Appendix A
Statement of Work for OU3 Remedial Investigation/Feasibility Study
Motorola 52nd Street Superfund Site
Operable Unit 3

Dated 08/06/09

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ADEQ	Arizona Department of Environmental Quality
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Consent Order	Administrative Order on Consent
EPA	Environmental Protection Agency
EW	East Washington
FS	Feasibility Study
FSP	Field Sampling Plan
Freescale	Freescale Semiconductor, Inc.
GBRA	Groundwater Baseline Risk Assessment
HASP	Health and Safety Plan
Honeywell	Honeywell International
IDW	investigation-derived waste
ISCO	In-Situ Chemical Oxidation
µg/l	micrograms per liter
Motorola	Motorola Semiconductor Products Sector
OCPs	organochlorine pesticides
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
OU3 RI/FS Site	Geographical locations where the Work under Setttlement Agreement is conductedPCBs polychlorinated biphenyls
PRP	Potentially Responsible Party
PWSD	Phoenix Water Services Department of Pollution Control Division
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
Site	Motorola 52nd Street Superfund Site
SOW	Statement of Work
TCA	1,1,1-trichoroethane
TCE	trichloroethene
VOCs	volatile organic compounds
WQARF	Water Quality Assurance Revolving Fund

1.0 INTRODUCTION

The Motorola 52nd Superfund Site is located in Phoenix, Arizona. Operable Unit 3 (OU3) is one of three Operable Units (OUs) for the Site. This Statement of Work (SOW) describes the work required to support the completion of the Remedial Investigation and Feasibility Study for OU3 (OU3 RI/FS) of the Motorola 52nd Street Superfund Site (Site). This effort is referred to as the OU3 RI/FS, and the geographical locations where work is being conducted is defined as the OU3 RI/FS Site. This SOW is to be implemented pursuant to the Administrative Order on Consent (Consent Order) with the Environmental Protection Agency (EPA), issued under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The SOW includes the installation of additional groundwater monitoring wells, soil vapor monitoring well installation, collection and analysis of groundwater samples and soil vapor samples, preparation of groundwater monitoring reports, aquifer testing, and treatability studies, and evaluation of possible remedial alternatives appropriate for OU3. The primary purpose of the data generated under the requirements of this SOW is to finalize necessary data collection activities to prepare an OU3 RI/FS Report and a Groundwater Baseline Risk Assessment (GBRA). EPA has or anticipates entering into separate agreements with other potentially responsible parties (PRPs) to conduct facility-specific Remedial Investigations for the identification and evaluation of historic and continuing sources. Such agreements would also address appropriate remedial actions for sources originating on these facilities. The Respondents will consider available facility-specific data, the results of the OU3 RI/FS SOW and prior OU3 groundwater investigations in preparing the OU3 RI/FS Report.

EPA shall maintain lead responsibility for community involvement activities within OU3.

1.1 Site Description

The Motorola 52nd Street Superfund Site is located in the City of Phoenix, Maricopa County, Arizona. The Site is approximately 7,800 acres and consists of three adjoining groundwater OUs: OU1, OU2, and OU3. OU1, approximately 1,000 acres, is the easternmost OU and contains the former Motorola 52nd Street semi-conductor plant. The boundaries of OU1 are 52nd Street to the east, Palm Lane to the north, Van Buren Street to the south, and 44th Street to the west. Operable Unit 2 is approximately 3,800 acres, lies west of OU1, and contains the OU2 Groundwater Extraction System and several OU2 PRP facilities, including the Honeywell International (Honeywell) 34th Street Facility. The approximate boundaries of OU2 are McDowell Street to the north, 44th Street to the east, Buckeye Road to the south, the OU2 Groundwater Extraction System, and 20th Street to the west. OU3 is approximately 3,000 acres west of OU2. The boundaries of OU3 are McDowell Road to the north, the OU2 Groundwater Extraction System and 20th Street to the east, Buckeye Road to the south, and 7th Avenue to the west. EPA is the lead regulatory agency for OU3 and the OU2 Groundwater

Extraction System. The Arizona Department of Environmental Quality (ADEQ) is the lead regulatory agency for OU1 and OU2.

West of OU3 is the West Van Buren Water Quality Assurance Revolving Fund (WQARF) site overseen by ADEQ. The West Van Buren WQARF site is within the area bounded by Van Buren Street to the north, 7th Avenue to the east, Buckeye Road to the south, and 75th Avenue to the west.

1.2 Site Background

The Motorola Semiconductor Products Sector (Motorola) owned and operated the Motorola 52nd Street facility from 1956 to 1999. As part of its electronics manufacturing operation, Motorola used solvents, including trichloroethene (TCE) and 1,1,1-trichoroethane (TCA), to clean and degrease parts and equipment. In 1982, a solvent leak was discovered in an underground storage tank at the facility. A Preliminary Investigation Report was published in 1983 indicating groundwater contamination was present at the plant and to the west of the plant. In September 1988, ADEQ and EPA selected an interim remedy in the Record of Decision (ROD) for OU1 consisting of on-site soils cleanup and off-site groundwater containment near 46th Street. On October 4, 1989, EPA placed the Motorola, Inc. (52nd Street Plant) Site on the National Priorities List (NPL). Motorola (now Freescale Semiconductor, Inc. [Freescale]) continues the operation of the groundwater treatment plant completed in 1992 under ADEQ oversight. Groundwater is treated using air-stripping and carbon adsorption. The treated water is used by ON Semiconductor for their facility operations and then discharged to the City of Phoenix sewer system. In 1991, Motorola undertook RI activities in the OU2 Study Area under ADEQ oversight and completed a Feasibility Study in October 1993.

In 1992, the Honeywell 34th Street facility (formerly Allied Signal Aerospace Company) was identified as a potentially responsible party (PRP) within OU2. Elevated levels of TCE, TCA, and other volatile organic compounds (VOCs) were detected in samples from soils and groundwater monitoring wells in and around the Honeywell facility. Honeywell has conducted a Focused RI of VOCs at the 34th Street Facility under ADEQ oversight and submitted its Facility Remedial Investigation Report to ADEQ in December 2006.

In July 1994, ADEQ and EPA selected an interim remedy in a ROD for the OU2 Study Area, consisting of containment of the groundwater plume at approximately 20th Street with a groundwater extraction and treatment system. The treatment system began operation in September 2001 using carbon adsorption for treating groundwater. The treated groundwater is discharged to the Salt River Project Grand Canal for use as irrigation water. Freescale and Honeywell constructed, and have operated, the OU2 treatment system under EPA oversight. At the direction of EPA and ADEQ, the Companies (Honeywell and Freescale) have recently negotiated an Administrative Order on Consent with ADEQ to continue to operate and maintain the system under ADEQ oversight. The Order is pending at this time.

In 1983, a groundwater sample collected from the Eastlake Park irrigation well located in the OU3 Study Area near 16th Street and Jefferson Street contained chlorinated VOCs. With this discovery, the Arizona Department of Health Services began investigations. In 1986, the newly formed ADEQ, under Arizona's WQARF program, continued the groundwater investigations. Limited data was available to evaluate the plume distribution at the time, which led to the East Washington (EW) Area well installation program. Between 1992 and 1994, ADEQ installed 20 groundwater monitoring wells in the EW Area.

Initially, the VOC source detected in the groundwater as part of the Eastlake Park Area investigation was unknown. The Motorola 1992 OU2 RI report indicated that the contamination migrating from the Motorola facility extended into the EW Area. The extension of groundwater contamination into the EW Area prompted ADEQ and EPA to create the OU3 Study Area to address co-mingled VOC groundwater contamination. In 1997, ADEQ and EPA established the boundaries of OU3, historically referred to as the "OU3 Study Area." ADEQ and EPA determined that the investigation of groundwater contamination and potential source areas beyond 20th Street to 7th Avenue would continue under the federal Superfund program. EPA initiated a fund-lead RI/FS and PRP Search update in 1999.

1.3 Operable Unit 3 Study Area Status

EPA has conducted two phases of fund-lead groundwater investigations and initiated PRP-lead investigations of several potential sources in the OU3 Study Area. The Phase I and II groundwater investigation results were presented in the *Final Groundwater Investigation Report, Phase I and II Well Installation, Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix Arizona* (Shaw, 2005). Groundwater monitoring results have been published in quarterly and semiannual groundwater monitoring reports. Information gathered during EPA's Phase I and Phase II investigations on geology, hydrogeology and the nature and extent of contamination are contained in Attachment A to this SOW.

Currently, focused RI work is being performed or planned at individual facilities within OU3. The Respondents will conduct specified field work and will produce deliverables to EPA for review and approval that are in accordance with the Consent Order, this SOW, and appropriate guidance and reference documents. Table 1 presents a summary of deliverables and selected guidance. Reference documents are included in Table 2.

The Respondents will furnish all necessary personnel, materials, and services needed, or incidental to, performing the field work. All work performed under the SOW shall be under the direction and supervision of qualified personnel. All technical reports and other deliverables shall be prepared under the direction and supervision of an Arizona Professional Engineer or Registered Geologist.

2.0 OU3 RI/FS WORK PLAN

The Respondents shall prepare and submit to EPA a draft OU3 RI/FS Work Plan within 60 days of the effective date of the Consent Order. Copies shall be submitted in accordance with the Consent Order.

Specifically, the Work Plan shall present the following:

- A background summary of the Site.

- The Respondents' technical and management approach to each task to be performed, including a detailed description of each task; the assumptions used; the identification of any technical uncertainties (with a proposal for the resolution of those uncertainties); the information needed for each task; any information to be produced during and at the conclusion of each task; and a description of the work products that will be submitted to EPA. The Respondents shall identify any contractors or subcontractors it plans to use to accomplish all or part of a task's objectives.

- A schedule of specific dates for the start and completion of each required activity and submission of each deliverable required by the SOW. The schedule shall also include information about timing, initiation and completion of all critical path milestones for each activity and deliverable.

- Recommendation(s) for modification and/or additions to the groundwater monitoring well location(s) or soil gas collection locations beyond those described in this SOW. The Work Plan shall include the rationale for any modifications to the RI investigation.

- The Respondents' approach to data management to address requirements for project management systems, including tracking, storing and retrieving data. The Respondents must follow ADEQ's most current groundwater data submittal guidance. At this time, the *Groundwater Data Submittal Guidance Document (Version 3.3)*, Arizona Department of Environmental Quality, Waste Programs Division, Superfund Programs Section, March 2005, is the most recent version.

The Respondents shall revise the draft Work Plan according to EPA comments and submit a final Work Plan for EPA review and approval. The final Work Plan is due within 30 days of receipt of EPA comments. A summary of other Deliverables pursuant to this SOW and due dates are included as Table 1.

3.0 DEVELOP SITE-SPECIFIC PLANS

3.1 Field Sampling Plan and Quality Assurance Project Plan

The Respondents shall submit a Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP).

The draft FSP and QAPP will be incorporated into the RI Work Plan and due within 60 days of the effective date of the Consent Order (see Table 1)..

The Respondents shall revise the draft FSP and QAPP according to EPA comments and submit final plans for EPA review and approval. The final FSP and QAPP are due within 30 days of receipt of EPA comments.

3.2 Health and Safety Plan

The Respondents shall submit a site-specific Health and Safety Plan (HASP). The HASP for the Site must specify how workers will be protected during any OU3 RI/FS Site activities through the identification, evaluation, and control of health and safety hazards. The HASP must also provide an emergency response plan describing how to handle potential OU3 RI/FS Site emergencies and how to minimize the risks associated with a response. The HASP must also address health and safety requirements for OU3 RI/FS Site visitors.

The HASP is due within 45 days of the effective date of the Consent Order.

EPA does not provide “approval” of HASPs. Each employer, contractor, and subcontractor is responsible for ensuring that workers follow applicable Federal and State worker health and safety regulations.

4.0 DATA ACQUISITION

Data acquisition starts with EPA approval of the FSP and QAPP, and ends with the demobilization of field personnel and equipment from the OU3 RI/FS Site. The Respondents shall perform the following field activities for groundwater monitoring well installation and sampling: aquifer testing, soil gas sampling, and bench-scale treatability study testing in accordance with the EPA-approved Work Plan, FSP, and QAPP developed pursuant to Section 3.0.

4.1 Mobilization and Permitting

Mobilization shall involve procurement of subcontractors, equipment, personal protective equipment, monitoring devices, supplies, and appropriate security measures for well installation and a staging area. The Respondents shall arrange for utility surveys and permits for all off-site activities, coordinate with analytical and geotechnical testing laboratories, and provide for storage of investigation-derived waste (IDW).

The Respondents shall comply with the substantive requirements of all applicable local, state and federal permitting for on-site actions and all requirements for off-site actions. Prior to mobilizing for field efforts, private property owners will be contacted to obtain temporary access, where necessary, for installation and sampling of monitoring wells and soil vapor monitoring wells.

4.2 Groundwater Monitoring Well Installation and Sampling

The Respondents shall, as part of the groundwater investigation work plan, install additional groundwater monitoring wells to complete VOC and 1,4-dioxane characterization within the Shallow, Intermediate and Deep Zones. The Shallow, Intermediate and Deep Zones are assumed to correspond to the ADEQ Hydrostratigraphic Units A, B and D, respectively, which are discussed in more detail in Attachment A, Section 1.2.

It is expected that approximately four (4) monitoring wells will be constructed in the Shallow Zone, three (3) monitoring wells in the Intermediate Zone, and one (1) monitoring well in the Deep Zone. Figure 1 shows the approximate proposed locations for these monitoring wells. The monitoring well locations are summarized below:

- One Shallow Zone well (OU3-10A) near monitoring well EWOU3-10S-R
- One Shallow Zone well (OU3-16A) in western OU3
- One Shallow Zone well (OU3-17A) upgradient of well GH-MW-11
- One Shallow Zone well (OU3-20A) along OU3/OU2 boundary
- One Intermediate (M) Zone well (OU3-16B) in western OU3
- One Intermediate (M) Zone well (OU3-19B) in eastern OU3

- One Intermediate (M) Zone well (OU3-20B) along OU3/OU2 boundary
- One Deep Zone well (OU3-18D) in south-central OU3

These well locations are intended to serve the following purposes:

OU3-10A: Due to water level decline at well AEW01-24R (a.k.a., EWOU3-10S-R, ADWR Well 55-580790) the water table is below the existing well's screen interval. The well had TCE concentrations as high as 430 micrograms per liter (µg/L) and was the furthest downgradient in the OU3 Shallow Zone providing information on TCE migration out of OU3. Replacement of Shallow Zone well AEW01-24R will provide information on TCE migration out of OU3.

OU3-16A and OU3-16B: The Shallow and Intermediate Zone TCE groundwater plumes continue west into the West Van Buren WQARF site. Well AVB115-01, within the West Van Buren WQARF site, has a screen interval of 70 to 150 feet below ground surface (bgs), which covers the Shallow Zone and extends into the First Intermediate Zone. A Shallow and an Intermediate Zone well are needed within OU3 upgradient from well AVB115-01 to evaluate plume concentrations within the Shallow and Intermediate Zones.

OU3-17A: Insufficient data is available from the Shallow Zone in the southern portion of the TCE groundwater plume. The Shallow Zone monitoring well GH-MW-11 is associated with a petroleum product release, and VOC water quality from this well may be compromised due to in-situ biological activity. A Shallow Zone well, upgradient of well GH-MW-11, would help to further delineate this portion of the plume.

OU3-19B: The plume core of the Intermediate Zone is not well defined in central and eastern OU3. The location of the plume core in the Intermediate Zone is thought to be between wells OU3-12D and OU3-13D, but has not been monitored. Intermediate Zone well OU3-19B will better define what is believed to be the core of the plume.

OU3-18D: Insufficient data is available from the Intermediate and Deep Zones in the southern portion of the TCE groundwater plume. Monitoring well OU3-18D will be installed to characterize the Deep Zone downgradient of EW-13-268. A corresponding B Unit well (OU3-18B) will be installed adjacent to OU3-18D. The Respondents assume that the B Unit well will be installed as part of the facility specific focused RI work for the Walker Power Facility.

OU3-20A: Insufficient data is available in the southeast portion of OU3 along the western OU2 boundary. Monitoring Well OU3-20A will be installed in the Shallow Zone directly downgradient of the OU2 boundary.

OU3-20B: Insufficient data is available in southeast portion of OU3 along the western OU2 boundary. Monitoring Well OU3-20B will be installed in the Intermediate Zone directly downgradient of the OU2 boundary.

As part of the work plan development, the respondents will perform an evaluation to improve understanding of the hydrostratigraphic connection between the lithologic units in OU2 and OU3. This evaluation, performed to better understand the transition from OU2 to OU3, will include the development of stratigraphic cross-sections and the assessment of historical water-level trends. As part of this evaluation, water-level gradients and VOC mass flux across the OU2/OU3 boundary will be reviewed. If based on this evaluation, Respondents conclude any of the above-proposed wells are not necessary or revise locations, Respondents will provide a basis for such exclusion or proposals for supplemental wells or different locations in the Work Plan.

If at any time during the investigation the Respondents identify a need for additional data to complete the characterization of the extent of VOCs in the Shallow, Intermediate, or Deep Zones, the Respondents shall submit a Technical Memorandum documenting the need for additional data to the EPA Remedial Project Manager (RPM) within 30 days of identification. EPA shall notify the Respondents in writing as promptly as practicable whether the additional data should be collected. The Respondents shall incorporate any such additional data collected into reports and deliverables unless EPA indicates otherwise.

At each cluster well location, an initial pilot hole will be continuously cored using a rotasonic drill rig to the deepest well's target depth at that location. At locations for Intermediate and Deep Zone wells, depth-specific groundwater sampling shall be performed and the samples analyzed on an expedited turnaround to obtain VOC data. The VOC data and cores will be evaluated to select the Intermediate and Deep Zone well screen intervals. The deepest of the cluster wells will be installed in the pilot hole, if possible. The additional Shallow Zone cluster well will be designed from that pilot hole's analytical and lithologic information and shall be constructed in a nearby boring. The Shallow Zone wells, that are not part of a cluster well installation, will be drilled via rotasonic drill rig. The Shallow Zone well screen intervals will be identified based on the depth of the water table.

The soil core will not be collected at the OU3-10S well location, as lithologic data are available from the Phase II well installation program. Shallow Zone well screen intervals will be identified based on the depth of the water table. Bulk soil samples of OU3 aquifer material will be collected for later use in bench-scale testing to be performed in Section 4.7.

The project technical team will be consulted on the final cluster well design prior to installation. The project technical team will consist of representatives from EPA, ADEQ, and the Respondents. It is anticipated that the well design reviews will be completed within 12 to 24 hours by the project technical team.

For any new wells that are installed as part of the SOW, the Respondents will collect four quarterly water quality samples prior to inclusion in the OU3 groundwater monitoring program. The groundwater samples from newly installed wells shall be analyzed for VOCs using EPA Method 8260B and for 1,4-dioxane using EPA Method 8270C. If discharge water is to be sent to the City of Phoenix wastewater system, to comply with Phoenix Water Services Department Pollution Control Division (PWSD) wastewater discharge requirements, the initial groundwater samples shall be analyzed for organochlorine pesticides (OCPs) by EPA Method 8081A and polychlorinated biphenyls (PCBs) by EPA Method 8082. Following the four quarterly sampling events, the wells shall be added to the OU3 groundwater monitoring program.

For OU3 groundwater monitoring, groundwater samples shall continue to be analyzed for VOCs and 1,4-dioxane. For wells purged directly to PWSD, OCP and PCB, analyses shall be added if the initial monitoring well results yield OCP and PCB concentrations that exceed the instantaneous effluent limitations for a PWSD permit.

EPA will be responsible for the September 2009 OU3 groundwater quality sampling event. After September 2009, the Respondents will assume responsibility for the OU3 Study Area groundwater-monitoring program through either the completion of the September 2010 sampling event or completion of the final OU3 FS, whichever occurs first. The Respondents will coordinate with EPA to transfer or revise current access agreements to OU3 monitoring wells.

4.3 Groundwater Well Installation Report

Within 45 days after receipt of validated groundwater analytical results from the initial groundwater sampling event, the Respondents shall submit a draft Well Installation Report describing, at a minimum, the methods and procedures used for well installation and containing borehole, well construction logs, and field documentation. The report shall also contain photographs taken at each new monitoring well location. The well report will include the analytical data from the initial groundwater sampling event.

The Respondents shall revise the Well Installation Report according to EPA comments and submit a final report for EPA review and approval. The final report is due 30 days after receipt of EPA comments.

4.4 Groundwater Monitoring Reports

The Respondents shall submit groundwater monitoring data transmittal reports on a quarterly basis during the period that the Respondents are responsible for the groundwater monitoring. The groundwater monitoring data transmittal reports shall include at a minimum: final analytical reports; tabular summaries of analytical concentrations and water-level elevations; and graphical presentation of potentiometric surface and water quality for the A, B and D Aquifer zones. On an annual basis, the Respondents will prepare a groundwater monitoring report. The annual groundwater monitoring reports shall include, at a minimum, information on the sampling and analysis methods used, groundwater levels, chemical and groundwater level temporal trends,

analytical results, and data quality assessment. In the event that the annual groundwater monitoring report coincides with the OU3 RI report preparation, annual groundwater monitoring report data will not be prepared separately and the information will be included in the OU3 RI report.

The draft data transmittal reports and annual groundwater monitoring reports shall be submitted to EPA within 45 days of receipt of validated analytical data. The Respondents shall submit unvalidated data to EPA electronically, as soon as it is available.

The Respondents shall revise the draft report according to EPA comments and submit a final report for EPA review and approval. The final report is due 30 days after receipt of EPA comments

4.5 Install and Sample Soil Vapor Monitoring Wells.

As part of the groundwater investigation work plan, the Respondents shall install three (3) multi-port soil vapor monitoring wells (SVMWs) to allow for assessment of the potential of VOC off-gassing from the Shallow Zone groundwater. Use of multi-port soil vapor monitor wells will quantify the vertical distribution of soil vapor concentrations and allow direct measurement of the relationship between observed groundwater concentrations and soil vapor concentrations that are due to off-gassing from the water-table surface and the attenuation of the soil vapor concentrations in the vadose zone at increasing distance from the water-table.

The SVMWs will be installed after installation and initial sampling of the proposed groundwater monitoring wells. The SVMWs will be located in those regions of the OU3 Shallow Zone, where VOC concentrations are highest and where there are significant variations of Shallow Zone lithology. The respondents will make efforts to reasonably assure that the SVMWs are installed within approximately 100 feet of existing or new Shallow Zone groundwater monitoring wells to allow for correlation of groundwater concentrations to deep soil vapor concentrations that would be associated with VOC off-gassing from the Shallow Zone water table. If due to safety or physical access constraints a SVMW cannot be installed within 100 feet of an existing or new Shallow Zone groundwater monitoring well, Respondents will discuss revised well locations with EPA. The proposed locations for the SVMWs include installation adjacent to the following Shallow Zone Wells: Well EW-19S, Well OU3-5SR and Well OU3-10S.

The SVMWs will be drilled via rotasonic drill rig and be installed to a depth of approximately 10 feet above the current Shallow Zone water table elevation. The nested SVMWs will have four ports. The specific SVMW construction will include four nested wells: four (4) ½ inch diameter schedule 80 polyvinyl chloride (PVC) ports. Each individual well will use approximately two (2) feet of 0.050 inch slotted schedule 80 PVC screen. The nested wells will include a shallow (Port A) SVMW, an intermediate shallow SVMW (Port B) well, an intermediate deep (Port C) SVMW, and a deep (Port D) SVMW. The screened intervals will be

selected based on the lithology encountered during drilling of multiple wells near the area. During drilling, the Respondents shall also collect site-specific soil parameters including, at a minimum, total organic carbon, soil bulk density, total soil porosity, and percent of moisture and air content in soil.

The SVMW will be outfitted with air-tight fittings and all soil vapor sampling activities will conducted in accordance with California Regional Water Quality Control Board (CRWQCB) "Interim Guidance For Active Soil Gas Investigation" (February 25, 1997), and with the "Advisory - Active Soil Gas Investigations" (ASGI), jointly developed by Department of Toxic Substances Control (DTSC) and California Regional Water Quality Control Board - Los Angeles Region (January 28, 2003). Sufficient duplicate samples will be collected during each sampling event to allow a statistical evaluation of soil vapor concentration confidence.

The SVMWs will be sampled on a quarterly basis for one year. If the first two quarters of soil vapor sampling show no detectable COC concentrations above detection limits provided in the QAPP, the Respondents will be allowed to discontinue any further soil vapor monitoring from the these wells.

4.6 Soil Vapor Well Installation Report

Within 45 days after receipt of the validated analytical data from the initial SVMW sampling event, the Respondents shall submit a draft Soil Vapor Monitor Well Installation Report describing, at a minimum, the methods and procedures used for well installation, borehole information, construction logs, and field documentation. If it is determined that additional data would be beneficial to complete the evaluation, the report will include a Technical Memorandum describing additional data collection activities.

The Respondents shall revise the Soil Vapor Monitor Well Installation Report according to EPA comments and submit a final report for EPA review and approval. The final report is due 30 days after receipt of EPA comments.

4.7 Soil Vapor Well Monitoring Reports

The Respondents shall submit Soil Vapor Monitor Well Data Transmittal Reports on a quarterly basis for one year. The Data Transmittal Reports shall include, at a minimum, final analytical data, and a tabular summary of soil vapor chemical concentrations. At the completion of one year of quarterly soil vapor monitoring data, the Respondents shall prepare a Soil Vapor Monitor Well Report. The report shall include, at a minimum, information on the sampling and analysis methods used, chemical temporal trends, analytical results, and data quality assessment.

The draft quarterly data transmittals shall be submitted to EPA within 45 days of receipt of validated analytical data. The Respondents shall submit unvalidated data to EPA electronically, as soon as it is available.

The Respondents shall revise the draft Soil Vapor Monitoring report according to EPA comments and submit final report for EPA review and approval. The final report is due 30 days after receipt of EPA comments. In the event that the completion of soil vapor monitoring coincides with the preparation of the OU3 RI report, a separate Soil Vapor Monitoring Report will not be required and the information will be included in the OU3 RI report.

4.8 Aquifer Tests and Reporting

Limited hydraulic data (e.g., transmissivity, hydraulic conductivity and storage coefficient) are available for the three water-bearing zones, Shallow, Intermediate and Deep Zones in OU3. The Respondents shall propose aquifer test(s) to obtain hydraulic data for consideration and evaluation of the aquifer characteristics needed to identify and evaluate potential remedial alternatives or other needs identified by the Respondents.

These aquifer test(s) will be performed after both the execution of new well installation and sampling (Section 4.2) and the receipt of validated analytical data from the first round of semi-annual sample collection that includes the newly installed wells. The aquifer testing will consist of two (2) constant-rate discharge tests (one in the shallow zone [A unit] and one in the intermediate zone [B unit]) and selected slug-type aquifer tests. The purpose of the constant-rate discharge tests will be to calculate aquifer parameters averaged over a pumping induced cone of depression and geographically distributed slug tests to estimate the variability in hydraulic conductivity. Not more than twenty (20) slug-type aquifer tests will be performed in OU3 to estimate horizontal hydraulic conductivity. At least one constant-rate discharge test will be conducted in both the Shallow and Intermediate Zones to obtain data to calculate storativity (specific yield), anisotropy, hydraulic conductivity (vertical and horizontal), or other aquifer parameters deemed necessary. It is assumed that the constant-rate discharge test will utilize existing OU3 monitoring wells as the pumping and water-level observation wells. The location of the constant rate pump tests will be based on a location within OU3 that has sufficient observation well density and the tests will be performed for a significant duration to achieve stabilization of water levels and evaluate leaky aquifers or boundary conditions. Following the constant-rate discharge test, a recovery test will also be performed. In the RI Work Plan, the Respondents will provide details on the aquifer test design, including step-drawdown tests for determining appropriate pumping rates, test durations, and test monitoring. The locations and number of the aquifer tests may be modified based on investigation results and revised locations will be included in a Technical Memorandum.

Within 60 days of completing an aquifer test, the Respondents shall submit a draft Aquifer Test Report describing the methods and procedures used and the results of the constant rate discharge, recovery and slug tests.

The Respondents shall revise the draft Aquifer Test Report according to EPA comments and submit a final report for EPA review and approval. The final report is due 30 days after receipt of EPA comments**.**

4.9 In-Situ Treatability Study Technical Memorandum

The Respondents will perform an in-situ treatability study for the purpose of assessing the potential to successfully utilize in-situ methods to address VOC-affected groundwater within the impacted OU3 aquifers. In-situ methods will include both chemical oxidation/reduction and enhanced bioremediation for chlorinated VOCs. An In-Situ Implementability Technical Memorandum will be prepared that will include a literature review assessing implementability of in-situ methods in large southwestern alluvial aquifers, and the efficacy of performing a bench-scale test.

If the study indicates that in-situ treatment is applicable to OU3 and bench-scale information will be valuable, a bench-scale study (e.g., column studies) of potentially successful agents that utilizes representative OU3 alluvial material samples will be performed. The purpose of the bench-scale testing will be to assess the key parameters needed to evaluate the implementability of a full-scale in-situ option. The bench-scale test will be designed to quantify parameters such as oxidant demand, bacterial populations, scale/slime formation, longevity, contaminant reduction rate, and potential metal mobilization. Details of the bench-scale testing process and evaluation methods will be provided in the Bench-Scale Testing Technical Memorandum.

The draft In-Situ Implementability Technical Memorandum will be submitted to EPA 30 days after submittal of the draft OU3 RI/FS Work Plan. The Respondents shall revise the Technical Memorandum according to EPA comments and submit a final Technical Memorandum for EPA review and approval. The final report is due 30 days after receipt of EPA comments.

If performed, the draft Bench-Scale Testing Technical Memorandum will be submitted to EPA 30 days after finalization of the In-Situ Implementability Technical Memorandum. The Respondents shall revise the Bench-Scale Testing Technical Memorandum according to EPA comments and submit a final Bench-Scale Technical Memorandum for EPA review and approval. The final report is due 30 days after receipt of EPA comments.

4.10 In-Situ Bench-Scale Treatability Study Report

If bench-scale testing is performed, the Respondents shall submit unvalidated data from bench-scale testing electronically to EPA as soon as it is available. Within 45 days after receipt of validated analytical data, the Respondents shall submit a Bench-Scale Treatability Testing Report. The report will present the findings of the study and will be used as part of the FS alternative evaluation for selection of an OU3 groundwater remedy.

The Respondents shall revise the draft report according to EPA comments and submit a final Bench-Scale Testing Report within 30 days after receipt of EPA comments. The Respondents

may consider additional studies or pilot study based on the results of the bench-scale testing. These studies may be proposed in separate Technical Memoranda.

5.0 PROGRESS REPORTING

5.1 Notification of Initiation of Field Work and Notification of Completion of Field Work

The Respondents will notify EPA with a Notification of Initiation of Field Work at least fifteen (15) days prior to initiating any physical work in the field. The Notification will include the planned dates for field activities so that EPA may adequately schedule oversight tasks. The Respondents will notify EPA in writing within five (5) days of completion of field work activities, with a Notification of Completion of Field Work. Upon submission of the Notification of Initiation of Field Work, Respondents will provide Weekly Field Progress Reports according to the requirements in the Consent Order. Weekly Field Progress Reports may be discontinued upon Notification of Completion of Field Work.

5.2 Weekly Field Activity Reports

The Respondents shall submit weekly field activity reports. At a minimum, these weekly activity reports shall: (1) describe the actions which have been taken to comply with this Settlement Agreement during that week; (2) include all results of sampling and tests and all other data received by the Respondent; (3) describe work planned for the next two weeks with schedules relating such work to the overall project schedule for OU3 RI Field Activities completion; and (4) describe all problems encountered and any anticipated problems, any actual or anticipated delays, and solutions developed and implemented to address any actual or anticipated problems or delays.

The reports should be submitted via electronic mail and are due each week on Thursday during field work.

5.3 Monthly Progress Reports

When the Respondents are not conducting field work, the Respondents shall provide monthly progress reports. At a minimum, these progress reports shall: (1) describe the actions during that month; (2) include all results of sampling and tests and all other data received by the Respondent; (3) describe work planned for the next two months with schedules relating such work to the overall project schedule for OU3 RI Field Activities completion; and (4) describe all problems encountered and any anticipated problems, any actual or anticipated delays, and solutions developed and implemented to address any actual or anticipated problems or delays.

The reports shall be submitted via electronic mail and are due on the fifteenth (15) business day of each month for the preceding month's work.

6.0 Investigation -Derived Waste Disposal

The Investigation-Derived Waste (IDW) will include soil cuttings, liquid waste from equipment decontamination, well development, well purging, and personal protective equipment. The IDW shall be contained pending characterization and disposal.

Soil cuttings and wastewater generated during well installation shall be properly managed and tested to confirm disposal requirements.

Prior to shipping any hazardous substances, pollutants, or contaminants from the Site to an off-site location, the Respondents shall obtain EPA's certification that the proposed receiving facility is operating in compliance with the requirements of CERCLA Section 121(d)(3), 42 U.S.C. §9621(d)(3), and 40 C.F.R. §300.440.

7.0 Sample Analysis

The Respondents shall arrange for and carry out the environmental analyses of samples collected for the previous tasks, in accordance with the FSP and QAPP. The sample analysis task begins with the Respondents arranging the sample analysis work with a state-accredited laboratory and completing the field sampling program. The task ends with the Respondents verifying that the laboratory completed the requested analyses, submitted all sample data packages for third party validation, and submitted unvalidated data to EPA. For the purposes of this SOW, "third party" is defined as any party other than the entity performing the laboratory analysis.

8.0 Data Validation

The Respondents shall arrange for and carry out third party validation of the analytical data received from the laboratory during the previous tasks, according to the EPA-approved FSP and QAPP. The sample validation task begins with the Respondents transmitting all sample data packages received from the laboratory to the third party validator for validation in accordance with EPA's National Functional Guidelines for Data Review and applicable method quality control standards. This task ends with the Respondents providing EPA with data validation reports.

9.0 Community Involvement

EPA shall maintain lead responsibility for community involvement activities within OU3. Given the Respondents' responsibility to complete the requirements described in this SOW and their knowledge of daily activities at the OU3 RI/FS Site, the Respondents may be requested to provide support to EPA in preparation and dissemination of fact sheets, flyers, power point presentations, and other audiovisual materials designed to apprise the community of current or proposed activities. In advance of the publication of any material to the community, EPA shall provide an advance copy of such material to Respondents and request comment concerning the accuracy of such material. Any comments from Respondents shall be provided to EPA within 30 days of receipt of such material.

The Respondents may be requested to prepare, for EPA review and approval, an informational fact sheet for distribution to residents and businesses in neighborhoods that will be affected by soil gas sampling, well installation and groundwater sampling activities. The fact sheet will explain the basic details of the investigation and provide appropriate contact information several weeks in advance of scheduled activities. Affected residents and businesses will be notified by EPA of field activities a minimum of a week in advance of scheduled work via door hangers or flyers distributed door-to-door. Private well owners will be notified by EPA of sampling events via an informational letter.

10.0 OU3 Remedial Investigation Report

The Respondents will prepare an OU3 Remedial Investigation Report (RI Report or RI) consistent with EPA's October 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. The Draft RI Report will describe the sampling conducted and data produced in Task 5 to characterize the nature and extent of contamination. The Draft RI Report will include an updated OU3 Site Conceptual Model. Where modeling is appropriate, Respondents will identify such model(s) to EPA in the OU3 Work Plan or a supplement to such Work Plan. All data and programming, including any proprietary programs, will be made available to EPA together with a sensitivity analysis. The Draft RI Report will include the EPA provided results from the individual focused RI/FS reports that are essential for completion of the OU3 Groundwater RI/FS. Soil vapor data available from the individual OU3 facility-specific focused RI/FS reports will not be included in the draft RI report. The draft RI will include groundwater data that is available from EPA at the time that the draft is submitted, and is relevant for the purposes of the OU3 RI Report. The Draft RI Report will also include a draft Groundwater Baseline Risk Assessment as described in Task 11 and an evaluation of remedial action objectives (RAOs). If four quarters of soil vapor monitor well data are needed to calculate risk assessment confidence limits, and this data is not available at the time that the RI is finalized, the final RI will discuss this fact and the data and calculations will be included in the FS.

The contents of the draft OU3 RI Report will include the following elements:

1. Executive Summary

2. Site Background, including regional conditions and conditions specific to OU3

3. Field Investigation and Technical Approach

4. Chemical Analysis and Analytical Methods

5. Field Methodologies

    Monitoring Well Installation

    Groundwater Sampling

    Hydrogeological Assessment

    Soil Vapor Monitoring Well Installation

    Soil Vapor Monitoring Well Sampling

6. Site Characteristics

Surface Features, Geology, Hydrogeology, Meteorology, Soils, Demographics and Land Use, Ecological Assessment

7. Nature and Extent of Contamination

Contaminant Sources

Contaminant Distribution and Trends

8. Fate and Transport

Contaminant Characteristics

Transport Processes

Contaminant Migration Trends

9. Groundwater Baseline Risk Assessment

10. Summary and Conclusions

Summary of nature and extent of contamination

Data limitations and recommendations for future work

Recommended remedial action objectives

The Respondents will submit the Draft OU3 RI Report to EPA within 90 days of Notification of Completion of Field Work. The Respondents shall revise the Draft OU3 RI Report according to EPA comments and submit a Final OU3 RI Report for EPA review and approval. The Final OU3 RI Report is due 60 days after receipt of EPA comments.

11.0 OU3 Groundwater Baseline Risk Assessment

The Respondents will prepare an OU3 Groundwater Baseline Risk Assessment (GBRA) that evaluates the potential threat to human health and the environment in the absence of any remedial action. The GBRA will be used to determine whether remediation is necessary at the OU3 RI/FS Site, provide justification for performing remedial action, and determine what exposure pathways need to be remediated. The draft and final GBRA will be submitted as part of the draft and final RI. If four quarters of soil vapor monitor well data are needed to calculate risk assessment confidence limits, and these data are not available at the time that the RI is finalized, the final RI will discuss this fact and the data and calculations will be included in the FS.

The GBRA will include the following:

Hazard Identification: Identify the major contaminants of concern.

Dose-Response Assessment: Contaminants of Concern should be selected based on their intrinsic toxicological properties.

Conceptual Exposure/Pathway Analysis: Critical exposure pathways will be identified and analyzed.

Characterization of Site and Potential Receptors: Identify human populations in the exposure pathways.

Exposure Assessment: Identify the magnitude of actual or potential human exposures, and routes by which receptors are exposed, the frequency and duration of these exposures, and the routes by which receptors are exposed. The exposure assessment shall include an evaluation of the likelihood of such exposures occurring and shall provide the basis for the development of acceptable exposure levels. In developing the exposure assessment, the Respondents shall develop reasonable maximum estimates of exposure for both current land use conditions and potential future land use in OU3.

Risk Characterization: Chemical-specific toxicity information, combined with quantitative and qualitative information from the exposure assessment, shall be compared to measured levels of contaminant exposure levels and the levels predicted through environmental fate and transport modeling. These comparisons shall determine whether concentrations of contaminants at or near OU3 are affecting or could potentially affect human health.

Identification of Limitations/Uncertainties: The Respondents shall identify critical assumptions (e.g., background concentrations and conditions) and uncertainties in the report.

Human Health Site Conceptual Model: Based on the contaminant identification, exposure assessment, toxicity assessment, and risk characterization, the Respondents shall develop a human health conceptual site exposure model.

12.0 OU3 Feasibility Study

The Respondents shall submit a Draft OU3 Feasibility Study (FS) Work Plan and Report consistent with EPA's October 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. The Draft FS Work Plan will identify any additional work required to finalize an evaluation of alternatives and prepare the FS Report. The Work Plan will provide a schedule for submittal of the FS Report.

The Draft OU3 FS Report shall contain the following information consistent with the Guidance:

1. An Executive Summary.

2. Summary of Feasibility Study Objectives.

3. Summary of Remedial Objectives.

4. Describe General Response Actions.

5. Identification & Screening of Remedial Technologies.

6. Remedial Alternatives Description.

7. Detailed Analysis of Remedial Alternatives. The Respondents will perform a detailed analysis of the remedial alternatives against the nine evaluation criteria. Once the alternatives have been assessed against the nine criteria, the Respondents will conduct a comparative analysis to evaluate the relative performance of each alternative in relation to each specific evaluation criterion.

8. A Summary and Conclusions.

The Respondents shall submit the Draft OU3 FS Work Plan 60 days after EPA approval of the Final OU3 RI Report. The Respondents shall revise the Draft OU3 FS Work Plan according to EPA comments and submit a Final OU3 FS Work Plan for EPA review and approval. The Final OU3 FS Work Plan is due 60 days after receipt of EPA comments.

The Respondents shall submit the Draft OU3 FS Report in accordance with the approved FS Work Plan schedule. The Respondents shall revise the Draft OU3 FS Report according to EPA comments and submit a Final OU3 FS Report for EPA review and approval. The Final OU3 FS Report is due 60 days after receipt of EPA comments.

13.0 REFERENCES

Arizona Department of Environmental Quality, 2005. *Groundwater Data Submittal Guidance Document (Version 3.3).* Waste Programs Division, Superfund Programs Section. March.

Cal EPA, 2003. *Advisory - Active Soil Gas Investigations.* Published Jointly by California Department of Toxic Substances Control and the California Regional Water Quality Control Board, Los Angeles Region. January 28.

Shaw Environmental, Inc., 2005. *Final Groundwater Investigation Report, Phase I and II Well Installation, Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix, Arizona.* January.

Table 1
Summary of Deliverables
Motorola 52nd Street Superfund Site OU3 Study Area

TASK	DELIVERABLE	NO. of COPIES	DUE DATE
2.0	Draft OU3 RI/FS Work Plan	5	60 days after effective date of Consent Order
2.0	Final OU3 RI /FS Work Plan	5	30 days after receipt of EPA comments
3.1	Draft Field Sampling Plan	5	Included with RI Work Plan
3.1	Final Field Sampling Plan	5	30 days after receipt of EPA comments
3.1	Draft Quality Assurance Project Plan	5	Included with RI Work Plan
3.1	Final Quality Assurance Project Plan	5	30 days after receipt of EPA comments
3.2	Health and Safety Plan	5	45 days after effective date of Consent Order
4.2	Technical Memorandum documenting need for additional data (if needed)	5	30 Days after identification of need for additional data
4.3	Draft Groundwater Well Installation Report	5	45 days after receipt of validated data from initial sampling event
4.3	Final Groundwater Well Installation Report	5	30 days after receipt of EPA comments
4.4	Draft Groundwater Monitoring Report	5	45 days after receipt of validated data
4.4	Final Groundwater Monitoring Report	5	30 days after receipt of EPA comments
46	Draft Soil Vapor Monitor Well Installation Report	5	45 days after receipt of validated data from initial sampling event
4.6	Final Soil Vapor Monitor Well Installation Report	5	30 days after receipt of EPA comments
4.7	Draft Soil Vapor Well Monitoring Report	5	45 days after receipt of validated data
4.7	Final Soil Vapor Well Monitoring Report	5	30 days after receipt of EPA comments
4.8	Draft Aquifer Test Report	5	60 days after completion of aquifer test
4.-8	Final Aquifer Test Report	5	30 days after receipt of EPA comments
4.9	Draft In-Situ Implementability Technical Memorandum	5	30 days after submittal of draft RI/FS Work Plan
4.9	Final In-Situ Implementability Technical Memorandum	5	30 days after receipt of EPA comments
4.10	Draft Bench-Scale Treatability Study Report	5	45 days after receipt of validated analytical data
4.10	Final Bench-Scale Treatability Study Report	5	30 days after receipt of EPA comments
5.1	Notification of Initiation of Field Work (FW)	5	15 days in advance FW
5.1	Notification of Completion of Field Work (FW)	5	5 days after completion of FW
5.2	Weekly Field Progress Reports	Electronic to team	Weekly

TASK	DELIVERABLE	NO. of COPIES	DUE DATE
5.3	Monthly Progress Reports	Electronic to team	15th business day of the following month
10.0	Draft OU3 RI Report	5	90 days after Notification of Completion of field work
10.0	Final OU3 RI Report	5	-60 days after receipt of EPA comments
11.0	Draft GBRA	5	Same as draft RI
11.0	Final GBRA	5	Same as final RI
12.0	Draft OU3 FS Work Plan	5	60 days after EPA approval of RI
12.0	Final OU3 FS Work Plan	5	60 days after receipt of EPA comments
12.0	Draft OU3 FS Report	5	In accordance with approved FS Work Plan Schedule
12.0	Final OU3 FS Report	5	60 days after receipt of EPA comments

Table 2
Regulations and Guidance Documents

The following list, although not comprehensive, consists of many of the regulations and guidance documents that apply to the RI/FS process:

1. American National Standards Practices for Respiratory Protection. American National Standards Institute Z88.2 1980, March 11, 1981.

2. ARCS Construction Contract Modification Procedures, September 1989, OERR Directive 9355.5-01/FS.

3. CERCLA Compliance with Other Laws Manual, Two Volumes, U.S. EPA, Office of Emergency and Remedial Response, August 1988 (DRAFT), OSWER Directive No. 9234.1 01 and 02.

4. Community Relations in Superfund - A Handbook, U.S. EPA, Office of Emergency and Remedial Response, January 1992, OSWER Directive No. 9230.0-3C.

5. A Compendium of Superfund Field Operations Methods, Two Volumes, U.S. EPA, Office of Emergency and Remedial Response, EPA/540/P 87/001a, August 1987, OSWER Directive No. 9355.0 14.

6. Construction Quality Assurance for Hazardous Waste Land Disposal Facilities, U.S. EPA, Office of Solid Waste and Emergency Response, October 1986, OSWER Directive No. 9472.003.

7. Contractor Requirements for the Control and Security of RCRA Confidential Business Information, March 1984.

8. Data Quality Objectives for Remedial Response Activities, U.S. EPA, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, EPA/540/G 87/003, March 1987, OSWER Directive No. 9335.0 7B.

9. Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, U.S. EPA Region IV, Environmental Services Division, April 1, 1986 (revised periodically).

10. EPA NEIC Policies and Procedures Manual, EPA 330/9 78 001 R, May 1978, revised November 1984.

11. Federal Acquisition Regulation, Washington, DC: U.S. Government Printing Office (revised periodically).

12. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, U.S. EPA, Office of Emergency and Remedial Response, October 1988, OSWER Directive NO. 9355.3 01.

13. Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potential Responsible Parties, U.S. EPA Office of Emergency and Remedial Response, EPA/540/G-90/001, April 1990.

14. Guidance on Expediting Remedial Design and Remedial Actions, EPA/540/G-90/006, August 1990.

15. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, U.S. EPA Office of Emergency and Remedial Response (DRAFT), OSWER Directive No. 9283.1 2.

16. Guide for Conducting Treatability Studies Under CERCLA, U.S. EPA, Office of Emergency and Remedial Response, Prepublication version.

17. Guide to Management of Investigation-Derived Wastes, U.S. EPA, Office of Solid Waste and Emergency Response, Publication 9345.3-03FS, January 1992.

18. Guidelines and Specifications for Preparing Quality Assurance Project Plans, U.S. EPA, Office of Research and Development, Cincinnati, OH, QAMS 004/80, December 29, 1980.

19. Health and Safety Requirements of Employees Employed in Field Activities, U.S. EPA, Office of Emergency and Remedial Response, July 12, 1982, EPA Order No. 1440.2.

20. Interim Guidance on Compliance with Applicable of Relevant and Appropriate Requirements, U.S. EPA, Office of Emergency and Remedial Response, July 9, 1987, OSWER Directive No. 9234.0 05.

21. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, U.S. EPA, Office of Emergency and Remedial Response, QAMS 005/80, December 1980.

22. Methods for Evaluating the Attainment of Cleanup Standards: Vol. 1, Soils and Solid Media, February 1989, EPA 23/02-89-042; vol. 2, Ground Water (Jul 1992).

23. National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule, Federal Register 40 CFR Part 300, March 8, 1990.

24. NIOSH Manual of Analytical Methods, 2nd edition. Volumes I VII for the 3rd edition, Volumes I and II, National Institute of Occupational Safety and Health.

25. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute of Occupational Safety and Health/Occupational Health and Safety Administration/United States Coast Guard/Environmental Protection Agency, October 1985.

26. Permits and Permit Equivalency Processes for CERCLA On-Site Response Actions, February 19, 1992, OSWER Directive 9355.7-03.

27. Procedure for Planning and Implementing Off-Site Response Actions, Federal Register, Volume 50, Number 214, November 1985, pages 45933-45937.

Attachment A
Site Setting/Nature and Extent of Contamination

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AWQS	Aquifer Water Quality Standard
bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
1,1-DCE	1,1-dichloroethene
EPA	Environmental Protection Agency
GIR	Groundwater Investigation Report
HSU	Hydrostratigraphic Unit
LAU	Lower Alluvial Unit
µg/l	micrograms per liter
MAU	Middle Alluvial Unit
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
PCE	tetrachloroethene
TCE	trichloroethene
UAU	Upper Alluvial Unit
VOCs	volatile organic compounds
WQARF	Water Quality Assurance Revolving Fund

1.0 SITE SETTING

This section summarizes the Operable Unit 3 (OU3) geologic and hydrogeologic settings, which were based on the Phase I and II investigation programs and presented in the *Final Groundwater Investigation Report (GIR), Phase I and II Well Installation, Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix, Arizona* (Shaw, 2005).

1.1 Geology

The Motorola 52nd Street Superfund Site is located in the West Salt River Sub-Basin of the Phoenix Active Management Area. The structural basin formed during mid-Tertiary crustal extension and late-Tertiary regional northwest-trending normal faulting. Erosion of tilted and uplifted fault blocks filled in adjacent structural lows. Subsequent sediment deposition by the ancestral Salt River in the Pleistocene and Holocene brought in material originating from outside the basin and buried much of the remaining bedrock pediments. This material was deposited over the eroded Middle Tertiary rocks comprising the pediment (Reynolds and Bartlett, 2002).

The sediments within the basin have been grouped into three alluvial units, the Lower Alluvial Unit (LAU) of Miocene-Pliocene age, the Middle Alluvial Unit (MAU) of Pliocene-Pleistocene age, and the Upper Alluvial Unit (UAU) of Holocene (Recent) age (Reeter and Remick, 1986). The LAU and MAU are composed of sediments deposited in closed basin environments. The LAU consists of coarser sediments near the basin margins and fine-grained sediments (mudstone and evaporite deposits) towards the basin center. Generally, MAU sediments consist of sand and gravel deposited in alluvial fans near the basin margins. The fan deposits grade to fine-grained fluvial, playa, and evaporite deposits within the basin's central portions. Typically, coarser sediments interfinger with the finer deposits.

The UAU sediments were deposited in an open fluvial setting integrating channel, terrace, floodplain, and alluvial fan environments (CASS, 2003). In OU3, the UAU consists of packages of interbedded sand, silt, and clay belonging to the Basin Fill and thick sequences of predominantly sand and gravel belonging to the Salt River Gravels. The Salt River Gravels were deposited by the ancestral Salt River (Reynolds and Bartlett, 2002). OU3 is covered with a veneer of Recent-age alluvial deposits, which are a mixture of sand, silt, clay, and gravels.

Within OU2 and OU3 , the Camels Head Formation was encountered in the subsurface and forms bedrock ridges. Within the OU2 Study Area, a northwesterly-trending buried bedrock ridge lies between 32nd Street and 24th Street, just north of Sky Harbor International Airport, with a buried valley immediately to the ridge's east (Reynolds and Bartlett, 2002). A similar buried bedrock ridge was mapped across the OU2/OU3 boundary (LFR Levine-Fricke, unpublished data, 2004). This bedrock ridge trends northwest and southeast from approximately Adams and 20th Streets to Pierce and 17th Streets. The Phase II OU3-12C pilot hole was advanced to a

depth of 396 feet below the ground surface (bgs), in an attempt to encounter bedrock. Bedrock was not encountered during the OU3 drilling program.

1.2 Hydrogeology

OU3 groundwater occurs within the unconsolidated UAU deposits. For this investigation, this unit has been subdivided into four hydrostratigraphic zones: Shallow (S), First Intermediate (M), Second Intermediate (M2), and Deep (D). These units are described below. The Shallow Zone generally corresponds to the Arizona Department of Environmental Quality's A Hydrostratigraphic Unit (HSU) recognized in Operable Unit 1 (OU1) and Operable Unit 2 (OU2). The Intermediate Zone generally corresponds to the B HSU and the Deep Zone to the D HSU.

Aquifer Unit	Aquifer Subunit	Hydrostratigraphic Zone	ADEQ Hydrostratigraphic Unit	Description
Upper Alluvial Aquifer	Salt River Gravels	Shallow Zone (S)	A	Coarse-grained Salt River Gravels, including minor amounts of interbedded and laterally discontinuous fine-grained deposits.
	Basin Fill	First Intermediate Zone (M)	B	Interbedded coarse and fine-grained deposits dominated by gravel similar to Salt River Gravels. Base of zone commonly includes a fine-grained layer.
		Second Intermediate Zone (M2)	B	Interbedded coarse and fine-grained deposits dominated by gravel similar to Salt River Gravels.
		Deep Zone (D)	D	Upper fine-grained layer with an underlying interval of interbedded fines and sand.

1.3 OU3 Study Area Groundwater Investigation

Two investigation phases have been conducted in the OU3 Study Area. The scope of work for the Phase I and II field programs were presented in the following documents:

- *Final Groundwater Investigation Work Plan, Motorola 52nd Street Superfund Site Operable Unit 3 Study* (IT, 2001)
- *Work Plan Supplement to the Final Groundwater Investigation Work Plan for Proposed Phase II Wells, Motorola 52nd Street Superfund Site Operable Unit 3 Study Area* (IT, 2003)

Both phases included construction of groundwater monitoring wells.

- Phase I: Fifteen (15) wells were installed from February 2002 to May 2002.
- Phase II: Thirteen (13) wells were installed from May 2003 to July 2003. This phase included the abandonment and replacement of three Phase I wells (OU3-5S/M/D).

The Phase I and II groundwater investigation results were presented in the GIR (Shaw, 2005). Groundwater monitoring results have been submitted in quarterly and semiannual groundwater monitoring reports. The most recent groundwater monitoring report contained data for March 2007 (Shaw, 2007).

The March 2007 groundwater elevation data indicated that groundwater flow within the OU3 Study Area generally coincides with topography, flowing toward the west to west-southwest (Figures A-1, A-2, and A-3). The Shallow Zone's potentiometric surface is affected by the OU2 extraction system on the eastern boundary (Figure A-1). The groundwater gradient flattens and has a slight flow reversal in the treatment system's vicinity. Generally, groundwater within the Intermediate Zone flowed to the west in March 2007 (Figure A-2). The Intermediate Zone potentiometric surface is interpreted to be depressed in the OU2 extraction system's vicinity. The Deep Zone potentiometric surface (Figure A-3) is interpreted to be affected by the bedrock ridge on the eastern boundary of OU3. Groundwater gradients are steeper in the northeast, approaching the ridge, with flow interpreted around the ridge gaining a southerly trend. Within the central and western portions of OU3, groundwater flow returns to a west-southwest orientation.

Evaluation of head differences between well clusters screened in the Shallow, Intermediate and Deep Zones are variable throughout the year and appear to respond to seasonal fluctuation and aquifer demand. In March 2007, head differences between the well pairs in the Shallow and Intermediate Zones were small, varying from 0.07 to 0.75 feet, with most differences less than 0.5 feet. The head differences between the Intermediate Zone M and M2 well pairs were less, ranging from 0.21 to 0.44 feet. The well pairs between the Shallow or Intermediate Zone wells and the Deep Zone wells showed a larger differential. The head differences ranged from 1.73 to 10.05 feet with the majority of the variations between 3 and 6 feet.

The vertical gradients measured in well pairs screened in the Shallow and Intermediate Zones for downward gradients in March 2007 ranged from 0.0007 to 0.0081 feet/feet and upward gradients ranged from -0.0009 to -0.0076 feet/feet. Generally, the vertical gradients are slightly less or equivalent to horizontal gradients. The vertical gradients between the Shallow or Intermediate Zones and the Deep Zone were upward during March 2007 ranging from -0.0159 to -0.1058 feet/feet. The vertical gradients are higher than the horizontal gradient indicating upward vertical flow dominates at most well pairs where groundwater appears to be discharging from the Deep Zone into the Intermediate Zone within OU3.

The vertical gradients and head differentials between the Shallow and Intermediate Zones, and between the two Intermediate Zones, show limited variability between the zones. These zones consist of similar materials and suggest little hydraulic contrast between wells completed above and below the finer-grained layer marking the base of the First Intermediate Zone. Piezometric data show greater variability between the Deep Zone and shallower hydrogeologic units. However, existing OU3 data it is not conclusive on whether the Deep Zone is confined within OU3.

Groundwater elevations within OU3 generally decreased between the baseline (September 2002 for the Phase I wells and May 2003 for the Phase II wells) and September 2004 monitoring events. Within this period, the average groundwater elevation declined approximately 6.8 feet in the Shallow Zone, 6.9 feet in the Intermediate Zone, and 6.6 feet in the Deep Zone. The largest groundwater elevation declines occurred in the Shallow Zone at OU3-11S (8.5 feet), in the Intermediate Zone at OU3-10M (9.5 feet), and in the Deep Zone at OU3-1D (7.4 feet). This area-wide groundwater elevation decrease is most likely the result of several years of below-average precipitation and from pumping of the OU2 groundwater extraction system.

Periodic releases from the Granite Reef Dam into the Salt River occurred between December 2004 and April 2005. The releases caused heavy flow through the Salt River, where discharges in OU3 caused groundwater elevation increases in early 2006. Based on March 2007 data, groundwater elevations are slightly below baseline levels collected in 2002 and 2003, with the average Shallow Zone groundwater elevation 0.533 feet below baseline, the average Intermediate Zone groundwater elevation 0.45 feet below baseline. Deep Zone monitoring wells have shown an increase in water levels since baseline and are on average 2.6 feet above baseline.

Hydraulic conductivity values for the water-bearing zones have not been determined for OU3. Hydraulic conductivity values in the Salt River Gravels within the East Washington Area are reported by Kleinfelder, Inc. (1989) to range between 180 feet/day and 1,700 feet/day. Reynolds and Bartlett (2002) report calculated hydraulic conductivity values within OU1 for the Salt River Gravels of 200 feet/day to 450 feet/day. Roy F. Weston, Inc. (Weston, 1997) conducted an aquifer test within the Deep Zone in the West Van Buren Water Quality Assurance Revolving Fund (WQARF) site. The location was south of Madison Street, between 13th and 15th Avenues. The test results indicate that the Deep Zone is confined within the interval pumped (250 to 300 feet bgs). Calculated transmissivity values for the pumped well are 1,522 to 5,314 gallons/day/foot, or 108 to 380 feet/day. Evidence for hydraulic connection between the Deep Zone and shallower aquifer materials was not observed (Weston, 1997).

2.0 NATURE AND EXTENT OF CONTAMINATION

Monitoring data collected by the Environmental Protection Agency (EPA) from February 2002 through March 2007 showed halogenated and non-halogenated volatile organic compounds (VOCs) and 1,4-dioxane in groundwater samples collected from OU3. The initial analytical program for groundwater samples included perchlorate. However, the analysis was removed because perchlorate was not detected. Based on the groundwater analytical results, the following is a list of detected compounds, with maximum concentrations detected and the Arizona Aquifer Water Quality Standard (AWQS). Compounds and results exceeding the AWQS are in bold type.

Compound	Maximum Concentration Detected (µg/L)	Aquifer Water Quality Standard (µg/L)
1,1,1-Trichloroethane	1	200
1,1,2,2-Tetrachloroethene	47J	None
1,1,2-Trichloro-1,2,2-trifluoroethane	4	None
1,1,2-Trichloroethane	**92J**	**5**
1,1-Dichloroethane	50	None
1,1-Dichloroethene	**60**	**7**
1,2-Dichloroethane	**1.4**	**5**
1,4-Dioxane	12	None
Acetone	67J	None
Bromodichloromethane	**310**	100 (total trihalomethanes)
Bromoform	**24**	
Chlorodibromomethane	**29**	
Chloroform	**74**	
Bromochloromethane	0.28J	None
Chloromethane	1.9	None
cis-1,2-Dichloroethene	**370**	**70**
Dibromomethane	0.28J	None
Dichlorodifluoromethane	0.8	None
Methyl ethyl ketone	860J	None
Tetrachloroethene	**19**	**5**
Trichloroethene	**760**	**5**
trans-1,2-Dichloroethene	**7.6**	**100**
Trichlorofluoromethane	4.4	None
Vinyl chloride	0.8	2

Note:
µg/L = micrograms per liter

Table A-1 summarizes the detected analytical results for the March 2007 groundwater sampling event.

2.1 VOC Distribution

Trichloroethene (TCE) was the most widespread analyte detected in the March 2007 OU3 groundwater samples, followed by tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethane, and 1,1-dichloroethene (1,1-DCE). Three analytes were detected at concentrations above their AWQS limits: TCE (5 micrograms per liter [µg/L]), PCE (5 µg/L), and 1,1-DCE (7 µg/L). Vinyl chloride was not detected above the practical quantitation limit of 0.5 µg/L in the March 2007 OU3 groundwater samples. Compound 1,4-dioxane was detected in samples collected from 16 of the 43 wells, all of which were within the Shallow and Intermediate Zones. The highest concentration of 1,4-dioxane was 4.3 µg/L in monitoring well OU3-10M. Enforceable regulatory levels have not been promulgated for this compound, although EPA Region 9 has set a Preliminary Remediation Goal (EPA, 2004a) of 6.1 µg/L (based on a 70-year lifetime exposure) and the EPA Office of Water has set a health-based advisory level of 3 µg/L (based on a 70-year lifetime exposure) (EPA, 2004b).

2.1.1 Shallow Zone TCE Concentrations

Within the Shallow Zone, March 2007 TCE concentrations above 50 µg/L are observed along Van Buren Street (Figure A-4) forming the plume axis or "core." TCE concentrations above 50 µg/L were collected at wells EW-19S, EW-20, and EWOU3-10S-R. The maximum historical TCE concentration of 720 µg/L was detected in the December 2002 sample collected at well EW-19S; however, the plume core is not well defined to the east and west of well EW-19S.

Generally, the northern and southern boundaries of the TCE plume within the Shallow Zone are defined. However, the TCE extent at the southern boundary is uncertain due to a 5,000-foot gap between wells OU3-11S and TT-2. The plume extends beyond the western OU3 boundary into the West Van Buren WQARF site. Wells AVB14-01 and AVB 115-01, which provide data on the plume's core extension into the West Van Buren WQARF site and outside of OU3, had March 2007 groundwater samples results yielding 73 µg/L and 150 µg/L of TCE, respectively.

2.1.2 Intermediate Zone TCE Concentrations

The Intermediate Zone is subdivided into the First Intermediate Zone and Second Intermediate Zone. The VOC concentrations are similar in magnitude between the M and M2 cluster wells (Figure A-5). The Intermediate Zone TCE plume extent is similar to the Shallow Zone TCE plume and mimics the Shallow Zone's pattern of higher TCE concentrations along Van Buren Street. Groundwater samples from wells OU3-10M2, OU3-5MR, OU3-5M2, and OU3-2M had TCE at concentrations that exceeded 100 µg/L. The plume's higher concentrations are not well defined.

The northern TCE plume boundary is defined by the groundwater data, except near the OU2/OU3 boundary. In the southwest, the plume does not appear to extend south of wells OU3-11M and OU3-11M2, where TCE concentrations are less than 5 µg/L. Limited data is available to define TCE distribution for the remaining southern plume extent, with only well EW-13-168 in the southeast. The plume extends beyond the western OU3 boundary into the West Van Buren WQARF site.

2.1.3 Deep Zone TCE Concentrations

Within OU3, March 2007 samples from four Deep Zone wells had detectable TCE concentrations which also exceeded the Arizona AWQS of 5 µg/L. The highest Deep Zone TCE concentration was obtained from well NW-7D (18 µg/L). The TCE plume with concentrations above the AWQS was limited to a small area in the OU3 Study Area's southeastern portion (Figure A-6). Recent well installations along the OU3/OU2 boundary have better defined the northern and southern extent of the plume through southeastern OU3 (CRA, 2005 and 2006). The TCE extent to the south crosses the OU2/OU3 boundary between East Jackson Street and East Sky Harbor Circle North. The plume's northern edge crosses the OU3/OU2 boundary between Washington Street and Madison Street.

2.1.4 Vertical Extent

Figure A-7 shows an east-west cross-section that transverses OU3 through much of the TCE plume axis. Historically, TCE concentrations within OU3 are slightly greater in the Intermediate Zone than in the Shallow Zone. Near the OU2/OU3 boundary, the March 2007 TCE concentrations for well pair NW-8S and NW-8M were 25 µg/L and 160 µg/L, respectively (Figures A-4 and A-5). Within the central portion of the plume, the March 2007 TCE concentrations for well pair EW-19S and OU3-2M were 79 µg/L and 190 µg/L, respectively (Figure A-7). Approximately 3,500 feet downgradient of the EW-19S/OU3-2M well pair, the March 2007 TCE concentrations for well cluster OU3-5MR and OU3-5M2 were 140 µg/L and 200 µg/L, respectively (Figure A-7). Near the western boundary of OU3, the March 2007 TCE concentrations for wells EWOU3-10S-R, OU3-10M, and OU3-10M2 were 69 µg/L, 90 µg/L, and 110 µg/L, respectively (Figures A-4 and A-5).

Deep Zone TCE concentrations exceeding the AWQS of 5 µg/L are depicted in Figure A-6. The Deep Zone contamination above the AWQS is limited to southeast corner of OU3.

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