"OU" refers to operable unit.

**Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.

FIVE-YEAR REVIEW SUMMARY FORM (continued)

ISSUES

OU1 Issues Include:

- DNAPL present in bedrock at and near the former Motorola 52nd Street Facility continues to serve as an ongoing source of groundwater contamination upgradient of the OCC extraction system. Without addressing this issue, the required duration of OU1 Interim Remedy operation could suggest future remedy failure.

- ON Semiconductor is phasing out manufacturing operations at the former Motorola 52nd Street Facility and requires that a new beneficial end-use for groundwater treated at the IGWTP be implemented. If a decision document modifying the end use in the ROD/LOD is not implemented by the time the facility ceases accepting the treated groundwater, the interim remedy will not function as intended by the ROD/LOD in the future.

- Due in part to the ongoing lowering of the groundwater table, extracted groundwater volumes and contaminant mass rates have declined since initial OU implementation rendering the Interim Remedy less efficient than originally intended by decision documents. This decrease in efficiency has the potential to affect future remedy effectiveness, particularly with respect to groundwater plume containment.

- The age and condition of IGWTP equipment, as well as the high level of operational complexity required to maintain effectiveness of the system, may lead to future operational issues and a decline in Operation and Maintenance adequacy.

- The soil vapor extraction operations identified in the ROD/LOD have ceased; the effectiveness of completed soil cleanup activities has not been adequately evaluated. No soil cleanup in the ATP area (as required by the ROD/LOD) has been conducted.

- Given current developments in the evaluation of vapor intrusion to indoor air, the extent to which this potential contaminant pathway affects nearby residents and site workers has not been adequately evaluated to date.

OU2 Issues Include:

- A possible long term issue with capture is indicated for an area southeast of the OU2 GES; in this region, there is contamination upgradient of the OU2 GES that exceeds the AWQS and is expected to travel along a flow path outside the limit of capture. Without action to address this issue, the interim remedy will likely fail to capture this contamination in the future.

- Given current developments in the evaluation of vapor intrusion to indoor air, the lack of a comprehensive framework for the assessment of the vapor intrusion to indoor air pathway in OU2 remains an issue.

FIVE-YEAR REVIEW SUMMARY FORM (continued)

RECOMMENDATIONS AND FOLLOW-UP ACTIONS

OU1 Recommendations Include:

- Continue review and investigation of approaches to mitigate the impact of DNAPL present in bedrock at and near the former Motorola 52nd Street Facility.

- Select a demonstrated beneficial end use for groundwater treated at the IGWTP and implement a decision document modifying the end use defined in the ROD/LOD.

- Where increased groundwater extraction could potentially promote increased containment of contamination, take measures to increase groundwater extraction.

- Conduct an engineering review of IGWTP operations to improve efficiency and better document operations. The review should focus on reducing operational complexity where appropriate, identifying where documentation could be more specific, and assessing the remaining service life of equipment, including process monitoring/controls.

- Conduct additional studies/investigations to demonstrate compliance of completed soil cleanup activities with appropriate remediation criteria (e.g., SRLs) and assess whether additional soil cleanup at the Motorola Facility areas is required. These activities may be conducted with planned work to evaluate soil gas and the VI to indoor air contaminant pathways at the former facility.

- Evaluate the VI to indoor air contaminant pathway in the residential neighborhood between the former Motorola 52nd Street Facility and the OCC. Conduct additional VI studies/investigations at the former facility.

OU2 Recommendations Include:

- Develop a work plan to address contamination southeast of the OU2 GES that has the potential to migrate west and outside the limit of capture in the future.

- Develop a comprehensive approach to evaluate the vapor intrusion to indoor air contaminant pathway for the OU2 area.

FIVE-YEAR REVIEW SUMMARY FORM (continued)

PROTECTIVENESS STATEMENT(S)

OU1 Protectiveness Statement:

A protectiveness determination of the interim remedy at Motorola 52nd Street Superfund Site OU1 cannot be made at this time until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation on the former Motorola facility. It is expected that this investigation will be completed no later than the next Five-Year Review. When the investigation is complete, a protectiveness determination will be made. This five year review also identified other issues that may affect long term protectiveness: the presence of DNAPL in the bedrock at the Motorola facility; the need for a new beneficial end-use for groundwater treated at the IGWTP; declining groundwater levels that may affect extraction rates; and the age and condition of IGWTP equipment that may lead to future operational issues.

A number of issues were identified during the Five-Year Review that may impact whether the OU1 interim remedy is protective in the long-term. To address issues with the potential to impact long-term protection, the following actions need to be taken:

- Continue review and investigation of approaches to mitigate the impact of DNAPL present in bedrock at and near the former Motorola 52nd Street Facility.
- Select a demonstrated beneficial end use for groundwater treated at the IGWTP and issue a decision document modifying the end use defined in the ROD/LOD.
- Where increased groundwater extraction could potentially promote increased containment of contamination, take measures to increase groundwater extraction.
- Conduct an engineering review of IGWTP operations to improve efficiency and better document operations.

OU2 Protectiveness Statement:

A protectiveness determination of the interim remedy at Motorola 52nd Street Superfund Site OU2 cannot be made at this time until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation within the OU2 area. It is expected that this investigation will be completed no later than the next Five-Year Review. When the investigation is complete, a protectiveness determination will be made. The interim remedy provides hydraulic containment across the width and depth of the VOC plume in groundwater near I-10. However, because of the potential for the plume to migrate west and outside the current capture zone, a long-term protectiveness statement can not be made.

OTHER COMMENTS

Make any other comments here:

Issues, Recommendations, and Follow-Up Actions applicable directly to the treatment systems operations as they impact protectiveness are included in this summary table. Additional follow-up items for development of a final sitewide final remedy are also included in this document in Tables 9-3 and 9-4.

1.0 INTRODUCTION

The Arizona Department of Environmental Quality (ADEQ) and United States Environmental Protection Agency (EPA), with the support of URS Corporation (URS), have conducted a Five-Year Review of remedial actions implemented at the Motorola 52nd Street Superfund Site (the Site) in Phoenix, Arizona (see Figure 1-1). The purpose of Five-Year Reviews is to determine whether the implemented remedies at the Site are protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Site was placed on the EPA National Priorities List (NPL) in 1989 after establishment of Operable Unit (OU) 1 to address groundwater and soil contamination associated with the former Motorola 52nd Street manufacturing facility. Since that time, the Site has expanded into three OUs that are principally defined geographically, with multiple regulating agencies, community representatives, and Potentially Responsible Parties (PRPs) participating in various investigation, assessment, and remediation activities to support Site cleanup. Currently, ADEQ is the lead agency for OU1 and OU2, where interim remedial actions are ongoing. EPA is the lead agency for OU3 (which is designated a Study Area where no remedial actions have been selected), sitewide vapor intrusion (VI) investigation activities, and community involvement.

As lead agencies for the various Site OUs, ADEQ and EPA are authorized to perform this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) §121(c), as amended, which states that:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

This requirement is further interpreted in the National Contingency Plan (NCP) 40 CFR §300.430(f)(4)(ii) which states that:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Thus, this statutory Five-Year Review was conducted because remedial actions have been implemented at the Site that, upon completion, will leave contamination above levels that allow for unlimited use and unrestricted exposure of impacted environmental media. Although three Five-Year Reviews have been conducted for OU1 and two Five-Year Reviews have been conducted for OU2, this is the first sitewide Five-Year Review presenting relevant information for all three operable units (remedial action protectiveness will only be evaluated for OU1 and OU2 where interim remedies have been selected in Records of Decision (RODs). This Five-Year Review was triggered by the signature date of the previous Five-Year Review reports for OU1 and OU2, September 28, 2006.

The Five-Year Review Period documented in this report is from August 2006 through October 2010. The previous Five-Year Review period for the September 2006 OU1 and OU2 reports was from September 2001 through July 2006.

ADEQ retained the services of URS for Site Five-Year Review activities under the Arizona Superfund Response Action Contract (ASRAC) EV09-0100 and Task Assignment EV-10-0074. URS, a multi-disciplinary engineering firm providing technical services for public agencies and private sector companies worldwide, prepared this report with ADEQ direction and EPA oversight and review.

Preparation of this report follows *Comprehensive Five-Year Review Guidance* prepared by the EPA (2001) and relies significantly on site chronology and background text developed for the Site in previous Five-Year Review Documents by ADEQ, Harding ESE, and LFR Inc. (in 2001 and 2006).

2.0 SITE CHRONOLOGY

Tables 2-1 and 2-2 present important site chronology information for OU1 and OU2, respectively.

Table 2-1 Chronology of Events in OU1

Event	Date
Manufacturing operations commenced at the Motorola 52nd Street facility (the Motorola Facility).	1956
A dry well located in the Motorola Facility Courtyard area was used for solvent disposal.	1963 to 1974
The Motorola Facility Southwest Parking Lot (SWPL) area was used for waste chemical storage.	1974 to 1976
Motorola discovered a discrepancy in the inventory for 1,1,1-Trichloroethane (TCA) in a 5,000-gallon underground storage tank (UST).	November 1982
Motorola notified the Arizona Department of Health Services (ADHS) of the leaking TCA underground tank.	January 1983
Remedial Investigation (RI) activities initiated.	February 1983
Installed 23 wells located at the Motorola Facility, 6 off-facility wells, and 2 piezometers. Also identified private wells for sampling.	February through September 1983
The Preliminary Investigation Report for the Motorola Facility was submitted to the Arizona Department of Health Services (ADHS) by Motorola.	December 1983
A workplan and a Quality Assurance Project Plan (QAPP) for the implementation of the Remedial Investigation/Feasibility Study (RI/FS) were issued.	October 1984
Conducted an initial soil gas investigation at the site.	November 1984
RI/FS wells were installed to supplement Preliminary Investigation wells.	December 1984 through August 1986
Soil gas investigation indicated that PCE existed at elevated concentrations between Motorola Facility Buildings A-D and A-A and in the southwest corner of the SWPL.	February/March 1985
Monitor wells DM-201 and others installed; aquifer test conducted.	July/August 1985
Source verification investigations conducted.	October 1985 through February 1986
Motorola voluntarily initiated a groundwater treatment program at the facility with the installation of two extraction wells (DM-301 and DM-302) in the Courtyard Area.	May 1986
Submitted the results of a preliminary screening of remedial action technologies and/or alternatives to ADEQ as a draft report.	August 8, 1986
Conducted a well survey to identify existing monitor wells, public wells, and private wells in an area downgradient from the Site.	September 1986 through October 1986
A work plan to implement the groundwater Pilot Treatment Plant (PTP) was issued.	September 4, 1986
PTP operations initiated.	September 15, 1986
Draft results of the RI/FS study were submitted to ADEQ.	June 1987
A draft Remedial Action Plan (RAP) for Operable Unit 1 (OU1) was submitted to ADEQ.	June 1988
The United States Environmental Protection Agency (EPA) issued a Record of Decision (ROD) for OU1 and ADEQ issued a Letter of Determination (LOD) for OU1.	September 1988
Additional soil gas samples were collected within the Motorola Facility SWPL and Courtyard areas.	January 1989
Motorola entered into a Consent Order (CO) with ADEQ to implement a groundwater and soil interim remedy known as OU1.	June 20, 1989
The Motorola 52nd Street CO was lodged with the Arizona Superior Court.	July 26, 1989
The site was placed on the EPA Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List (NPL).	October 4, 1989
A sump in the southwest corner of Motorola Facility Building A-D was identified as another potential source of contamination in the SWPL area.	1990
A hydrologic report supporting an application for a Poor Quality Groundwater Withdrawal Permit (PQGWWP) for the OU1 extraction wells was submitted to the Arizona Department of Water Resources (ADWR).	January 4, 1991
The Motorola Facility SWPL investigation was initiated.	February 1991

Event	Date
A soil gas investigation was conducted within the SWPL area.	March 1991
100% completed design drawings for the Integrated Groundwater Treatment Plant (IGWTP) were submitted to ADEQ.	March 1991
ADWR issued PQGWWP No. 59-0530577 for the OU1 groundwater extraction program.	May 8, 1991
Pumping activities were initiated in the SWPL area.	June 28, 1991
An additional soil gas investigation was conducted within the SWPL area.	October 1991 through November 1991
Drilled SWPL monitor and extraction wells; conducted a soil gas investigation in the SWPL area.	January through February 1992
The Final Remedy RI report for OU1 was completed and submitted by Motorola to ADEQ.	February 19, 1992
A baseline report documenting conditions prior to the startup of the IGWTP was submitted to ADEQ.	May 1992
The SWPL remedy was expanded.	May 1992
Installation of the Courtyard soil vapor extraction (SVE) system was completed.	May 7, 1992
The Courtyard SVE system was initially started up and subsequently shut down for process modifications.	June 3, 1992
The IGWTP became operational.	July 1992
A final draft SWPL RI Work Plan was submitted to ADEQ.	September 11, 1992
The Courtyard SVE pilot program began operation.	September 21, 1992
A draft In-Situ Air Sparge (AS)/SVE System Field Test (Pilot Test) Plan was submitted to ADEQ.	September 23, 1992
The AS/SVE pilot program began operation in two locations within the SWPL area (the parking lot and Building A-D). Phase I SVE within the parking lot area was performed.	February 11, 1993
The Phase 2 SVE test within the Building A-D area was performed in the SWPL area.	February 15, 1993
The Phase 3 AS test was performed on well AS002 in Building A-D in the SWPL area.	February 19, 1993
The combined AS/SVE Phase 4 test was initiated in SWPL area.	February 20, 1993
The SWPL AS/SVE pilot program ended.	February 25, 1993
The Courtyard SVE pilot program ended.	March 31, 1993
Progress reporting activities for OU1 operations were implemented.	April 1993
The first effectiveness report for OU1 was submitted to ADEQ; this report documented operations conducted in 1992.	May 1993
The Draft SWPL RI report was submitted to ADEQ.	June 9, 1993
The Interim Remedy Feasibility Study Report was submitted to ADEQ.	October 1993
Operation of the IGWTP was suspended due to a vinyl chloride air emission problem.	June to December 1993
A Supplement Interim Remedy Feasibility Study Report was submitted to ADEQ.	December 10, 1993
The IGWTP was put back into continuous operation.	December 28, 1993
Motorola initiated a program of periodic recovery of dense non-aqueous phase liquid (DNAPL).	1994
A report evaluating a bedrock investigation was submitted to ADEQ.	February 18, 1994
Motorola submitted the 1993 OU1 Effectiveness Report to ADEQ.	September 1994
An Addendum to the SWPL RI Report was submitted to ADEQ.	October 14, 1994
A report summarizing the results of the Courtyard SVE pilot program was submitted to ADEQ.	December 1994
A groundwater monitoring plan for OU1 was submitted to ADEQ.	December 1, 1994
The AS/SVE Pilot Program for SWPL Report was submitted to ADEQ.	April 21, 1995
The SWPL Remediation Design Report was submitted to ADEQ.	April 21, 1995
A design report, plans, and specifications detailing SVE/AS for the SWPL were submitted to ADEQ.	April 25, 1995
Motorola submitted the 1994 OU1 Effectiveness Report to ADEQ.	April 28, 1995
ADEQ approved the SVE/AS design plans for the SWPL.	June 1, 1995
The First Five-Year Review Report for OU1 was finalized by ADEQ.	September 1995
A multi-depth soil gas investigation was performed within the Courtyard area.	December 4, 1995
Final construction specifications for the installation of the AS/SVE system at the SWPL Building A-D were submitted to ADEQ.	February 1996
Motorola submitted the 1995 OU1 Effectiveness Report to ADEQ.	March 1, 1996
Motorola submitted the Soil Gas Survey report to ADEQ.	March 15, 1996
The SWPL Remediation Operation Plan was submitted to ADEQ.	March 29, 1996
Motorola confirmed that air emission controls (changed in 1993) were final.	March 31, 1996

Event	Date
SWPL AS/SVE operations began.	November 1996
Motorola submitted the 1996 OU1 Effectiveness Report to ADEQ.	March 1, 1997
Operation of the AS/SVE system at the SWPL ended.	April 1997
A report on the evaluation of the Courtyard SVE system was submitted to ADEQ.	April 28, 1997
ADEQ approved an updated monitoring plan prepared by Motorola subject to minor modifications.	December 17, 1997
The final updated monitoring plan was submitted by Motorola to ADEQ.	January 1998
Motorola submitted a Request for Modification of the OU1 PQGWWP to eliminate chloroform, 1,2-dichloroethene (1,2-DCE), and carbon tetrachloride from the key parameters list, reduce the sampling for VOCs in extraction wells on an annual basis. The request was approved by ADWR.	January 5, 1998
Motorola submitted the 1997 OU1 Effectiveness Report to ADEQ.	March 31, 1998
Motorola submitted a No Further Action request for the Courtyard SVE system.	April 30, 1998
A report on the evaluation of the SWPL SVE system was submitted to ADEQ.	December 22, 1998
Motorola's Communications, Power, and Signal Group was split off to become ON Semiconductor. Motorola remains responsible for the remediation effort related to its former operations at the 52nd Street facility.	1999
Motorola submitted the 1998 OU1 Effectiveness Report to ADEQ.	March 31, 1999
Motorola submitted the 1999 OU1 Effectiveness Report to ADEQ.	March 1, 2000
An updated Operation and Maintenance (O&M) Manual for the IGWTP was submitted to ADEQ.	August 2000
Motorola submitted the 2000 OU1 Effectiveness Report to ADEQ.	March 2001
Motorola submitted a No Further Action request for the SWPL SVE system.	March 21, 2001
The Second Five-Year Review Report for OU1 was completed by ADEQ.	September 2001
In response to the Second Five-Year Review, Motorola conducted studies and evaluated the OU1 groundwater treatment remedy.	2002
Motorola submitted the 2001 OU1 Effectiveness Report to ADEQ.	March 2002
ADEQ determined that soil cleanup in the SWPL area was complete.	November 15, 2002
Motorola submitted the 2002 OU1 Effectiveness Report to ADEQ.	March 2003
Motorola shut down the IGWTP after discovering cracks in the carbon vessels that serve as air emission controls.	April 1, 2003
Motorola submitted the OU1 Evaluation – Shutdown and Monitoring Report evaluating the impact on groundwater flow and contaminant migration as a result of the recent shutdown of the IGWTP.	July 31, 2003
The IGWTP was restarted after Motorola replaced the carbon vessels.	August 4, 2003
Motorola submitted a Work Plan for a Soil Vapor Intrusion Risk Assessment.	September 17, 2003
Motorola submitted a Letter of Intent to conduct a Feasibility Study for the OU1 area.	October 20, 2003
Motorola submitted the 2003 OU1 Effectiveness Report to ADEQ.	March 2004
Motorola spun off its semiconductor sector into a new company, Freescale Semiconductor, which is a wholly owned subsidiary of Motorola, Inc. Freescale began directing remediation efforts related to the 52nd Street Facility on Motorola's behalf later that year.	April 2004
Freescale submitted a revised QAPP for the OU1 area to ADEQ.	April 12, 2004
Freescale submitted a revised Work Plan for a Soil Vapor Intrusion Risk Assessment.	September 2004
Freescale submitted a capture analysis as part of a request to turn off extraction well DM-311.	September 7, 2004
Freescale submitted a Work Plan to Install Additional Monitor Wells in the OU1 area.	January 27, 2005
Freescale submitted the 2004 OU1 Effectiveness Report to ADEQ.	March 2005
Freescale submitted the Groundwater Remedial Alternatives Analysis (RAA) Report to ADEQ.	September 30, 2005
Freescale submitted an Addendum to the RAA Report, Evaluation of Technical Impracticability of Groundwater Restoration at the Motorola 52nd Street OU1.	December 2005
Freescale submitted the 2005 OU1 Effectiveness Report to ADEQ.	March 2006
The Third Five-Year Review Report for OU1 was completed by ADEQ.	September 25, 2006
Freescale documented the installation of two new wells (DM609 and DM610) in a letter report.	January 5, 2007
Freescale submitted the 2006 OU1 Effectiveness Report to ADEQ.	March 2007
Freescale submitted the 2007 OU1 Effectiveness Report to ADEQ.	March 2008
Freescale documented the installation of three new wells on the Old Crosscut Canal (DM611, DM612, and DM613).	May 15, 2008

Event	Date
Freescale submitted the Bedrock Extraction Pilot Study Work Plan to ADEQ for review and comment.	July 31, 2008
Freescale submitted the 2008 OU1 Effectiveness Report to ADEQ.	March 2009
Freescale prepared a report evaluating alternative end use options for groundwater treated at the IGWTP after On Semiconductor notified them that they would soon be suspending manufacturing operations at the 52nd Street Facility.	June 10, 2009
Freescale documented the installation of the Bedrock Extraction Pilot Study wells (DM314, DM614, and DM615).	September 8, 2009
Freescale submitted the 2009 OU1 Effectiveness Report to ADEQ.	March 2010
Freescale submitted the revised Evaluation of Remediated Groundwater End Use Options report.	April 30, 2010
Freescale documented bedrock extraction pilot study progress in a Preliminary Findings Report.	April 30, 2010
EPA and Freescale entered into an Administrative Order on Consent to conduct soil gas sampling and possible indoor air sampling supporting a vapor intrusion investigation.	August 31, 2010

Notes:
ADEQ – Arizona Department of Environmental Quality
ADHS – Arizona Department of Health Services
ADWR – Arizona Department of Water Resources
AS – air sparging
CO – Consent Order
COC – Contaminant of Concern
SVE – soil vapor extraction
DNAPL – dense non-aqueous phase liquid
EPA – United States Environmental Protection Agency
EW – extraction well
FS – Feasibility Study
IGWTP – Integrated Groundwater Treatment Plant
MCL – Maximum Contaminant Level
NPL – National Priorities List
OU1 – Operable Unit 1
PCE – tetrachloroethene
PQGWWP – Poor Quality Groundwater Withdrawal Permit
PRP – Potentially Responsible Party
PTP – Pilot Treatment Plant
QAPP – Quality Assurance Program Plan
RI – Remedial Investigation
SWPL – Southwest Parking Lot
TCA – 1,1,1-Trichloroethane
TCE – Trichloroethene
UST – underground storage tank
VOC – volatile organic compound

Table 2-2 Chronology of Events in OU2

Event	Date
Chlorinated volatile organic compounds (VOCs) first detected in Desert Hills Well near Monroe and 27th Streets	1983
ADEQ conducted a Remedial Investigation and initiated an investigation of potentially responsible parties (PRP's).	1985-1989
The East Washington area was listed on ADEQ's Water Quality Assurance Revolving Fund (WQARF) Priority List.	1987
Questionnaires mailed to 995 facilities located in the East Washington area requesting information regarding their hazardous substance use, storage, and disposal practices.	July 1988
ADEQ completed the Phase I Report for the East Washington area, which was made available for public review.	August 1989
ADEQ and Freescale continued an area-wide groundwater investigation to define the extent of groundwater contamination in the OU2 area. Approximately 48 monitor wells with 120 sampling ports were installed and over 300 aquifer tests were conducted.	1990-1992
ADEQ and EPA developed a second operable unit (OU2) study area to address groundwater contamination and a final remedy.	1992
Freescale submitted the Remedial Investigation Report to ADEQ confirming that contamination was migrating from the Motorola facility and into the East Washington area.	1992
ADHS completed a Baseline Risk Assessment concluding *no imminent health hazard.*	1992
EPA named additional potentially responsible parties: Honeywell, ITT Cannon, and Tiernay Turbines (now Walker Power Systems).	1992
Freescale submitted the Final Remedy Remedial Investigation Report to ADEQ.	February 1992
Freescale submitted the Response to Comments on Final Remedy Remedial Investigation Report to the EPA.	June 8, 1992
Freescale submitted a Pre-Design Remedial Investigation Work Plan.	July 15, 1992
Freescale submitted the Addendum to the Pre-Design Remedial Investigation Work Plan.	August 3, 1992
ADHS submitted the Baseline Risk Assessment to ADEQ.	November 1992
Center for Environmental Health Studies submitted the Critique of the Baseline Risk Assessment to ADHS.	November 1992
ADEQ discovered groundwater contamination (TCE) in the area downgradient of the Old Cross Cut Canal thought to be a part of the East Washington Area, a separate contaminant plume.	1993
EPA named the City of Phoenix a Potentially Responsible Party.	1993
Freescale issued a series of reports documenting the development and calibration of a flow and transport model that was used for the evaluation of remedial alternatives in the area from 46th Street to approximately 24th Street between McDowell and Buckeye Roads.	1993
ATSDR completed an update to the 1988 Health Assessment.	1993
ADEQ and EPA determined that this would be a second operable unit (OU2).	March-August 1993
Freescale submitted a Draft Detailed Analysis of Alternatives for the final remedy.	March 1993
Freescale submitted a Draft Interim Remedy Feasibility Study Report to ADEQ.	August 1993
Freescale submitted an updated Interim Remedy Feasibility Study Report to ADEQ.	October 1, 1993
Freescale submitted the Interim Remedy Feasibility Study Report to ADEQ.	November 9, 1993
Freescale submitted the Supplement to Interim Remedy Feasibility Study Report to ADEQ.	December 1993
ADEQ and EPA issued a proposed groundwater remedy for public review and comment.	December 1993
ADEQ requested Honeywell, ITT Cannon, the City of Phoenix, and Freescale to implement the groundwater remedy.	1994
ADEQ approved the updated Interim Remedy Feasibility Study Report submitted by Freescale.	January 1994
Freescale submitted a Hydrogeologic Investigation of Subsurface Bedrock Conditions Report of the East Washington Area WQARF Site.	February 1994
Public meeting held to take oral comment from the public regarding the OU2 Feasibility Study.	February 9, 1994
The EPA submitted the Record of Decision Operable Unit 2 East Phoenix Groundwater Containment.	July 21, 1994
Freescale submitted a letter with results of additional drilling conducted to confirm the depth to bedrock	November 1994
ADEQ issued a No Further Action letter to ITT Cannon.	1995

Event	Date
ATSDR completed an update to the 1988 Health Assessment and the 1993 update to the Health Assessment.	1996
Freescale submitted M52 Model Documentation Report to ADEQ.	February 1996
Freescale submitted the M52 Model Documentation Report presenting models of predicted groundwater flow and contaminant transport of VOCs from Freescale and other sources.	February 1996
Freescale and the City of Phoenix signed a Consent Decree with ADEQ to implement the design of a groundwater containment and treatment system for OU2. Honeywell withdrew from the agreement and did not participate in the design.	October 1, 1996
ADEQ and EPA determined that the investigation of groundwater contamination from 52nd Street would continue to 7th Avenue under the federal Superfund program.	1997
Honeywell submitted the Honeywell Preliminary Analysis of Freescale Model to ADEQ.	January 1997
Freescale and Honeywell (The Companies) submitted the Remedial Design Work Plan Operable Unit 2 to ADEQ.	March 1997
The Companies submitted the Preliminary (30%) Design Report Operable Unit 2 Area to ADEQ.	October 1997
The Companies submitted the Pre-Final (90%) Design Report Operable Unit 2 Area to ADEQ.	September 18, 1998
Environmental Simulations Inc. submitted the Groundwater Modeling of the OU2 Recovery System to Honeywell.	November 1998
EPA issued a Unilateral Administrative Order (UAO) to The Companies for construction, start-up, and two years of operation and maintenance of the groundwater treatment system.	November 10, 1998
Submittal of the Final 100% Design Report Operable Unit 2, Motorola 52nd Street Superfund Site.	July 1999
EPA issued the Explanation of Significant Differences to Operable Unit 2 Record of Decision.	September 30, 1999
The Companies submitted the Remedial Action Work Plan Operable Unit 2 Area.	November 1999
Construction of the treatment system began.	March 2000
EPA submitted Comments to Draft and Final Remedial Action Work Plans to Freescale and Honeywell.	May 2000
IT Corporation submitted the Summary of Preliminary Groundwater Flow and Contaminant Transport Simulations to EPA.	March 2001
The Arbitrator's Final Decision and Findings of Fact and Conclusions of Law were submitted to the Companies.	July 11, 2001
Construction Completion Notification was provided to the EPA.	September 24, 2001
Pre-Final construction inspection was conducted by ADEQ and EPA.	September 26, 2001
EPA issued the Five Year Review Report First Five Year Review Report.	September 28, 2001
Final construction inspection was conducted by ADEQ and EPA.	October 23, 2001
The Companies submitted the Construction Completion Report.	December 6, 2001
The OU2 groundwater treatment system became fully operational, designed to pump at a rate of approximately 5,000 gallons per minute.	December 13, 2001
The Companies submitted the Start Up Report 20th Street Groundwater Treatment Facility to EPA.	January 2002
The Companies submitted the Operation and Maintenance Manual.	January 24, 2002
Updates and revisions to the Operation and Maintenance Manual were submitted.	February 6, 2002
Freescale conducted an additional investigation of the bedrock ridge area and submitted a report of the results.	May 2002
Updates and revisions to the Operation and Maintenance Manual were submitted.	May 11, 2002
The Companies submitted the Revised Tables and Figures July through November 2001 Baseline Monitoring Report OU2 to EPA.	June 7, 2002
Updates and revisions to the Operation and Maintenance Manual were submitted.	July 13, 2002
The Companies submitted the Results of Hydrogeological and Construction Services for Installation of Extraction and Monitor Wells to Honeywell, Freescale.	August 29, 2002
The Companies submitted the Groundwater Extraction System Adjustments OU2 to EPA.	October 18, 2002
The OU2 groundwater treatment system's pumping rate was reduced to 2,650 gpm.	November 2002
Freescale submitted the Evaluation of Groundwater Extraction Rates OU2 Remedy to EPA.	November 5, 2002
The Companies submitted the Proposal/Concurrence to Install Additional Groundwater Monitoring Wells OU2 to EPA.	December 24, 2002

Event	Date
The Companies submitted a Revised Proposal to Install Additional Groundwater Monitoring Wells and Responses to February 7th EPA Comment on the December 24, 2002 Proposal to Install Additional Monitoring Wells.	February 28, 2003
The Companies submitted an Addendum to Revised Proposal to Install Additional Monitor Wells dated February 28, 2003.	March 27, 2003
The Companies submitted the Effectiveness Report 2002, 20th Street Groundwater Treatment Facility.	April 2003
EPA approved the Revised Proposal to install 11 groundwater monitoring wells.	April 4, 2003
The Companies submitted the Draft Remedial Action Report for Motorola 52ndStreet Superfund Site Operable Unit 2.	April 10, 2003
The Companies submitted the Remedial Action Report.	April 10, 2003
The Companies submitted the Revised 2002 OU2 Annual Effectiveness Report.	April 11, 2003
The Companies submitted a clarification letter to the Revised Proposal dated February 28, 2003 to install 11 additional groundwater monitoring wells at four locations.	May 15, 2003
The Companies installed 11 additional monitoring wells to provide more data to assess groundwater capture of the treatment system.	June -July 2003
The Companies submitted Report of Results of Additional Monitoring Well Installations.	September 12, 2003
The combined extraction well flow rate was maintained at 2,350 gpm (300 gpm lower than the previous year) with the southern extraction well operating in a cyclic pumping mode.	November 2003
EPA issued the Second Amended UAO.	December 2003
The Companies submitted a proposal: Staged Restart of Extraction Wells EW-M and EW-S in February 2004 After SRP Grand Canal Shutdown.	January 26, 2004
The Companies submitted Responses to February 2nd EPA Comments on the Staged Restart of Extraction Wells EW-M and EW-S Proposal Dated January 26,2004.	February 6, 2004
The Companies submitted a Proposal to Install One Additional Groundwater Monitor Well Screened in the Basin Fill Deposits South of EW-06 in response to EPA's letter dated February 19, 2004.	March 1, 2004
A new monitor well (NW09-D) was added to better define the lateral and vertical extent of contamination to the south around 20th Street.	March 2004
The Companies submitted an Evaluation of Hydraulic Capture After Staged Restart of Extraction Wells EW-M and EW-S on February 11, 2004 after SRP Grand Canal Shutdown.	March 23, 2004
The Companies submitted the 2003 Effectiveness Report.	April 15, 2004
The Companies submitted a Notification Letter of a Newly Installed Groundwater Monitor Well NW09-D Preliminary Analytical Results. TCE was found at a concentration of 10 ppb. This well location is slightly outside of the southern extent of capture.	May 18, 2004
The Companies submitted Capture Zone Calculations for OU2. The following analyses were conducted: (1) a manually drawn flow net; (2) a simple capture zone analysis; (3) an evaluation of groundwater chemistry concentration trends.	May 28, 2004
The Companies submitted a revised Operation and Maintenance Manual.	July 1, 2004
The Quarterly Groundwater Monitoring Report (GMR) for the period March through May 2004 was submitted.	July 14, 2004
The Companies submitted a report documenting the abandonment of ADEQ monitor well EW-12 and the modification of ADEQ monitor well EW-7.	July 19, 2004
The Companies submitted a Work Plan to Install Four Additional Groundwater Monitor Wells. The Work Plan described the rationale, procedures, and schedule for the groundwater monitor well installations planned to further characterize the extent of chlorinated solvents at the boundaries of the groundwater plume around 20th Street.	October 14, 2004
The Quarterly GMR for the period June through August 2004 was submitted.	October 15, 2004
The Companies submitted the revised Work Plan to Install Four Additional Groundwater Monitor Wells, Operable Unit 2 Area.	November 10, 2004
The Quarterly GMR for the period September through November 2004 was submitted.	January 15, 2005
The Companies submitted the December 2004 through February 2005 GMR, and the Effectiveness Report - 2004 20th Street Groundwater Treatment Facility 52nd Street Superfund Site.	April 14, 2005
The Companies submitted the Addendum to the Construction Completion Report, Results of Additional Groundwater Monitor Well (NW09-D2, NW10-D, NW11-D, and NW-12D) Installations.	June 14, 2005
The Companies submitted the March - May 2005 GMR.	July 11, 2005

Event	Date
Freescale letter submitted requesting EPA concurrence on the sale of portion of the land at 12 N. 20th for the City of Phoenix Light Rail Project.	July 27, 2005
EPA concurrence on sale of 255 square feet of land.	August 29, 2005
The Companies submitted the Technical Memorandum including Work Plan to Install Additional Groundwater Monitor Wells/Piezometers at Four Locations.	September 22, 2005
The Companies submitted Responses to EPA September 6, 2005 Comments.	October 7, 2005
The Companies submitted the June through August 2005 GMR.	October 14, 2005
The Companies submitted the 2005 Effectiveness Report for OU2.	April 14, 2006
The Companies submitted the December 2005 – February 2006 Quarterly GMR	April 15, 2006
The Companies submitted the March – May 2006 Quarterly GMR	July 15, 2006
The Companies submitted the June – August 2006 Quarterly GMR	October 15, 2006
The Companies submitted the September – November 2006 Quarterly GMR	January 15, 2007
The Companies submitted the December – February 2007 Quarterly GMR	April 15, 2007
The Companies submitted the March – May 2007 Quarterly GMR	July 15, 2007
The Companies submitted the June – August 2007 Quarterly GMR	October 15, 2007
Five new monitoring wells (NW17-S, NW18-S&M, NW19-M&D), three piezometers (NW15-S, NW16-M/D), and one soil boring (NW20) were installed.	November 2007
The Companies submitted the September – November 2007 Quarterly GMR	January 15, 2008
The Companies submitted the 2007 Effectiveness Report for OU2	April 2008
The Companies submitted the December – February 2008 Quarterly GMR	April 15, 2008
The Companies submitted the March – May 2008 Quarterly GMR	July 15, 2008
ADEQ approved the finalized Focused Remedial Investigation for the Honeywell 34th Street Facility	September 2008
The Companies submitted the June – August 2008 Quarterly GMR	October 15, 2008
The Companies issue a response to EPA June 13, 2008 Comments and ADEQ August 7, 2008 Comments to the 2007 Effectiveness Report	November 14, 2008
The Companies submitted the September – November 2008 Quarterly GMR	January 15, 2009
The Companies submitted the 2008 Effectiveness Report for OU2	April 2009
The Companies submitted the December – February 2009 Quarterly GMR	April 15, 2009
The Companies submitted the March – May 2009 Quarterly GMR	July 15, 2009
Boron SRP Grand Canal Mixing Zone Approval Issued for 20th Street Treatment System Discharge	September 9, 2009
The Companies submitted the June – August 2009 Quarterly GMR	October 15, 2009
The Companies submitted the September – November 2009 Quarterly GMR	January 15, 2010
The Companies submitted the 2009 Effectiveness Report for OU2	April 2010
The Companies submitted the December – February 2010 Quarterly GMR	April 15, 2010

Notes:
On the 15th of each month Conestoga-Rovers submitted Monthly Progress Reports

ADEQ – Arizona Department of Environmental Quality
ADHS – Arizona Department of Health Services
ATSDR – Agency for Toxic Substances and Disease Registry
ADWR – Arizona Department of Water Resources
Companies – Refers to Freescale and Honeywell
CRA – Conestoga-Rovers Associates
EPA – United States Environmental Protection Agency
GMR – Groundwater Monitoring Report
OU2 – Operable Unit 2
PRP – Potentially Responsible Party
TCA – 1,1,1-Trichloroethane
TCE – Trichloroethene
VOC – volatile organic compound
WQARF – Water Quality Assurance Revolving Fund
For the purpose of continuity, Freescale is used to refer to both Motorola and Freescale (except when referring specifically to the Motorola 52nd Street Facility)

3.0 BACKGROUND

3.1 SITE LOCATION AND DESCRIPTION

3.1.1 OU Boundaries

The Site is generally defined by the extent of impacted groundwater that underlies a 7-mile stretch of a highly urbanized region in east-central Phoenix, Arizona and spans from downtown Phoenix (at 7th Avenue) to just east of Sky Harbor Airport (around 52nd Street). Figure 1-1 presents the boundaries of the three Site OUs developed to designate regions where remedial investigation and/or response activities are occurring. OU boundaries extend beyond the extent of contamination and are as follows:

- OU1 (approximately 500 acres in area) is the easternmost operable unit and is located north of State Route 202, west of Papago Park and the Phoenix Military Reservation and primarily east of the Old Crosscut Canal. It includes the former Motorola 52nd Street Facility at 5005 E. McDowell Road (which is currently operated by ON Semiconductor, a spin-off company from Motorola, Inc.[Motorola]) and is roughly bounded by Palm Lane to the north, 52nd Street to the east, Roosevelt Street to the south, and 44th Street to the west (ADEQ, 2009).

- OU2 (approximately 3,800 acres in area) is adjacent to the western boundary of OU1 and the eastern boundary of OU3. It is primarily located south of State Route 202 and north of Sky Harbor Airport. OU2 includes the Honeywell facility at 111 S. 34th Street (the 34th Street Facility) and is approximately bounded by McDowell Road to the north, 44th Street to the east, Buckeye Road to the south, and 20th Street to the west (Shaw Environmental Inc. [Shaw], 2005).

- OU3 (a Study Area approximately 3,000 acres in area) is the westernmost operable unit and is primarily located south of US Interstate 10 and west of State Route 51. It is generally bounded by McDowell Road to the north, 20th Street to the east, Buckeye Road to the south, and 7th Avenue to the west (Shaw, 2005). The West Van Buren Water Quality Assurance Revolving Fund (WQARF) site is located hydraulically downgradient and adjacent to the western boundary of OU3.

3.1.2 Local Geographic Setting

The Salt River is a dominant geographic feature in the vicinity of the Site and is located approximately one to two miles south of the OU boundaries (see Figure 1-1). The Salt River

flows on an intermittent basis in response to significant rainfall events and/or releases from upstream dams. The direction of flow is generally from east to west.

An extensive man-made canal system, used historically to convey water for agricultural purposes, is located throughout the Phoenix Metropolitan Area. The canal system is currently operated by the Salt River Project (SRP) to supply water for both domestic and irrigational use and includes two canals within the boundaries of the Site:

- The Old Crosscut Canal (OCC) is located in OU1 between 44th and 46th Street (adjacent to State Route 143) and connects the Grand Canal to the Arizona Canal. It is used to convey stormwater to the Salt River but can be operated to transfer water between the Grand and Arizona Canals (SRP, 2010).

- The Grand Canal runs diagonally across OU2 from just north of the Salt River (south of Washington Street) across Metropolitan Phoenix to the Agua Fria River near the Glendale Municipal Airport.

These canals serve as regional reference locations and are incorporated into the remedies selected for the Site (see Section 4).

3.1.3 Overview of Site Hydrogeology

Groundwater at the Site occurs within the unconsolidated sedimentary deposits and underlying bedrock of the West Salt River Valley (WSRV) sub-basin of the Phoenix Active Management Area (AMA). Basin wide, the Salt River Valley alluvial aquifer is defined by three hydrogeologic units: the Lower Alluvial Unit (LAU), Middle Alluvial Unit (MAU), and Upper Alluvial Unit (UAU). The UAU near the eastern boundary of the WSRV is the primary focus of Site contaminant investigation and is comprised of:

- ***Salt River Gravels.*** This subunit represents the older channel deposits of the Salt River and is comprised of coarse-grained rounded gravels, cobbles, and boulders that include minor amounts of interbedded and laterally discontinuous fine-grained (sandy) deposits. The Salt River Gravels are present in OU2 and OU3 and are also referred to as ADEQ Hydrostratiographic Unit (HSU) A or the Shallow Zone (S) of the aquifer.

- ***Upper Basin Fill.*** This subunit includes interbedded coarse and fine-grained deposits with gravels that are similar to the Salt River Gravels. The Upper Basin Fill is present in all three Site OUs and is also referred to as ADEQ HSU B or the Intermediate Zone (M) of the aquifer. Some investigators further define two portions of Upper Basin Fill that are referred

to as the First and Second Intermediate Zones of the aquifer. These zones are separated by a fine-grained layer at the base of the First Intermediate Zone.

- ***Deeper or Lower Basin Fill.*** This subunit is relatively more consolidated than either ADEQ HSU A or B and includes a fine-grained layer underlain by interbedded fines (silt) and sand. The Lower Basin Fill is present in OU2 and OU3 and is also referred to as ADEQ HSU D or the Deep Zone (D) of the aquifer.

The UAU in the vicinity of the Site is underlain by bedrock that consists of tilted and faulted middle Tertiary sedimentary and volcanic rocks and Proterozoic crystalline rock that generally slopes downward underneath the Site from east to west (Reynolds and Bartlett, 2002). Various bedrock rises penetrating through the stratigraphy of the alluvium form ridges that intercept and divert alluvial groundwater flow. Significant ridges identified by past investigators of Site contamination include: the OU1 Bedrock Ridge, the Honeywell Bedrock Ridge, and the OU2 Bedrock Ridge. It should be noted that ADEQ has designated the bedrock as a hydrostratiographic unit (ADEQ HSU C) since groundwater contamination is known to move between the alluvium and fractured bedrock where present (predominantly in OU1).

The aquifer system is generally unconfined but fairly complex due to the geologic heterogeneity of saturated sediments and interactions with bedrock. As of 2010, the depth to groundwater at the Site ranged from approximately 25 to 80 feet (ft) below ground surface (bgs) in OU1 monitoring wells (Clear Creek Associates, 2010a) to between around 75 and 95 ft bgs in OU3 monitoring wells (ERM, 2010). Groundwater flow direction is impacted locally by OU1 and OU2 groundwater extraction systems but regionally, flow is to the west and southwest. The hydraulic conductivity of the alluvial aquifer varies across the Site but ranges from around 2 to 50 ft per day in OU1 and from around 1 to 450 ft per day in OU2 and OU3.

Groundwater recharge to the UAU occurs from precipitation, infiltration from the Salt River, runoff from regional mountains, and irrigation. Significant stormwater discharges and upstream surface water releases to the Salt River particularly impact water levels and flow directions in the immediate vicinity of the river (i.e., near the Honeywell 34th Street Facility in OU2).

3.2 LAND AND RESOURCE USE

Land use at the Site has not significantly changed since contamination was first discovered at the former Motorola 52nd Street Facility in 1982. Land use is comprised of a mixture of residential, commercial, and industrial uses:

- In OU1, the former Motorola 52nd Street Facility is located immediately adjacent to residential property to the west, commercial property to the north, the Arizona National Guard facility (Phoenix Military Reservation) and Papago Park to the east, and industrial property to the south.

- OU2 generally consists of industrial and commercial property surrounding Sky Harbor Airport, including the Honeywell 34th Street Facility, the ITT Cannon property and D-Velco property, and various industrial, commercial, and residential properties to the north of the airport. The Arizona State Hospital is located north of the airport at the corner of Roosevelt and 24th Streets.

- The OU3 Study Area includes a fairly mixed use region in the eastern portion of the study area and the downtown Phoenix area in the western third of the study area where major attractions such as Chase Field, the US Airways Center, and the Arizona Center are located. Industrial facilities are predominantly situated in the southern portion of the study area.

Groundwater extracted from the Site is not currently being used as a source of public drinking water. The City of Phoenix provides potable water (sourced from supplies outside the Site) to Site residents. There are currently two known water supply wells located at the Site that are not associated with the interim remedies. These are the Morgan Well (a.k.a., Well 4626G which is used for domestic, non-potable purposes) and SRP Well 18E-5N (an irrigation supply well that discharges into the Grand Canal). Both wells operate on an intermittent basis in response to demand.

3.3 SITE HISTORY

Due to the extensive and ongoing nature of investigations addressing Site contamination, this section summarizes activities predominantly conducted prior to remedy implementation to support evaluation of these remedies as part of the Five-Year Review process. Appendix A presents additional detail for further reference.

3.3.1 Initial Discovery of Contamination and Designation of OU1

The former Motorola 52nd Facility commenced operations in 1956 and used chlorinated solvents such as trichloroethene (TCE) and 1,1,1- trichloroethane (1,1,1-TCA) to clean parts and equipment in the manufacture of electronics. In November of 1982, Motorola discovered a discrepancy in the inventory for a 5,000-gallon underground storage tank (UST) located in the Courtyard area of the facility (see Figure 3-1). The UST was tested and determined to be leaking.

A summary of environmental characterization/assessment and preliminary response activities conducted to initially address facility contamination follows:

- ***1983 Preliminary Investigation.*** This investigation identified twenty-five combined possible sources of contamination in the Courtyard, Acid Treatment Plant (ATP), and Southwest Parking Lot (SWPL) areas of the former Motorola 52nd Street Facility. These sources included surface discharges, spills, tank and pipe leaks, and discharges to leach fields and dry wells. The principle source of contamination was determined to be the leaking UST and a former dry well, both located in the facility Courtyard. This dry well was used for solvent disposal from 1963 to 1974 (prior to environmental regulations regulating these discharges) and was abandoned in 1983. It was originally estimated that approximately 93,000 gallons of TCE was disposed of in the dry well.

- ***1984 to 1987 Remedial Investigation (RI) Activities.*** These activities included the installation and sampling of monitoring wells to further characterize hydrogeologic and water quality conditions at and downgradient of the facility and the completion of multiple soil gas and source verification investigations to evaluate the extent of VOC contamination in groundwater and identify/confirm facility source areas. A well survey was also conducted to identify existing monitoring wells, public supply wells, and private wells in the area bounded by Oak Street to the north, Washington Street to the south, 52nd Street to the east, and 24th Street to the west.

- ***1984 to 1987 Feasibility Study (FS) Activities.*** An FS was conducted to evaluate different remedial alternatives to address the contaminated soil at the facility and contaminated groundwater at and downgradient of the facility. Following preliminary screening of technologies, four alternatives for on-site source control and/or off-site management of contamination migration were evaluated Other FS activities included: development of a detailed cost estimate for the design and installation of each alternative; conduct of a risk assessment to evaluate exposure pathways and to collect toxicological data on contaminants; preparation of a detailed capital and operations and maintenance cost estimate; and model simulation of remedial alternatives.

- ***1986 Initiation of Groundwater Treatment Operations.*** Motorola voluntarily initiated a groundwater treatment program at the former Motorola 52nd Street facility in May 1986. Two groundwater extraction wells, DM-301 and DM-302, were installed in the Courtyard area (see Figure 3-1) to supply contaminated groundwater to a Pilot Treatment Plant (PTP). The PTP operated from September 15, 1986 until startup of the Integrated Groundwater Treatment Plant (IGWTP) in July 1992.

In June 1988, following submission of the Motorola 52nd Street Facility FS, Motorola prepared a Remedial Action Plan (RAP) for a groundwater containment and soil vapor extraction remedy to address groundwater and soil contamination associated with the facility. Based on their review of this document, ADEQ issued a Letter of Determination (LOD) and the EPA issued a Record of Decision (ROD) in September 1988 that established the interim remedy as an operable unit (OU1) to partially cleanup VOC contamination in soil and groundwater. In October 1989, EPA added the Site to the CERCLA National Priorities List (NPL) which designated it as a Superfund site.

Section 4.1 presents detailed information regarding the OU1 interim remedy.

3.3.2 Expansion of Site Investigation Activities and Establishment of OU2

In 1982, groundwater contamination was discovered in wells west of OU1. TCE was detected in the Desert Hills well (near Monroe and 27th Streets) and in the Eastlake Park well (near Jefferson and 16th Streets). The groundwater contamination was initially thought to be unrelated to the former Motorola 52nd Street Facility and was designated by the ADEQ in 1987 as part of the East Washington (EW) WQARF Area.

A summary of environmental characterization/assessment activities conducted in the region downgradient of OU1 follows:

- ***1990 to 1992 Groundwater Investigation.*** ADEQ and Motorola conducted an investigation that included the installation of approximately 48 monitoring wells (with a total of 120 sampling ports) and completion of over 300 aquifer tests. The area-wide sampling effort confirmed that contamination from the former Motorola 52nd Street Facility had migrated westward into the East Washington WQARF area. As a result, ADEQ and EPA designated a region downgradient of OU1 as a second operable unit (i.e., OU2) study area to the Site (see Figure 3-2) to address the groundwater contamination before a final remedy was selected.

- ***1993 Feasibility Study Activities.*** Motorola completed a Draft Interim Remedy FS Report for OU2 in 1993. Proposed remedial objectives were also presented in the FS Report. The results of the FS supported the decision that a pump and treat remedy would be an effective interim remedy to capture the OU2 region of the groundwater plume.

In July 1994, ADEQ and EPA issued a ROD selecting an interim OU2 groundwater remedy. The purpose of the OU2 interim remedy was to provide additional containment of contaminated groundwater in the region downgradient of OU1. In September 1999, the EPA issued an Explanation of Significant Differences (ESD) to the OU2 interim remedy ROD describing

changes in the treatment system based on the results of analysis in the OU2 Final (100%) Design Report.

Since implementation of the OU2 interim remedy, additional sources of contamination contributing to the regional VOC plume downgradient of OU1 area have been investigated. The Honeywell 34th Street Facility along with other facilities has been identified as a source of both chlorinated VOCs and petroleum hydrocarbons in OU2.

3.3.3 Establishment of the OU3 Study Area

To address co-mingling of regional VOC plumes downgradient of OU2, EPA and ADEQ established the boundaries of the OU3 Study Area in 1997 (see Figure 3-3). From February 2002 through July 2003, EPA conducted a phased field program that included the installation of additional monitoring wells to further characterize groundwater contamination in the study area. TCE was the most commonly detected VOC, with the highest concentrations noted along Van Buren Street. Other VOCs detected during these monitoring activities included: 1,1-DCE, 1,1-dichloroethane (1,1-DCA), cis-1,2-DCE, PCE, and 1,4-dioxane.

On September 23, 2009, EPA signed a Settlement Agreement and AOC with the OU3 Working Group (Honeywell and APS) to complete a comprehensive RI/FS for OU3. This work is referred to as the Phase III RI and is ongoing. The OU3 Working Group issued the *Final OU3 Phase III Groundwater Remedial Investigation and Feasibility Study Work Plan* in August 2010.

3.4 BASIS FOR TAKING ACTION

3.4.1 Summary of OU1 Contamination

Based on the results of remedial investigation activities conducted prior to issuing the first Site ROD (see Section 3.3.1), conclusions summarizing the nature and extent of contamination at and near the former Motorola 52nd Street Facility are as follows:

- The results of the source verification investigation showed contaminant concentrations at three source locations (Courtyard, ATP, and SWPL). At these locations, organic contaminants were found in both soil and groundwater. The dry well, located in the Courtyard, had the highest concentration of VOCs in soil and groundwater. The high levels of VOC concentrations in the saturated and unsaturated zones at the dry well and the former UST indicated the presence of DNAPL.

- Soil, groundwater, and bedrock contamination have been documented at the former Motorola 52nd Street Facility. TCE is the major VOC contaminant Groundwater contamination extends to the west and then west-southwest of the former Motorola 52nd Street Facility and consists

primarily of VOCs. DNAPL is thought to exist primarily within the fractures of bedrock as a free-phase DNAPL. Since the DNAPL undergoes only limited degradation, it persists for long periods of time while slowly dissolving into the groundwater. The DNAPL is essentially immobile and recovery using pumping wells is slow.

3.4.2 Summary of OU2 Contamination

At the time OU2 was established (in the early 1990s), VOC-impacted groundwater migrating downgradient of OU1 and the former Motorola 52nd Street Facility was the primary known source of contamination in OU2. TCE was identified as the major contaminant and the impacted groundwater plume extended across the entire extent of OU2 (from the boundary with OU1 to the boundary with OU3) in what is now known as ADEQ HSU A, B, and D.

3.4.3 Health Assessments

Several health assessments have been conducted for the Site. A summary of the major conclusions from recent health assessments is presented below. A more detailed description of each of the health assessments is presented in Appendix B.

- 1988 Health Assessment
- 1992, 1993, and 1996 Health Assessment Update and Baseline Risk Assessment
- 1992 ADHS Soil Gas Exposure Assessment
- 2002 Health Assessment

2005 Evaluation of Potential Vapor Intrusion to Indoor Air Risk at OU1

Freescale Semiconductor, Inc. (Freescale; on behalf of Motorola) submitted a memorandum entitled Potential Indoor Air Vapor Intrusion Risks for Motorola 52nd Street Superfund Site Operable Unit 1 to ADEQ on December 6, 2005 (Sciences International, 2005). The memorandum estimated the risks from potential vapor intrusion into residences within the OU1 area using soil gas data collected in 1995. Screening levels were generally based on EPA's published cancer and non-cancer potency factors. Where no EPA factors were available, California EPA inhalation potency factors were used. The results indicated low total potential risk levels that are within the risk management range of 10^{-6} (or lower) to 10^{-4}. Most of the results were below the 10^{-6} risk level. At two locations, TCE and PCE were reported at concentrations between the 10^{-5} and 10^{-4} risk level and 5 locations were reported between 10^{-6} and 10^{-5}.

Since 2005, EPA's draft health risk assessments of TCE (2001 and 2009) and PCE (2008) indicate that these chemicals may pose a greater risk than previously considered for cancer as well as non-cancer health effects. EPA has proposed to revise both TCE and PCE's status as human carcinogens. In addition, the soil gas samples used in the 2005 assessment (collected in 1995) were taken using technology that, although current at the time, has since improved with regard to leak detection protocols, the sealing of the sampling equipment and the depth at which samples should be collected. Therefore, EPA Region 9 determined that changes in vapor intrusion to indoor air risk assessment warrant further review of the conclusions reached by Freescale.

Using the draft TCE and PCE health risk assessments, indoor air Regional Screening Levels, and vapor intrusion attenuation factors developed by the California Environmental Protection Agency, EPA Region 9 developed health-based screening values to evaluate soil gas sample results. The levels of TCE and PCE from the 1995 soil gas sampling event exceeded Region 9's soil gas screening levels at several locations. Therefore, further soil gas sampling is necessary to determine whether indoor air sampling is warranted. Additional vapor intrusion evaluations are planned or ongoing. A discussion of the additional vapor intrusion activities is presented in Section 5.1.3.3.

4.0 REMEDIAL ACTIONS

4.1 OU1

4.1.1 Remedy Selection

In September 1988, ADEQ issued a LOD and the EPA issued a ROD for an OU1 interim remedy. These documents approved the Draft RAP for the Motorola 52nd Street Facility (see Section 3.3.1) and the interim remedy proposed therein. Although not explicitly stated as a remedial action objective (RAO), the OU1 LOD indicates that the intent of the interim remedy is to be part of a final remedy for the Site that will protect human health and the environment by containing the migration of high concentrations of VOCs in groundwater via extraction and treatment to a level commensurate with its use. These efforts would thus reduce the toxicity, mobility, or volume of contamination present at the Site. The major components of the interim remedy selected in the LOD and ROD include the following:

- Extraction and treatment of groundwater from the Courtyard/50th Street area at the Motorola 52nd Street Facility.
- Extraction and treatment of vapor phase organic contaminants from soils at the Courtyard/50th Street, the ATP, and the SWPL areas of the Motorola 52nd Street Facility.
- Extraction of groundwater designed to contain contaminant migration in alluvium groundwater (east of) at the OCC.
- Treatment at the Motorola 52nd Street Facility of groundwater extracted from the OCC containment system.
- Use of all treated groundwater at the Motorola 52nd Street Facility to replace water currently purchased from the City of Phoenix.

The total groundwater extraction and treatment flow rate identified in the LOD was approximately 810 gallons per minute (gpm). The interim remedy did not select restoration of the aquifer as a remedial action objective. The objective of the ROD and LOD is to contain the migration of high concentrations of VOCs in groundwater at the OCC. However, the ROD and LOD did state compliance with an aquifer restoration Applicable or Relevant and Appropriate Requirement (ARAR) would be revisited in the final ROD and LOD. The remedy was designed to meet the substantive requirements of applicable permits.

4.1.2 Interim Remedy Implementation

On June 20, 1989, Motorola signed a consent order (CO) with ADEQ agreeing to implement the interim groundwater and soil remedy defined as OU1 (Civil Action No. CV89-16807). Motorola was identified as an RP and, as required by the LOD and ROD, ordered to contain and control the migration and reduce the level of contaminants in the groundwater. Appendix A presents additional information regarding the requirements of the OU1 CO.

4.1.2.1 Description of Groundwater Remedy

Groundwater Treatment Activities Identified as Ongoing in the LOD. As stated in Section 3.3.1, Motorola installed a PTP in 1986 at the former Motorola 52nd Street Facility to treat extracted groundwater from the Courtyard source area via air stripping. This operation was ongoing at the time the LOD was issued and extraction of groundwater from this region of the former Motorola 52nd Street Facility was formally incorporated into the LOD and ROD as part of the OU1 interim remedy in 1988.

Operation of the PTP occurred from September 1986 through July 1992 and included extraction of approximately 35 to 60 gallons per minute (gpm) of groundwater from Courtyard area wells DM301, DM302, DM303, and DM304 (see Figure 3-1). The Courtyard extraction wells (DM301 through DM304) are screened at the interface between the alluvium and bedrock (approximately 50 to 150 ft bgs) with DM302 located in the vicinity of the former dry well identified as a past solvent disposal location for the facility.

Implementation of Remaining Groundwater Extraction and Treatment Components of the LOD. The remaining components of the groundwater remedy were implemented by:

- Installing extraction wells along the eastern bank of the OCC to contain migration of contamination downgradient of the facility.
- Constructing a pipeline to convey groundwater from the OCC extraction wells to a new groundwater treatment facility constructed at the former Motorola 52nd Street Facility (i.e., the Integrated Groundwater Treatment Plant [IGWTP]).
- Constructing a pipeline to convey groundwater from the Courtyard area wells to the IGWTP.
- Treating up to 810 gpm of extracted groundwater at the IGWTP via air stripping, polishing with liquid-phase granular active carbon (GAC) and treating the off-gas with vapor-phase GAC.

Motorola expanded groundwater treatment and extraction activities to include the SWPL area of the former Motorola 52nd Street Facility in 1991 to address contamination identified subsequent to FS and RAP development.

Operations at the IGWTP began in 1992 and initially included extraction from the four Courtyard extraction wells that previously discharged to the PTP (DM301 through DM304), twelve SWPL extraction wells (DM201, DM201-OB1, DM702 through DM707, DM713, DM714, DM718, and DM724), and nine OCC extraction wells located approximately one-half mile west of the former Motorola 52nd Street Facility (DM305 through DM313). Like the Courtyard extraction wells, the SWPL and OCC extraction wells are all completed at the bedrock/alluvium interface.

Three OCC extraction wells (DM311, DM312, and DM313 – located at the southern end of the OCC extraction alignment) were removed from service with ADEQ concurrence in 2004, 1995, and 1993, respectively. VOC concentrations in groundwater extracted from these wells were less than corresponding Maximum Contaminant Levels (MCLs) for drinking water and pumping of the wells was determined to be unnecessary for adequate plume capture. During the current Five-Year Review Period, the on-facility extraction well network was expanded to include DM314 which is located north of the Courtyard area in the northwest portion of the facility (see Section 5.1.3.1).

All pumps used in the OU1 extraction network are submersible pumps and range in size from a third to 7.5 horsepower (HP). The larger HP pumps (1.5 to 7.5 HP) are installed in OCC wells and reflect the significant contribution these wells have to total IGWTP influent flow. Groundwater extraction flow can be monitored and shut down remotely from the IGWTP control room.

Groundwater extracted at the OCC is conveyed to the IGWTP located near the former ATP area of the former Motorola 52nd Street Facility in a 10 to 14-inch diameter (depending on location) Dual Cast fiberglass reinforced resin subgrade piping network (see Figure 3-1). A similarly constructed piping network conveys groundwater from the Courtyard and SWPL extraction wells to the IGWTP.

Treatment at the IGWTP (see Figure 4-1) includes:

- ***Flow equalization.*** Two 17,000-gal equalization tanks (T101 and T102) are plumbed in parallel and receive extracted groundwater from the on-facility and off-facility groundwater conveyance systems.

- ***Liquid transfer.*** Three separate liquid transfer pump systems include a system of two 15-HP transfer pumps (plumbed in parallel) to pump water from the equalization tanks to the first packed tower aerator (PTA; referred to as AS-201), a similar system to pump water from the AS-201 to the second PTA (AS-301), and two 30-HP transfer pumps (plumbed in parallel) to pump water from the second PTA through a liquid-phase GAC system. Operation of each of these transfer pump systems is controlled by level controls in preceding tanks or sumps (at the base of the PTAs).

- ***Chemical amendment.*** Sodium hexametaphosphate (a sequestering agent) and acid feed systems can meter chemicals into PTA influents to routinely inhibit scaling or can be used for maintenance descaling of packing material within the PTA. Storage of acid at the IGWTP was not required during the current Five-Year Review Period.

- ***Air stripping.*** Two 10-ft diameter PTAs (AS-201 and AS-301) plumbed in series are filled with 15 ft of 2-inch diameter Jeager Tripacks and are equipped with a single 30-HP blower (B-304) to supply air at 6,500 cfm in reverse series for countercurrent air stripping of VOCs from groundwater.

- ***GAC polishing.*** Four liquid-phase GAC contactors (AC-501 through AC-504) are plumbed in two parallel treatment trains of two units in series to remove residual contaminants from aerated groundwater via adsorption. Only one treatment train at a time received direct process flow during the current Five-Year Review Period. Treatment train operation continues until breakthrough between the lead and lag vessels is noted; GAC change-out in contactors occurs on an as needed basis and spent GAC is shipped off-site as a hazardous waste.

- ***Treated water distribution to ON Semiconductor for use in manufacturing operations.*** Groundwater treated at the IGWTP has historically been directed to the facility Reverse Osmosis/Deionized Water (RO/DI) plant and/or the facility cooling tower system. During the current Five-Year Review Period, Freescale was notified that manufacturing operations at ON Semiconductor will be discontinued and an alternative end use for treated groundwater will be required (see Section 5.1.4.1).

- ***PTA off-gas treatment with GAC.*** Air stripper off-gas was originally routed through a dehumidifier to two vapor-phase GAC contactors operated in parallel (the GAC in these contactors was previously regenerated on-site) prior to being recirculated to the air strippers. Following the observation of cracks in these vessels, Motorola replaced the contactors in

2003 with a single pass 10,000-lb capacity vapor adsorption unit that requires off-site regeneration of the GAC.

As of December 2010, extracted groundwater flow into the equalization tanks occurred at a rate of approximately 275 gpm. To accommodate a process flow rate through the IGWTP of approximately 400-450 gpm (the total capacity of the IGWTP is approximately 800 gpm) treatment plant transfer pump operation is intermittent and controlled by level controls in the equalization tanks.

DNAPL Extraction. DNAPL is recovered on a weekly to biweekly basis from monitoring well MP03-D (located in the Courtyard) by bailing and/or pumping. The recovered DNAPL is temporarily stored at the IGWTP in the solvent recovery storage tank system prior to disposal off-site as hazardous waste (aqueous phase groundwater, if present, is decanted from the tank and pumped to influent equalization tanks). MP03-D is screened in bedrock from approximately 155 to 170 ft bgs.

Groundwater Remedy Permitting. Groundwater extraction in OU1 occurs in accordance with the requirements of a Poor Quality Groundwater Withdraw Permit (PQGWWP) issued by ADWR in May 1991 and renewed in 2005 (Permit No. 59-530577). The current permit requires quarterly water level monitoring and annual sampling of extraction wells with semi-annual reporting.

There currently is no air permit for OU1 treatment operations.

4.1.2.2 Description of Soil Remedy

According to the LOD, three regions of the Motorola 52nd Street Facility were to be addressed via SVE as part of the OU1 interim remedy:

- ***The Courtyard Area.*** Motorola operated a pilot SVE system in the Courtyard Area from September 1992 through March 1993. The system consisted of one SVE well (EX-1) connected to a single blower that routed soil gas to the two vapor phase GAC vessels that also received the PTP air stripper off-gas. The pilot system was successful at removing approximately 350 pounds of VOCs during the 6 months that it operated. However, contaminant levels measured 2 years after the pilot test was completed showed levels has rebounded to those which existed prior to operation of the pilot SVE system. Motorola submitted a letter requesting closure of the Courtyard SVE system on April 30, 1998. The letter stated that continued SVE operations would not be effective at eliminating the residual VOC mass believed to be present in low permeability soils in the vadose zone, the potential impact of any residual VOCs on existing shallow groundwater in the area was negligible and continued SVE operations were not economically viable. ADEQ reviewed Motorola's

request and denied it based on the success of the pilot test and the fact that the pilot system did not meet the requirement of the Consent Order which required that VOC concentrations throughout the thickness of the unsaturated zone be reduced to levels that stabilize at minimal concentrations of recovery. Instead, ADEQ recommended preparing a work plan for the collection of soil or soil gas samples pending revision of Arizona's Soil Rule (which occurred in 2007). The Soil Rule will evaluate impact to groundwater from soil contamination and EPA Region 9's SGHHSLs will be used to evaluate soil gas data to assess whether an indoor air evaluation is warranted. Evaluation of Courtyard soil is pending with associated soil gas and vapor intrusion to indoor air evaluations as part of the future facility VI investigation. This investigation should be completed no later than the next Five-Year Review.

- ***Acid Treatment Plant Area.*** No active soil remediation in the ATP area has occurred to date. EPA, ADEQ and Freescale plan to conduct a soil gas investigation of ATP soils as part of forthcoming facility soil gas and vapor intrusion to indoor air evaluation activities.

- ***The Southwest Parking Lot Area.*** In February 1993, Motorola operated a pilot air sparge (AS)/SVE test in the SWPL area (including Building A-D). The pilot system included three SVE wells (TW-001 through TW-003) and one air sparge well (AS-002) and confirmed that these technologies were effective in reducing VOC contamination in the SWPL area. A full-scale system operated from November 1996 through April 1997 and consisted of six combined SVE/AS wells, a knockout tank, two process SVE blowers, six vapor phase GAC vessels (four vessels arranged in parallel with the remaining two vessels serving as lag vessels), a heat exchanger, and an air compressor for air sparging. The SVE system was designed to produce an effective radius of influence from 30 to 40 ft. The AS system was designed to produce an effective radius of approximately 90 ft of sparging influence. After SVE treatment, soil gas VOC concentrations decreased substantially (2 parts per million by volume [ppmv]) when compared to the soil gas concentrations prior to treatment. On March 21, 2001, Motorola provided a written request for a No Further Action (NFA) determination for soil remediation at the SWPL Area (supplemental information was transmitted on September 18, 2002). ADEQ determined that the soil cleanup in the SWPL Area was complete in a letter dated November 15, 2002. This area may be reevaluated as part of the upcoming soil gas and vapor intrusion to indoor air evaluation.

4.1.3 System Operation and Maintenance

This section presents operation and maintenance (O&M) information for the IGWTP located at the former Motorola 52nd Street Facility (which is currently operated by ON Semiconductor).

The Courtyard SVE and SWPL SVE systems remained shut down during the current Five-Year Review Period.

4.1.3.1 O&M Manual

Prior to the current Five-Year Reporting Period, Motorola last updated the O&M Manual for the IGWTP in August 2000. A recent update of the manual occurred in July 2009 (although this document has not been submitted to ADEQ). The O&M manual consists of basic system design criteria, operation and maintenance requirements of major system components, and monitoring and reporting requirements. The manual also establishes site specific health and safety requirements necessary for safe and efficient operation of the groundwater treatment system. The O&M Manual is intended to be used in conjunction with the OU1 Health and Safety/Emergency Response Plan (HASP). The OU1 HASP is revised occasionally to reflect changes in equipment, operations, and procedures.

4.1.3.2 Operational Issues

Since 1992 when IGWTP operation began, OU1 groundwater treatment has been relatively continuous over the past years. As noted in the process description presented in Section 4.1.2.1, air stripper off gas was previously recirculated within this process operation (a closed loop system) prior to replacement of the vapor phase GAC treatment vessels in 2003. After installation of the "roll-off" type of carbon unit, process operations were reconfigured from a closed loop system to discharge the air stripper off-gas after treatment (a single pass system). This process change resulted in the generation of scale in the air strippers which required batch treatment with acid in 2004. Scale is currently controlled with the addition of sodium hexametaphosphate.

4.1.3.3 O&M Costs

The original estimate for annual O&M of the system (prepared in 1987) was $700,000. Since startup, O&M costs for IGWTP operation have varied significantly.

- From 1996 to 2000, annual costs ranged from approximately $265,000 to $897,000. Lower annual costs were observed in the last two years of this period and were attributed to a reduced level of required staffing and a less frequent vapor phase carbon regeneration schedule.

- From 2001 to 2005, annual costs ranged from approximately $578,000 to $1,210,000. Costs were relatively consistent from 2002 through 2005 (around $1,100,000); Freescale attributed the increase as of 2002 to the ON Semiconductor-Motorola separation, stating that recent

costs represented the accrual of land and utility costs not previously captured since OU1 was integrated into the manufacturing operations at the former Motorola 52nd Street Facility.

– From 2006 to 2010, annual costs ranged from approximately $1,210,000 to $1,320,000 (excluding costs recovered by ADEQ and EPA for agency oversight; see Table 4-1). A significant portion of operating costs (approximately $380,000 on an annual basis) includes payments made by Freescale (on behalf of Motorola) to ON Semiconductor for supply of various utilities to the treatment plant. Approximately $450,000 of the annual costs presented above is associated with support of IGWTP and other remedial operations including installation of additional wells, technical support, and supplementary investigations.

Table 4-1 O&M Costs for OU1

Year	Utilities*	Materials/ Supplies	Disposal/ Regeneration	Operation**/ Monitoring/ Reporting	Other Expenses***	Agency Oversight	Annual Total (Excluding Agency Oversight)	Cost Per Million Gallons of Extracted Groundwater Treated†	Cost Per Pound of TCE Removed†
2006	$378,342	Included in Operating Costs	$51,739	$370,976	$404,554	$254,345	$1,205,611	$5,520/Mgal	$713/lb
2007	$381,219	Included in Operating Costs	$61,578	$397,877	$369,058	$180,509	$1,209,732	$6,140/Mgal	$937/lb
2008	$386,336	Included in Operating Costs	$69,500	$430,599	$429,691	$71,612	$1,316,126	$6,930/Mgal	$1,470/lb
2009	$383,385	Included in Operating Costs	$15,745	$446,041	$449,680	$26,436	$1,294,851	$6,870/Mgal	$1,710/lb
2010††	$382,800	Included in Operating Costs	$31,490	$450,000	$445,970	$144,481	$1,310,260	Not Available	Not Available
Average	*$382,416*	---	*$46,010*	*$419,099*	*$419,791*	*$135,477*	*$1,267,316*	*$6,370/Mgal*	*$1,210/lb*

Notes:
* Excludes water discharge costs.
** Maintenance and repairs are included in this item.
*** Includes well installation/abandonment, additional technical support/reports to agencies, permit/access fees, additional studies, new sewer connection, etc.
† Based on annual quantities presented in Effectiveness Reports and Utilities, Materials/Supplies, Disposal/Regeneration, and Operation/Monitoring/Reporting costs only.
†† Includes projected costs (compiled in November 2010).
Mgal million gallons
TCE trichloroethene
lb pound

Source of cost data:
Freescale Semiconductor, Inc.

4.2 OU2

4.2.1 Remedy Selection

In July 1994, ADEQ and EPA issued a ROD selecting the interim groundwater remedy known as OU2. The purpose of the OU2 interim remedy was to provide additional containment of contaminated portions of the groundwater downgradient of OU1. The OU2 ROD identified the following remedial objectives:

- Establish a capture zone across the entire width and depth of the contaminant plume.
- Reduce concentrations of contaminated groundwater within the alluvial aquifer upgradient of the extraction wells.

The interim remedy selected in the ROD included groundwater extraction near 20th Street and Washington Street, treatment of water by either air stripping (with off-gas treatment by synthetic resin adsorption) or advanced oxidation, and injection of treated water back into the aquifer in locations allowing additional control of the contaminant plume.

In September 1999, EPA issued an ESD to the July 1994 ROD for the OU2 interim remedy. The ESD modified the interim remedial action because changes were determined to be efficient and cost effective. The major components of the OU2 interim remedy selected in the ROD as modified by the ESD include the following:

- Extraction of groundwater designed to contain the full width and depth of the plume near Interstate 10.
- Treatment of extracted groundwater via carbon adsorption and ultraviolet (UV) oxidation.
- Discharge of treated water to the SRP Grand Canal.

The OU2 ROD specified that groundwater will be treated to a level at or below MCLs.

4.2.2 Interim Remedy Implementation

In November 1996, a Consent Decree was entered into by ADEQ, Freescale, and the City of Phoenix for the design of the OU2 groundwater treatment system. On November 30, 1998, EPA issued a Unilateral Administrative Order (UAO) to Freescale and Honeywell for construction, start up, and two years of O&M of the OU2 groundwater treatment system. A second amended UAO was issued on December 11, 2003 that required continued O&M of the OU2 interim

remedy. Appendix A presents additional information regarding the requirements of the OU2 1996 Consent Decree (CD) and 1998 UAO.

Construction of the 20th Street Groundwater Treatment Facility began in March 2000 and was completed in September 2001. The treatment system became fully operational on December 31, 2001.

The Groundwater Extraction System (GES) supplies water to the 20th Street Groundwater Treatment Facility and consists of three extraction wells located along 20th Street (EWN, EWM, and EWS). The extraction wells are designed to provide hydraulic containment west of Interstate 10. There is also a total of 53 monitoring wells that constitute the OU2 treatment system monitoring network (see Figure 3-2).

The 20th Street Groundwater Treatment Facility has been in operation since December 31, 2001. The treatment system is designed to treat approximately 5,300 gpm. As of the Site Inspection in December 2010, the treatment system is operated at approximately 2,450 gpm due to dewatering of the alluvium.

The 20th Street Groundwater Treatment Facility consists of 18 GAC vessels and one UV oxidation system with hydrogen peroxide amendment. Groundwater from the extraction wells is pumped at the current average rate of 2,450 gpm (800 gpm from EW-N; 1,350 gpm from EW-M, and 300 gpm from EW-S) to the treatment plant and through four pairs of GAC vessels connected in series. The UV oxidation system is not in operation because vinyl chloride has not been detected in extracted groundwater. The treated water is routed through underground piping to a discharge point on the Grand Canal (see Figure 3-2).

Occasional slow flow backflushing of the GAC units is required to flush out entrained air from the carbon and restratify carbon in the vessels. The backflushed water is collected in a backwash wastewater tank and is subsequently discharged to the City of Phoenix sanitary sewer system. Spent GAC is returned to the supplier for regeneration and then is returned to the treatment plant.

Pumps used in the OU2 extraction network include two lineshaft vertical turbine pumps (in EW-N and EW-M) and one submersible pump (in EW-S). Extracted groundwater is conveyed to the treatment plant in a 16 to 24-inch diameter (depending on location) thermally welded high density polyethylene (HDPE) subgrade piping network.

4.2.3 System Operation and Maintenance

4.2.3.1 O&M Manual

Daily maintenance activities are performed by Conestoga-Rovers & Associates (CRA) in accordance with the updated July 2004 *Revised Final Operation and Maintenance Manual, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit 2 Area, Phoenix, Arizona*. The monitoring plan is also outlined in the revised O&M Manual; groundwater quality monitoring is performed semiannually (March and September) for the process sampling at the three extraction wells. However, a subset of monitoring wells is monitored on a quarterly basis as described in the Effectiveness Reports for the hydraulic (water level) monitoring.

4.2.3.2 Operational Issues

Few significant issues other than annual SRP Grand Canal shutdowns have been reported as impacting treatment facility operations. The SRP Grand Canal shutdowns are annual events mandated by SRP so they can maintain the canal system. SRP does not allow any discharges to the canal during these shutdowns. They typically last approximately one month. The 20th Street Groundwater Treatment Facility personnel use this time to perform preventative maintenance on the system. This preventative maintenance can include leaking valve replacement, well/pump overhauls, pipe inspections, and other pertinent items based on previous system operation.

In December 2005, the treatment system was shut down because TCE was detected in the November 2005 facility discharge sample at concentrations of 4.1 μg/L and 4.2 μg/L. The system was restarted following change-outs of the four primary GAC carbon vessels.

4.2.3.3 O&M Costs

O&M costs for 20th Street Groundwater Treatment Facility operation have not varied significantly since startup in 2001:

- 2001 annual costs were approximately $415,702. These costs included start-up and system commissioning.
- From 2002 to 2005, annual costs ranged from approximately $776,431 to $1,027,508. Costs were relatively consistent from 2002 through 2005 (around $910,000).
- From 2006 to 2010, annual costs ranged from approximately $1,014,485 to $1,680,715 (see Table 4-2). Costs were relatively consistent with the exception of 2007. The additional costs in 2007 were due to additional rounds of well installation performed following the previous Five-Year Review.

Table 4-2 O&M Costs for OU2

Year	Utilities*	Materials/ Supplies	Disposal/ Regeneration	Operation**/ Monitoring/ Reporting	Other Expenses***	Agency Oversight	Annual Total (Excluding Agency Oversight)	Cost Per Million Gallons of Extracted Groundwater Treated†	Cost Per Pound of TCE Removed†
2006	$134,828	$77,000	$157,265	$552,000	$170,231	$277,984	*$1,091,324*	$654/MGal	$432/lb
2007	$147,178	$68,000	$161,000	$530,000	$501,528	$273,009	*$1,407,706*	$934/MGal	$782/lb
2008	$153,748	$172,000	$208,250	$516,000	$80,068	$177,350	*$1,130,066*	$1,022/MGal	$1,058/lb
2009	$157,807	$42,000	$163,500	$424,000	$119,543	$107,635	*$906,850*	$751/MGal	$904/lb
2010††	$133,598	$82,200	$179,400	$397,000	$98,052	$257,987	*$890,250*	Not Available	Not Available
Average	$145,432	$88,240	$173,883	$483,800	$193,884	$218,793	$1,085,239	$840/Mgal	$794/lb

Notes:
* Excludes water discharge costs.
** Maintenance and repairs are included in this item.
*** Includes well installation/abandonment, additional technical support/reports to agencies, permit/access fees, additional studies, new sewer connection, etc.
† Based on annual quantities presented in Effectiveness Reports and Utilities, Materials/Supplies, Disposal/Regeneration, and Operation/Monitoring/Reporting costs only.
†† Includes costs through October 30, 2010.
Mgal million gallons
TCE trichloroethene
lb pound

Source of cost data:
Freescale Semiconductor, Inc.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

5.1 OU1

5.1.1 Protectiveness Statements Issued in Previous Five-Year Reviews

Three Five-Year Reviews have been conducted to evaluate the protectiveness of OU1. The last protectiveness statement selected for OU1 in 2006 is summarized below.

The Third Five-Year Review of OU1 concluded that a protectiveness determination for the interim remedy could not be made until further information was obtained (ADEQ and LFR, 2006). Maintaining bedrock capture was noted as a continuing issue; however, a lack of adequate groundwater data and a need to fill several additional data gaps were identified as necessary to fully evaluate OU1 capture effectiveness. At the time the Third Five-Year Review of OU1 was prepared, it was expected that recommended follow-up actions would take approximately 1 year to complete. In 2007, ADEQ issued the Third Five-Year Review Addendum Report for OU1 which presented implemented progress on follow-up actions but stated that the protectiveness determination would be deferred to the following Five-Year Review.

5.1.2 Status of Recommendations/Follow-Up Actions from Last Review

Table 5-1 presents the status of recommendations and follow-up actions from the 2006 Five-Year Review for OU1. This table is an updated version of the progress table presented in the Third Five-Year Review Addendum Report for OU1.

5.1.3 Summary of Implemented Actions

Additional detail regarding significant implemented actions is presented in the following sections. Table 5-1 presents information regarding actions not discussed below.

5.1.3.1 Expansion of the OU1 Well Network

During the current Five-Year Review Period, nine new wells were added to the OU1 well network (see Issue Numbers 1, 2, 3 and 4 in Table 5-1):

- Monitoring well DM607 (a Flexible Liner Underground Technologies [FLUTe] system multiport well) was installed in March of 2006 and made functional after various retrofits in January 2007.

- Monitoring wells DM609 and DM610 were completed in December of 2006 to further delineate the northern boundary of OU1 and to evaluate other sources of contaminants of

concern in the area. DM609 is screened in alluvium and installed to a depth of 99 ft bgs just above the bedrock/alluvium contact. DM610 was completed 100 ft into the bedrock to a depth of 195 ft bgs.

– Monitoring wells DM611, DM612, and DM613 were installed in October of 2007, along the east bank of the OCC between extraction wells DM307 and DM308, to better delineate the depth of the plume. DM611 was installed in the alluvium to a depth of 102 ft bgs to monitor the alluvium aquifer. DM612 and DM613 were installed to 225 ft bgs and 400 ft bgs, respectively, to monitor contaminated groundwater in bedrock.

– Three new wells were installed as part of the OU1 Bedrock Pilot Study. Wells DM314, DM614, and DM615 were constructed west of the former Motorola 52nd Street Facility in the 50th Street alignment, south of McDowell Road. Monitoring wells DM614 and DM615 were installed first, in December of 2008. These wells were installed in the bedrock at 275 and 400 ft, respectively, to evaluate the response to pumping at varying depths below the extraction well, DM314. DM314 was installed in January of 2009 to a depth of 265 ft to extract groundwater from the bedrock aquifer.

5.1.3.2 Bedrock Extraction Pilot Study

In response to submission of the Groundwater Remedial Alternative Analysis (RAA) Report (see Issue Number 6 in Table 5-1), ADEQ requested that extraction of groundwater from bedrock in the Courtyard former source area be further evaluated. DNAPL is present in this region of the Site and continues to serve as an ongoing source of contamination to alluvial groundwater. During the current Five-Year Reporting Period, a Bedrock Extraction Pilot Study was initiated to assess the permeability of bedrock in the Courtyard area, investigate the effects of extraction, and evaluate whether operations are practicable.

Extraction of groundwater from DM314 began in September 2009 and continues to date. Cycled pumping occurs at a rate of approximately 5 gpm and is controlled by water level sensors installed in the well. The extracted groundwater is treated in the IGWTP. Water levels are monitored in several observation wells via pressure transducers and additional wells via periodic manual gauging.

Table 5-1 Actions Taken Since the Last Five-Year Review for OU1

Issue No.	Issue Type	Follow-up Actions and Recommendations	Responsible Party	Oversight Agency	Completion Date	Status as of June 2010
1, 2, 3	Groundwater Capture	A work plan should be prepared and submitted to ADEQ to address the OU1 data gaps identified in Section 8.1.1. The work plan should include a summary of the current conceptual site model, a review of the existing OU1 groundwater monitoring well network and other available data, identify the data gaps, and propose the work necessary to fill the data gaps.	Freescale	ADEQ	2007; Analysis Ongoing	Freescale installed three new wells in 2006 (DM607 – a FLUTe multiport well down-gradient of the OCC; DM609 and DM610 – conventional wells north of EW-18) and three new wells in 2007 (DM611, DM612, and DM613 – conventional wells at the OCC between extraction wells DM307 and DM308, downgradient from DM606). These wells are intended to evaluate hydraulic capture both in the alluvium and bedrock in the northern portion of the plume and along the central axis of the plume (both at the extraction alignment and downgradient of it). Other identified data gap issues will be addressed in the forth-coming OU1 Final Remedy Feasibility Study.
4	Groundwater Capture	A work plan should be prepared and submitted to ADEQ to address the bedrock hydraulic conductivity and extraction issues. The work plan should include the installation of a deep bedrock extraction and monitor wells such that a bedrock extraction pilot study may be completed to evaluate bedrock hydraulic conductivity. The results of the study should be incorporated into the feasibility study for the final remedy.	Freescale	ADEQ	July 2008	Freescale submitted a workplan and initiated a pilot study to evaluate extraction of ground-water from the bedrock near the source area. The Bedrock Pilot Study includes a new bedrock extraction well (DM314) and two new bedrock monitoring wells (DM614 and DM615) all located near existing monitoring well DM601. Continuous extraction from DM314 began in September 2009 and continues to date (the water is treated at the IGWTP). Freescale submitted a report summarizing the first six months of operation in April 2010.
5	Groundwater Capture	Freescale should prepare a plan to monitor the concentrations in DM-313. If these concentrations continue to increase and exceed the MCL, the well should be put back into operation.	Freescale	ADEQ	Not Applicable	Freescale is monitoring concentrations in this well on an annual basis. TCE concentrations have decreased since 2005 and have remained stable since that time (less than 1.4 μg/L).

Issue No.	Issue Type	Follow-up Actions and Recommendations	Responsible Party	Oversight Agency	Completion Date	Status as of June 2010
6	Groundwater Source Removal	Freescale submitted a Groundwater Remedial Alternatives Analysis report in September 2005 followed by an Addendum to the Groundwater Remedial Alternatives Analysis report in December 2005 evaluating treatment technologies for DNAPL. The report is currently under review by ADEQ.	Freescale ADEQ	ADEQ	12/29/2006	Comments regarding these reports were provided by ADEQ in a letter dated October 18, 2006. The Bedrock Pilot Study (see Item 4) is being conducted in response to issues raised during the review process.
7	Groundwater Source Removal	Freescale should prepare a plan to evaluate the effectiveness of the source area treatment system.	Freescale	ADEQ	Ongoing	Freescale will prepare a plan to evaluate the effectiveness of the source area treatment system in the forthcoming OU1 Final Remedy Feasibility Study.
8	Soil	Freescale should develop a work plan to evaluate the vadose zone at the Courtyard area. The work plan should include evaluation criteria for clean-up. ADEQ will provide Freescale with the evaluation criteria once the Soil Rule and Guidance is finalized.	Freescale	ADEQ EPA	Ongoing	The EPA and Freescale negotiated an AOC and SOW effective August 31, 2010 to evaluate vapor intrusion into nearby buildings resulting from contaminated groundwater and soil associated with OU1. The current SOW will evaluate soil gas in the residential neighborhood between the facility and the OCC. A forthcoming SOW is expected to evaluate soil (via soil gas sampling) at the facility – including the Courtyard, ATP and SWPL areas. ADEQ will review this SOW to evaluate whether the proposed work also adequately assesses the extent of soil clean-up.
9	Soil	A work plan should also be developed for establishing clean-up criteria at the ATP. The criteria will be established once the Soil Rule and Guidance is finalized and should be included in the work plan.	Freescale	ADEQ EPA	Ongoing	See response to Issue 8.
10	Health Assessment Issues	A review of the toxicity values for COCs at the Site should be conducted before the final remedy is selected.	ADEQ EPA	ADEQ EPA	Ongoing	ADEQ and EPA continue to review health risks associated with site COCs.

Issue No.	Issue Type	Follow-up Actions and Recommendations	Responsible Party	Oversight Agency	Completion Date	Status as of June 2010
11	Health Assessment Issues	Freescale has previously prepared a work plan to address the vapor intrusion to indoor air pathway. Once the guidance for evaluating the vapor intrusion to indoor air pathway is finalized or EPA and ADEQ can agree to the process for evaluating the pathway, an indoor air risk evaluation should be conducted at the Site. The work plan should be updated to meet the final guidance requirements.	Freescale	ADEQ EPA	Ongoing	See response to Issue 8.
12	Health Assessment Issues	ADEQ and Freescale should develop a plan to collect groundwater samples from Mr. Morgan's well and take further actions if necessary.	Freescale ADEQ	ADEQ	July 2007	Access was granted to ADEQ. Samples were collected by ADEQ and Freescale in July 2007 and by ADEQ in March 2008 and September 2010. The property owner uses the well for landscaping purposes.
13	Health Assessment Issues	ADEQ issues a fact sheet every other year to all the addresses listed within the Motorola 52nd Street Superfund Site. ADEQ will include a note in the next fact sheet requesting owners to notify ADEQ of any private well.	ADEQ	ADEQ	May 2007	The note was added to the fact sheet that was mailed out in May 2007.
14	O&M	The secondary containment system's protective coating should be repaired.	Freescale	ADEQ	Not Available	Freescale repaired the protective coating.
15	O&M	The PVC piping, valves, and other appurtenances that show signs of weathering should be replaced.	Freescale	ADEQ	Not Available	Freescale replaced weathered process piping and appurtenances.
16	O&M	The stainless steel steam pressure tanks should be replaced if they are brought back into use.	Freescale	ADEQ	Not Applicable	As a necessary component of treating air emissions, the tanks were replaced with a new 'roll-off' type air emission control device in 2003. If brought back into service, ADEQ will require Freescale to replace the stainless steel steam pressure tanks.
17	O&M	Steel appurtenances that show signs of rusting and/or corrosion should be replaced.	Freescale	ADEQ	Not Available	Freescale replaced rusting/corroded steel appurtenances.
18	General	ADEQ should establish a list of COCs for the Site. Once the list has been established, Freescale should conduct a sampling round to evaluate the COC list for the RAOs for the final remedy.	Freescale ADEQ	ADEQ EPA	2006; Final Development Ongoing	Freescale submitted a letter justifying their list of COCs in 2006. ADEQ and EPA are currently developing a method of approach to establish a comprehensive sitewide COC list.

Issue No.	Issue Type	Follow-up Actions and Recommendations	Responsible Party	Oversight Agency	Completion Date	Status as of June 2010
19	General	Freescale should include the air emission and groundwater influent/ effluent analytical data in the annual Effectiveness Reports.	Freescale	ADEQ	3/31/07	Freescale began including air emission and groundwater influent/effluent analytical data in the 2006 Effectiveness Report dated March 31, 2007.
20	General	ADEQ will conduct a PRP search for upgradient sources and will evaluate whether these sources will impact the remedy.	ADEQ	ADEQ	Ongoing	Researching PRPs is an ongoing process.

Notes:
ADEQ – Arizona Department of Environmental Quality
AOC – Administrative Order on Consent
ATP – Acid Treatment Plant
COC – Contaminant of Concern
DNAPL – Dense Non-Aqueous Phase Liquid
EPA – Environmental Protection Agency
EW – Extraction Well
MCL – Maximum Contaminant Level
O&M – Operation and Maintenance
OUI – Operable Unit 1
PRP – Potential Responsible Party
RAO – Remedial Alternative Objective
SOW – Statement of Work
TCE – Trichloroethene
VOC – Volatile Organic Compounds

Although currently under review by ADEQ and EPA, Freescale's preliminary findings of the Bedrock Extraction Pilot Study (as documented by their contractor Clear Creek and Associates, 2010b) are as follows:

- The permeability of the bedrock is very low. Short-term testing shows limited connection between the extraction and observation wells; however, monitoring over the first six months of operation shows impacts on the wells closest to the pumping well. Delays in observed responses suggest groundwater flow in the bedrock is more aptly modeled by a 'very low permeable equivalent porous media instead of a fracture flow medium'.

- Groundwater extraction from DM314 has a limited extent of influence but has impacts on vertical gradient within 25 ft of the well. Localized changes in surrounding water quality were observed.

- Given the elevated concentrations of TCE present in the groundwater extracted from DM314 (66,000 to 130,000 μg/L), the well has removed a significant amount of mass for the volume of water pumped (143 pounds [lb] of VOCs in six months). At this time, it is difficult to assess whether observed mass removal rates are sustainable.

5.1.3.3 Evaluation of the Vapor Intrusion to Indoor Air Pathway

Since the last Five-Year Review, EPA's understanding of soil gas movement and potential vapor intrusion has evolved. In 2005, a memorandum entitled *Potential Indoor Air Vapor Intrusion Risks for Motorola 52nd Street Superfund Site Operable Unit 1* was prepared that estimated the risks from potential vapor intrusion into residences within the OU1 area using soil gas data collected in 1995. Screening levels were generally based on EPA's published cancer and non-cancer potency factors at that time. It concluded that the risks were within EPA's risk range. Since this 2005 report, EPA's draft health risk assessments of TCE (2001 and 2009) and PCE (2008) indicate that these chemicals may pose a greater risk than previously considered for cancer as well as non-cancer health effects. EPA has proposed to revise both TCE and PCE's status as human carcinogens. Applying EPA's latest models for estimating potential vapor intrusion and using the current health-based screening values to the 1995 soil gas sampling results indicates that there is a potential for vapor intrusion and further investigation is warranted.

EPA initiated work to further investigate the VI to indoor air pathway of VOC contamination within the boundaries of OU1 (see Issue Numbers 8 and 11 in Table 5-1). EPA negotiated an Administrative Order on Consent (AOC) and a Statement of Work (SOW) with Freescale

effective August 31, 2010 to perform soil gas sampling and, if needed, indoor air sampling in the residential neighborhood west of the former Motorola 52nd Street Facility.

5.1.3.4 Evaluation of Alternative Treated Water End Use Options

As noted in Section 4.1.1, the OU1 LOD requires that extracted groundwater treated in the IGWTP be beneficially reused at the former Motorola 52nd Street Facility (operated by ON Semiconductor). During the current Five-Year Review Period, ON Semiconductor announced that they were discontinuing manufacturing operations at their 52nd Street facility, prompting Freescale to secure a new end use for the IGWTP. Freescale conducted an evaluation of alternative end uses and documented the analysis for ADEQ and EPA review in a letter report dated June 10, 2009 that was subsequently revised and issued on behalf of Freescale by Clear Creek and Associates on April 30, 2010.

On the basis of the evaluation, Freescale proposed discharge to the sanitary sewer as its preferred interim alternative for discharge enduse. Discharge to the SRP Grand Canal (both direct and via the OCC), discharge to the sanitary sewer, as well as reinjection were evaluated as potential long-term alternatives for the treated water.

On January 26, 2010, ADEQ issued a letter to Freescale which stated their support for discharge to the sanitary sewer as a temporary solution and requested that Freescale submit a schedule for implementing the preferred end use alternative for long-term use of the treated effluent. In their April 30, 2010 response, Freescale identified multiple steps to implement the temporary discharge to the sanitary sewer and finalize the selection of a preferred long-term end use.

The change in discharge use will require an ESD of the OU1 interim remedy ROD.

5.1.3.5 Remediated Quantities

Through the end of 2009, treatment activities in OU1 have remediated the following quantities of groundwater and DNAPL (as documented in the most recent OU1 Effectiveness Report prepared by Freescale [Clear Creek Associates, 2010d]):

- An estimated 7.7 million gallons of groundwater were extracted and treated for reuse at the Motorola 52nd Street Facility in the PTP (which operated from 1986 to 1992). Based on historical chemical data and available totalized flow readings, the estimated mass of VOCs recovered during PTP operation is 1,896 lb as TCE.

- An estimated 3,065 million gallons of groundwater containing approximately 20,385 lb of VOCs removed as TCE have been treated for reuse at the Motorola 52nd Street Facility in the IGWTP. Since the end of the period documented in the last OU1 Five-Year Review

(December 2005), the IGWTP has treated approximately 533 million gallons of groundwater containing approximately 3,211 lb of VOCs removed as TCE.

- Approximately 14 gallons of DNAPL and 7,551 gallons of impacted groundwater have been removed from MP03-D. These volumes correspond to a mass of approximately 244 lb as TCE based on an assumption that this contaminant is present in the impacted groundwater at the solubility limit for this compound. Since the end of the period documented in the last OU1 Five-Year Review (December 2005), approximately 5 gallons of DNAPL and 1,764 gallons of impacted groundwater have been removed from MP03-D (an equivalent mass of approximately 78 lb as TCE).

5.2 OU2

5.2.1 Protectiveness Statements Issued in Previous Five-Year Reviews

Two Five-Year Reviews have been conducted to evaluate the protectiveness of OU2. The last protectiveness statement selected for OU2 in 2006 is summarized below:

The Second Five-Year Review of OU2 concluded that a protectiveness determination of the OU2 interim remedy could not be made pending collection of further information (ADEQ and LFR, 2006). The follow-up actions and recommendations identified in the report included: additional well installations to better define data gaps, implementation of a more conservative evaluation of capture, evaluation of boron concentrations in the effluent discharge, and an evaluation of indoor air risk following finalization of indoor air methodologies.

5.2.2 Status of Recommendations/Follow-Up Actions from Last Review

Table 5-2 presents the status of recommendations and follow-up actions from the 2006 Five-Year Review for OU2. This table is an updated version of the progress table presented in the Second Five-Year Review Addendum Report for OU2.

5.2.3 Summary of Implemented Actions

Additional detail regarding significant implemented actions is presented in the following sections. Table 5-2 presents information regarding actions not discussed below.

Table 5-2 Preliminary Status of Follow-up Actions from the 2006 OU2 Review

Issue No.	Issue Type	Follow-up Actions and Recommendations	Responsible Party	Oversight Agency	Completion Date	Status as of June 2010
1	Groundwater Capture Issues	A work plan should be prepared and submitted to ADEQ to address the data gaps along the north side of the OU2 plume. The work plan should include the installation of monitor wells in each of the three alluvial subunits.	Freescale and Honeywell	EPA ADEQ	03/30/2007	Determination made by ADEQ and EPA to address this issue as part of the final remedy for OU2.
2	Groundwater Capture Issues	A work plan should be prepared and submitted to ADEQ to address the data gaps along the south side of the OU2 plume. The work plan should include the installation of monitor wells in each of the three alluvial subunits.	Freescale and Honeywell	EPA ADEQ	03/30/2007	Piezometers NW15-S and NW16-M/D and monitoring wells NW19-M/D installed to provide additional information.
3	Groundwater Capture Issues	A work plan should be prepared and submitted to ADEQ to address the data gaps downgradient of the OU2 treatment system. The work plan should include the installation of monitor wells in the D subunit.	Freescale and Honeywell	EPA ADEQ	03/30/2007	Monitoring Wells NW17-S and NW18-S/M installed to provide additional information.
4	Groundwater Capture Issues	Future capture evaluations shall include a conservative interpretation of groundwater elevation data, an analysis of water level pairs for appropriately configured monitor wells, capture zone calculations that are conceptually consistent with site data and interpretation, and concentration trend analysis that includes historic data.	Freescale and Honeywell	EPA ADEQ	03/30/2007; Ongoing Evaluation Occurs During Effectiveness Report Preparation	Water Level Pair evaluation is ongoing and evaluated in the annual Effectiveness Reports.
5	Groundwater Future Issues	Freescale and Honeywell should continue to monitor the extraction rates for EW-S.	Freescale and Honeywell	EPA ADEQ	Not Applicable	Regular monitoring is ongoing; following changes to the EW-S pumping system, extraction rates have stabilized.

Issue No.	Issue Type	Follow-up Actions and Recommendations	Responsible Party	Oversight Agency	Completion Date	Status as of June 2010
6	Groundwater Future Issues	Freescale and Honeywell should develop a plan to monitor groundwater capture along the southern boundary, particularly in subunit D.	Freescale and Honeywell	EPA ADEQ	03/30/2007	Piezometers NW15-S and NW16-M/D and monitoring wells NW19-M/D installed to provide additional information.
7	Groundwater Future Issues	Freescale and Honeywell should prepare a plan to evaluate the effectiveness of the OU2 treatment system on the stagnation zones upgradient and downgradient of the Honeywell bedrock ridge.	Freescale and Honeywell	EPA ADEQ	03/30/2007	Determination made by ADEQ and EPA to address this issue as part of the final remedy for OU2.
8	Groundwater Future Issues	Freescale and Honeywell should develop a plan to conduct long-term multi-well aquifer tests in subunits B and D. The data obtained from these tests will be useful for designing a final remedy for OU2.	Freescale and Honeywell	EPA ADEQ	Not Applicable	Long-term multi-well aquifer testing in the Basin Fill of OU2 is planned to support OU2 final remedy development.
9	Groundwater Future Issues	The final OU2 remedy will need to incorporate the Honeywell LNAPL remedy.	Freescale and Honeywell	EPA ADEQ	Ongoing	The ADEQ Underground Storage Tank Program has approved portions of the Honeywell LNAPL Corrective Action Plan addressing free product. Dissolved-phase contamination will likely be addressed in the OU2 final remedy.
10	Health Assessment Issues	A review of the toxicity values for COCs at the Site should be conducted before the final remedy is selected.	ADEQ EPA	ADEQ EPA	Ongoing	ADEQ and EPA continue to review health risks associated with site COCs.
11	Health Assessment Issues	An indoor air risk evaluation should be conducted at the Site. Once the guidance for evaluating the vapor intrusion to indoor air pathway is finalized or EPA and ADEQ can agree to the process for evaluating the pathway, an indoor air risk evaluation should be performed for the OU2 area.	Freescale and Honeywell	EPA ADEQ	Ongoing	ADEQ and EPA are still discussing a process for indoor air pathway assessment at OU2.
12	Health Assessment Issues	Effluent samples should be collected and analyzed for boron. If the results are above the surface water limit for agricultural irrigation, SRP should be notified.	Freescale and Honeywell	EPA ADEQ	03/30/2007	EPA requested boron samples to be collected during the September 2007 sampling round.

Issue No.	Issue Type	Follow-up Actions and Recommendations	Responsible Party	Oversight Agency	Completion Date	Status as of June 2010
13	General Issues	The Agencies recommend a technical work group meeting to discuss and address groundwater elevation and quality data, capture issues, and hydrostratigraphic issues.	Freescale and Honeywell ADEQ	EPA ADEQ	11/15/2006	A Technical Working Group meeting was held on 11/15/06

Notes:
ADEQ – Arizona Department of Environmental Quality
COC – Contaminant of Concern
COP – City of Phoenix
EPA – Environmental Protection Agency
GES – Groundwater Extraction System
IGWTP –Integrated Groundwater Treatment Plant
LNAPL – Light Non-Aqueous Phase Liquid
MCL – Maximum Contaminant Level
OCC-Old Crosscut Canal
O&M – Operation and Maintenance
OU2 – Operable Unit 2
PRP – Potentially Responsible Party
ROD – Record of Decision
SRP – Salt River Project
TCE – Trichloroethene
VI – Vapor Intrusion
VOC – Volatile Organic Compounds

5.2.3.1 Expansion of the OU2 Well Network

During the current Five-Year Review Period, five new wells and three piezometers were added to the OU2 well network (see Issue Numbers 2, 3 and 6 in Table 5-2). These wells were installed between September and November of 2007. The primary intent of these wells was to better define the plume boundaries and monitor the subsurface response to the treatment system upgradient and along the southern plume boundary. A description of the wells is provided below:

- Monitoring wells NW17-S and NW18-S/M are installed downgradient of the OU2 GES. Both NW17-S and NW18-M are screened in colluvium (i.e., an accumulation of loose rock debris and soil deposited by gravity down steep slopes). Monitoring well NW18-S is screened in HSU A and is co-located with NW18-M (installed along Adams Street between 18th and 19th Streets). NW17-S is located west of 19th Street and south of Van Buren Road.

- Piezometer NW15-S is located south and upgradient of the OU2 GES on Jackson Street between I-10 and 22nd Street. NW15-S is screened in colluvium.

- Piezometers NW16-M and D are screened across HSU B and D, respectively. These piezometers are installed south of EW-S along 20th Street, south of Washington Street.

- Monitoring wells NW19-M and D are screened across HSU B and D, respectively. These wells are located south and upgradient of the GES near Harrison Street, just east of I-10.

5.2.3.2 Boron Evaluation

Boron concentrations exceeding the Agriculture Irrigation and Livestock Arizona Surface Water Quality Standard (SWQS) of 1.0 mg/L are present in treated water discharged from the OU2 treatment system (see Issue Number 12 in Table 5-2). Boron is a naturally-occurring element found throughout the alluvial aquifer system of the Phoenix Active Management Area and in the OU2 treatment system influent. To address this issue, a mixing zone area has been designated to assess compliance with the SWQS within the SRP Grand Canal. The mixing zone is defined from the point of entry of the treated effluent into the Grand Canal to 800 ft downstream of the discharge location. This zone of the canal has no outlets for irrigation or livestock use. Increased monitoring of boron concentrations in the system effluent, the SRP Grand Canal downstream, and SRP Grand Canal upstream of the mixing zone have been implemented.

5.2.4 Other Progress Made During the Review Period

5.2.4.1 Honeywell 34th Street Facility BSVE System

A Biologically-enhanced Soil Vapor Extraction (BSVE) system has been constructed and is operating at the Honeywell 34th Street Facility to address a light non-aqueous phase liquid (LNAPL) jet fuel plume that exists under the facility (see Issue Number 9 in Table 5-2). Although the system is primarily designed to treat jet fuel contamination, it also removes chlorinated VOCs associated with the Site from the soil gas within the area of influence of process equipment. The system operates by extracting jet fuel-laden soil vapor and treats the vapor via thermal oxidation and carbon polishing. The system also has the capability of injecting air into the subsurface in an effort to promote biological growth that facilitates the subsurface breakdown of jet fuel. The system consists of 36 dual action soil vapor extraction/air injection wells and the treatment system. The estimated operating time of the BSVE system is currently projected to be seven to ten years. The system is regulated under the ADEQ UST Program but, because it is also treating Site COCs, will be considered when selecting the final remedy for the Site.

The BSVE system began operation in May of 2009 and continued throughout the remainder of the current Five-Year Review Period.

5.2.4.2 Honeywell 34th Street Facility Focused Remedial Investigation

Honeywell prepared a Final Focused Remedial Investigation (FRI) for its 34th Street Facility and published in final including all appendices on August 8, 2008. The FRI focused on 1,1,1-TCA, TCE, and the associated chlorinated daughter products. This approach was taken based on previous use of these compounds at the facility and these are the primary compounds of interest for the OU2 area. Work specifically for the FRI and performed previously, but discussed in the report includes: installation of 132 groundwater monitoring wells, 3 piezometers, 9 geologic borings, 4 soil-gas investigations, 2 geophysical investigations, aquifer testing, petroleum hydrocarbon investigations, mercury investigation, additional soil investigations, and groundwater monitoring.

Results of the FRI indicate: (1) the presence of chlorinated VOCs in the vadose zone; primarily in, but not limited to, the area of the BSVE influence area, and (2) the presence of a large regional chlorinated VOC plume in the regional aquifer. Concentrations of chlorinated VOCs have reduced since investigation activities began particularly following the implementation of the 20th Street Groundwater Treatment Facility.

5.2.4.3 Remediated Quantities

Through the end of 2009, treatment activities in OU2 have remediated the following quantities of groundwater and/or other contaminated environmental media (as documented in the 2009 OU2 Effectiveness Report prepared by Honeywell and Freescale [CRA, 2010] and the Third Quarter 2010 BSVE progress report prepared by Honeywell [CH_2M Hill, 2010]):

- An estimated 8,920 million gallons of groundwater containing approximately 11,668 lb of VOCs has been treated to date and put to beneficial use as irrigation water via discharge to the SRP Grand Canal. The 20th Street Groundwater Treatment Facility has treated approximately 3,690 million gallons of groundwater containing approximately 3,742 lb of VOCs since the end of the period documented in the previous OU2 Five-Year Review (May 31, 2006).

- From startup in May 2009 through the end of September 2010, the BSVE system has removed approximately 1,771,000 lb of hydrocarbons from the subsurface via biodegradation and volatilization. During the same time period, the BSVE system has removed an estimated 265 lb of chlorinated VOCs from the subsurface.

6.0 FIVE YEAR REVIEW PROCESS

6.1 ADMINISTRATIVE COMPONENTS

This Five-Year Review for the Site was managed by ADEQ with technical support provided by project staff from ADEQ, EPA Region 9 and URS. The project team included:

- Wendy Flood (ADEQ Federal Projects Unit) – OU1/Sitewide Project Manager
- Brian Stonebrink (ADEQ Remedial Projects Section) – OU2/Former OU3 Project Manager
- Sherri Zendri (ADEQ Superfund Programs Unit) – Former OU2/ Sitewide Project Manager
- Delfina Olivarez (ADEQ Federal Projects Unit) – OU3 Project Manager
- Felicia Calderon (ADEQ Remedial Projects Unit) – Community Involvement Coordinator
- Wayne Miller (ADEQ Federal Projects Unit) – OU1/Sitewide Hydrologist
- Joellen Meitl (ADEQ Federal Projects Unit) – OU2 Hydrologist
- Janet Rosati (EPA Region 9) – OU3/ OU1 VI and Sitewide Project Manager
- Martin Zeleznik (EPA Region 9) – OU1/OU2 Project Manager
- Leanna Rosetti (EPA Region 9) – Community Involvement Coordinator
- Will Neese, PE (URS) – Project Manager/Environmental Engineer

- Natalie Chrisman Lazarr, PE (URS) – Civil Engineer
- Andrew Messer, RG (URS) - Hydrogeologist

In mid-August 2010, ADEQ (URS) finalized a workplan presenting a proposed scope of work and summarizing a description of site-specific activities supporting completion of the review. The workplan and associated schedule outlined the following Five-Year Review components:

- Community Notification and Involvement
- Document Review
- Data Review
- Interviews
- Site Inspections

The project schedule included in the workplan extended from August 2010 through September 2011. The following sections describe how the review components listed in the workplan were implemented and present key results of completed activities.

6.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

EPA's community involvement coordinator (CIC) with support from ADEQ's CIC conducted all community notification and involvement activities supporting the Five-Year Review. Associated community notification and involvement activities included:

- Publication of a notice announcing the commencement of Five-Year Review Activities for the Site and soliciting community input (in La Voz on September 10, 2010 and in the Arizona Republic on September 23, 2010). See Appendix C for copies of public notices.

- Interview of community members for both the Five-Year Review and the 2010 update of the Site Community Involvement Plan (CIP) in September and October 2010. The CIP was previously updated in 2009.

- Discussion of Five-Year Review activities (with an invitation for community members to be interviewed) at multiple public meetings convened to inform the affected community of project status and answer questions.

- Publication of a notice announcing the completion of Five-Year Review Activities for the Site and the availability of the review at Site document repositories (the notice is expected to be distributed within 3 months of report finalization).

During the current Five-Year Review Period, additional community involvement activities included:

- Formation of a Community Informational Group (CIG) for the Site with the support of the Phoenix Revitalization Corporation (PRC), a local community organization (the CIG replaces the previous Community Advisory Group [CAG] for the site established in 2001). CAG meetings were discontinued in 2007, after which EPA and ADEQ held general public meetings three to four times per year. The first CIG meeting was held on June 16, 2010 with a subsequent meeting held on September 22, 2010. At these meetings, CIG establishment details and various Site issue updates were discussed. CIG meetings are generally conducted on a quarterly basis.

- Periodic monthly meetings of the Lindon Park Neighborhood Association, the recipient of a Technical Assistance Grant (TAG) for the Site. The TAG provides funding for an independent technical advisor that serves as a resource to the community in the interpretation and review of Site activities.

- A workshop by the ADHS to address community health concerns. The workshop was conducted at a scheduled TAG meeting on June 1, 2010.

- Maintenance of Site document repositories at the Burton Barr Public Library, the Phoenix Public Library – Saguaro Branch, the ADEQ Records Management Center, and websites managed by ADEQ (http://www.azdeq.gov/environ/waste/sps/phxsites.html#mot52a) and EPA (www.epa.gov/region09/Motorola52ndSt).

6.3 DOCUMENT REVIEW

ADEQ (URS) reviewed a variety of documents presenting background information for each OU and documenting activities conducted during the current Five-Year Review Period. Appendix D presents a list of available documents reviewed.

6.4 DATA REVIEW

6.4.1 OU1 Data Review

Data collected from OU1 are presented in semi-annual PQGWWP reports and annual effectiveness reports prepared by Freescale (Clear Creek Associates). The following presentation of collected data is summarized from these documents (prepared during the current Five-Year Review Period), unless otherwise noted.

6.4.1.1 Groundwater Data Review

Overview of the OU1 Groundwater Monitoring Program. The OU1 groundwater well network currently consists of over 100 wells that are monitored on a quarterly basis for water level elevations and either semi-annually, annually, or bi-annually (depending on the well) for select VOCs by EPA Method 8260b (i.e., PCE, TCE, 1,1,1-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCA, 1,2-DCE [both cis and trans isomers], and vinyl chloride [VC]). TCE is the predominant VOC reported in samples collected from OU1; however, other compounds in the OU1 VOC analyte list are present. Select wells (e.g. DM602, DM603-115, DM604, DM605-170) are also evaluated for inorganic parameters (typically arsenic, boron, and nitrate) on an annual basis. The monitored OU1 well network (see Figure 3-1) includes conventional monitoring wells, various multiport monitoring wells, and the extraction wells that supply groundwater to the IGWTP.

Groundwater Elevations. Since implementation of the OCC containment system, OU1 groundwater monitoring data indicate a general lowering of the water table due to regional groundwater pumping and multi-year drought conditions in the Phoenix Metropolitan Area. Freescale (Clear Creek Associates) estimates this regional decline to be on the order of 12 ft since 1992 (per December 2009 OU1 monitoring data). However, pumping of OU1 extraction wells has also contributed to localized decreases in groundwater elevations. The saturated thickness of the alluvium underlying the Courtyard area has decreased since 1992 from approximately 35 to 15 ft in thickness. Further, a significant portion of the alluvium underlying the SWPL area is now currently dry (the depth to bedrock in this region is shallow). In OCC extraction wells, groundwater elevations have decreased since 1992 by approximately 40 to 75 ft due to pumping and the regional groundwater table decline (based on December 2009 water level data and well efficiency calculations performed by Clear Creek Associates).

Alluvial groundwater gradient and flow direction are impacted by both OU1 pumping and interactions with bedrock penetrations through the alluvial aquifer. Although the regional direction of alluvial groundwater flow is generally to the southwest, water level elevations in the vicinity of extraction operations indicate localized alluvial flow towards extraction wells. As of December 2009, Freescale (Clear Creek Associates) estimates that the observed influence of pumping at the OCC on surrounding groundwater levels is up to 1,000 ft west of operating OCC extraction wells.

Baseline TCE Concentrations. Many of the OU1 network wells were sampled for VOCs during a 1992 baseline monitoring period conducted prior to initiating groundwater extraction activities at the OCC (i.e., implementing the groundwater containment portion of the OU1 interim remedy). These data are routinely used to support evaluation of remedy performance. The highest TCE concentrations observed during baseline monitoring were present in the Courtyard

source area wells screened in bedrock and located at the former Motorola 52nd Street Facility. These include: DM-601 at 200 ft bgs (58,000 μg/L), MP03-D at 162 ft bgs (870,000 μg/L), MP36-C at 114 ft bgs (14,000 μg/L), and MP36-D at 162 ft bgs (180,000 μg/L). Prior to initiating plume containment operations at the OCC, TCE concentrations in associated OCC extraction wells (screened at the alluvium/bedrock interface) ranged from 250 to 3,800 μg/L (in DM310 and DM307, respectively).

Impacts of OU1 Extraction Activities on TCE Concentrations. Appendix E includes tables and figures summarizing groundwater elevation and TCE concentration data excerpted from the 2006 through 2009 Effectiveness Reports prepared by Freescale (Clear Creek Associates). In general, these data suggest that although only minor impacts on TCE concentrations can be attributed to source area groundwater extraction efforts (in the Courtyard area), containment activities at the OCC have resulted in significant decreases in TCE concentrations at and downgradient of the OCC groundwater extraction system.

Based on a review of groundwater analytical data presented during the current Five-Year Review Period, the following notable observations by location are made:

- ***In the Courtyard Source Area.*** In the Courtyard extraction wells (DM301, DM302, DM303, and DM304), TCE concentrations have decreased only slightly from 1992 baseline monitoring levels (between 1,300 and 2,700 μg/L) to 2009 concentrations (between 920 and 1,100 μg/L) but varied significantly in the interim (particularly at DM301 and DM302). TCE concentrations in surrounding monitoring wells (screened in bedrock) have remained high with a general trend towards increasing concentrations at shallow bedrock depths (TCE concentrations at the shallow bedrock monitoring ports of DM601 and MP36-C have increased by an order of magnitude since 1992).

- ***Downgradient of the 52nd Street Facility and Upgradient of the OCC.*** In between the former Motorola 52nd Street Facility and the OCC extraction system, many of the alluvial-screened wells and/or associated well ports have gone dry since 1992. At one of the only remaining wells in this vicinity with well ports screened in the bedrock aquifer (i.e., DM606), TCE concentrations have varied significantly since 1992. The highest concentrations of TCE observed at this location have been at depths of 185 and 250 ft bgs (over 10,000 μg/L and 4,000 μg/L, respectively). However, concentrations at these depths have since decreased and ranged between 1,200 and 2,200 during the current Five-Year Review Period.

- ***At the OCC extraction system.*** In the OCC extraction wells (DM305 through DM313), TCE concentrations have decreased from 1992 baseline levels by an order of magnitude in all

wells except DM307 (near the middle of the contaminant plume) and DM313 (the most southern OCC extraction well). At DM313, TCE concentrations in 1992 were negligible (less than 0.5 μg/L) and generally remained so during the current Five-Year Review Period (concentrations ranged from to 0.56 to 1.4 μg/L). At DM307, the 2009 concentration (2,600 μg/L) is lower but relatively comparable to the 1992 concentration (3,800 μg/L). It should be noted that concentrations at DM307 were generally less than 500 μg/L from 1994 to 2001 but have trended towards increasing concentrations since that time.

- ***In the vicinity of the OCC extraction system.*** Notable changes observed since 1992 baseline levels in monitoring wells located in the vicinity of the OCC extraction system are the increasing trend in TCE concentrations at DM602 (which is not readily understood given inferred alluvial groundwater flow direction) and the decreasing trend in TCE concentrations observed in deep bedrock ports of DM603 (which could be due to the influence of groundwater extraction activities). TCE concentrations began to significantly increase at DM602, a conventional, bedrock interface screened well sampled at 120 ft bgs, around late 2003. Concentrations observed during the current Five-Year Review Period ranged from 150 to 280 μg/L and are two orders of magnitude higher than those observed in 1992. In DM603 (a Westbay well), TCE concentrations at 245 ft bgs have decreased by at least two orders of magnitude since 1992; TCE concentrations at 205 ft bgs have been more variable but appear to be decreasing as well.

- ***Downgradient of the OCC extraction system.*** At downgradient wells DM502, DM503, DM607, DM120, TCE concentrations have generally decreased since the 1992 baseline monitoring event. Baseline TCE concentrations in these wells ranged from less than 0.2 to 58 μg/L. During the current Five-Year Review Period, the only downgradient wells indicating TCE concentrations at or exceeding the MCL (5 μg/L) included: DM502-079 (at 3.8 to 12 μg/L), DM502-119 (at 2.3 to 5 μg/L), and DM120 (at 8.5 to 14 μg/L).

Thus, the OCC extraction network is effectively decreasing TCE concentrations in the vicinity of the groundwater extraction wells and in the alluvial groundwater plume west of the OCC. These results support the conclusion that the extent of the contaminant plume is likely contracting downgradient of the extraction system.

6.4.1.2 Treatment Plant Data Review

During the current Five-Year Review Period, monitoring of the IGWTP included:

- ***Monthly logging of groundwater extraction totalized volumes from individual extraction well flow meters.*** Figure 6-1 summarizes the average groundwater extraction rate over time

for the OCC, Courtyard, and SWPL well systems. This figure shows the relatively significant quantity of extracted groundwater the OCC well network contributes to the OU1 treatment system and depicts the reduced rate of groundwater extraction from Courtyard wells in 2009. Courtyard well extraction was temporarily shutdown from December 2008 through July 2009 as part of the Bedrock Extraction Pilot Study.

- ***Collection of water samples on a monthly basis from the influent equalization tanks, following treatment in the first air stripper, and after liquid-phase GAC polishing.*** Influent samples are evaluated for the OU1 VOC analyte list used in groundwater monitoring. The effluent samples (i.e., post liquid-phase GAC polishing) are evaluated for a more comprehensive EPA Method 8260b analyte list (the method is not identified in annual effectiveness reports). Figure 6-2 summarizes average TCE concentrations at various locations in the IGTWP process flow during the current Five-Year Review Period. As indicated in the figure, influent TCE concentrations markedly decreased in 2009 (likely due to suspension of Courtyard well extraction activities) and significantly increased in 2010 after extraction from the Courtyard well network resumed and the new bedrock extraction well (DM314) was brought on-line. Figure 6-2 also appears to suggest a decreasing trend in AS-201 treatment efficiency during the current Five-Year Review Period (treatment efficiencies decreased from 99.9% in 2006 to 97.3% in 2010; Freescale, 2010).

- ***Collection of influent and effluent air samples on a monthly basis from the vapor-phase GAC process unit that treats air stripper off-gas.*** Air samples are evaluated using EPA Method TO-15. The results of air sample collection are used to monitor when the carbon in this system needs to be replaced. During the current Five-Year Review Period, vapor-phase carbon changeouts were generally performed twice per year in April and Oct/November until 2009 when relatively low influent concentrations in air stripper operations (due to Courtyard groundwater extraction suspension) likely reduced carbon loading in the off-gas treatment system. Figure 6-3 summarizes TCE concentrations in off-gas treatment operations and indicates that influent off-gas concentrations increased significantly in late 2009.

Appendix E includes summary tables presenting IGWTP data excerpted from the 2006 through 2009 Effectiveness Reports prepared by Freescale (Clear Creek) Associates. Air sample results suggest that many compounds are present at low concentrations in effluent samples from the air treatment process (including VC).

6.4.1.3 Capture Zone Analysis

Each year, Freescale (Clear Creek Associates) evaluates OCC extraction system performance in their annual effectiveness reports which conclude that the OU1 groundwater remedy is effective

at containing the contaminant plume at the OCC. ADEQ (URS) reviewed the most recent capture zone analysis (presented in the 2009 Effectiveness Report) as part of this Five-Year Review. Appendix F presents a technical memorandum summarizing this review. Findings include:

- The capture evaluation conducted by Freescale (Clear Creek Associates) is generally consistent with applicable EPA guidance documents; however, simplifying assumptions were required in some instances that increase the uncertainty of evaluation results in a complex hydrogeologic environment.

- Interpretation of water level data was the primary tool used by Freescale (Clear Creek Associates) to demonstrate capture. Groundwater elevation data used to construct contour maps included water levels for extraction wells that were calculated using estimated well efficiencies for these wells. Therefore, the evaluation of capture based on estimated water levels includes uncertainty and requires other lines of evidence to support the conclusion that capture is effective.

- There are additional lines of evidence that generally support effective capture at the OCC. These include: (1) the capture zone estimated from actual data compares favorably with a capture zone predicted by a site-specific numerical groundwater flow model; and (2) TCE concentrations downgradient of the OCC extraction system have decreased significantly over time while concentrations upgradient of the extraction system have remained relatively constant or increased.

- Potential issues noted with the performance of the capture system include the observation of increasing TCE concentrations at DM602 which is located approximately 400 ft northwest of the most northern OCC extraction well (see Section 6.4.1.1). While Freescale (Clear Creek Associates) maintains that this well is located within the capture zone and attributes the increase to a reduced saturated thickness that is now more significantly impacted by high concentrations migrating out of bedrock, the increase could also be indicative of insufficient capture in the northern end of the extraction system if the groundwater elevation contour maps are incorrectly influenced by pumping well water level estimates. Monitor wells downgradient from DM602 do not show an increasing trend in TCE concentrations suggesting that there is no migration downgradient of the OCC extraction system at this time.

- The review of capture conducted by ADEQ (URS) concludes that the OCC extraction system is containing the bulk of the groundwater contaminant plume at this location; the groundwater plume downgradient of the OCC is likely contracting and the migration of contamination into OU2 is being mitigated. However, the use of corrected water level data for extraction wells in the development of groundwater elevation contour maps and an

increasing trend in contaminant concentrations at DM602 introduce uncertainty into the containment analysis which may impact how readily the extent of containment can be assessed in the future.

6.4.2 OU2 Data Review

Data collected from OU2 are presented in monthly O&M summaries, quarterly monitoring reports, and annual effectiveness reports prepared by Honeywell and Freescale (CRA). The following presentation of collected data is summarized from these documents (prepared during the current Five-Year Review Period), unless otherwise noted.

6.4.2.1 Groundwater Data Review

Overview of the OU2 Groundwater Monitoring Program. The OU2 groundwater well network currently consists of over 75 wells that are monitored on a quarterly basis for water level elevations and either quarterly, annually, or semi-annually (depending on the well) for VOCs by EPA Method 8260b. TCE is the predominant VOC reported in samples collected from OU2; however, other compounds in the OU2 VOC analyte list are present. The well network (see Figure 3-2) includes conventional monitoring wells, nested monitoring wells, and the extraction wells that supply groundwater to the treatment system.

Groundwater Elevations. OU2 groundwater monitoring data indicate a general lowering of the regional water table since the beginning of treatment system monitoring in 2001, presumably due to multi-year drought conditions in the Phoenix Metropolitan Area and pumping of the extraction wells. Pumping of OU2 extraction wells has also contributed to localized decreases in groundwater elevations. However, recent data indicates a slight increasing trend in the OU2 area in 2009 likely due to extended releases of water into the Salt River channel in 2009. The trend continued to be observed during the 2010 monitoring event. Current groundwater elevations within the OU2 area range from 997 to 1013 ft above mean sea level.

Alluvial groundwater gradient and flow direction are impacted by OU2 pumping. Although the regional direction of alluvial groundwater flow is generally to the west-southwest, water level elevations in the vicinity of extraction operations indicate localized alluvial flow towards extraction wells.

Baseline TCE Concentrations. Many of the OU2 network wells were sampled for VOCs during the baseline monitoring period conducted before OU2 groundwater extraction activities began. The original baseline monitoring occurred in September of 2001. The highest TCE concentrations observed at that time were present in EW03 in HSU A (at 630 μg/L); NW03 in HSU A (at 470 μg/L); DM509 in HSU B (at 870 μg/L); PZ01-B in HSU B (at 580 μg/L);

EW12-227 (at 450 μg/L) and DM516-210 in HSU D (at 200 μg/L). Prior to initiating plume containment operations, TCE concentrations in extraction wells EWN, EWM, and EWS (screened across all three HSUs) were 98, 320, and 320 μg/L, respectively.

Due to a significant expansion of the monitoring well network, a second baseline monitoring event was conducted in September of 2006 (near the beginning of the current Five-Year Review Period). The highest TCE concentrations observed during this secondary baseline period were present in EW03 in HSU A (at 320 μg/L); DM510-110 in HSU A (at 260 μg/L); DM518-OB1 in HSU A (at 260 μg/L); DM509 in HSU B (at 890 μg/L); ASE72-B in HSU B (at 350 μg/L); DM511-110 in HSU B (at 300 μg/L); DM518-OB1 in HSU B (at 260 μg/L); OU302-M in HSU B (at 210 μg/L); NW08-M in HSU B (at 190 μg/L); ASE76-B in HSU B (at 150 μg/L); ASE85-B in HSU B (at 130 μg/L); BC11-A in HSU D (at 120 μg/L); and ASE76-B in HSU D (at 150 μg/L). The TCE concentrations in September of 2006 for extraction wells EWN, EWM, and EWS were 14, 170, and 33 μg/L, respectively.

Impacts of OU2 Extraction Activities on TCE Concentrations. Appendix G includes relevant charts and figures, including concentration trends for select wells, excerpted from the 2006 through 2009 Effectiveness Reports prepared by Honeywell and Freescale (CRA). In general, presented data indicate a general decrease in groundwater TCE concentrations in most monitored wells.

Based on a review of groundwater analytical data collected during the current Five-Year Review Period, the following notable observations are made:

- In the extraction wells, TCE concentrations decreased from 2001 baseline monitoring levels. Well EWN decreased from 98 μg/L (9/2001) to 46 μg/L (3/2010); Well EWM decreased from 320 μg/L (9/2001) to 81 μg/L (3/2010); Well EWS decreased from 320 μg/L (9/2001) to 13 μg/L (3/2010).

- In two of the extraction wells, TCE concentrations decreased from 2006 baseline monitoring levels. Well EWM decreased from 170 μg/L (9/2006) to 81 μg/L (3/2010) and Well EWS decreased from 33 μg/L (9/2006) to 13 μg/L (3/2010). Well EWN indicated an increase in TCE concentrations from 14 μg /L (9/2006) to 46 μg/L (3/2010). This may be due to higher concentration portions of the plume reaching the influence area of the extraction well. EWN continues to be monitored as part of the OU2 groundwater sampling program.

- Notable changes observed in monitoring wells in the vicinity of the extraction system (since baseline levels) are decreasing trends in TCE concentrations in the A, B, and D ADEQ

HSUs. TCE concentrations in ADEQ HSU A show a significant decrease in concentrations, especially in those wells downgradient or parallel to the treatment system. Wells indicating this decrease include: NW03, EW06, EW07, NW06-S, NW04, EW22, and EW13-118. ADEQ HSU B wells indicating decreased TCE concentrations include: NW02, NW11-M, NW07-M, OU312-M, and OU302-M. ADEQ HSU D wells showing reduced TCE concentrations include: NW07-D, NW14-D, NW13-D, NW09-D, and EW13-228. No wells downgradient or parallel with the system have shown significant increases in TCE concentrations when compared with the baseline concentrations.

In summary, a comparison of the baseline, 2006 and 2010 groundwater concentrations demonstrates that the TCE plume width continues to decrease downgradient of the extraction system from north to south. The plume narrowing is observed in all three subunits of the OU2 area, with HSU D demonstrating the least change in TCE concentrations over time.

6.4.2.2 Treatment Plant Data Review

During the current Five-Year Review Period, monitoring of the 20th Street Groundwater Treatment Facility included:

- ***Monthly logging of groundwater extraction totalized volumes from individual extraction well flow meters.*** Flow rates for each extraction well are documented in the monthly O&M summaries prepared by Honeywell and Freescale (CRA). The current extraction well flow rate set points are 800 gpm, 1,290 gpm, and 300 gpm for wells EWN, EWM, and EWS, respectively. The flow rate at Well EWN was increased to its current flow rate from the previous Five-Year Review flow rate of 600 gpm. The Well EWM flow rate has been reduced from the previous Five-Year Review flow rate of 1,350 gpm to the current flow rate. The flow rate at EWS has increased over the last five years from its previous value of 200 gpm. Flow rate adjustments were performed to maintain hydraulic capture following monitoring events, or in response to increasing water levels, allowing for additional extraction capacity.

- ***Collection of water samples on a monthly basis from the influent and effluent.*** The individual extraction wells, the combined influent, and the effluent streams are sampled and evaluated for VOCs. Individual wells are only sampled on a quarterly basis during regular monitoring of the well network. Results of monthly sampling for both the influent and effluent are provided in Appendix G. Influent sample results generally show decreasing VOC concentrations over time. The effluent sampling results indicate the system is operating in conformance with the discharge requirements.

- ***Collection of influent and effluent samples on a monthly basis from the liquid-phase GAC process units.*** Samples are evaluated for VOCs. The results of sampling are used to monitor when the carbon in this system needs to be replaced. During the current Five-Year Review Period, carbon changeouts were performed when lead vessel sampling indicated break-through. Carbon is generally changed out at an operational vessel every four to six months.

Appendix G includes summary tables presenting facility data excerpted from the 2006 through 2009 Effectiveness Reports prepared by Honeywell and Freescale (CRA).

6.4.2.3 Capture Zone Analysis

Each year, Honeywell and Freescale (CRA) evaluate 20th Street Groundwater Treatment Facility performance in their annual effectiveness reports which conclude that the OU2 groundwater remedy is effective at containing the contaminant plume in the vicinity of Interstate 10. ADEQ (URS) reviewed the most recent capture zone analysis (presented in the 2009 Effectiveness Report) as part of this Five-Year Review. Appendix H presents a technical memorandum summarizing this review. Findings include:

- The capture evaluation was conducted by Honeywell and Freescale (CRA) in the context of EPA guidance for a systematic approach for evaluating capture. Honeywell and Freescale (CRA) state that the lines of evidence are sufficient to show plume containment. However, only two lines of evidence are presented; the interpretation of groundwater water level information and an evaluation of concentration trend data. Additional lines of evidence including numerical modeling and/or calculations should be used to further support the evaluation of capture.

- The Honeywell and Freescale (CRA) capture zone evaluation indicates adequate capture is likely occurring for VOCs above the AWQS in the area of Interstate 10 in HSUs A and B; however, future evaluations should be supported with a more rigorous approach to defining groundwater contours, flow paths, the limit of capture, and the target capture zone (TCZ). Interpretations based on groundwater levels should be supported with calculations and a comparison between predicted and observed results. Analytical calculations should be provided to support estimates for the downgradient stagnation point, the extraction rate required to provide adequate capture, and the width of the capture zone.

- Interpretations of adequate capture in HSU D include more uncertainty and are more difficult to evaluate. Capture uncertainty is introduced through the use of somewhat arbitrary construction of groundwater elevation contours and unconventional construction of flow

paths in areas where data are sparse. Groundwater currently in the stated TCZ for HSU D with the potential to escape capture is only slightly above the AWQS.

- Longer-term issues with capture are indicated for areas southeast from the OU2 GES that exceed the AWQS and are outside the limit of capture. If contaminant concentrations migrate westward as indicated, the TCZ as currently stated will expand and include areas outside the current limits of capture.

The review of capture conducted by ADEQ (URS) concludes that adequate capture by the OU2 GES is likely occurring in the vicinity of Interstate 10 in HSU A and B; the width of the groundwater TCE plume continues to decrease downgradient of the GES. However, use of only two lines of evidence in capture zone analyses and uncertainty introduced where data are sparse (particularly in HSU D) suggest that a more rigorous approach to capture evaluations should be conducted in the future.

6.5 INTERVIEWS

Five-Year Review interviews were conducted in September 2010, October 2010, and February 2011 by ADEQ and URS with assistance from EPA Region 9. The purpose of the interviews was to obtain information supporting an assessment of remedy protectiveness. Individuals interviewed include: Wendoly Abrego, Pam Amorin, Betty Brannan, Martha Breitenbach, Steve Brittle, Rene Chase Dufault, Josephine Duffy, Dave Christiana, Robert Frank, Les Holland, Michael Johnson, Dr. Ruthann Marston, Jenn McCall, Phil McNeely, Troy Meyer-Kennedy, Gary Piers & Lorana Mineer, Mary Moore, Manfred Plaschke, Julie Riemenschneider, Janet Rosati, Tom Suriano, Jason Weed, Karol Wolf, and Jerry Worsham.

Interview summaries and detailed interview documentation are presented in Appendix I.

6.6 SITE INSPECTIONS

6.6.1 Inspection of the OU1 Treatment System

ADEQ and URS conducted an inspection of the OU1 treatment facility on December 2, 2010. The purpose of the inspection was to assess the protectiveness of the remedy by evaluating public access to the treatment system, the condition of associated equipment, and the general adequacy of O&M. The inspection included a review of on-site documentation, evaluation of site access restrictions, and a reconnaissance of process areas and equipment. The results of the inspection are presented in detail in the OU1 Site Inspection Documentation attached as Appendix J (which also includes a site inspection team summary and photograph log). A brief summary of the highlights of the system inspection is presented below:

- Access to the IGWTP and associated process components (e.g., extraction wells, the OCC extraction well motor control building) is well controlled.

- IGWTP documents and logs are readily available for review, for the most part, in the treatment facility control room; however, documentation could be more substantive and easier to assess in terms of whether it is up to date.

- Freescale maintains a high level of operational up-time for the OU1 treatment system. The IGWTP is currently between 91.7% and 97.7% operational.

- The system currently shows signs of wear and tear (e.g., weathering of exposed equipment) and is not operationally efficient (e.g., unnecessary operational complexity and relatively high cost per volume of groundwater treated). The IGWTP currently treats only 30 to 40% of the original design flow for the facility.

- The sump controls for the pipeline double-containment system are not currently functional.

- Two of the four liquid-phase carbon units have been removed from service for treatment of scale; the descaling chemical used to treat these carbon units is recycled into the main process flow.

- Proper operation of the IGWTP relies on the experience and competence of Freescale's contractor for treatment system operation. If replacement of this contractor was necessary or if significant issues associated with aging equipment arise in the future, documentation regarding day to day procedures/operations is likely not specific enough to mitigate problems that would be encountered.

- Detailed information regarding treatment facility operations is not generally submitted to ADEQ with annual effectiveness reports; this limits an assessment of O&M adequacy.

6.6.2 Inspection of the OU2 Treatment System

ADEQ and URS conducted an inspection of the OU2 treatment facility on December 1, 2010. The purpose and extent of the inspection were similar to that noted for the OU1 inspection in Section 6.6.1. The results of the inspection are presented in detail in the OU2 Site Inspection Documentation attached as Appendix K (which also includes a site inspection team summary and photograph log). A brief summary of the highlights of the system inspection is presented below:

- In general the OU2 system was found to be in good repair and effectively maintained.

- Site fencing and site equipment are kept in good working order and maintain a complete perimeter around the compound.

- It was observed that tank warning signs were beginning to be sun bleached and are hard to read.

- No current signs labeling the wastewater sump as a confined space were noted onsite.

- Remote extraction well sites are kept well maintained, fenced, and locked.

- Preventative maintenance and upkeep is very effective as indicated by the high operational uptimes of the system.

- Facility documents and logs are readily available for review in the control room and are maintained in an organized fashion that facilitates data review.

7.0 TECHNICAL ASSESSMENT

Both OU1 and OU2 are interim remedies conducted to mitigate the impacts of Site contamination while a final remedy is developed. To specifically evaluate the protectiveness of these remedies per *Comprehensive Five-Year Review Guidance*, the scope of the following technical assessment is limited to the interim remedy requirements defined in applicable decision documents (see Sections 4.1.1 and 4.2.1, respectively).

The following sections assess protectiveness of each remedy using a series of three questions prescribed by *Comprehensive Five-Year Review Guidance*.

7.1 OU1

7.1.1 Question A: Is the remedy functioning as intended by the decision documents?

7.1.1.1 Remedial Action Performance

Based on a review of site data, available documentation, and the results of the OU1 site inspection, the system is generally functioning as intended by the interim remedy LOD and ROD:

- Extraction of groundwater from the Courtyard/50th Street source area with treatment of the groundwater at the IGWTP is ongoing. The quantity of groundwater extracted is low relative to the OCC extraction system but significant concentrations of VOCs are being removed which contribute to the total quantity of mass removed from the subsurface by the OU1 interim remedy. Source area extraction systems have a beneficial, yet localized, impact on the quality of groundwater within bedrock in this region.

- Operation of the OCC extraction well system has achieved the primary operational requirement of decision documents which is to contain contaminant migration in alluvium groundwater at the east bank of the OCC. There is some uncertainty in the assessment of capture conducted by Freescale (particularly with respect to specific methodologies used to interpret water level data and a notable concentration trend in a nearby monitoring well); however, the conclusion that the OCC extraction well system is containing the bulk of the groundwater contaminant plume at this location is supported by multiple lines of evidence. The OU1 treatment system (the IGWTP) treats extracted groundwater to a level commensurate with its use via best available technologies for VOC treatment (i.e., air stripping and liquid-phase GAC). The current flow rate processed by the IGWTP (approximately 275 gpm on an annualized basis) is significantly lower than the design flow rate for this system (810 gpm) due to the general lowering of the water table. The impact of this reduced flow rate is that the system must be operated on an intermittent basis (introducing operational complexity) and the quantity of mass removed from the subsurface is lower than originally scoped.

- Treated water discharged from the IGWTP is beneficially used by ON Semiconductor (the current operator of the former Motorola 52nd Street Facility). It is noted that due to the planned phase out of manufacturing operations at the ON Semiconductor facility, a decision document for the OU1 interim remedy will be required in the near future to change the end use of the treated water selected in the ROD/LOD. As a temporary measure (not more than one year), the end use will be discharge to the City of Phoenix sanitary sewer system.

- The only major component of the OU1 interim remedy that is currently not being implemented (or assessed as complete) is the extraction and treatment of VOCs from source area soils at the former Motorola 52nd Street Facility. SVE treatment of soil in the Courtyard and SWPL areas was conducted prior to the current Five-Year Review Period. Although ADEQ determined that soil cleanup in the SWPL Area was complete in 2002, no determination has been made regarding whether Courtyard SVE operations are complete/comply with appropriate remediation criteria (e.g., Soil Remediation Levels) and whether either region has the potential to impact risk due to the vapor intrusion to indoor air

pathway. Treatment has not occurred to date in the ATP area. Evaluation of whether any further treatment targeting soil and/or soil gas in the Courtyard and ATP areas is currently planned as part of forthcoming VI investigations of the 52nd Street Facility (see Section 5.1.3.3). Because soil cleanup is a required component of the LOD, failure to have completed that cleanup has implications for assessing the current protectiveness of the interim remedy.

7.1.1.2 System O&M Effectiveness

During the current Five-Year Review Period, O&M of the IGTWP has been effective as indicated by the high level of operational uptime of the treatment system (the system was between 91.7% and 97.7% operational) and the production of treated water compliant with MCLs for use by ON Semiconductor. However, based on the results of the site inspection, a number of issues including the age and condition of equipment and the unnecessary complexity of operations suggest that further review of system O&M is warranted to ensure that future treatment system effectiveness does not deteriorate in the near future (see Section 6.6.1).

Additional assessment of system O&M effectiveness is hindered by the lack of detail regarding IGWTP process operations presented in annual effectiveness reports. Specific topics that are currently not adequately addressed and should be presented in detail in the text of annual effectiveness reports include:

- A current process description (including a presentation of operating conditions during the reporting period)
- A discussion of any process changes that occurred during the reporting period (including a presentation of specific activities or events that resulted in operational downtime).
- An evaluation of collected process/operational data
- An assessment of regulatory compliance

ADEQ does not have a copy of the most recent O&M manual for the IGWTP. All updates should be submitted to ADEQ for reference during regulatory oversight activities.

7.1.1.3 O&M Costs

Table 4-1 summarizes annual OU1 O&M costs for the current Five-Year Review Period. These annual costs are not substantially higher than the original O&M cost estimate for the system ($700,000 per year), given how long ago the estimate was prepared (in 1987) and whether or not the estimates are comparable. However, there is a sufficient disparity between the current annualized average rate of groundwater treated (264 gpm from 2006 through 2009) and the

design flow rate on which the original estimate was based (810 gpm). This suggests that treatment is, at present, significantly less cost efficient than the original design intended.

If compared to OU2 O&M costs (see Table 4-2), the average cost per million gallons of groundwater treated and cost per pound of TCE removed for OU1 are higher. Since average TCE concentrations in groundwater influents at OU1 are higher than at OU2 (between 350 to 650 µg/L at OU1 versus less than 150 µg/L at OU2), the difference between the relative costs is not merely a matter of decreasing concentrations at OU1 due to the length of time this system has operated. The OU1 treatment system is likely less cost efficient relative to other remedies implemented at the Site because of the age of the system, the technologies employed, and the cost to Freescale for use of utilities.

7.1.1.4 Opportunities for Optimization

Although the treatment system is currently effective in terms of operational capability, opportunities for optimization via improvements in efficiency include:

- Increase efforts to extract highly impacted groundwater from the Courtyard area. As documented in the RAA report prepared by GeoTrans in 2005 and indicated by preliminary results of the Bedrock Extraction Pilot Study, considerable increases in mass removal are possible in the near term. Increases in influent concentrations as a result of these efforts will need to be evaluated from an air permitting perspective to ensure compliance with local regulations (per the operator of the IGWTP, the treatment system currently operates below air permit thresholds).

- Conduct an engineering review of IGWTP operations to improve efficiency and better document operations. The review should focus on reducing operational complexity where appropriate, identifying where documentation could be more specific, and assessing the remaining service life of equipment, including process monitoring/controls.

7.1.1.5 Early Indicators of Potential Remedy Problems

Significant issues that suggest a potential for future OU1 interim remedy problems include:

- A decreasing groundwater table that has led to decreased extraction well flow rates (which likely impact the extent of plume capture and have resulted in inefficient IGWTP operation).

- The presence of DNAPL in fractured bedrock at and near the Former Motorola 52nd Street Facility that serves as an ongoing source of groundwater contamination to both the alluvial and bedrock aquifer systems. Without more aggressively addressing the presence of DNAPL

in former source areas, the duration required to operate the containment system at the OCC is likely unreasonable and could suggest future remedy failure.

– An aging and inefficient groundwater treatment system (the IGWTP).

7.1.1.6 Implementation of Institutional Controls and Site Control Measures

The LOD and ROD for the OU1 interim remedy do not include any required institutional controls. However, site control measures currently in place to promote the protectiveness of the OU1 interim remedy include:

– ***Facility access control.*** The IGWTP and associated process components, including off-site equipment at OCC, are secure and public access to these facilities is controlled.

7.1.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

7.1.2.1 Changes in Standards and To Be Considered (TBCs)

Because the OU1 interim remedy is a containment remedy, the interim ROD did not include ARARs for aquifer restoration. Currently the groundwater in OU1 has limited use (the only known use is by a private owner for landscaping purposes) which is the same as the conditions in place at the time the LOD and ROD were developed. The private well is regularly sampled by ADEQ and the results are provided to the owner of the well.

No specific ARARs or TBCs are identified in the LOD or ROD; however, the LOD does state that the remedy will meet the substantive requirements of permits. The OU1 interim remedy meets the requirements of the PQGWWP permit that was issued in 2005. There are no treatment standards in the PQGWWP.

There is no air permit for the IGWTP. However, the IGWTP influent concentrations recently increased significantly as a result of implementing the Bedrock Extraction Pilot Study. The previous understanding was that air discharged from the air strippers is below the regulatory threshold for a Maricopa County air permit. This was based on an analysis using the historical concentrations coming into the treatment plant. Due to the variable concentrations associated with the Bedrock Pilot Study, a regular review of air permit/substantive requirement applicability based on uncontrolled emissions (emissions prior to air treatment) is warranted and should be incorporated into annual effectiveness reporting.

7.1.2.2 Changes in Land Use

No significant changes in land use within the OU1 boundaries occurred during the current Five-Year Review Period.

7.1.2.3 Changes in Known Exposure Pathways, Toxicity, and Other Contaminant Characteristics

As indicated in Section 3.4.3 (Health Assessments), the EPA recently issued draft TCE and PCE risk assessments/toxicological reviews suggesting that these Site contaminants may pose a greater risk than previously considered for cancer as well as non-cancer health effects. EPA Region 9 used information presented in the recent assessments/reviews in evaluating historic OU1 soil gas data collected in 1995 and determined that further soil gas sampling is necessary to adequately assess the vapor intrusion to indoor air pathway at OU1.

1,4-dioxane has been detected at the Site and a toxicological review was finalized during the current Five-Year Review Period (in August 2010). Although no regulatory standard for this compound in groundwater has been established, EPA has established a Preliminary Remediation Goal (PRG) for 1,4-dioxane. The toxicity values presented in the recent review and the PRG will be utilized in upcoming risk assessments supporting final remedy development.

No other significant changes in known exposure pathways, toxicity, or other contaminant characteristics (for the recognized chemicals of potential concern) occurred during the current Five-Year Review Period that would impact the assessment of protectiveness at OU1.

7.1.2.4 Changes in Risk Assessment Methods

No changes in risk assessment methods occurred during the current Five-Year Review Period that would impact the assessment of protectiveness at OU1.

7.1.2.5 New Contaminants and/or Contaminant Sources

Freescale (Clear Creek Associates) has presented information in their annual effectiveness reports suggesting that an unidentified source of PCE contamination is located upgradient and to the east of EW-18. Since EW-18 is located within the projected containment region of the OCC extraction system and PCE is a Site contaminant readily removed in the IGWTP, this potentially new contamination source does not affect the protectiveness of the interim remedy.

7.1.2.6 Progress towards Meeting Remedial Action Objectives

The OU1 interim remedy is meeting the objective of containing the migration of high concentrations of VOCs in groundwater at the OCC. Operations have significantly reduced concentrations of Site contaminants migrating into OU2.

7.1.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Data from the 1995 soil gas sampling event showed that several locations within the OU1 area exceeded EPA Regions 9's health-based soil gas screening values for TCE and PCE. Recent EPA draft risk assessments indicate that both TCE and PCE pose a greater risk for cancer and non-cancer health effects than previously considered. Applying EPA's latest models for estimating potential vapor intrusion and using the current health-based screening values to evaluate the 1995 soil gas sampling results suggests that there is a potential for vapor intrusion to indoor air within the OU1 area. The vapor intrusion to indoor air pathway may impact the protectiveness of the OU1 remedy and thus warrants further investigation.

7.1.4 Technical Assessment Summary

According to the data reviewed and the information obtained during the site inspection and the interviews, OU1 is functioning as intended by the interim remedy LOD and ROD with one significant exception. A major component of the OU1 interim remedy is currently not being implemented and/or assessed as complete. The effectiveness of completed soil cleanup activities conducted in the Courtyard/50th Street and SWPL areas has not been adequately evaluated, and no soil cleanup in the ATP area has been conducted to date. Updated soil data are needed to evaluate the potential impact to groundwater from contaminated soil and updated soil gas data are needed to begin the evaluation of the vapor intrusion to indoor air pathway. Although investigations are planned to investigate whether further soil cleanup in OU1 is necessary, the status of this required component of the LOD calls into question the current protectiveness of the interim remedy.

Future protectiveness of the interim remedy may be impacted by:

- The presence of DNAPL in bedrock at and near the former Motorola 52nd Street Facility. Without aggressively addressing DNAPL in former source areas that continues to serve as an ongoing source of groundwater contamination, the duration required to operate the containment system at the OCC is likely unreasonable and could suggest future remedy failure.

- The planned phase out of manufacturing operations at the ON Semiconductor facility. A decision document for the OU1 interim remedy will be required to change the end use of the treated water selected in the ROD/LOD.

- The continued lowering of the groundwater table and associated impacts on extracted groundwater rates. Decreases in groundwater extraction rates render the OU1 interim remedy less efficient and have the potential to affect groundwater plume containment.

- The age and condition of IGWTP equipment and the high level of operational complexity required to maintain treatment effectiveness. The IGWTP currently treats only a portion of the original design flow and is significantly less cost efficient than the original design intended.

7.2 OU2

7.2.1 Question A: Is the remedy functioning as intended by the decision documents?

7.2.1.1 Remedial Action Performance

Based on the review of the site data, available documentation, and Five-Year Review interviews, the OU2 20th Street Groundwater Treatment Facility is functioning as intended by the interim ROD, as modified by the ESD. The operation of the three extraction wells has achieved the remedial objective of providing hydraulic capture across the width and depth of the plume near I-10.

During the review of the annual effectiveness report capture evaluation section it was noted that the capture evaluation implements only two lines of evidence to evaluate system capture in the area of I-10. A more robust evaluation implementing additional lines of evidence that may be available should be undertaken for future evaluations. Additional available lines of evidence may include: (1) calculations; (2) a comparison between predicted and observed results; (3) estimates for the downgradient stagnation point; (4) the extraction rate required to provide adequate capture; and (5) the width of the capture zone.

The annual effectiveness reports do not specifically address the concentrations of contaminants within the wells upgradient of the System as they relate to the secondary goals of the ROD. The actual concentrations of these wells are discussed, however a brief discussion of the actual concentrations relative to the secondary requirements of the ROD would be useful to document progress towards meeting these requirements.

7.2.1.2 System O&M Effectiveness

The operation and maintenance of the system has been effective as indicated by the high operational uptimes. The system normally operates above the 95 percentile during operational windows. During the non-operational periods created by the annual SRP shutdown required major and minor maintenance on the system is completed.

Updating aging signage is recommended Discharge to the SRP Grand Canal is within the requirements of the discharge agreement and is regularly sampled and maintained.

7.2.1.3 O&M Costs

Table 4-2 summarizes annual OU2 O&M costs for the current Five-Year Review Period. These annual costs are relatively consistent, with the exception of years in which additional wells are installed for the monitoring network or extraction wells require rehabilitation or pump replacement. Costs specific to the O&M of the system range from approximately $787,000 to $1,050,000 per year.

7.2.1.4 Opportunities for Optimization

The system currently operates in accordance with the interim ROD as a containment remedy. However the system is not directly remediating the higher concentration areas of the groundwater plume. Opportunities for the current system to provide direct remediation of these areas should be evaluated as this may help reduce the overall timeframe for site remediation.

7.2.1.5 Early Indicators of Potential Remedy Problems

Preventative maintenance and system operation is currently effective. Continued review of system operation, mechanical equipment efficiency, and site housekeeping are necessary to continue high operational uptimes.

Additionally the capture evaluation noted that an upgradient area to the southeast away from the vicinity of I-10 has concentrations of contaminants above the AWQS and appears to be in a flowpath that would eventually travel outside the current capture zone of the treatment facility. This may pose a future impact to the treatment system's protectiveness. An evaluation of the long term fate of the contaminants in this region and a proposed mechanism to deal with the results of this evaluation should be developed.

7.2.1.6 Implementation of Institutional Controls and Site Control Measures

The interim ROD does not include any required institutional controls. However, measures currently in place to promote the protectiveness of the OU2 interim remedy include:

– ***Facility access control.*** The facility is secure and public access to these facilities is controlled.

7.2.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

7.2.2.1 Changes in Standards and TBCs

Per the interim ROD, the OU2 interim remedy has a secondary objective to reduce upgradient VOC concentrations to below the associated AWQS. The AWQS have not changed during the current Five-Year Review Period.

No additional ARARs or TBCs identified in the ROD have changed in a way to affect protectiveness.

7.2.2.2 Changes in Land Use

No significant changes in land use within the OU2 boundaries occurred during the current Five-Year Review Period.

7.2.2.3 Changes in Known Exposure Pathways, Toxicity, and Other Contaminant Characteristics

As detailed in Sections 3.4.3 and 7.1.2.3, draft TCE and PCE risk assessments/toxicological reviews have been issued by the EPA indicating these contaminants may pose a greater risk than previously considered for cancer and non-cancer health effects. Depending on the results of the pending sitewide vapor intrusion activities and any new forthcoming guidance/regulations regarding vapor intrusion and TCE/PCE toxicity values, an updated review of the OU2 interim remedy and its effectiveness may be warranted in the future.

As discussed in the previous OU2 Five-Year Review report development of a groundwater regulatory standard for 1,4-dioxane is ongoing. 1,4-dioxane has been detected at the Site. Although there is not yet a regulatory standard for 1,4-dioxane, the EPA has established a Preliminary Remediation Goal (PRG). Therefore 1,4-dioxane impacts at the Site will be considered in the development of a final remedy.

It should be noted that a means for investigating and mitigating potential vapor intrusion impacts from the Site groundwater VOC plume will be part of the OU2 RI/FS. This potential exposure pathway will likely need to be reconsidered during future Five-Year Reviews.

7.2.2.4 Changes in Risk Assessment Methods

No changes in risk assessment methods occurred during the current Five-Year Review Period that would impact the assessment of protectiveness at OU2.

7.2.2.5 New Contaminants and/or Contaminant Sources

No new contaminants or new contaminant sources have been identified within the OU2 area in the last five years.

7.2.2.6 Progress towards Meeting Remedial Action Objectives

The treatment system is meeting the primary objective of capture the width and depth of the plume near the I-10. Current data indicates a potential for future achievement of the objective of achieving AWQS concentrations in groundwater upgradient of the 20th Street Facility.

7.2.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The review of capture conducted by ADEQ (URS) concludes that adequate plume capture is likely occurring in the area of interstate 10. However, a long-term issue with capture is indicated for a high concentration area upgradient and southeast from the OU2 GES. Although this area is outside the requirements of the current ROD, it may impact the ROD in the future. Based on current assessment of groundwater flowpaths, the contamination is expected to migrate westward and outside the current limits of capture likely impacting future remedy protectiveness.

7.2.4 Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the OU2 remedy is functioning as intended by the interim ROD. The system is currently meeting the primary objectives.

However several long term issues that may affect protectiveness were identified. These include: 1) There is contamination upgradient of the OU2 GES in the vicinity of monitoring wells ASE75-B and PL202-N that exceeds the AWQS and is expected to travel along a flow path outside the limit of capture. 2) Given current developments in the evaluation of vapor intrusion to indoor air, the lack of a comprehensive framework for the assessment of the vapor intrusion to indoor air pathway in OU2 remains an issue.

Groundwater wells within the Motorola Superfund Site are not currently being used for drinking water. The Arizona Department of Water Resources (ADWR) notifies ADEQ and EPA the intent of any new groundwater well installation within a one mile radius of the Motorola

Superfund project area. This provides a mechanism for ADEQ and EPA to evaluate the purpose and use of any new groundwater wells in the area. In addition, municipalities are required to comply with the Clean Water Act regulations and ensuring that any water served to the public meets all drinking water standards.

8.0 ISSUES

Tables 8-1 and 8-2 summarize issues with the OU1 and OU2 interim remedies (as defined by the ROD/LOD and ROD/ESD, respectively) that were identified during the technical assessment presented in Section 7.0. A reference is provided to previous Five-Year issue numbers for current issues that are ongoing and/or related to issues that were presented in the previous Five-Year Review (conducted in 2006). Tables 5-1 and 5-2 describe previous Five-Year issues and provide a summary of the issue status. It should be noted that Tables 8-1 and 8-2 do not include previous Five-Year issues that are currently being addressed as part of ongoing final remedy development for the Site as only interim remedy issues that affect protectiveness are presented in these tables.

A determination of whether the issues identified likely affect current or future protectiveness is also presented in Tables 8-1 and 8-2. Per *Comprehensive Five-Year Guidance*, protectiveness is assessed based on whether the remedy is functioning as intended by the decision documents, whether the exposure assessment performed at the time of remedy selection is still valid, and whether there is any other information that could call into question the protectiveness of the remedy. Protectiveness is generally defined by the risk of contamination to potential site receptors.

Tables 8-3 and 8-4 summarize additional items to be addressed at the OUs but do not directly affect protectiveness. These items are included to provide a framework for working toward a final remedy at the site. As with Tables 8-1 and 8-2, Tables 8-3 and 8-4 include a reference to previous Five-Year Review Report Issues.

Table 8-1 Issues with the OU1 Interim Remedy

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Issue	Affects Protectiveness (Y/N) [b]	
			Current	Future
1	Issue 4	DNAPL present in bedrock at and near the former Motorola 52nd Street Facility continues to serve as an ongoing source of groundwater contamination upgradient of the OCC extraction system. Without addressing this issue, the required duration of OU1 Interim Remedy operation could suggest future remedy failure.	N	Y
2	Not Applicable	ON Semiconductor is phasing out manufacturing operations at the former Motorola 52nd Street Facility and requires that a new beneficial end-use for groundwater treated at the IGWTP be implemented. If a decision document modifying the end use in the ROD/LOD is not implemented by the time the facility ceases accepting the treated groundwater, the interim remedy will not function as intended by the ROD/LOD in the future.	N	Y
3	Not Applicable	Due in part to the ongoing lowering of the groundwater table, extracted groundwater rates have declined since initial OU implementation rendering the Interim Remedy less efficient than originally intended by decision documents. This decrease in efficiency has the potential to affect future remedy effectiveness, particularly with respect to groundwater plume containment.	N	Y
4	Issue 14, 15, and 17	The age and condition of IGWTP equipment, as well as the high level of operational complexity required to maintain effectiveness of the system, may lead to future operational issues and a decline in Operation and Maintenance adequacy. Specific potential concerns observed during the site inspection include: – Treatment of only 30 to 40% of the original design flow – Relatively high per unit cost for treatment – Non-functional sump controls for the pipeline double-containment system – Removal of two liquid-phase carbon units from service for treatment of scale and recycling of descaling/scale prevention solution in process operations – Signs of environmental exposure/weathering of equipment and process areas – Insufficient detail in maintenance documentation	N	Y
5	Issue 8 and 9	The soil vapor extraction operations identified in the ROD/LOD have ceased; the effectiveness of completed soil cleanup activities has not been adequately evaluated. No soil cleanup in the ATP area (as required by the ROD/LOD) has been conducted.	Y	Y
6	Issue 11	Given current developments in the evaluation of vapor intrusion to indoor air, the extent to which this potential contaminant pathway affects nearby residents and site workers during interim remedy implementation has not been adequately evaluated to date.	Y	Y

Notes:

[a] For current issues that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-1 for a description of the current status of the issue.

[b] Protectiveness is assessed based on whether the remedy is functioning as intended by the ROD/LOD, whether the exposure assessment performed at the time of remedy selection is still valid, and whether there is any other information that could call into question the protectiveness of the remedy (i.e., result in unacceptable risks to potential receptors of contamination).

Table 8-2 Issues with the OU2 Interim Remedy

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Issues	Affects Protectiveness (Y/N) [b]	
			Current	Future
1	Not Applicable	A possible long term issue with capture is indicated for an area southeast of the OU2 GES; in this region, there is contamination upgradient of the OU2 GES that exceeds the AWQS and is expected to travel along a flow path outside the limit of capture. Without action to address this issue, the interim remedy will likely fail to capture this contamination in the future.	N	Y
2	Issue 11	Given current developments in the evaluation of vapor intrusion to indoor air, the lack of a comprehensive framework for the assessment of the vapor intrusion to indoor air pathway in OU2 remains an issue.	Y	Y

Notes:

[a] For current issues that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-2 for a description of the status of the issue.

[b] Protectiveness is assessed based on whether the remedy is functioning as intended by the ROD/LOD, whether the exposure assessment performed at the time of remedy selection is still valid, and whether there is any other information that could call into question the protectiveness of the remedy (i.e., result in unacceptable risks to potential receptors of contamination).

Table 8-3 Items to be Addressed that Do Not Impact Protectiveness for OU1

Item Number	Previous Five-Year Issue Reference [a]	Item to be Addressed
1	Issue 1, 2, and 3	Although available data support the conclusion that the OCC extraction system is containing the bulk of the groundwater contaminant plume at this location, the use of corrected water level data for extraction wells in the development of groundwater elevation contour maps and an increasing trend in contaminant concentrations at DM602 introduce uncertainty into the containment analysis.
2	Not Applicable	Reporting of IGWTP operations in annual effectiveness reports is not sufficient to promote a comprehensive evaluation of treatment system effectiveness and demonstrate compliance with regulatory requirements (particularly with respect to the substantive permit requirements of local air quality authorities).
3	Not Applicable	Remedial action objectives (RAOs) need to be developed for the OU1 final remedy to progress the remedy selection process.
4	Not Applicable	Ongoing concerns regarding subsidence associated with groundwater extraction were noted by community members during the 2011 Five-Year Review interview process.
5	Issue 7	Past observations regarding groundwater contaminant concentrations in shallow bedrock have suggested that the onsite groundwater extraction system may not be sufficiently reducing or eliminating contaminant migration from the source area. ***(Ongoing Issue from 2006 Five-Year Review)***
6	Issue 10	Changes to the toxicity levels for certain Site contaminants have occurred since the OU1 Record of Decision was issued. ***(Ongoing Issue from 2006 Five-Year Review)***
7	Issue 13	There is a potential for unregistered, private wells to exist in the OU1 area. ***(Ongoing Issue from 2006 Five-Year Review)***
8	Issue 18	The contaminants of concern (COCs) need to be identified for the OU1 final remedy so that an evaluation of current health risks can be performed. A sitewide-based approach to selecting and evaluating COCs would promote comprehensive assessment of potential issues that span across operable units. ***(Ongoing Issue from 2006 Five-Year Review)***
9	Issue 20	Additional upgradient sources to groundwater contamination within OU1 may exist. ***(Ongoing Issue from 2006 Five-Year Review)***

Notes:
[a] For current items that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number.

Table 8-4 Items to be Addressed that Do Not Impact Protectiveness for OU2

Item Number	Previous Five-Year Issue Reference [a]	Item to be Addressed
1	Issue 4	Only two lines of evidence (i.e., interpretation of groundwater water level information and an evaluation of concentration trend data) are presented for evaluation of the OU2 capture zone in annual Effectiveness Reports; supporting calculations and/or modeling results demonstrating hypothetically feasible limits of capture are not presented with a discussion of variances between theoretical and observed results. Capture uncertainty is introduced through the use of somewhat arbitrary construction of groundwater elevation contours and unconventional construction of flow paths in areas where data are sparse, particularly in Subunit D.
2	Not Applicable	Annual Effectiveness Reports do not sufficiently assess whether concentrations of contaminated groundwater within the alluvial aquifer upgradient of GES extraction wells are decreasing (a remedial objective of the OU2 interim remedy).
3	Not Applicable	At the OU2 groundwater treatment facility, current tank warning signs are wearing with age and are not legible. Access to the wastewater sump is not clearly labeled as a confined space.
4	Not Applicable	Remedial action objectives (RAOs) need to be developed for the OU2 final remedy to progress the remedy selection process.
5	Not Applicable	Ongoing concerns regarding subsidence associated with groundwater extraction were noted by community members during the 2011 Five-Year Review interview process.
6	Issue 1	Little to no groundwater elevation and quality data are available in any of the subunits along the north side of the OU2 plume. As a result, the impact of the OU2 treatment system cannot be adequately evaluated in that area. Additional monitoring wells are needed along the north side of the OU2 plume in each of the subunits to evaluate the OU2 capture effectiveness. ***(Ongoing Issue from 2006 Five-Year Review)***
7	Issue 7	A high concentration zone on the upgradient and downgradient side of the Honeywell bedrock ridge may not be addressed by the OU2 Groundwater Extraction System (GES). ***(Ongoing Issue from 2006 Five-Year Review)***
8	Issue 8	Long-term multi-well aquifer tests in subunits B and D are needed to gain a better understanding of the OU2 conceptual site model and to facilitate future OU2 analyses. ***(Ongoing Issue from 2006 Five-Year Review)***
9	Issue 9	The Honeywell light non-aqueous phase liquid (LNAPL) remedy will need to be incorporated into the OU2 final remedy. ***(Ongoing Issue from 2006 Five-Year Review)***
10	Issue 10	Changes to the toxicity levels for certain Site contaminants have occurred since the OU2 Record of Decision was issued. ***(Ongoing Issue from 2006 Five-Year Review)***
11	Issue 18	The contaminants of concern (COCs) need to be identified for the OU2 final remedy so that an evaluation of current health risks can be performed. A sitewide-based approach to selecting and evaluating COCs would promote comprehensive assessment of potential issues that span across operable units. ***(Ongoing Issue from 2006 Five-Year Review)***

Notes:

[a] For current items that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations based on the issues identified in Section 8.0 are presented in Tables 9-1 and 9-2 for the OU1 and OU2 interim remedies, respectively. The presented recommendations directly correspond to the issues presented in Tables 8-1 and 8-2 which can be referred to for a description of the basis for the recommendation.

In the past, OU1 and OU2 Five-Year Review reports presented issues that were not limited in scope to the interim remedies and included items that support final remedy development. To maintain continuity and support project progress, Tables 9-3 and 9-4 summarize as follow-up actions ongoing issues identified in the previous Five-Year Review as well as issues identified during this review that do not impact protectiveness. These follow up actions are intended to be supplementary to the recommendations listed in Tables 9-1 and 9-2 and will be used by regulatory authorities to track project progress towards construction completion for the Site. The follow up actions presented in these tables are not meant to be comprehensive in nature and do not factor into the determination of protectiveness for the interim remedies.

Table 9-1 Recommendations to Address OU1 Interim Remedy Issues

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Recommendations	Party Responsible	Oversight Agency	Milestone Date	Issue Affects Protectiveness (Y/N) [b]	
						Current	Future
1	Issue 4	Continue review and investigation of approaches to mitigate the impact of DNAPL present in bedrock at and near the former Motorola 52nd Street Facility.	Freescale	ADEQ	July 2013	N	Y
2	Not Applicable	Select a demonstrated beneficial end use for groundwater treated at the IGWTP and implement a decision document modifying the end use defined in the ROD/LOD.	Freescale	ADEQ	November 2014	N	Y
3	Not Applicable	Where increased groundwater extraction could potentially promote increased containment of contamination, take measures to increase groundwater extraction.	Freescale	ADEQ	December 2014	N	Y
4	Issue 14, 15, and 17	Conduct an engineering review of IGWTP operations to improve efficiency and better document operations. The review should focus on reducing operational complexity where appropriate, identifying where documentation could be more specific, and assessing the remaining service life of equipment, including process monitoring/controls.	Freescale	ADEQ	November 2014	N	Y
5	Issue 8 and 9	Conduct additional studies/investigations to demonstrate compliance of completed soil cleanup activities with appropriate remediation criteria (e.g., SRLs) and assess whether additional soil cleanup at the Motorola Facility areas is required. These activities may be conducted with planned work to evaluate soil gas and the VI to indoor air contaminant pathways at the former facility.	Freescale	ADEQ	December 2014	Y	Y
6	Issue 11	Evaluate the VI to indoor air contaminant pathway in the residential neighborhood between the former Motorola 52nd Street Facility and the OCC. Conduct additional VI studies/investigations at the former facility.	Freescale	EPA	December 2014	Y	Y

Notes:

[a] For current issues that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-1 for a description of the current status of the issue.

[b] Protectiveness is assessed based on whether the remedy is functioning as intended by the ROD/LOD, whether the exposure assessment performed at the time of remedy selection is still valid, and whether there is any other information that could call into question the protectiveness of the remedy (i.e., result in unacceptable risks to potential receptors of contamination).

Table 9-2 Recommendations to Address OU2 Interim Remedy Issues

Current Five-Year Issue Number	Previous Five-Year Issue Number [a]	Recommendations	Party Responsible	Oversight Agency	Milestone Date	Issue Affects Protectiveness (Y/N) [b]	
						Current	Future
1	Not Applicable	Develop a work plan to address contamination southeast of the OU2 GES that has the potential to migrate west and outside the limit of capture in the future.	Freescale and Honeywell	ADEQ/EPA	June 2013	N	Y
2	Issue 11	Develop a comprehensive approach to evaluate the vapor intrusion to indoor air contaminant pathway for the OU2 area.	EPA	EPA	December 2014	Y	Y

Notes:

[a] For current issues that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-1 for a description of the issue and status summary.

[b] Protectiveness is assessed based on whether the remedy is functioning as intended by the ROD/LOD, whether the exposure assessment performed at the time of remedy selection is still valid, and whether there is any other information that could call into question the protectiveness of the remedy (i.e., result in unacceptable risks to potential receptors of contamination).

Table 9-3 OU1 Follow-up Actions

Follow-Up Action Number	Previous Five-Year Issue Reference [a]	Follow-Up Action	Party Responsible	Oversight Agency
1	Issue 1, 2, and 3	Address uncertainty in the OCC extraction system containment analysis. A sensitivity analysis demonstrating the impact of corrected water level data (with a range of well efficiency values) on containment may address some uncertainty in the use of this approach. Additional piezometers demonstrating capture in the vicinity of DM602 and field testing at DM602 to evaluate the source of increasing TCE concentrations could also reduce uncertainty and further demonstrate whether increasing concentrations observed at this well are being captured by the OCC extraction system.	Freescale	ADEQ
2	Not Applicable	Provide greater detail regarding IGWTP operations in annual effectiveness reports. Specific topics that should be presented include: – Process description – Process changes – Process/operational data – Regulatory compliance (including assessment of local air quality authority requirements) Submit any updates of the IGWTP O&M Manual to ADEQ.	Freescale	ADEQ
3	Not Applicable	Develop RAOs for the OU1 final remedy.	ADEQ/EPA	ADEQ/EPA
4	Not Applicable	Address the community's concern regarding sitewide subsidence associated with groundwater extraction activities.	ADEQ	ADEQ
5	Issue 7	Evaluate source area treatment system effectiveness as part of the forthcoming OU1 Final Remedy Feasibility Study.	Freescale	ADEQ
6	Issue 10	Incorporate a review of associated health risk data into the development of a sitewide contaminant of concern (COC) list (see Follow-Up Action No. 8).	ADEQ/EPA	ADEQ/EPA
7	Issue 13	Include requests soliciting information regarding potential unknown users of extracted groundwater in routine public notices/fact sheets for the Site.	EPA	EPA
8	Issue 18	Develop a sitewide COC list.	ADEQ/EPA	ADEQ/EPA
9	Issue 20	Conduct a PRP search for upgradient sources to OU1 contamination and evaluate whether these sources impact the remedy.	ADEQ	ADEQ

Notes:
[a] For current items that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-1 for a description of the current status of the issue.

Table 9-4 OU2 Follow-up Actions

Follow-Up Action Number	Previous Five-Year Issue Reference [a]	Follow-Up Action	Party Responsible	Oversight Agency
1	Issue 4	Support interpretations based on groundwater levels with calculations and a comparison between predicted and observed results for limits of capture. Analytical calculations should be provided to support estimates for the downgradient stagnation point, the extraction rate required to provide adequate capture, and the width of the capture zone. Additional piezometer locations could be used to reduce uncertainty of potentially incomplete capture in Subunit D.	Freescale and Honeywell	ADEQ/EPA
2	Not Applicable	Include an in-text description of whether concentrations of contaminated groundwater within the alluvial aquifer upgradient of OU2 extraction wells are decreasing in annual Effectiveness Reports.	Freescale and Honeywell	ADEQ/EPA
3	Not Applicable	Replace tank warning signs that are wearing with age and/or not legible. Install confined space signs in accordance with OSHA requirements.	Freescale and Honeywell	ADEQ/EPA
4	Not Applicable	Develop RAOs for the OU2 final remedy.	ADEQ/EPA	ADEQ/EPA
5	Not Applicable	Address the community's concern regarding sitewide subsidence associated with groundwater extraction activities.	ADEQ	ADEQ
6	Issue 1	Address data gaps along the north side of the OU2 plume as part of final OU2 remedy development.	Freescale and Honeywell	ADEQ/EPA
7	Issue 7	Address high concentration zones upgradient and downgradient of the Honeywell Bedrock Ridge as part of OU2 final remedy development.	Freescale and Honeywell	ADEQ/EPA
8	Issue 8	Develop a plan to conduct long term multiwell aquifer tests in the Basin Fill to support the design of the OU2 final remedy.	Freescale and Honeywell	ADEQ/EPA
9	Issue 9	Incorporate appropriate portions of the ADEQ Underground Storage Tank Program-approved Honeywell LNAPL remedy (i.e., actions to address dissolved phase contamination) into the OU2 final remedy.	ADEQ/EPA	ADEQ/EPA
10	Issue 10	Incorporate a review of associated health risk data into the development of a sitewide contaminant of concern (COC) list (see Follow-Up Action No. 12).	ADEQ/EPA	ADEQ/EPA
11	Issue 18	Develop a sitewide COC list.	ADEQ/EPA	ADEQ/EPA

Notes:

[a] For current items that are ongoing and/or related to issues presented in the previous Five-Year Review (conducted in 2006) this column presents the previous Five-Year Review issue number – see Table 5-2 for a description of the current status of the issue.

10.0 PROTECTIVENESS STATEMENTS

10.1 OU1

A protectiveness determination of the interim remedy at Motorola 52nd Street Superfund Site OU1 can not be made at this time until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation on the former Motorola facility. It is expected that this investigation will be completed no later than the next Five-Year Review. When the investigation is complete, a protectiveness determination will be made. This five year review also identified other issues that may affect long term protectiveness: the presence of DNAPL in the bedrock at the Motorola facility; the need for a new beneficial end-use for groundwater treated at the IGWTP; declining groundwater levels that may affect extraction rates; and the age and condition of IGWTP equipment that may lead to future operational issues.

A number of issues were identified during the Five-Year Review that may impact whether the OU1 interim remedy is protective in the long-term. To address issues with the potential to impact long-term protection, the following actions need to be taken:

- Continue review and investigation of approaches to mitigate the impact of DNAPL present in bedrock at and near the former Motorola 52nd Street Facility.

- Select a demonstrated beneficial end use for groundwater treated at the IGWTP and issue a decision document modifying the end use defined in the ROD/LOD.

- Where increased groundwater extraction could potentially promote increased containment of contamination, take measures to increase groundwater extraction.

- Conduct an engineering review of IGWTP operations to improve efficiency and better document operations.

10.2 OU2

A protectiveness determination of the interim remedy at Motorola 52nd Street Superfund Site OU2 can not be made at this time until further information is obtained. Further information will be obtained by completing a soil gas and vapor intrusion to indoor air investigation within the OU2 area. It is expected that this investigation will be completed no later than the next Five-Year Review. When the investigation is complete, a protectiveness determination will be made. The interim remedy provides hydraulic containment across the width and depth of the VOC plume in

groundwater near I-10. However, because of the potential for the plume to migrate west and outside the current capture zone, a long-term protectiveness statement can not be made.

11.0 NEXT REVIEW

The next five-year review for the Site is required by September 2016, five years from the date of this review.

12.0 REFERENCES

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FIGURES

APPENDIX A

SUPPLEMENTARY SITE HISTORY INFORMATION

APPENDIX B

SITE HEALTH ASSESSMENT OVERVIEW

APPENDIX C

2011 FIVE-YEAR REVIEW PUBLIC NOTICES AND FACT SHEETS

APPENDIX D

LIST OF DOCUMENTS REVIEWED

APPENDIX E

OU1 SITE DATA EXCERPTED FROM 2006 THROUGH 2010 EFFECTIVENESS REPORTS

APPENDIX F

OU1 CAPTURE ZONE ANALYSIS

APPENDIX G

OU2 SITE DATA EXCERPTED FROM 2006 THROUGH 2010 EFFECTIVENESS REPORTS

APPENDIX H

OU2 CAPTURE ZONE ANALYSIS

APPENDIX I

INTERVIEW DOCUMENTATION

APPENDIX J

OU1 SITE INSPECTION DOCUMENTATION

APPENDIX K

OU2 SITE INSPECTION DOCUMENTATION