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UNITED STATES DISTRICT COURT
DISTRICT OF ARIZONA

- x
United States of America,

Plaintiff,

Civil Action No. 89-594-TUC-RMB

v.

Burr-Brown Corporation (now Texas Instruments Tucson Corporation),

Defendant.
- x

AND

- x
State of Arizona,

Plaintiff,

Civil Action No. 4:15-cv-00257-DCB

v.

Texas Instruments Tucson Corporation,

Defendant.
- x

FINAL CONSENT DECREE

TABLE OF CONTENTS

I. BACKGROUND

A. The United States of America ("United States"), on behalf of the Administrator of the United States Environmental Protection Agency ("EPA"), filed a complaint in this matter pursuant to Sections 106 and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. §§ 9606, 9607.

B. Consistent with the National Contingency Plan, 40 C.F.R. Part 300 ("NCP"), the United States seeks to implement a remedial action to address releases and threatened releases of hazardous substances at the Tucson International Airport Area ("TIAA") Superfund Site ("Site").

C. In accordance with the NCP and Section 121(f)(1)(F) of CERCLA, 42 U.S.C. § 9621(f)(1)(F), EPA notified the State of Arizona (the "State") of negotiations with the potentially responsible party ("PRP") regarding the implementation of the remedial design and remedial action for the Project Area, as defined below, which is located within the Site, and EPA has provided the State with an opportunity to participate in such negotiations and be a party to this Consent Decree.

D. The State has also filed a complaint against the Settling Defendant in this Court alleging that the Settling Defendant is liable to the State under Section 107 of CERCLA, 42 U.S.C. § 9607, and under supplemental State law the Water Quality Assurance Revolving Fund, A.R.S. § 49-281 et. seq.

E. This Consent Decree implements the April 20, 2012 Record of Decision Amendment ("2012 ROD Amendment") for Area B of the Site and supersedes a 1990 Consent Decree between the United States and Settling Defendant's corporate predecessor-in-interest, Burr-Brown Corporation ("1990 Consent Decree"). The 1990 Consent Decree implemented the

original Record of Decision that was signed by EPA on August 22, 1988 ("1988 ROD"). The Settling Defendant that has entered into this Consent Decree ("Settling Defendant") does not admit any liability to Plaintiffs arising out of the transactions or occurrences alleged in the complaints, nor does it acknowledge that the release or threatened release of hazardous substance(s) at or from the Project Area constitutes an imminent and substantial endangerment to the public health or welfare or the environment.

F. In 1982, EPA began investigating groundwater contamination at various geographic locations within the Site. For the purpose of investigating and remediating groundwater contamination, EPA divided the Site into two geographic areas: (1) TIAA Superfund Site Area A, which comprises the main groundwater contamination plume located to the west of the airport, and (2) TIAA Superfund Site Area B, which includes the West Plume B, Arizona Air National Guard, Texas Instruments ("Project Area"), and the former West-Cap project areas, located to the north and west of the airport.

G. Pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, EPA placed the Site on the National Priorities List ("NPL"), set forth at 40 C.F.R. Part 300, by publication in the Federal Register on September 8, 1983, 48 Fed. Reg. 40,658.

H. The 1988 ROD addresses groundwater contamination north of Los Reales Road in "Area A" and all of the contamination in "Area B." The original response action included the pumping and treating of contaminated groundwater and was successful in containing the groundwater and inhibiting the migration of contaminated groundwater to other areas. Between 1992 and 2009, the Settling Defendant operated the pump and treat system at the Project Area. However, the original response action was not effective in treating the source areas of contamination in a timely manner, by no fault of Settling Defendant.

I. EPA completed a Final Focused Feasibility ("FFS") Study in October 2011 which reevaluated remedial alternatives for Area B.

J. Pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, EPA published notice of the completion of the FFS and of the proposed plan for remedial action on October 18, 2011, in a major local newspaper of general circulation. EPA provided an opportunity for written and oral comments from the public on the proposed plan for remedial action. A copy of the transcript of the public meeting is available to the public as part of the administrative record upon which the EPA Region 9 Regional delegatee based the selection of the response action.

K. The decision by EPA on the remedial action to be implemented in the Project Area is embodied in the 2012 ROD Amendment, on which the State has given its concurrence. The 2012 ROD Amendment replaces EPA's selected remedy for the Area B portion of the Site with in-situ chemical oxidation using potassium permanganate injected in source areas of contamination. The 2012 ROD Amendment includes EPA's explanation for its remedy selection over other alternatives as well as a responsiveness summary to the public comments. Notice of the final plan was published in accordance with Section 117(b) of CERCLA, 42 U.S.C. § 9617(b).

L. Based on the information presently available to EPA and the State, EPA and the State believe that the Work will be properly and promptly conducted by the Settling Defendant if conducted in accordance with the requirements of this Consent Decree and its appendices.

M. Solely for the purposes of Section 113(j) of CERCLA, 42 U.S.C. § 9613(j), the remedy set forth in the 2012 ROD Amendment and the Work to be performed by the Settling Defendant shall constitute a response action taken or ordered by the President for which judicial review shall be limited to the administrative record.

N. The Parties recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and implementation of this Consent Decree will expedite the cleanup of the Project Area and will avoid prolonged and complicated litigation between the Parties, and that this Consent Decree is fair, reasonable, and in the public interest.

NOW, THEREFORE, it is hereby Ordered, Adjudged, and Decreed:

II. JURISDICTION

1. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331, 1367, and 1345, and 42 U.S.C. §§ 9606, 9607, and 9613(b). This Court also has personal jurisdiction over the Settling Defendant. Solely for the purposes of this Consent Decree and the underlying complaints, the Settling Defendant waives all objections and defenses that it may have to jurisdiction of the Court or to venue in this District. The Settling Defendant shall not challenge the terms of this Consent Decree or this Court's jurisdiction to enter and enforce this Consent Decree.

III. PARTIES BOUND

2. This Consent Decree applies to and is binding upon the United States and the State and upon the Settling Defendant and its successors, and assigns. Any change in ownership or corporate status of the Settling Defendant including, but not limited to, any transfer of assets or real or personal property, shall in no way alter the Settling Defendant's responsibilities under this Consent Decree.

3. The Settling Defendant shall provide a copy of this Consent Decree to each contractor hired to perform the Work required by this Consent Decree and to each person

representing the Settling Defendant with respect to the Project Area or the Work, and shall condition all contracts entered into hereunder upon performance of the Work in conformity with the terms of this Consent Decree. The Settling Defendant or its contractors shall provide written notice of the Consent Decree to all subcontractors hired to perform any portion of the Work required by this Consent Decree. The Settling Defendant shall nonetheless be responsible for ensuring that its contractors and subcontractors perform the Work in accordance with the terms of this Consent Decree. With regard to the activities undertaken pursuant to this Consent Decree, each contractor and subcontractor shall be deemed to be in a contractual relationship with the Settling Defendant within the meaning of Section 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3).

IV. DEFINITIONS

4. Unless otherwise expressly provided in this Consent Decree, terms used in this Consent Decree that are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Consent Decree or its appendices, the following definitions shall apply solely for purposes of this Consent Decree:

"1988 Record of Decision" or "1988 ROD" shall mean the EPA Record of Decision relating to the TIAA Site signed on August 22, 1988, by the Regional Administrator, EPA Region 9, and all attachments thereto.

"1990 Consent Decree" means the consent decree in this action between the United States and Settling Defendant's corporate predecessor-in-interest, Burr-Brown Corporation.

"2012 Record of Decision Amendment" or "2012 ROD Amendment" shall mean the EPA Record of Decision Amendment relating to Area B of the TIAA Site signed on April 20, 2012 by the Assistant Director or designee, Superfund Division, EPA Region 9, and all attachments thereto. The 2012 ROD Amendment is attached as Appendix A.

"ADEQ" shall mean the Arizona Department of Environmental Quality and any successor departments or agencies of the State.

"CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675.

"Consent Decree" shall mean this Consent Decree and all appendices attached hereto (listed in Section XXVIII). In the event of conflict between this Consent Decree and any appendix, this Consent Decree shall control.

"Day" or "day" shall mean a calendar day unless expressly stated to be a working day. The term "working day" shall mean a day other than a Saturday, Sunday, or federal or State of Arizona holiday. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal or State of Arizona holiday, the period shall run until the close of business of the next working day.

"DOJ" shall mean the United States Department of Justice and its successor departments, agencies, or instrumentalities.

"Effective Date" shall mean the date upon which this Consent Decree is entered by the Court as recorded on the Court docket, or, if the Court instead issues an order approving the Consent Decree, the date such order is recorded on the Court docket.

"EPA" shall mean the United States Environmental Protection Agency and its successor departments, agencies, or instrumentalities.

"EPA Hazardous Substance Superfund" shall mean the Hazardous Substance Superfund established by the Internal Revenue Code, 26 U.S.C. § 9507.

"Interest" shall mean:

1) for payments to be made to the EPA, interest at the rate specified for interest on investments of the EPA Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year. Rates are available online at http://www.epa.gov/ocfopage/finstatement/superfund/int_rate.htm.

2) for payments to be made to the State, interest at a rate specified for interest pursuant to A.R.S. § 49-113.

"National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

"Operation and Maintenance" or "O&M" shall mean all activities required to maintain the effectiveness of the Remedial Action as required under the Operation and Maintenance Plan approved or developed by EPA pursuant to Section VI (Performance of the Work by Settling Defendant) and the SOW.

"Paragraph" shall mean a portion of this Consent Decree identified by an Arabic numeral or an upper or lower case letter.

"Parties" shall mean the United States, the State of Arizona, and the Settling Defendant.

"Performance Standards" shall mean the cleanup levels and other measures of achievement of the remedial action objectives, set forth in the 2012 ROD Amendment and the SOW and any modified standards established pursuant to this Consent Decree.

"Plaintiffs" shall mean the United States and the State of Arizona.

"Project Area" shall mean the same area that was previously known as the "Burr-Brown Corporation Site" located in Tucson, Arizona and is generally identified as "Texas Instruments" in Figure 2 of the 2012 ROD and any other areas where a hazardous substance, hazardous waste, hazardous constituent, pollutant or contaminant from the Project Area has been deposited, stored, disposed of, or placed, or has migrated or otherwise come to be located. The "Burr-Brown Corporation Site" was described in the 1990 Consent Decree as follows:

> The Site is located in Township 15, South, Range 14, East, and Section 17 in Pima County, Arizona. The Site Encompasses property owned by Burr-Brown, property immediately contiguous to the Burr-Brown property and the area between the northern boundary of the plant site and Valencia Road. For Purposes of this Consent Decree , the [Burr-Brown Corporation Site] is defined as the areal extent of groundwater contamination that is the easternmost of the two plumes which EPA has designated as "Area "B" in its Feasibility Study of the Tucson International Airport Area Superfund Site (the "Superfund Site"") and in the [1988] Record of Decision. The Superfund Site was listed on the "Expanded Eligibility List," a preliminary National Priorities List

(NPL) on July 23, 1982. It was proposed for inclusion on the original NPL on December 30, 1982, and was included on the NPL on September 8, 1983.

"Response Costs" shall mean all costs, not previously paid by Settling Defendant, including, but not limited to, direct and indirect costs that the United States incurred or incurs in reviewing or developing plans, reports, and other deliverables submitted pursuant to this Consent Decree or the 1990 Consent Decree, in overseeing implementation of the Work, or in otherwise implementing, overseeing, or enforcing this Consent Decree or the 1990 Consent Decree, including, but not limited to, payroll costs, contractor costs, travel costs, laboratory costs and the costs incurred pursuant to Paragraph 9 (Notice to Successors-in-Title and Transfers of Real Property), Sections VII (Remedy Review), IX (Access and Institutional Controls) (including, but not limited to, the cost of attorney time and any monies paid to secure access and/or to secure, implement, monitor, maintain, or enforce Institutional Controls including, but not limited to, the amount of just compensation), XV (Emergency Response), Paragraph 45 (Funding for Work Takeover), Section XIX (Dispute Resolution), Section XXIX (Community Involvement), and all litigation costs.

"RCRA" shall mean the Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992 (also known as the Resource Conservation and Recovery Act).

"Remedial Action" shall mean all activities Settling Defendant is required to perform under the Consent Decree to implement the 2012 ROD Amendment related to the Project Area, in accordance with the SOW, the final Remedial Design and Remedial Action Work Plans, and other plans approved by EPA, until the Performance Standards are met, and excluding performance of the Remedial Design, O&M, and the activities required under Section XXV (Retention of Records).

"Remedial Design" shall mean those activities to be undertaken by Settling Defendant to develop the final plans and specifications for the Remedial Action pursuant to the SOW.

"Section" shall mean a portion of this Consent Decree identified by a Roman numeral.

"Settling Defendant" shall mean Texas Instruments Tucson Corporation.

"Site" shall mean the TIAA Site, in Tucson, Pima County, Arizona, and is depicted generally on the map attached as Appendix B.

"State" shall mean the State of Arizona.

"State Future Response Costs" shall mean the reasonable and necessary costs incurred by the State, including ADEQ, after the Effective Date, including the costs in reviewing and overseeing the Work including the costs associated with collecting and analyzing split samples, reviewing any deliverables submitted and consulting with EPA. Such costs shall include salaries and benefits paid to the state employees and other direct and indirect costs.

"Statement of Work" or "SOW" shall mean the statement of work for implementation of the Remedial Design, Remedial Action, and O&M at the Project Area, as set forth in Appendix C to this Consent Decree and any modifications made in accordance with this Consent Decree.

"Supervising Contractor" shall mean the principal contractor retained by Settling Defendant to supervise and direct the implementation of the Work under this Consent Decree.

"TIAA Burr Brown Special Account" shall mean the special account, within the EPA Hazardous Substance Superfund, established for the Site by EPA pursuant to Section 122(b)(3) of CERCLA, 42 U.S.C. § 9622(b)(3).

"Transfer" shall mean to sell, assign, convey, lease, mortgage, or grant a security interest in, or where used as a noun, a sale, assignment, conveyance, or other disposition of any interest by operation of law or otherwise.

"United States" shall mean the United States of America and each department, agency, and instrumentality of the United States, including EPA, and any federal natural resource trustee.

"Waste Material" shall mean (1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); (2) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); (3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27); and (4) any "hazardous material" or "hazardous substance" under Arizona law.

"Work" shall mean all activities and obligations the Settling Defendant is required to perform under this Consent Decree, except the activities required under Section XXV (Retention of Records).

V. GENERAL PROVISIONS

5. Objectives of the Parties. The objectives of the Parties in entering into this Consent Decree are to protect public health or welfare or the environment by the design and implementation of response actions at the Project Area by the Settling Defendant, to pay response costs of the Plaintiffs, and to resolve the claims of Plaintiffs against the Settling Defendant as provided in this Consent Decree. This Consent Decree replaces and supersedes the 1990 Consent Decree.

6. Commitments by the Settling Defendant. The Settling Defendant shall finance and perform the Work in accordance with this Consent Decree, the 2012 ROD Amendment, the

SOW, and all work plans and other plans, standards, specifications, and schedules set forth in this Consent Decree or developed by the Settling Defendant and approved by EPA pursuant to this Consent Decree. The Settling Defendant shall pay the United States for its Response Costs and shall pay the State for State Future Response Costs as provided in this Consent Decree.

7. Compliance with Applicable Law. All activities undertaken by the Settling Defendant pursuant to this Consent Decree shall be performed in accordance with the requirements of all applicable federal and state laws and regulations. The Settling Defendant must also comply with all applicable or relevant and appropriate requirements of all federal and state environmental laws as set forth in the 2012 ROD Amendment and the SOW. The activities conducted pursuant to this Consent Decree, if approved by EPA, shall be deemed to be consistent with the NCP as provided in Section 300.700(c)(3)(ii) of the NCP.

8. Permits

a. As provided in Section 121(e) of CERCLA, 42 U.S.C. § 9621(e), and Section 300.400(e) of the NCP, no permit shall be required for any portion of the Work conducted entirely on-site (i.e., within the areal extent of contamination or in very close proximity to the contamination and necessary for implementation of the Work). Where any portion of the Work that is not on-site requires a federal or state permit or approval, the Settling Defendant shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals.

b. The Settling Defendant may seek relief under the provisions of Section XVIII (Force Majeure) for any delay in the performance of the Work resulting from a failure to obtain, or a delay in obtaining, any permit or approval referenced in Paragraph 8.a. and

required for the Work, provided that it has submitted timely and complete applications and taken all other actions necessary to obtain all such permits or approvals.

c. This Consent Decree is not, and shall not be construed to be, a permit issued pursuant to any federal or state statute or regulation.

9. Notice to Successor-in-Title and Transfers of Real Property

a. As of the Effective Date of this Consent Decree, Settling Defendant represents that it does not, at present, own any property within the Project Area. For any real property owned or controlled by the Settling Defendant located at the Project Area after the Effective Date, the Settling Defendant shall, within fifteen (15) days after the closing date of the acquisition of the real property or control, submit to EPA for review and approval a proposed notice to be filed with the appropriate land records office that provides a description of the real property and provides notice to all successors in title that the real property is part of the Project Area, that EPA has selected a remedy for Area B of the Site, and that the potentially responsible party has entered into a Consent Decree requiring implementation of the remedy. The notice also shall identify the United States District Court in which the Consent Decree was filed, the name and civil action number of this case, and the date the Consent Decree was entered by the Court. The Settling Defendant shall record the notice within ten (10) days after EPA's written approval of the notice. The Settling Defendant shall provide EPA with a certified copy of the recorded notice within ten (10) days after recording such notice.

b. The Settling Defendant shall, at least sixty (60) days prior to any Transfer of any real property located at the Project Area, give written notice: (1) to the transferee regarding the Consent Decree; and (2) to EPA and the State regarding the proposed Transfer,

including the name and address of the transferee and the date on which the transferee was notified of the Consent Decree.

c. Considering the transfer of real property located at the Project Area prior to the Effective Date, unless the United States otherwise consents in writing, the Settling Defendant shall continue to comply with its obligations under the Consent Decree, including, but not limited to, its obligation to provide and/or secure access.

VI. PERFORMANCE OF THE WORK BY THE SETTLING DEFENDANT

10. Selection of Supervising Contractor.

a. All aspects of the Work to be performed by the Settling Defendant pursuant to Sections VI (Performance of the Work by The Settling Defendant), VII (Remedy Review), VIII (Quality Assurance, Sampling, and Data Analysis), IX (Access and Institutional Controls), and XV (Emergency Response) shall be under the direction and supervision of the Supervising Contractor, the selection of which shall be subject to disapproval by EPA after a reasonable opportunity for review and comment by the State. Within ten (10) days after the lodging of this Consent Decree, the Settling Defendant shall notify EPA and the State in writing of the name, title, and qualifications of any contractor proposed to be the Supervising Contractor. With respect to any contractor proposed to be Supervising Contractor, the Settling Defendant shall demonstrate that the proposed contractor has a quality assurance system that complies with ANSI/ASQC E4-2004, "Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use" (American National Standard), by submitting a copy of the proposed contractor's Quality Management Plan ("QMP"). The QMP should be prepared in accordance with "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B-01/002, March 2001, reissued May 2006) or equivalent documentation as determined by EPA.

EPA will issue a notice of disapproval or an authorization to proceed regarding hiring of the proposed contractor. If at any time thereafter, the Settling Defendant proposes to change a Supervising Contractor, the Settling Defendant shall give such notice to EPA and the State and must obtain a notice of authorization to proceed from EPA, after a reasonable opportunity for review and comment by the State, before the new Supervising Contractor performs, directs, or supervises any Work under this Consent Decree.

b. If EPA disapproves a proposed Supervising Contractor, EPA will notify the Settling Defendant in writing. The Settling Defendant shall submit to EPA and the State a list of contractors, including the qualifications of each contractor that would be acceptable to them within thirty (30) days after receipt of EPA's disapproval of the contractor previously proposed. EPA will provide written notice of the names of any contractor(s) that it disapproves and an authorization to proceed with respect to any of the other contractors. The Settling Defendant may select any contractor from that list that is not disapproved and shall notify EPA and the State of the name of the contractor selected within twenty-one (21) days after EPA's notice of authorization to proceed.

c. If EPA fails to provide written notice of its authorization to proceed or disapproval as provided in this Paragraph and this failure prevents the Settling Defendant from meeting one or more deadlines in a plan approved by EPA pursuant to this Consent Decree, the Settling Defendant may seek relief under Section XVIII (Force Majeure).

11. Performance of Work in Accordance with SOW. The Settling Defendant shall conduct all Work in accordance with the SOW, including: (a) develop the Remedial Design, as appropriate; (b) perform the Remedial Action; and (c) operate, maintain, and monitor the effectiveness of the Remedial Action; all in accordance with the SOW and all EPA-approved,

conditionally-approved, or modified deliverables as required by the SOW. All deliverables required to be submitted for approval under the CD or SOW shall be subject to approval by EPA.

12. Modification of SOW or Related Work Plans.

a. If EPA determines that it is necessary to modify the Work specified in the SOW and/or in work plans developed pursuant to the SOW to achieve and maintain the Performance Standards or to carry out and maintain the effectiveness of the remedy set forth in the 2012 ROD Amendment, and such modification is consistent with the scope of the remedy set forth in the 2012 ROD Amendment, then EPA may issue such modification in writing and shall notify the Settling Defendant of such modification. For the purposes of this Paragraph and Paragraphs 47 (Completion of the Remedial Action) and 48 (Completion of the Work) only, the "scope of the remedy set forth in the 2012 ROD Amendment" for the Project Area is In-Situ Chemical Oxidation (ISCO) using potassium permanganate injected into the volatile organic compound (VOC) source and residual areas in the groundwater plume, groundwater monitoring (i.e., attenuation parameters outside of the treatment zones would be monitored to ensure the effectiveness of the remedy), and institutional controls to limit or prevent public access to areas where treatment of residual VOCs will be ongoing. This remedy is designed to meet the following Remedial Action Objectives: (1) reduce the risk of exposure to contaminants; (2) restore contaminated groundwater to support existing and future uses, i.e., drinking water; and (3) prevent or reduce migration of groundwater contamination above maximum contaminant levels. If the Settling Defendant objects to the modification it may, within thirty (30) days after EPA's notification, seek dispute resolution under Paragraph 66.b (Record Review).

b. The SOW and/or related work plans shall be modified: (1) in accordance with the modification issued by EPA; or (2) if the Settling Defendant invokes dispute resolution,

in accordance with the final resolution of the dispute. The modification shall be incorporated into and enforceable under this Consent Decree, and the Settling Defendant shall implement all Work required by such modification. The Settling Defendant shall incorporate the modification into the work plans required by the SOW, as appropriate.

c. Nothing in this Paragraph shall be construed to limit EPA's authority to require performance of further response actions as otherwise provided in this Consent Decree.

13. Nothing in this Consent Decree, the SOW, or the work plans constitutes a warranty or representation of any kind by Plaintiff that compliance with the Work requirements set forth in the SOW and the work plans will achieve the Performance Standards.

14. Off-Site Shipment of Waste Material.

a. The Settling Defendant may ship hazardous substances, pollutants, and contaminants from the Site to an off-Site facility only if Settling Defendant complies with Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3), and 40 C.F.R. § 300.440. Settling Defendant will be deemed to be in compliance with CERCLA Section 121(d)(3) and 40 C.F.R. § 300.440 regarding a shipment if Settling Defendant obtains a prior determination from EPA that the proposed receiving facility for such shipment is acceptable under the criteria of 40 C.F.R. § 300.440. The Settling Defendant may ship Investigation Derived Waste (IDW) from the Site to an off-Site facility only if it complies with EPA's "Guide to Management of Investigation Derived Waste," OSWER 9345.3-03FS (Jan. 1992).

b. The Settling Defendant may ship Waste Material from the Site to an out-of-state waste management facility only if, prior to any shipment, it provides written notice to the appropriate state environmental official in the receiving facility's state and to the EPA

Project Coordinator. This notice requirement shall not apply to any off-Site shipments when the total quantity of all such shipments will not exceed ten (10) cubic yards. The written notice shall include the following information, if available: (1) the name and location of the receiving facility; (2) the type and quantity of Waste Material to be shipped; (3) the schedule for the shipment; and (4) the method of transportation. The Settling Defendant also shall notify the state environmental official referenced above and the EPA Project Coordinator of any major changes in the shipment plan, such as a decision to ship the Waste Material to a different out-of-state facility. The Settling Defendant shall provide the written notice after the award of the contract for Remedial Action construction and before the Waste Material is shipped.

VII. REMEDY REVIEW

15. Periodic Review. The Settling Defendant shall conduct any studies and investigations that EPA requests in order to permit EPA to conduct reviews of whether the Remedial Action is protective of human health and the environment at least every five (5) years as required by Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and any applicable regulations.

16. EPA Selection of Further Response Actions. If EPA determines, at any time, that the Remedial Action is not protective of human health and the environment, EPA may select further response actions for the Site in accordance with the requirements of CERCLA and the NCP.

17. Opportunity to Comment. The Settling Defendant and, if required by Sections 113(k)(2) or 117 of CERCLA, 42 U.S.C. §§ 9613(k)(2) or 9617, the public, will be provided with an opportunity to comment on any further response actions proposed by EPA as a result of the review conducted pursuant to Section 121(c) of CERCLA and to submit written comments for the record during the comment period.

18. The Settling Defendant's Obligation to Perform Further Response Actions. If EPA selects further response actions relating to the Project Area, EPA may require the Settling Defendant to perform such further response actions, but only to the extent that the reopener conditions in Paragraphs 82 or 83 (United States' Pre- or Post-Certification Reservations) are satisfied. The Settling Defendant may invoke the procedures set forth in Section XIX (Dispute Resolution) to dispute (a) EPA's determination that the reopener conditions of Paragraphs 82 or 83 are satisfied, (b) EPA's determination that the Remedial Action is not protective of human health and the environment, or (c) EPA's selection of the further response actions. Disputes pertaining to whether the Remedial Action is protective or to EPA's selection of further response actions shall be resolved pursuant to Paragraph 66.b (Record Review).

19. Submission of Plans. If the Settling Defendant is required to perform further response actions pursuant to Paragraph 16, it shall submit a plan for such response action to EPA for approval in accordance with the procedures of Section VI (Performance of the Work by The Settling Defendant). The Settling Defendant shall implement the approved plan in accordance with this Consent Decree.

VIII. QUALITY ASSURANCE, SAMPLING, AND DATA ANALYSIS

20. Quality Assurance.

a. The Settling Defendant shall use quality assurance, quality control, and chain of custody procedures for all treatability, design, compliance, and monitoring samples in accordance with "EPA Requirements for Quality Assurance Project Plans (QA/R5)" (EPA/240/B-01/003, March 2001, reissued May 2006), "Guidance for Quality Assurance Project Plans (QA/G-5)" (EPA/240/R-02/009, December 2002), and "Uniform Federal Policy for Quality Assurance Project Plans," Parts 1 3, EPA/505/B-04/900A though 900C (March 2005),

and subsequent amendments to such guidelines upon notification by EPA to the Settling Defendant of such amendment. Amended guidelines shall apply only to procedures conducted after such notification.

b. Prior to the commencement of any monitoring project under this Consent Decree, the Settling Defendant shall submit to EPA for approval, after a reasonable opportunity for review and comment by the State, a Quality Assurance Project Plan ("QAPP") that is consistent with the SOW, the NCP, and applicable guidance documents. If relevant to the proceeding, the Parties agree that validated sampling data generated in accordance with the QAPP(s) and reviewed and approved by EPA shall be admissible as evidence, without objection, in any proceeding under this Consent Decree. The Settling Defendant shall ensure that EPA and State personnel and their authorized representatives are allowed access at reasonable times to all laboratories utilized by the Settling Defendant in implementing this Consent Decree, to the extent possible considering the rules, guidelines, and any contractual provisions relevant to the laboratory(ies) used. In addition, the Settling Defendant shall ensure that such laboratories shall analyze all samples submitted by EPA pursuant to the QAPP for quality assurance monitoring. The Settling Defendant shall ensure that the laboratories it utilizes for the analysis of samples taken pursuant to this Consent Decree perform all analyses according to accepted EPA methods that are documented in the "USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, ILM05.4" (December 2006), and the "USEPA Contract Laboratory Program Statement of Work for Organic Analysis, SOM01.2 (amended April 2007)," "USEPA Contract Laboratory Program Statement of Work for Inorganic Superfund Methods (Multi-Media, Multi-Concentration)," ISM01.2 (Jan. 2010), or other methods acceptable to EPA, and is a laboratory that is certified by the State. The Settling Defendant shall ensure that all laboratories it uses for

analysis of samples taken pursuant to this Consent Decree participate in an EPA or EPA-equivalent quality assurance/quality control ("QA/QC") program. The Settling Defendant shall use only laboratories that participate in an EPA-Accepted QA/QC program or other program acceptable to EPA. The Settling Defendant shall ensure that all field methodologies utilized in collecting samples for subsequent analysis pursuant to this Consent Decree are conducted in accordance with the procedures set forth in the QAPP approved by EPA.

21. Upon request, the Settling Defendant shall allow split or duplicate samples to be taken by EPA and the State or their authorized representatives. The Settling Defendant shall notify EPA and the State not less than thirty (30) days in advance of any sample collection activity unless shorter notice is agreed to by EPA. In addition, EPA and the State shall have the right to take any additional samples that EPA or the State deems necessary. Upon request, EPA and the State shall provide to the Settling Defendant split and/or duplicate samples of any samples they take as part of Plaintiffs' oversight of the Settling Defendant's implementation of the Work.

22. The Settling Defendant shall submit to EPA and the State electronic copies of the results of all sampling and/or tests or other data obtained or generated by or on behalf of the Settling Defendant related to the Project Area and/or the implementation of this Consent Decree unless EPA agrees otherwise.

23. Notwithstanding any provision of this Consent Decree, the United States and the State retain all of their information gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

IX. ACCESS AND INSTITUTIONAL CONTROLS

24. If the Project Area is owned or controlled by the Settling Defendant:

a. the Settling Defendant shall, provide the United States, the State, and their representatives, contractors, and subcontractors, with access at all reasonable times to the Project Area, to conduct any activity regarding the Consent Decree including, but not limited to, the following activities:

i. Monitoring the Work;

ii. Verifying any data or information submitted to the United States or the State;

iii. Conducting investigations regarding contamination at or near the Project Area;

iv. Obtaining samples;

v. Assessing the need for, planning, or implementing additional response actions at or near the Project Area;

vi. Assessing implementation of quality assurance and quality control practices as defined in the approved CQAPP;

vii. Implementing the Work pursuant to the conditions set forth in Paragraph 86 (Work Takeover);

viii. Inspecting and copying records, operating logs, contracts, or other documents maintained or generated by the Settling Defendant or its agents, consistent with Section XXIV (Access to Information);

ix. Assessing the Settling Defendant's compliance with the Consent Decree;

x. Determining whether the Project Area or other real property is being used in a manner that is prohibited or restricted, or that may need to be prohibited or restricted under the Consent Decree; and

xi. Implementing, monitoring, maintaining, reporting on, and enforcing any Institutional Controls.

b. The Settling Defendant shall not use the Project Area, or such other real property, in any manner that EPA determines will pose an unacceptable risk to human health or to the environment due to exposure to Waste Material or interfere with or adversely affect the implementation, integrity, or protectiveness of the Remedial Action or O&M.

25. If the Project Area, or any portion of the Project Area is owned or controlled by persons other than the Settling Defendant, the Settling Defendant shall use best efforts to secure from such persons an agreement to provide access thereto for the United States, the State, and the Settling Defendant, and their representatives, contractors, and subcontractors, to conduct any activity regarding the Consent Decree including, but not limited to, the activities listed in Paragraph 24.

26. For purposes of Paragraph 25, "best efforts" includes the payment of reasonable sums of money to obtain access. If, within ninety (90) days after the Effective Date, the Settling Defendant has not obtained agreements to provide access as required by Paragraph 25, the Settling Defendant shall promptly notify the United States in writing, and shall include in that notification a summary of the steps that the Settling Defendant has taken to attempt to comply

with Paragraph 25. The United States and the State may, as they deem appropriate, assist the Settling Defendant in obtaining access. The Settling Defendant shall reimburse the United States and the State under Section XVI (Payments for Response Costs) for all costs incurred, direct or indirect, by the United States and the State in obtaining such access, including, but not limited to, the cost of attorney time and the amount of monetary consideration paid or just compensation.

27. If EPA determines that Institutional Controls in the form of state or local laws, regulations, ordinances, zoning restrictions, or other governmental controls are needed at or in connection with the Project Area, the Settling Defendant shall cooperate with EPA's and the State's efforts to secure and ensure compliance with such governmental controls.

28. Notwithstanding any provision of the Consent Decree, the United States and the State retain all of their access authorities and rights, as well as all of their rights to require Institutional Controls, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable statute or regulations.

X. REPORTING REQUIREMENTS

29. The Settling Defendant shall submit to EPA and the State electronic copies of written monthly progress reports that meet the requirements of the SOW. The Settling Defendant shall submit these progress reports to EPA and the State by the tenth (10^{th}) day of every month following the lodging of this Consent Decree until EPA notifies the Settling Defendant pursuant to Paragraph 49.b of Section XIV (Certification of Completion). If requested by EPA or the State, the Settling Defendant shall also provide briefings for EPA and the State to discuss the progress of the Work. The Settling Defendant shall notify EPA of any change in the schedule described in the monthly progress report for the performance of any

activity, including, but not limited to, data collection and implementation of work plans, no later than seven (7) days prior to the performance of the activity.

30. Every six (6) months, commencing one (1) year after the notice of authorization to proceed under Paragraph 10 (Selection of Supervisory Contractor), Settling Defendant shall submit to EPA and the State electronic copies of a Semi-Annual Report that meets the requirements of the SOW.

31. Upon the occurrence of any event during performance of the Work that the Settling Defendant is required to report pursuant to Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of the Emergency Planning and Community Right-to-know Act ("EPCRA"), 42 U.S.C. § 11004, the Settling Defendant shall immediately orally notify the EPA Project Coordinator or the Alternate EPA Project Coordinator (in the event of the unavailability of the EPA Project Coordinator), or, in the event that neither the EPA Project Coordinator nor the Alternate EPA Project Coordinator is available, the Emergency Response Section, Region 9, United States Environmental Protection Agency. These reporting requirements are in addition to the reporting required by CERCLA Section 103 or EPCRA Section 304.

32. Within twenty (20) days after the onset of such an event, the Settling Defendant shall furnish to EPA and the State a written report, signed by the Settling Defendant's Project Coordinator, setting forth the events that occurred and the measures taken, and to be taken, in response thereto. Within thirty (30) days after the conclusion of such an event, the Settling Defendant shall submit a report setting forth all actions taken in response thereto.

33. The Settling Defendant shall submit electronic copies of all plans, reports, data, and other deliverables required by the SOW, or any other approved plans to EPA in accordance with the schedules set forth in such plans. The Settling Defendant shall simultaneously submit

electronic copies of all such plans, reports, data, and other deliverables to the State. If any deliverable includes maps, drawings, or other exhibits that are larger than 8.5" by 11", the Settling Defendant shall also provide EPA with paper copies of such exhibits.

34. All deliverables submitted by the Settling Defendant to EPA or the State that purport to document the Settling Defendant's compliance with the terms of this Consent Decree shall be signed by an authorized representative of the Settling Defendant.

XI. EPA APPROVAL OF PLANS, REPORTS, AND OTHER DELIVERABLES

35. Initial Submissions.

a. After review of any plan, report, or other deliverable that is required to be submitted for approval pursuant to this Consent Decree, EPA, after reasonable opportunity for review and comment by the State, shall: (i) approve, in whole or in part, the submission; (ii) approve the submission upon specified conditions; (iii) disapprove, in whole or in part, the submission; or (iv) any combination of the foregoing.

b. EPA also may modify the initial submission to cure deficiencies in the submission if: (i) EPA determines that disapproving the submission and awaiting a resubmission would cause substantial disruption to the Work; or (ii) previous submission(s) have been disapproved due to material defects and the deficiencies in the initial submission under consideration indicate a bad faith lack of effort to submit an acceptable plan, report, or deliverable.

36. Resubmissions. Upon receipt of a notice of disapproval under Paragraph 35.a(iii) or (iv), or if required by a notice of approval upon specified conditions under Paragraph 35.a(ii), the Settling Defendant shall, within thirty (30) days or such longer time as specified by EPA in

such notice, correct the deficiencies and resubmit the plan, report, or other deliverable for approval. After review of the resubmitted plan, report, or other deliverable, EPA may: (a) approve, in whole or in part, the resubmission; (b) approve the resubmission upon specified conditions; (c) modify the resubmission; (d) disapprove, in whole or in part, the resubmission, requiring the Settling Defendant to correct the deficiencies; or (e) any combination of the foregoing.

37. Material Defects. If an initially submitted or resubmitted plan, report, or other deliverable contains a material defect, and the plan, report, or other deliverable is disapproved or modified by EPA under 35.b(ii) or 36 (Resubmissions) due to such material defect, then the material defect shall constitute a lack of compliance for purposes of Paragraph 70. The provisions of Section XIX (Dispute Resolution) and Section XX (Stipulated Penalties) shall govern the accrual and payment of any stipulated penalties regarding the Settling Defendant's submissions under this Section.

38. Implementation. Upon approval, approval upon conditions, or modification by EPA under Paragraph 35 (Initial Submissions) or Paragraph 36 (Resubmissions), of any plan, report, or other deliverable, or any portion thereof: (a) such plan, report, or other deliverable, or portion thereof, shall be incorporated into and enforceable under this Consent Decree; and (b) the Settling Defendant shall take any action required by such plan, report, or other deliverable, or portion thereof, subject only to its right to invoke the Dispute Resolution procedures set forth in Section XIX (Dispute Resolution) with respect to the modifications or conditions made by EPA. The implementation of any non-deficient portion of a plan, report, or other deliverable submitted or resubmitted under Paragraph 35 (Initial Submissions) or 36 (Resubmissions) shall

not relieve the Settling Defendant of any liability for stipulated penalties under Section XX (Stipulated Penalties).

XII. PROJECT COORDINATORS

39. Within twenty (20) days after lodging this Consent Decree, the Settling Defendant, the State and EPA will notify each other, in writing, of the name, address, telephone number, and email address of their respective designated Project Coordinators and Alternate Project Coordinators. If a Project Coordinator or Alternate Project Coordinator initially designated is changed, the identity of the successor will be given to the other Parties at least five (5) working days before the change occurs, unless impracticable, but in no event later than the actual day the change is made. The Settling Defendant's Project Coordinator shall be subject to disapproval by EPA and shall have the technical expertise sufficient to adequately oversee all aspects of the Work. The Settling Defendant's Project Coordinator shall not be an attorney for any Settling Defendant in this matter. He or she may assign other representatives, including other contractors, to serve as a Site representative for oversight of performance of daily operations during remedial activities.

40. Plaintiffs may designate other representatives, including, but not limited to, EPA and State employees, and federal and State contractors and consultants, to observe and monitor the progress of any activity undertaken pursuant to this Consent Decree. EPA's Project Coordinator and Alternate Project Coordinator shall have the authority lawfully vested in a Remedial Project Manager ("RPM") and an On-Scene Coordinator ("OSC") by the NCP, 40 C.F.R. Part 300. EPA's Project Coordinator or Alternate Project Coordinator shall have authority, consistent with the NCP, to halt any Work required by this Consent Decree and to take any necessary response action when he or she determines that conditions at the Project Area

constitute an emergency situation or may present an immediate threat to public health or welfare or the environment due to release or threatened release of Waste Material.

XIII. PERFORMANCE GUARANTEE

41. In order to ensure the full and final completion of the Work, the Settling Defendant shall establish and maintain a performance guarantee, initially in the amount of $971,700, for the benefit of EPA (hereinafter "Estimated Cost of the Work"). The performance guarantee, must be one or more of the mechanisms listed below, in a form substantially identical to the relevant sample documents available from the "Financial Assurance" category on the Cleanup Enforcement Model Language and Sample Documents Database at http://cfpub.epa.gov/compliance/models/, and satisfactory to EPA. If the Settling Defendant intends to use multiple mechanisms, such multiple mechanisms shall be limited to surety bonds guaranteeing payment, letters of credit, trust funds, and insurance policies.

a. A surety bond unconditionally guaranteeing payment and/or performance of the Work that is issued by a surety company among those listed as acceptable sureties on federal bonds as set forth in Circular 570 of the U.S. Department of the Treasury;

b. One or more irrevocable letters of credit, payable to or at the direction of EPA, that is issued by one or more financial institution(s) (1) that has the authority to issue letters of credit and (2) whose letter-of-credit operations are regulated and examined by a federal or state agency;

c. A trust fund established for the benefit of EPA that is administered by a trustee (1) that has the authority to act as a trustee and (2) whose trust operations are regulated and examined by a federal or state agency;

d. A policy of insurance that (1) provides EPA with acceptable rights as a beneficiary thereof; and (2) is issued by an insurance carrier (i) that has the authority to issue insurance policies in the applicable jurisdiction(s) and (ii) whose insurance operations are regulated and examined by a federal or state agency;

e. A demonstration by the Settling Defendant that it meets the relevant financial test criteria of 40 C.F.R. § 264.143(f) and reporting requirements of this Section with respect to the Estimated Cost of the Work (plus the amount(s) of any other federal or any state environmental obligations financially assured through the use of a financial test or guarantee); or

f. A written guarantee to fund or perform the Work executed in favor of EPA by one or more of the following: (1) a direct or indirect parent company of the Settling Defendant; or (2) a company that has a "substantial business relationship" (as defined in 40 C.F.R. § 264.141(h)) with the Settling Defendant; provided, however, that any company providing such a guarantee must demonstrate to the satisfaction of EPA that it satisfies the relevant financial test criteria of 40 C.F.R. § 264.143(f) and reporting requirements of this Section with respect to the Estimated Cost of the Work (plus the amount(s) of any other federal or any state environmental obligations financially assured through the use of a financial test or guarantee) that it proposes to guarantee hereunder.

42. The Settling Defendant has selected, and EPA has found satisfactory, as an initial performance guarantee, the letter of credit pursuant to Paragraph 41.b, in the form attached hereto as Appendix D. Within thirty (30) days after the Effective Date, the Settling Defendant shall secure all executed and/or otherwise finalized mechanisms or other documents consistent with the form of performance guarantee attached as Appendix D to the EPA Regional Financial Management Officer in accordance with Section XXVI (Notices and Submissions), with a copy

to the United States and EPA and the State as specified in Section XXVI (Notices and Submissions).

43. If, at any time after the Effective Date and before issuance of the Certification of Completion of the Work pursuant to Paragraph 48, the Settling Defendant provides a performance guarantee for completion of the Work by means of a demonstration or guarantee pursuant to Paragraph 41(e) or 41(f), the Settling Defendant shall also comply with the other relevant criteria and requirements of 40 C.F.R. § 264.143(f) and this Section, including but not limited to: (a) the initial submission to EPA of required financial reports and statements from the relevant entity's chief financial officer ("CFO") and independent certified public accountant ("CPA") no later than thirty (30) days after the effective date, in the form prescribed by EPA in its financial test sample CFO letters and CPA reports available at: http://cfpub.epa.gov/compliance/models/view.cfm?model_ID=573; (b) the annual resubmission of such reports and statements within ninety (90) days after the close of each such entity's fiscal year; and (c) the prompt notification of EPA after each such entity determines that it no longer satisfies the financial test criteria and requirements set forth at 40 C.F.R. § 264.143(f)(1) and in any event within ninety (90) days after the close of any fiscal year in which such entity no longer satisfies such financial test requirements. For purposes of the performance guarantee mechanisms specified in this Section XIII, references in 40 C.F.R. Part 264, Subpart H, to "closure," "post-closure," and "plugging and abandonment" shall be deemed to include the Work; the terms "current closure cost estimate," "current post-closure cost estimate," and "current plugging and abandonment cost estimate" shall be deemed to include the Estimated Cost of the Work; the terms "owner" and "operator" shall be deemed to refer the Settling

Defendant making a demonstration under Paragraph 41(e); and the terms "facility" and "hazardous waste facility" shall be deemed to include the Project Area.

44. In the event that EPA determines at any time that a performance guarantee provided by the Settling Defendant pursuant to this Section is inadequate or otherwise no longer satisfies the requirements set forth in this Section, whether due to an increase in the estimated cost of completing the Work or for any other reason, or in the event that the Settling Defendant becomes aware of information indicating that a performance guarantee provided pursuant to this Section is inadequate or otherwise no longer satisfies the requirements set forth in this Section, whether due to an increase in the estimated cost of completing the Work or for any other reason, the Settling Defendant, within thirty (30) days after receipt of notice of EPA's determination or, as the case may be, within thirty (30) days of the Settling Defendant becoming aware of such information, shall obtain and present to EPA for approval a proposal for a revised or alternative form of performance guarantee listed in Paragraph 41 that satisfies all requirements set forth in this Section; provided, however, that if the Settling Defendant cannot obtain such revised or alternative form of performance guarantee within such thirty (30)-day period, and provided further that the Settling Defendant shall have commenced to obtain such revised or alternative form of performance guarantee within such thirty (30)-day period, and thereafter diligently proceeds to obtain the same, EPA shall extend such period for such time as is reasonably necessary for the Settling Defendant in the exercise of due diligence to obtain such revised or alternative form of performance guarantee, such additional period not to exceed thirty (30) days. In seeking approval for a revised or alternative form of performance guarantee, the Settling Defendant shall follow the procedures set forth in Paragraph 46.b. The Settling Defendant's inability to post a performance guarantee for completion of the Work shall in no way excuse

performance of any other requirements of this Consent Decree, including, without limitation, the obligation of the Settling Defendant to complete the Work in strict accordance with the terms of this Consent Decree.

45. Funding for Work Takeover. The commencement of any Work Takeover pursuant to Paragraph 85 shall trigger EPA's right to receive the benefit of any performance guarantee(s) provided pursuant to Paragraphs 41.a, 41.b, 41.c, 41.d, or 41.f, and at such time EPA shall have immediate access to resources guaranteed under any such performance guarantee(s), whether in cash or in kind, as needed to continue and complete the Work assumed by EPA under the Work Takeover. Upon the commencement of any Work Takeover, if (a) for any reason EPA is unable to promptly secure the resources guaranteed under any such performance guarantee(s), whether in cash or in kind, necessary to continue and complete the Work assumed by EPA under the Work Takeover, or (b) in the event that the performance guarantee involves a demonstration of satisfaction of the financial test criteria pursuant to Paragraph 41.e or Paragraph 41.f(2), the Settling Defendant (or in the case of Paragraph 41.f(2), the guarantor) shall immediately upon written demand from EPA deposit into a special account within the EPA Hazardous Substance Superfund or such other account as EPA may specify, in immediately available funds and without setoff, counterclaim, or condition of any kind, a cash amount up to but not exceeding the estimated cost of completing the Work as of such date, as determined by EPA. In addition, if at any time EPA is notified by the issuer of a performance guarantee that such issuer intends to cancel the performance guarantee mechanism it has issued, then, unless the Settling Defendant provides a substitute performance guarantee mechanism in accordance with this Section no later than thirty (30) days prior to the impending cancellation date, EPA shall be entitled (as of and after the date that is thirty (30) days prior to the impending

cancellation) to draw fully on the funds guaranteed under the then-existing performance guarantee. All EPA Work Takeover costs not reimbursed under this Paragraph shall be reimbursed under Section XVI (Payments for Response Costs).

46. Modification of Amount and/or Form of Performance Guarantee.

a. Reduction of Amount of Performance Guarantee. If the Settling Defendant believes that the estimated cost of completing the Work has diminished below the amount set forth in Paragraph 41, the Settling Defendant may, on any anniversary of the Effective Date, or at any other time agreed to by the Parties, petition EPA in writing to request a reduction in the amount of the performance guarantee provided pursuant to this Section so that the amount of the performance guarantee is equal to the estimated cost of completing the Work. The Settling Defendant shall submit a written proposal for such reduction to EPA that shall specify, at a minimum, the estimated cost of completing the Work and the basis upon which such cost was calculated. In seeking approval for a reduction in the amount of the performance guarantee, the Settling Defendant shall follow the procedures set forth in Paragraph 46.b(ii) for requesting a revised or alternative form of performance guarantee, except as specifically provided in this Paragraph 46.a. If EPA decides to accept the Settling Defendant's proposal for a reduction in the amount of the performance guarantee, either to the amount set forth in the Settling Defendant's written proposal or to some other amount as selected by EPA, EPA will notify the petitioning Settling Defendant of such decision in writing. Upon EPA's acceptance of a reduction in the amount of the performance guarantee, the Estimated Cost of the Work shall be deemed to be the estimated cost of completing the Work set forth in EPA's written decision. After receiving EPA's written decision, the Settling Defendant may reduce the amount of the performance guarantee in accordance with and to the extent permitted by such written

acceptance and shall submit copies of all executed and/or otherwise finalized instruments or other documents required in order to make the selected performance guarantee(s) legally binding in accordance with Paragraph 46.b(ii). In the event of a dispute, the Settling Defendant may reduce the amount of the performance guarantee required hereunder only in accordance with a final administrative or judicial decision resolving such dispute pursuant to Section XIX (Dispute Resolution). No change to the form or terms of any performance guarantee provided under this Section, other than a reduction in amount, is authorized except as provided in Paragraphs 44 or 46.b.

b. Change of Form of Performance Guarantee.

i. If, after the Effective Date, the Settling Defendant desires to change the form or terms of any performance guarantee(s) provided pursuant to this Section, the Settling Defendant may, on any anniversary of the Effective Date, or at any other time agreed to by the Parties, petition EPA in writing to request a change in the form or terms of the performance guarantee provided hereunder. The submission of such proposed revised or alternative performance guarantee shall be as provided in Paragraph 46.b(ii). Any decision made by EPA on a petition submitted under this Paragraph shall be made in EPA's sole and unreviewable discretion and such decision shall not be subject to challenge by the Settling Defendant pursuant to the dispute resolution provisions of this Consent Decree or in any other forum.

ii. The Settling Defendant shall submit a written proposal for a revised or alternative performance guarantee to EPA that shall specify, at a minimum, the estimated cost of completing the Work, the basis upon which such cost was calculated, and the proposed revised performance guarantee, including all proposed instruments or other documents

required in order to make the proposed performance guarantee legally binding. The proposed revised or alternative performance guarantee must satisfy all requirements set forth or incorporated by reference in this Section. The Settling Defendant shall submit such proposed revised or alternative performance guarantee to the EPA Regional Financial Management Officer in accordance with Section XXVI (Notices and Submissions). EPA will notify the Settling Defendant in writing of its decision to accept or reject a revised or alternative performance guarantee submitted pursuant to this Paragraph. Within ten (10) days after receiving a written decision approving the proposed revised or alternative performance guarantee, the Settling Defendant shall execute and/or otherwise finalize all instruments or other documents required in order to make the selected performance guarantee(s) legally binding in a form substantially identical to the documents submitted to EPA as part of the proposal, and such performance guarantee(s) shall thereupon be fully effective. The Settling Defendant shall submit copies of all executed and/or otherwise finalized instruments or other documents required in order to make the selected performance guarantee(s) legally binding to the EPA Regional Financial Management Officer within thirty (30) days after receiving a written decision approving the proposed revised or alternative performance guarantee in accordance with Section XXVI (Notices and Submissions) and to the United States and EPA and the State as specified in Section XXVI.

c. Release of Performance Guarantee. The Settling Defendant shall not release, cancel, or discontinue any performance guarantee provided pursuant to this Section except as provided in this Paragraph. If the Settling Defendant receives written notice from EPA in accordance with Paragraph 48 that the Work has been fully and finally completed in accordance with the terms of this Consent Decree, or if EPA otherwise so notifies the Settling

Defendant in writing, the Settling Defendant may thereafter release, cancel, or discontinue the performance guarantee(s) provided pursuant to this Section. In the event of a dispute, the Settling Defendant may release, cancel, or discontinue the performance guarantee(s) required hereunder only in accordance with a final administrative or judicial decision resolving such dispute pursuant to Section XIX (Dispute Resolution).

XIV. CERTIFICATION OF COMPLETION

47. Completion of the Remedial Action.

a. Within sixty (60) days after the Settling Defendant concludes that the Remedial Action has been fully performed and the Performance Standards have been achieved, the Settling Defendant shall schedule and conduct a pre-certification inspection to be attended by the Settling Defendant, EPA, and the State. If, after the pre-certification inspection, the Settling Defendant still believes that the Remedial Action has been fully performed and the Performance Standards have been achieved, it shall submit a written report requesting certification to EPA for approval, with a copy to the State, pursuant to Section XI (EPA Approval of Plans, Reports, and Other Deliverables) within thirty (30) days after the inspection. In the report, a registered professional engineer and the Settling Defendant's Project Coordinator shall state that the Remedial Action has been completed in full satisfaction of the requirements of this Consent Decree. The written report shall include as-built drawings signed and stamped by a professional engineer. The report shall contain the following statement, signed by a responsible corporate official of the Settling Defendant or the Settling Defendant's Project Coordinator:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry

of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If, after completion of the pre-certification inspection and receipt and review of the written report, EPA, after reasonable opportunity for review and comment by the State, determines that the Remedial Action or any portion thereof has not been completed in accordance with this Consent Decree or that the Performance Standards have not been achieved, EPA will notify the Settling Defendant in writing of the activities that must be undertaken by the Settling Defendant pursuant to this Consent Decree to complete the Remedial Action and achieve the Performance Standards, provided, however, that EPA may only require the Settling Defendant to perform such activities pursuant to this Paragraph to the extent that such activities are consistent with the "scope of the remedy set forth in the 2012 ROD Amendment," as that term is defined in Paragraph 12.a. EPA will set forth in the notice a schedule for performance of such activities consistent with the Consent Decree and the SOW or require the Settling Defendant to submit a schedule to EPA for approval pursuant to Section XI (EPA Approval of Plans, Reports, and Other Deliverables). The Settling Defendant shall perform all activities described in the notice in accordance with the specifications and schedules established pursuant to this Paragraph, subject to its right to invoke the dispute resolution procedures set forth in Section XIX (Dispute Resolution).

b. If EPA concludes, based on the initial or any subsequent report requesting Certification of Completion of the Remedial Action and after a reasonable opportunity for

review and comment by the State, that the Remedial Action has been performed in accordance with this Consent Decree and that the Performance Standards have been achieved, EPA will so certify in writing to the Settling Defendant. This certification shall constitute the Certification of Completion of the Remedial Action for purposes of this Consent Decree, including, but not limited to, Section XXI (Covenants by Plaintiffs). Certification of Completion of the Remedial Action shall not affect the Settling Defendant's remaining obligations under this Consent Decree.

48. Completion of the Work.

a. Within sixty (60) days after the Settling Defendant concludes that all phases of the Work, other than any remaining activities required under Section VII (Remedy Review), have been fully performed, the Settling Defendant shall schedule and conduct a pre-certification inspection to be attended by the Settling Defendant, EPA, and the State. If, after the pre-certification inspection, the Settling Defendant still believes that the Work has been fully performed, within thirty (30) days of the Pre-Certification Inspection, the Settling Defendant shall submit a Pre-Certification Written Report by a registered professional engineer stating that the Work has been completed in full satisfaction of the requirements of this Consent Decree. The report shall contain the statement set forth in Paragraph 47.a, signed by a responsible corporate official of the Settling Defendant or the Settling Defendant's Project Coordinator. If, after review of the written report, EPA, after reasonable opportunity for review and comment by the State, determines that any portion of the Work has not been completed in accordance with this Consent Decree, EPA will notify the Settling Defendant in writing of the activities that must be undertaken by the Settling Defendant pursuant to this Consent Decree to complete the Work, provided, however, that EPA may only require the Settling Defendant to perform such activities pursuant to this Paragraph to the extent that such activities are consistent with the "scope of the

remedy set forth in the 2012 ROD Amendment," as that term is defined in Paragraph 12.a. EPA will set forth in the notice a schedule for performance of such activities consistent with the Consent Decree and the SOW or require the Settling Defendant to submit a schedule to EPA for approval pursuant to Section XI (EPA Approval of Plans, Reports, and Other Deliverables). The Settling Defendant shall perform all activities described in the notice in accordance with the specifications and schedules established therein, subject to its right to invoke the dispute resolution procedures set forth in Section XIX (Dispute Resolution).

49. b. If EPA concludes, based on the initial or any subsequent request for Certification of Completion of the Work by the Settling Defendant and after a reasonable opportunity for review and comment by the State, that the Work has been performed in accordance with this Consent Decree, EPA will so notify the Settling Defendant in writing. Issuance of Certification of Completion of the Work does not affect the following continuing obligations: (1) activities under the Section VII (Remedy Review); (2) obligations under Paragraph c (Notice to Successors-in-Title and Transfers of Real Property) and Sections IX (Access and Institutional Controls), XXV (Retention of Records), and XXIV (Access to Information); and (3) reimbursement of EPA's Response Costs or State Future Response Costs under Section XVI (Payments for Response Costs).

XV. EMERGENCY RESPONSE

50. If any action or occurrence during the performance of the Work causes or threatens a release of Waste Material on, at, or from the Project Area and that either constitutes an emergency situation or that may present an immediate threat to public health or welfare or the environment, the Settling Defendant shall, subject to Paragraph 51, immediately take all appropriate action to prevent, abate, or minimize such release or threat of release, and shall

immediately notify the EPA's Project Coordinator, or, if the Project Coordinator is unavailable, the EPA Emergency Response Unit, Region 9 and, after notifying EPA, shall immediately notify the State. The Settling Defendant shall take such actions in consultation with EPA's Project Coordinator or other available authorized EPA officer and in accordance with all applicable provisions of the Health and Safety Plan/ Contingency Plan, and any other applicable plans or documents developed pursuant to the SOW. In the event that the Settling Defendant fails to take appropriate response action as required by this Section, and EPA or, as appropriate, the State take such action instead, the Settling Defendant shall reimburse EPA and the State all costs of the response action under Section XVI (Payments for Response Costs).

51. Subject to Section XXI (Covenants by Plaintiffs), nothing in the preceding Paragraph or in this Consent Decree shall be deemed to limit any authority of the United States, or the State, (a) to take all appropriate action to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Project Area, or (b) to direct or order such action, or seek an order from the Court, to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Project Area.

XVI. PAYMENTS FOR RESPONSE COSTS

52. Payments to EPA by the Settling Defendant of Response Costs. The Settling Defendant shall pay to EPA all Response Costs, as defined in Section IV (Definitions) of this Consent Decree, not inconsistent with the NCP.

a. On a periodic basis, EPA will send the Settling Defendant a bill requiring payment that includes an EPA Region 9 Cost Summary Report, which sets forth the direct and indirect costs incurred by EPA its contractors, and DOJ. The Settling Defendant shall make all

payments within thirty (30) days after the Settling Defendant's receipt of each bill requiring payment, except as otherwise provided in Paragraph 52, in accordance with Paragraphs 52.b (Payment Instructions for the Settling Defendant). Any payments collected shall be deposited by EPA in the TIAA Burr Brown Special Account to be retained and used to conduct or finance response actions at or in connection with the Site, or to be transferred by EPA to the EPA Hazardous Substance Superfund, provided however that EPA may deposit a Response Cost payment directly into the EPA Hazardous Substance Superfund if, at the time the payment is received, EPA estimates that the TIAA Burr Brown Special Account balance is sufficient to address currently anticipated future response actions to be conducted or financed by EPA at or in connection with the Site.

b. Payment Instructions for the Settling Defendant. Unless otherwise directed by EPA, all payments to EPA required in this Consent Decree shall be made by automated clearinghouse ("ACH") to:

PNC Bank

808 17th Street, NW

Washington, DC 20074

Contact: Jesse White 301-887-6548

ABA = 051036706

Transaction Code 22 - checking

Environmental Protection Agency

Account 310006 CTX Format

c. Payment References and Notices. All payments to EPA made under this Consent Decree shall reference the Site/Spill ID Number 09L8, and DOJ Case Number 90-11-3-

369. At the time of any payment required to be made under this Consent Decree, the Settling Defendant shall send notice that payment has been made to the United States, and to EPA, in accordance with Section XXVI (Notices and Submissions), and to the EPA Cincinnati Finance Office by email at cinwd_acctsreceivable.@epa.gov, or by mail at 26 W. Martin Luther King Drive, Cincinnati, Ohio 45268. Such notice shall also reference the Site/Spill ID Number, and DOJ Case Number.

53. Payments by the Settling Defendant of State Future Response Costs.

a. Within sixty (60) calendar days after the Effective Date, Settling Defendant shall pay to the State five-thousand dollars ($5,000.00) toward the State Future Response Costs that are expected to be incurred after the Effective Date. All payments under this Section must be made payable to the Arizona Department of Environmental Quality and forwarded to:

Nareej Deshpande
Attn: Accounts Receivable
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, Arizona 85007

The payment must include the case name and number, Site Code # 420000-05 and that payment is for the "Texas Instruments, Tucson Corporation Oversight Account." A copy of the payment must be sent to the ADEQ Project Manager. The State shall deposit payments under this Section in a Water Quality Assurance Revolving Fund ("WQARF") account referred to as the "Texas Instruments, Tucson Corporation Oversight Account." The State may thereafter draw down on this account from time to time to fund its State Future Response Costs. The Texas Instruments, Tucson Corporation Oversight Account is for the exclusive use of the State for its State Future

Response Costs under this Consent Decree. Settling Defendant is not liable for reimbursing the account for any other use of the funds.

c. Beginning on a quarterly basis after the Effective Date, the State shall provide to Settling Defendant a cost accounting summary consisting of invoices and summaries of direct and indirect costs incurred, including costs paid to its contractors in that quarter, and a summary of the State draw-downs made from the Texas Instruments, Tucson Corporation Oversight Account. The State shall also provide a report on the balance of the Texas Instruments, Tucson Corporation Oversight Account.

d. Subject to Paragraph "e" of this Section, for as long as this Consent Decree remains in effect, the State may notify Settling Defendant if the balance of the Texas Instruments, Tucson Corporation Oversight Account is five-hundred dollars ($500.00) or less. Within thirty (30) calendar days after receipt of the above notice, Settling Defendant shall deposit an amount sufficient to bring the balance of that account up to five-thousand dollars ($5,000.00).

e. The State reserves the right to incur State Future Response Costs and to bill Settling Defendant for reimbursement of the State Future Response Costs incurred if at any time the balance of the funds available in the Texas Instruments, Tucson Corporation Oversight Account is insufficient to cover the State Future Response Costs. Any State billing under this Paragraph must be made in accordance with the procedures established in this Section. Settling Defendant shall pay as provided in Paragraph "a" of this Section. The State may deposit the Settling Defendant's payments to the WQARF Fund only to the extent that the State has incurred and paid State Future Response Costs from the WQARF Fund; otherwise, the State shall deposit

the Settling Defendant's payments to the Texas Instruments, Tucson Corporation Oversight Account.

f. If, at any time, the Texas Instruments, Tucson Corporation Oversight Account funds have been used for any purpose other than payment of State Future Response Costs, the State shall give Settling Defendant a credit for the amount of those funds. Settling Defendant's obligations under paragraphs "d" and "e" of this Section are then suspended until the State has billed against the total amount of the credit.

54. The Settling Defendant may contest any Response Costs and State Future Response Costs billed under Paragraphs 52 (Payments by the Settling Defendant of Response Costs) and 53 (Payments by the Settling Defendant of State Future Response Costs) if it determines that EPA or the State has made a mathematical error or included a cost item that is not within the definition of Response Costs or State Future Response Costs, or if it believes EPA or the State incurred excess costs as a direct result of an EPA or State action that was inconsistent with a specific provision or provisions of the NCP. Such objection shall be made in writing within thirty (30) days after receipt of the bill and must be sent to the United States (if the United States' accounting is being disputed) or the State (if the State's accounting is being disputed) pursuant to Section XXVI (Notices and Submissions). Any such objection shall specifically identify the contested Response Costs or State Future Response Costs and the basis for objection. In the event of an objection, the Settling Defendant shall pay all uncontested Response Costs or State Future Response Costs to the United States or the State within thirty (30) days after the Settling Defendant's receipt of the bill requiring payment. Simultaneously, the Settling Defendant shall establish, in a duly chartered bank or trust company, an interest-bearing escrow account that is insured by the Federal Deposit Insurance Corporation ("FDIC"),

and remit to that escrow account funds equivalent to the amount of the contested Response Costs or State Future Response Costs. The Settling Defendant shall send to the United States, as provided in Section XXVI (Notices and Submissions), and the State a copy of the transmittal letter and check paying the uncontested Response Costs or State Future Response Costs, and a copy of the correspondence that establishes and funds the escrow account, including, but not limited to, information containing the identity of the bank and bank account under which the escrow account is established as well as a bank statement showing the initial balance of the escrow account. Simultaneously with establishment of the escrow account, the Settling Defendant shall initiate the Dispute Resolution procedures in Section XIX (Dispute Resolution). If the United States or the State prevails in the dispute, the Settling Defendant shall pay the sums due (with accrued interest) to the United States or the State within five (5) days after the resolution of the dispute. If the Settling Defendant prevails concerning any aspect of the contested costs, the Settling Defendant shall pay that portion of the costs (plus associated accrued interest) for which it did not prevail to the United States or the State within five (5) days after the resolution of the dispute. The Settling Defendant shall be disbursed any balance of the escrow account. All payments to the United States under this Paragraph shall be made in accordance with Paragraph 52.b. (Payment Instructions for the Settling Defendant). All payments to the State under this Paragraph shall be made in accordance with Paragraph 53 (Payments by the Settling Defendant of State Future Response Costs). The dispute resolution procedures set forth in this Paragraph in conjunction with the procedures set forth in Section XIX (Dispute Resolution) shall be the exclusive mechanisms for resolving disputes regarding the Settling Defendant's obligation to reimburse the United States and the State for their Response Costs and State Future Response Costs.

55. Interest. In the event that any payment for Response Costs or State Future Response Costs required under this Section is not made by the date required, the Settling Defendant shall pay Interest on the unpaid balance. The Interest on Response Costs or State Future Response Costs shall begin to accrue on the date of the bill. The Interest shall accrue through the date of the Settling Defendant's payment. Payments of Interest made under this Paragraph shall be in addition to other remedies and sanctions available to Plaintiffs by virtue of the Settling Defendant's failure to make timely payments under this Section including, but not limited to, payment of stipulated penalties pursuant to Paragraph 71.

XVII. INDEMNIFICATION AND INSURANCE

56. The Settling Defendant's Indemnification of the United States and the State.

a. The United States and the State do not assume any liability by entering into this Consent Decree or by virtue of any designation of the Settling Defendant as EPA's authorized representative under Section 104(e) of CERCLA, 42 U.S.C. § 9604(e). The Settling Defendant shall indemnify, save and hold harmless the United States, the State, and their officials, agents, employees, contractors, subcontractors, and representatives for or from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of the Settling Defendant, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Consent Decree, including, but not limited to, any claims arising from any designation of the Settling Defendant as EPA's authorized representative under Section 104(e) of CERCLA, 42 U.S.C. § 9604(e). Further, the Settling Defendant agrees to pay the United States and the State all costs they incur including, but not limited to, attorneys' fees and other expenses of litigation and settlement arising from, or on account of, claims made against the United States

or the State based on negligent or other wrongful acts or omissions of the Settling Defendant, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Consent Decree. Neither the United States nor the State shall be held out as a party to any contract entered into by or on behalf of the Settling Defendant in carrying out activities pursuant to this Consent Decree. Neither the Settling Defendant nor any such contractor shall be considered an agent of the United States or the State.

b. The United States and the State shall give the Settling Defendant notice of any claim for which the United States or the State plans to seek indemnification pursuant to this Paragraph 56, and shall consult with the Settling Defendant prior to settling such claim.

57. The Settling Defendant covenants not to sue and agrees not to assert any claims or causes of action against the United States and the State for damages or reimbursement or for set-off of any payments made or to be made to the United States or the State, arising from or on account of any contract, agreement, or arrangement between the Settling Defendant and any person for performance of Work on or relating to the Project Area, including, but not limited to, claims on account of construction delays. In addition, the Settling Defendant shall indemnify and hold harmless the United States and the State with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between the Settling Defendant and any person for performance of Work on or relating to the Project Area, including, but not limited to, claims on account of construction delays.

58. No later than fifteen (15) days before commencing any Work in the Project Area, the Settling Defendant shall secure, and shall maintain until the first anniversary after issuance of EPA's Certification of Completion of the Remedial Action pursuant to Paragraph 47 of Section

XIV (Certification of Completion), commercial general liability insurance with limits of one million dollars ($1,000,000.00), for any one occurrence, and automobile liability insurance with limits of one million dollars ($1,000,000.00), combined single limit, naming the United States and the State as additional insureds with respect to all liability arising out of the activities performed by or on behalf of the Settling Defendant pursuant to this Consent Decree. In addition, for the duration of this Consent Decree, the Settling Defendant shall satisfy, or shall ensure that its contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing the Work on behalf of the Settling Defendant in furtherance of this Consent Decree. Prior to commencement of the Work under this Consent Decree, the Settling Defendant shall provide to EPA and the State certificates of such insurance and a copy of each insurance policy. The Settling Defendant shall resubmit such certificates and copies of policies each year on the anniversary of the Effective Date. If the Settling Defendant demonstrates by evidence satisfactory to EPA and the State that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering the same risks but in a lesser amount, then, with respect to that contractor or subcontractor, the Settling Defendant need provide only that portion of the insurance described above that is not maintained by the contractor or subcontractor.

XVIII. FORCE MAJEURE

59. "Force majeure," for purposes of this Consent Decree, is defined as any event arising from causes beyond the control of the Settling Defendant, of any entity controlled by the Settling Defendant, or of the Settling Defendant's contractors that delays or prevents the performance of any obligation under this Consent Decree despite the Settling Defendant's best efforts to fulfill the obligation. The requirement that the Settling Defendant exercise "best

efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure and best efforts to address the effects of any potential force majeure (a) as it is occurring and (b) following the potential force majeure such that the delay and any adverse effects of the delay are minimized to the greatest extent possible. "Force majeure" does not include financial inability to complete the Work or a failure to achieve the Performance Standards.

60. If any event occurs or has occurred that may delay the performance of any obligation under this Consent Decree for which the Settling Defendant intends or may intend to assert a claim of force majeure, the Settling Defendant shall notify EPA's Project Coordinator orally or, in his or her absence, EPA's Alternate Project Coordinator or, in the event both of EPA's designated representatives are unavailable, the Director of the Superfund Division, EPA Region 9, within seventy-two (72) hours of when the Settling Defendant first knew that the event might cause a delay. Within ten (10) days thereafter, the Settling Defendant shall provide in writing to EPA and the State an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; the Settling Defendant's rationale for attributing such delay to a force majeure; and a statement as to whether, in the opinion of the Settling Defendant, such event may cause or contribute to an endangerment to public health or welfare, or the environment. The Settling Defendant shall include with any notice all available documentation supporting its claim that the delay was attributable to a force majeure. The Settling Defendant shall be deemed to know of any circumstance of which the Settling Defendant, any entity controlled by the Settling Defendant, or the Settling Defendant's contractors knew or should have known. Failure to comply with the above requirements regarding an event shall preclude the Settling Defendant

from asserting any claim of force majeure regarding that event, provided, however, that if EPA, despite the late or incomplete notice, is able to assess to its satisfaction whether the event is a force majeure under Paragraph 59 and whether the Settling Defendant has exercised its best efforts under Paragraph 59, EPA may, in its unreviewable discretion, excuse in writing the Settling Defendant's failure to submit timely or complete notices under this Paragraph.

61. If EPA, after a reasonable opportunity for review and comment by the State, agrees that the delay or anticipated delay is attributable to a force majeure, the time for performance of the obligations under this Consent Decree that are affected by the force majeure will be extended by EPA, after a reasonable opportunity for review and comment by the State, for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the force majeure shall not, of itself, extend the time for performance of any other obligation. If EPA, after a reasonable opportunity for review and comment by the State, does not agree that the delay or anticipated delay has been or will be caused by a force majeure, EPA will notify the Settling Defendant in writing of its decision. If EPA, after a reasonable opportunity for review and comment by the State, agrees that the delay is attributable to a force majeure, EPA will notify the Settling Defendant in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure.

62. If the Settling Defendant elects to invoke the dispute resolution procedures set forth in Section XIX (Dispute Resolution), it shall do so no later than fifteen (15) days after receipt of EPA's notice. In any such proceeding, the Settling Defendant shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate

the effects of the delay, and that the Settling Defendant complied with the requirements of Paragraphs 58 and 59. If the Settling Defendant carries this burden, the delay at issue shall be deemed not to be a violation by the Settling Defendant of the affected obligation of this Consent Decree identified to EPA and the Court.

63. The failure by EPA to timely complete any obligation under the Consent Decree, or any plan, report, or other deliverable approved by EPA under the Consent Decree, is not a violation of the Consent Decree, provided, however, that if such failure prevents the Settling Defendant from meeting one or more deadlines established by or approved under the Consent Decree, Settling Defendant may seek relief under this Section.

XIX. DISPUTE RESOLUTION

64. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes regarding this Consent Decree. However, the procedures set forth in this Section shall not apply to actions by the United States to enforce obligations of the Settling Defendant that have not been disputed in accordance with this Section.

65. Any dispute regarding this Consent Decree shall in the first instance be the subject of informal negotiations between the parties to the dispute. The period for informal negotiations shall not exceed thirty (30) days from the time the dispute arises, unless it is modified by written agreement of the parties to the dispute. The dispute shall be considered to have arisen when one party sends the other parties a written Notice of Dispute.

66. Dispute Resolution between EPA and the Settling Defendant.

a. Statements of Position.

i. In the event that the parties cannot resolve a dispute by informal negotiations under the preceding Paragraph, then the position advanced by EPA shall be considered binding unless, within thirty (30) days after the conclusion of the informal negotiation period, the Settling Defendant invokes the formal dispute resolution procedures of this Section by serving on the United States and the State a written Statement of Position on the matter in dispute, including, but not limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the Settling Defendant. The Statement of Position shall specify the Settling Defendant's position as to whether formal dispute resolution should proceed under Paragraph 66.b (Record Review) or 67.

ii. Within thirty (30) days after receipt of the Settling Defendant's Statement of Position, EPA will serve on the Settling Defendant its Statement of Position, including, but not limited to, any factual data, analysis, or opinion supporting that position and all supporting documentation relied upon by EPA. EPA's Statement of Position shall include a statement as to whether formal dispute resolution should proceed under Paragraph 66.b (Record Review) or Paragraph 67. Within twenty (20) days after receipt of EPA's Statement of Position, the Settling Defendant may submit a Reply.

iii. If there is disagreement between EPA and the Settling Defendant as to whether dispute resolution should proceed under Paragraph 66.b (Record Review) or 67, the parties to the dispute shall follow the procedures set forth in the paragraph determined by EPA to be applicable. However, if the Settling Defendant ultimately appeals to the Court to resolve the dispute, the Court shall determine which paragraph is applicable in accordance with the standards of applicability set forth in Paragraphs 66.b (Record Review) and 67.

b. Record Review. Formal dispute resolution for disputes pertaining to the selection or adequacy of any response action and all other disputes that are accorded review on the administrative record under applicable principles of administrative law shall be conducted pursuant to the procedures set forth in this Paragraph. For purposes of this Paragraph, the adequacy of any response action includes, without limitation, the adequacy or appropriateness of plans, procedures to implement plans, or any other items requiring approval by EPA under this Consent Decree, and the adequacy of the performance of response actions taken pursuant to this Consent Decree. Nothing in this Consent Decree shall be construed to allow any dispute by the Settling Defendant regarding the validity of the 2012 ROD Amendment's provisions.

i. An administrative record of the dispute shall be maintained by EPA and shall contain all statements of position, including supporting documentation, submitted pursuant to this Section. Where appropriate, EPA may allow submission of supplemental statements of position by the parties to the dispute.

ii. The Director of the Superfund Division, EPA Region 9, will issue a final administrative decision resolving the dispute based on the administrative record described in Paragraph 66.b(i). This decision shall be binding upon the Settling Defendant, subject only to the right to seek judicial review pursuant to Paragraphs 66.b(iii) and 66.b(iv).

iii. Any administrative decision made by EPA pursuant to Paragraph 66.b(ii) shall be reviewable by this Court, provided that a motion for judicial review of the decision is filed by the Settling Defendant with the Court and served on all Parties within thirty (30) days after receipt of EPA's decision. The motion shall include a description of the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the

schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Consent Decree. The United States may file a response to the Settling Defendant's motion.

iv. In proceedings on any dispute governed by this Paragraph, the Settling Defendant shall have the burden of demonstrating that the decision of the Superfund Division Director is arbitrary and capricious or otherwise not in accordance with law. Judicial review of EPA's decision shall be on the administrative record compiled pursuant to Paragraph 66.b(i).

67. Formal dispute resolution for disputes that neither pertain to the selection or adequacy of any response action nor are otherwise accorded review on the administrative record under applicable principles of administrative law, shall be governed by this Paragraph.

a. The Director of the Superfund Division, EPA Region 9, will issue a final decision resolving the dispute based on the statements of position and reply, if any, served under Paragraph 66. The Superfund Division Director's decision shall be binding on the Settling Defendant unless, within thirty (30) days after receipt of the decision, the Settling Defendant files with the Court and serves on the parties a motion for judicial review of the decision setting forth the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of the Consent Decree. The United States may file a response to the Settling Defendant's motion.

b. Notwithstanding Paragraph M (CERCLA Section 113(j) Record Review of 2012 ROD Amendment and Work) of Section I (Background), judicial review of any dispute governed by this Paragraph shall be governed by applicable principles of law.

68. Dispute Resolution between the State and Settling Defendant. If the Settling Defendant objects to any bill from the State pursuant to this Consent Decree, the State and the Settling Defendant shall attempt to resolve, expeditiously and informally, any such objection.

a. The Settling Defendant shall notify the State in writing of its objection(s) to any bills from the State within twenty (20) days of receipt of the bill, unless the objection(s) has been informally resolved. Such notice shall set forth the specific points of the objection(s), the position the Settling Defendant maintains should be adopted as consistent with the requirements of this Consent Decree, the factual and legal basis for this position, and all matters Settling Defendant considers necessary for the determination by the State. The State and the Settling Defendant shall have thirty (30) working days from the receipt of the written objection(s) to attempt to resolve the dispute. If agreement is reached, the resolution shall be reduced to writing and signed by the Settling Defendant and the State.

b. If the Settling Defendant and the State are unable to reach agreement within this thirty (30) working day period, the matter shall be referred to the Director of the ADEQ Waste Programs Division (Division Director). The State shall provide notice in writing of its position, including the position the State maintains should be adopted as consistent with the requirements of this Consent Decree, the factual and legal basis for this position, and all matters the State considers necessary for the determination by the Division Director. The Settling Defendant may reply to the State's notice of its position within ten (10) days of receipt. The Division Director shall then decide the matter on the basis of those written material and any meeting held between the State and the Settling Defendant.

69. The invocation of formal dispute resolution procedures under this Section shall not extend, postpone, or affect in any way any obligation of the Settling Defendant under this

Consent Decree, except as provided in this Paragraph, as agreed by EPA, or determined by the Court. Stipulated penalties with respect to the disputed matter shall continue to accrue but payment shall be stayed pending resolution of the dispute as provided in Paragraph 74. Notwithstanding the stay of payment, stipulated penalties shall accrue from the first day of noncompliance with any applicable provision of this Consent Decree. In the event that the Settling Defendant does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XX (Stipulated Penalties).

XX. STIPULATED PENALTIES

70. The Settling Defendant shall be liable for stipulated penalties in the amounts set forth in Paragraphs 71 and 72 to the United States for failure to comply with the requirements of this Consent Decree specified below, unless excused under Section XVIII (Force Majeure). "Compliance" by the Settling Defendant shall include completion of all payments and activities required under this Consent Decree, or any plan, report, or other deliverable approved under this Consent Decree, in accordance with all applicable requirements of law, this Consent Decree, the SOW, and any plans, reports, or other deliverables approved under this Consent Decree and within the specified time schedules established by and approved under this Consent Decree. Settling Defendant shall be liable for stipulated penalties to the State for failure to timely pay the State's Future Response Costs.

71. Stipulated Penalty Amounts - Work (Excluding Payments, Plans, Reports, and Other Deliverables).

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in Paragraph 71.b:

Penalty Per Violation Per Day	Period of Noncompliance
$3,000	1st through 14th day
$6,000	15th through 30th day
$15,000	31st day and beyond

b. Compliance Milestones.

i. Failure to timely and adequately select a contractor as required by Paragraph 10;

ii. Failure to perform the Work timely and adequately as set forth in any and all EPA approved plans;

iii. Failure to perform further response actions as required by Paragraph 18;

iv. Failure to provide access as required by Paragraph 24;

v. Failure to secure an access agreement pursuant to Paragraph 25;

vi. Failure to establish or maintain the performance guarantee required by Paragraph 41;

vii. Failure to perform emergency response as required by Paragraph 50; and

viii. Failure to indemnify, save and hold harmless the United States and the State from certain claims as required by Paragraph 57.

72. Stipulated Penalty Amounts – Payments, Plans, Reports, and other Deliverables. The following stipulated penalties shall accrue per violation per day for failure to submit timely or adequate reports or other plans and deliverables, including failure to pay Response Costs or State Future Response Costs, pursuant to the Consent Decree:

Penalty Per Violation Per Day	Period of Noncompliance
$1,500	1st through 14th day
$3,000	15th through 30th day
$8,000	31st day and beyond

73. In the event that EPA assumes performance of a portion or all of the Work pursuant to Paragraph 86 (Work Takeover), the Settling Defendant shall be liable for a stipulated penalty in the amount of $250,000. Stipulated penalties under this Paragraph are in addition to the remedies available under Paragraphs 45 (Funding for Work Takeover) and 86 (Work Takeover).

74. All penalties shall begin to accrue on the day after the complete performance is due or the day a violation occurs and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. However, stipulated penalties shall not accrue: (a) with respect to a deficient submission under Section XI (EPA Approval of Plans, Reports, and Other Deliverables), during the period, if any, beginning on the thirty-first (31st) day after EPA's receipt of such submission until the date that EPA notifies the Settling Defendant of any deficiency; (b) with respect to a decision by the Director of the Superfund Division, EPA Region 9, under Paragraph 66.b or 67.a of Section XIX (Dispute Resolution), during the period, if any, beginning on the twenty-first (21st) day after the date that the Settling Defendant's reply to EPA's Statement of Position is received until the date that the Director

issues a final decision regarding such dispute; or (c) with respect to judicial review by this Court of any dispute under Section XIX (Dispute Resolution), during the period, if any, beginning on the thirty-first (31st) day after the Court's receipt of the final submission regarding the dispute until the date that the Court issues a final decision regarding such dispute. Nothing in this Consent Decree shall prevent the simultaneous accrual of separate penalties for separate violations of this Consent Decree.

75. Following a determination that the Settling Defendant has failed to comply with a requirement of this Consent Decree, EPA or the State may give the Settling Defendant written notification of the same and describe the noncompliance. EPA and the State may send the Settling Defendant a written demand for the payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraph regardless of whether EPA or the State has notified the Settling Defendant of a violation.

76. All penalties accruing under this Section shall be due and payable to the United States or the State within thirty (30) days after the Settling Defendant's receipt from EPA or the State of a demand for payment of the penalties, unless the Settling Defendant invokes the Dispute Resolution procedures under Section XIX (Dispute Resolution) within the thirty (30)-day period. All payments to the United States or the State under this Section shall indicate that the payment is for stipulated penalties and shall be made in accordance with Paragraph 52 (Payments by the Settling Defendant of Response Costs) or 53 (Payments by the Settling Defendant of State Future Response Costs). Penalties shall continue to accrue as provided in Paragraph 74 during any dispute resolution period, but need not be paid until the following:

a. If the dispute is resolved by agreement of the Parties or by a decision of EPA that is not appealed to this Court, accrued penalties determined to be owed shall be paid to

EPA and the State within fifteen (15) days after the agreement or the receipt of EPA's decision or order;

b. If the dispute is appealed to this Court and the United States prevails in whole or in part, the Settling Defendant shall pay all accrued penalties determined by the Court to be owed to EPA and the State within sixty (60) days after receipt of the Court's decision or order, except as provided in Paragraph 76.c;

c. If the District Court's decision is appealed by any Party, the Settling Defendant shall pay all accrued penalties determined by the District Court to be owed to the United States and the State into an interest-bearing escrow account, established at a duly chartered bank or trust company that is insured by the FDIC, within sixty (60) days after receipt of the Court's decision or order. Penalties shall be paid into this account as they continue to accrue, at least every sixty (60) days. Within fifteen (15) days after receipt of the final appellate court decision, the escrow agent shall pay the balance of the account to EPA and the State or to the Settling Defendant to the extent that it prevails.

77. If the Settling Defendant fails to pay stipulated penalties when due, the Settling Defendant shall pay Interest on the unpaid stipulated penalties as follows: (a) if the Settling Defendant has timely invoked dispute resolution such that the obligation to pay stipulated penalties has been stayed pending the outcome of dispute resolution, Interest shall accrue from the date stipulated penalties are due pursuant to Paragraph 76 until the date of payment; and (b) if the Settling Defendant fails to timely invoke dispute resolution, Interest shall accrue from the date of demand under Paragraph 75 until the date of payment. If the Settling Defendant fails to pay stipulated penalties and Interest when due, the United States or the State may institute proceedings to collect the penalties and Interest.

78. The payment of penalties and Interest, if any, shall not alter in any way the Settling Defendant's obligation to complete the performance of the Work required under this Consent Decree.

79. Nothing in this Consent Decree shall be construed as prohibiting, altering, or in any way limiting the ability of the United States or the State to seek any other remedies or sanctions available by virtue of the Settling Defendant's violation of this Consent Decree or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Section 122(l) of CERCLA, 42 U.S.C. § 9622(l), provided, however, that the United States shall not seek civil penalties pursuant to Section 122(l) of CERCLA for any violation for which a stipulated penalty is provided in this Consent Decree, except in the case of a willful violation of this Consent Decree.

80. Notwithstanding any other provision of this Section, the United States and the State may, in their unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Consent Decree.

XXI. COVENANTS BY PLAINTIFFS

81. Covenants for the Settling Defendant by the United States. In consideration of the actions that will be performed and the payments that will be made by the Settling Defendant under this Consent Decree, and except as specifically provided in Paragraphs 82 and 83 (United States' Pre- and Post-Certification Reservations), and 85 (General Reservations of Rights), the United States covenants not to sue or to take administrative action against the Settling Defendant pursuant to Sections 106 and 107(a) of CERCLA relating to performance of the Work and payment of Response Costs. Except with respect to future liability, these covenants shall take effect upon the Effective Date. With respect to future liability, these covenants shall take effect

upon Certification of Completion of Remedial Action by EPA pursuant to Paragraph 47 of Section XIV (Certification of Completion). These covenants are conditioned upon the satisfactory performance by the Settling Defendant of its obligations under this Consent Decree. These covenants extend only to the Settling Defendant and do not extend to any other person.

82. United States' Pre-Certification Reservations. Notwithstanding any other provision of this Consent Decree, the United States reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, and/or to issue an administrative order, seeking to compel the Settling Defendant to perform further response actions relating to the Project Area and/or to pay the United States for additional costs of response if, (a) prior to Certification of Completion of the Remedial Action, (1) conditions at the Project Area, previously unknown to EPA, are discovered, or (2) information, previously unknown to EPA, is received, in whole or in part, and (b) EPA determines that these previously unknown conditions or information together with any other relevant information indicates that the Remedial Action is not protective of human health or the environment.

83. United States' Post-Certification Reservations. Notwithstanding any other provision of this Consent Decree, the United States reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, and/or to issue an administrative order, seeking to compel the Settling Defendant to perform further response actions relating to the Project Area and/or to pay the United States for additional costs of response if, (a) subsequent to Certification of Completion of the Remedial Action, (1) conditions at the Project Area, previously unknown to EPA, are discovered, or (2) information, previously unknown to EPA, is received, in whole or in part, and (b) EPA determines that these previously

unknown conditions or this information together with other relevant information indicates that the Remedial Action is not protective of human health or the environment.

84. For purposes of Paragraph 82 (United States' Pre-Certification Reservations), the information and the conditions known to EPA will include only that information and those conditions known to EPA as of the date the 2012 ROD Amendment was signed and set forth in the 2012 ROD Amendment and the administrative record supporting the 2012 ROD Amendment. For purposes of Paragraph 83 (United States' Post-Certification Reservations), the information and the conditions known to EPA shall include only that information and those conditions known to EPA as of the date of Certification of Completion of the Remedial Action and set forth in the 2012 ROD Amendment, the administrative record supporting the 2012 ROD Amendment, the post-2012 ROD Amendment administrative record, or in any information received by EPA pursuant to the requirements of this Consent Decree prior to Certification of Completion of the Remedial Action.

85. General Reservations of Rights. The United States reserves, and this Consent Decree is without prejudice to, all rights against the Settling Defendant with respect to all matters not expressly included within the United States' covenants. Notwithstanding any other provision of this Consent Decree, the United States reserves all rights against the Settling Defendant with respect to:

a. liability for failure by the Settling Defendant to meet a requirement of this Consent Decree;

b. liability arising from the past, present, or future disposal, release, or threat of release of Waste Material outside of the Project Area;

c. liability based on any future ownership of the Project Area by the Settling Defendant when such ownership commences after signature of this Consent Decree by the Settling Defendant.

d. liability based on the Settling Defendant's transportation, treatment, storage, or disposal, or arrangement for transportation, treatment, storage, or disposal of Waste Material at or in connection with the Site, other than as provided in the 2012 ROD Amendment, the Work, or otherwise ordered by EPA, after signature of this Consent Decree by the Settling Defendant;

e. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

f. criminal liability;

g. liability for violations of federal or state law that occur during or after implementation of the Work;

h. liability for additional response actions that EPA determines are necessary to achieve and maintain Performance Standards or to carry out and maintain the effectiveness of the remedy set forth in the 2012 ROD Amendment, but that cannot be required pursuant to Paragraph 12 (Modification of SOW or Related Work Plans); and

i. liability for costs that the United States will incur regarding the Project Area that are not within the definition of Response Costs.

86. Work Takeover.

a. In the event EPA determines that the Settling Defendant has (1) ceased implementation of any portion of the Work, (2) is seriously or repeatedly deficient or late in its

performance of the Work, or (3) is implementing the Work in a manner that may cause an endangerment to human health or the environment, EPA may issue a written notice ("Work Takeover Notice") to the Settling Defendant. Any Work Takeover Notice issued by EPA will specify the grounds upon which such Notice was issued and will provide Settling Defendant a period of twenty (20) days within which to remedy the circumstances giving rise to EPA's issuance of such Notice.

b. If, after expiration of the twenty (20)-day notice period specified in Paragraph 86.a, the Settling Defendant has not remedied to EPA's satisfaction the circumstances giving rise to EPA's issuance of the relevant Work Takeover Notice, EPA may at any time thereafter assume the performance of all or any portion(s) of the Work as EPA deems necessary ("Work Takeover"). EPA will notify the Settling Defendant in writing (which writing may be electronic) if EPA determines that implementation of a Work Takeover is warranted under this Paragraph. Funding of Work Takeover costs is addressed under Paragraph 45.

c. The Settling Defendant may invoke the procedures set forth in Paragraph 66.b (Record Review), to dispute EPA's implementation of a Work Takeover under Paragraph 86.b. However, notwithstanding the Settling Defendant's invocation of such dispute resolution procedures, and during the pendency of any such dispute, EPA may in its sole discretion commence and continue a Work Takeover under Paragraph 86.b. until the earlier of (1) the date that the Settling Defendant remedies, to EPA's satisfaction, the circumstances giving rise to EPA's issuance of the relevant Work Takeover Notice, or (2) the date that a final decision is rendered in accordance with Paragraph 66.b (Record Review) requiring EPA to terminate such Work Takeover. Notwithstanding any other provision of this Consent Decree, the United States

and the State retain all authority and reserve all rights to take any and all response actions authorized by law.

87. Covenant Not To Sue by the State. In consideration of the actions that will be performed and the payments that will be made by Settling Defendant under the terms of this Consent Decree and except as otherwise specifically provided in this Consent Decree or by A.R.S. § 49-292(B), the State, including ADEQ, covenants not to sue or to take administrative action against Settling Defendant pursuant to Section 107(a) of CERCLA, 42 U.S.C. §§ 9607(a) or A.R.S. § 49-285 for performance of the Work and for recovery of State Future Response Costs. This covenant not to sue shall take effect upon the Effective Date and is conditioned upon the complete and satisfactory performance by Respondent of all obligations under this Consent Decree. This covenant not to sue extends only to Settling Defendant and does not extend to any other person.

88. The covenant not to sue does not pertain to any matters other than those expressly identified therein. The State reserves, and this Consent Decree is without prejudice to, all rights against Settling Defendant with respect to all other matters, including, but not limited to:

a. claims based on conditions at the Site, previously unknown to the State, are discovered;

b. claims based on information, previously unknown to the State, is received, in whole or in part, and ADEQ determines that these previously unknown conditions or information together with any other relevant information indicates that the Work is not protective of public health, welfare or the environment;

c. claims based on a failure by the Settling Defendant to meet a requirement of this Consent Decree;

d. criminal liability;

e. liability under CERCLA, or any other federal or state law arising from the acts or omissions of Settling Defendant that are taken after the Effective Date.

XXII. COVENANTS BY THE SETTLING DEFENDANT

89. Covenants by the Settling Defendant. Subject to the reservations in Paragraph 91, the Settling Defendant covenants not to sue and agrees not to assert any claims or causes of action against the United States or the State with respect to the Project Area, and this Consent Decree, including, but not limited to:

a. any direct or indirect claim for reimbursement from the EPA Hazardous Substance Superfund through CERCLA Sections 106(b)(2), 107, 111, 112 or 113, or any other provision of law;

b. any claims under CERCLA Sections 107 or 113, RCRA Section 7002(a), 42 U.S.C. § 6972(a), or state law regarding the Project Area and this Consent Decree; or

c. any claims arising out of response actions at or in connection with the Project Area including any claim under the United States Constitution, the State Constitution, the Tucker Act, 28 U.S.C. §1491, the Equal Access to Justice Act, 28 U.S.C. § 2412, or at common law.

90. Except as provided in Paragraph 102 (Res Judicata and Other Defenses), the covenants in this Section shall not apply if the United States or the State brings a cause of action or issues an order pursuant to any of the reservations in Section XXI (Covenants by Plaintiffs),

other than in Paragraphs 88.c (claims based on a failure by the Settling Defendant to meet a requirement of this Consent Decree), 88.d (criminal liability), and 88.e (violations of federal/state law during or after implementation of the Work), but only to the extent that the Settling Defendant's claims arise from the same response action, response costs, or damages that the United States or the State is seeking pursuant to the applicable reservation.

91. The Settling Defendant reserves, and this Consent Decree is without prejudice to, claims against the United States, subject to the provisions of Chapter 171 of Title 28 of the United States Code, and brought pursuant to any statute other than CERCLA or RCRA and for which the waiver of sovereign immunity is found in a statute other than CERCLA or RCRA, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the United States, as that term is defined in 28 U.S.C. § 2671, while acting within the scope of his or her office or employment under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred. However, the foregoing shall not include any claim based on EPA's selection of response actions, or the oversight or approval of the Settling Defendant's plans, reports, other deliverables or activities. Nothing in this Consent Decree shall be deemed to constitute preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

XXIII. EFFECT OF SETTLEMENT; CONTRIBUTION

92. Nothing in this Consent Decree shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Consent Decree. Each of the Parties expressly reserves any and all rights (including, but not limited to, rights pursuant to Section 113 of CERCLA, 42 U.S.C. § 9613), defenses, claims, demands, and causes of action that each Party

may have with respect to any matter, transaction, or occurrence relating in any way to the Project Area against any person not a Party hereto. Nothing in this Consent Decree diminishes the right of the United States, or the State, pursuant to Section 113(f)(2) and (3) of CERCLA, 42 U.S.C. § 9613(f)(2)-(3), to pursue any such persons to obtain additional response costs or response action and to enter into settlements that give rise to contribution protection pursuant to Section 113(f)(2).

93. The Parties agree, and by entering this Consent Decree this Court finds, that this Consent Decree constitutes a judicially approved settlement pursuant to which the Settling Defendant has, as of the Effective Date, resolved liability to the United States within the meaning of Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613(f)(2), and is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Section 113(f)(2) of CERCLA, or as may be otherwise provided by law, for "matters addressed" in this Consent Decree. The "matters addressed" in this Consent Decree are the Work, Response Costs, and State Future Response Costs, provided, however, that if the United States or the State exercises rights under the reservations in Section XXI (Covenants by Plaintiffs), other than in Paragraphs 88.c (claims based on a failure by the Settling Defendant to meet a requirement of this Consent Decree), 88.d (criminal liability), or 88.e (violations of federal/state law during or after implementation of the Work), the "matters addressed" in this Consent Decree will no longer include those response costs or response actions that are within the scope of the exercised reservation.

94. The Parties agree that as of the Effective Date of this Consent Decree, the obligations of the Parties under the 1990 Consent Decree shall terminate.

95. The Parties further agree, and by entering this Consent Decree this Court finds, that the complaint filed by the United States in this action is a civil action within the meaning of Section 113(f)(1) of CERCLA, 42 U.S.C. § 9613(f)(1), and that this Consent Decree constitutes a judicially approved settlement pursuant to which the Settling Defendant has, as of the Effective Date, resolved liability to the United States within the meaning of Section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B).

96. The Settling Defendant shall, with respect to any suit or claim brought by it for matters related to this Consent Decree, notify the United States and the State in writing no later than sixty (60) days prior to the initiation of such suit or claim.

97. The Settling Defendant shall, with respect to any suit or claim brought against it for matters related to this Consent Decree, notify in writing the United States and the State within ten (10) days after service of the complaint on such Settling Defendant. In addition, each Settling Defendant shall notify the United States and the State within ten (10) days after service or receipt of any Motion for Summary Judgment and within ten (10) days after receipt of any order from a court setting a case for trial.

98. Res Judicata and Other Defenses. In any subsequent administrative or judicial proceeding initiated by the United States or the State for injunctive relief, recovery of response costs, or other appropriate relief relating to the Project Area, the Settling Defendant shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States or the State in the subsequent proceeding were or should have been brought in the instant case; provided, however, that nothing in this

Paragraph affects the enforceability of the covenants not to sue set forth in Section XXI (Covenants by Plaintiffs).

XXIV. ACCESS TO INFORMATION

99. The Settling Defendant shall provide to EPA and the State, upon request, copies of all records, reports, documents, and other information (including records, reports, documents, and other information in electronic form) (hereinafter referred to as "Records") within its possession or control or that of their contractors or agents relating to activities at the Site or to the implementation of this Consent Decree, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information regarding the Work. The Settling Defendant shall also make available to EPA and the State, for purposes of investigation, information gathering, or testimony, their employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

100. Business Confidential and Privileged Documents.

a. The Settling Defendant may assert business confidentiality claims covering part or all of the Records submitted to Plaintiffs under this Consent Decree to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). The Settling Defendant shall segregate and clearly identify all Records or parts thereof submitted under this Consent Decree for which the Settling Defendant asserts business confidentiality claims. Records determined to be confidential by EPA will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies Records when they are submitted to EPA and the State, or if EPA has notified the Settling Defendant that the Records are not confidential under the standards of Section 104(e)(7)

of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such Records without further notice to the Settling Defendant.

b. The Settling Defendant may assert that all or part of a Record is privileged or protected as provided by federal law. If the Settling Defendant asserts such a privilege in lieu of providing Records, it shall provide Plaintiffs with the following: (1) the title of the Record; (2) the date of the Record; (3) the name, title, affiliation (e.g., company or firm), and address of the author of the Record; (4) the name and title of each addressee and recipient; (5) a description of the contents of the Record; and (6) the privilege asserted by the Settling Defendant. If a claim of privilege applies only to a portion of a Record, the Record shall be provided to the United States in redacted form to mask the privileged portion only. The Settling Defendant shall retain all Records that it claims to be privileged until the United States has had a reasonable opportunity to dispute the privilege claim and any such dispute has been resolved in the Settling Defendant's favor.

101. No claim of privilege or protection shall be made with respect to: (a) any data, regarding the Site, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, radiological or engineering data; or (b) the portion of any other the Settling Defendant is required to create or generate pursuant to this Consent Decree.

XXV. RETENTION OF RECORDS

102. Until ten (10) years after the Settling Defendant's receipt of EPA's notification pursuant to Paragraph 48 (Completion of the Work), the Settling Defendant shall preserve and retain all non-identical copies of Records (including Records in electronic form) now in its possession or control or that come into its possession or control that relate in any manner to its liability under CERCLA with respect to the Site, provided, however, that the Settling Defendant

who is potentially liable as an owner or operator of the Site must retain, in addition, all Records that relate to the liability of any other person under CERCLA with respect to the Site. The Settling Defendant must also retain, and instruct its contractors and agents to preserve, for the same period of time specified above all non-identical copies of the last draft or final version of any Records (including Records in electronic form) now in its possession or control or that come into its possession or control that relate in any manner to the performance of the Work, provided, however, that the Settling Defendant (and its contractors and agents) must retain, in addition, copies of all data generated during the performance of the Work and not contained in the aforementioned Records required to be retained. Each of the above record retention requirements shall apply regardless of any corporate retention policy to the contrary.

103. At the conclusion of this record retention period, the Settling Defendant shall notify the United States and the State at least ninety (90) days prior to the destruction of any such Records, and, upon request by the United States or the State, the Settling Defendant shall deliver any such Records to EPA or the State. The Settling Defendant may assert that certain Records are privileged under the attorney-client privilege or any other privilege recognized by federal law. If the Settling Defendant asserts such a privilege, it shall provide Plaintiffs with the following: (a) the title of the Record; (b) the date of the Record; (c) the name, title, affiliation (e.g., company or firm), and address of the author of the Record; (d) the name and title of each addressee and recipient; (e) a description of the subject of the Record; and (f) the privilege asserted by the Settling Defendant. If a claim of privilege applies only to a portion of a Record, the Record shall be provided to the United States in redacted form to mask the privileged portion only. The Settling Defendant shall retain all Records that it claims to be privileged until the United States has had a reasonable opportunity to dispute the privilege claim and any such

dispute has been resolved in the Settling Defendant's favor. However, no Records created or generated pursuant to the requirements of this Consent Decree shall be withheld on the grounds that they are privileged or confidential.

104. The Settling Defendant certifies that, to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed, or otherwise disposed of any Records (other than identical copies) relating to its potential liability regarding the Site since the earlier of notification of potential liability by the United States or the State or the filing of suit against it regarding the Site and that it has fully complied with any and all EPA and State requests for information regarding the Site pursuant to Sections 104(e) and 122(e) of CERCLA, 42 U.S.C. §§ 9604(e) and 9622(e), and Section 3007 of RCRA, 42 U.S.C. § 6927, and state law.

XXVI. NOTICES AND SUBMISSIONS

105. Whenever, under the terms of this Consent Decree, written notice is required to be given or a report or other document is required to be sent by one Party to another, it shall be directed to the individuals at the addresses specified below, unless those individuals or their successors give notice of a change to the other Parties in writing. All notices and submissions shall be considered effective upon receipt, unless otherwise provided. Notices required to be sent to EPA, and not to the United States, under the terms of this Consent Decree should not be sent to the U.S. Department of Justice. Except as otherwise provided, notice to a Party by email (if that option is provided below) or by regular mail in accordance with this Section satisfies any notice requirement of the Consent Decree regarding such Party.

As to the United States: EES Case Management Unit
Environment and Natural Resources Division

	U.S. Department of Justice P.O. Box 7611 Washington, D.C. 20044-7611 eescdcopy.enrd@usdoj.gov Re: DJ # 90-11-3-369
As to EPA:	Mary Aycock, Remedial Project Manager United States Environmental Protection Agency Region 9 75 Hawthorne St. (SFD 6-2) San Francisco, CA 94105 aycock.mary@epa.gov
As to the Regional Financial Management Officer:	David Wood United States Environmental Protection Agency Region 9 75 Hawthorne St. San Francisco, CA 94105 wood.david@epa.gov
As to the State:	William J. Ellet Superfund Program Unit Manager Arizona Department of Environmental Quality

Southern Regional Office

400 West Congress Street, Ste. 433

Tucson, Arizona 85701

As to the Settling Defendant: Joe Bauer, Project Coordinator

Texas Instruments Tucson Corporation

13350 TI Boulevard, MS 329

Dallas, Texas 75243

XXVII. RETENTION OF JURISDICTION

106. This Court retains jurisdiction over both the subject matter of this Consent Decree and the Settling Defendant for the duration of the performance of the terms and provisions of this Consent Decree for the purpose of enabling any of the Parties to apply to the Court at any time for such further order, direction, and relief as may be necessary or appropriate for the construction or modification of this Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with Section XIX (Dispute Resolution).

XXVIII. APPENDICES

107. The following appendices are attached to and incorporated into this Consent Decree:

"Appendix A" is the 2012 ROD Amendment.

"Appendix B" is the map of the Texas Instruments Project Area/ TIAA Site-Tucson, Arizona.

"Appendix C" is the SOW.

"Appendix D" is the performance guarantee.

XXIX. COMMUNITY INVOLVEMENT

108. If requested by EPA or the State, the Settling Defendant shall participate in community involvement activities pursuant to the Community Involvement Plan to be developed by EPA. EPA will determine the appropriate role for the Settling Defendant under the Community Involvement Plan. The Settling Defendant shall also cooperate with EPA and the State in providing information regarding the Work to the public (e.g., participate in activities associated with the Unified Community Advisory Board and their associated meetings). As requested by EPA or the State, the Settling Defendant shall participate in the preparation of such information for dissemination to the public and in public meetings that may be held or sponsored by EPA or the State to explain activities at or relating to the Site. Costs incurred by the United States under this Section, including the costs of any technical assistance grant under Section 117(e) of CERCLA, 42 U.S.C. § 9617(e), shall be considered Future Response Costs that the Settling Defendant shall pay pursuant to Section XVI (Payments for Response Costs).

XXX. MODIFICATION

109. Except as provided in Paragraph 12 (Modification of SOW or Related Work Plans), material modifications to this Consent Decree, including the SOW, shall be in writing, signed by the United States and the Settling Defendant, and shall be effective upon approval by the Court. Except as provided in Paragraph 12, non-material modifications to this Consent Decree, including the SOW, shall be in writing and shall be effective when signed by duly authorized representatives of the United States and the Settling Defendant. A modification to the SOW shall be considered material if it implements a ROD amendment that fundamentally alters the basic features of the selected remedy within the meaning of 40 C.F.R. § 300.435(c)(2)(ii).

All modifications to the Consent Decree, other than the SOW, also shall be signed by the State, or a duly authorized representative of the State, as appropriate. Before providing its approval to any modification to the SOW, the United States will provide the State with a reasonable opportunity to review and comment on the proposed modification.

110. Nothing in this Consent Decree shall be deemed to alter the Court's power to enforce, supervise, or approve modifications to this Consent Decree.

XXXI. LODGING AND OPPORTUNITY FOR PUBLIC COMMENT

111. This Consent Decree shall be lodged with the Court for a period of not less than thirty (30) days for public notice and comment in accordance with Section 122(d)(2) of CERCLA, 42 U.S.C. § 9622(d)(2), and 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations that indicate that the Consent Decree is inappropriate, improper, or inadequate. The Settling Defendant consents to the entry of this Consent Decree without further notice.

112. If for any reason the Court should decline to approve this Consent Decree in the form presented, this agreement is voidable at the sole discretion of any Party and the terms of the agreement may not be used as evidence in any litigation between the Parties.

XXXII. SIGNATORIES/SERVICE

113. Each undersigned representative of the Settling Defendant to this Consent Decree and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice and the Director of the Waste Programs Division of the Arizona Department of Environmental Quality certifies that he or she is fully authorized to enter into the

terms and conditions of this Consent Decree and to execute and legally bind such Party to this document.

114. The Settling Defendant agrees not to oppose entry of this Consent Decree by this Court or to challenge any provision of this Consent Decree unless the United States has notified the Settling Defendant in writing that it no longer supports entry of the Consent Decree.

115. The Settling Defendant shall identify, on the attached signature page, the name, address, and telephone number of an agent who is authorized to accept service of process by mail on behalf of that Party with respect to all matters arising under or relating to this Consent Decree. The Settling Defendant agrees to accept service in that manner and to waive the formal service requirements set forth in Rule 4 of the Federal Rules of Civil Procedure and any applicable local rules of this Court, including, but not limited to, service of a summons. The Settling Defendant need not file an answer to the complaint in this action unless or until the Court expressly declines to enter this Consent Decree.

XXXIII. FINAL JUDGMENT

116. This Consent Decree and its appendices constitute the final, complete, and exclusive agreement and understanding among the Parties regarding the settlement embodied in the Consent Decree. The Parties acknowledge that there are no representations, agreements, or understandings relating to the settlement other than those expressly contained in this Consent Decree.

117. Upon entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment between and among the United States, the State, and the Settling Defendant. The Court enters this judgment as a final judgment under Fed. R. Civ. P. 54 and 58.

DATED this day of _____, 20__.

_____

United States District Judge

Signature Page for Consent Decree regarding the Tucson International Airport Area Superfund Site

FOR THE UNITED STATES OF AMERICA:

6/15/15
Date

PATRICIA L. HURST
Senior Counsel
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611

Signature Page for Consent Decree regarding the Tucson International Airport Area Superfund Site

FOR THE ENVIRONMENTAL PROTECTION AGENCY

8 June 2015

Date

Enrique Manzanilla
Director, Superfund Division, Region 9
U.S. Environmental Protection Agency
75 Hawthorne St.
San Francisco, CA 94105

R. Reynolds

Rebekah Reynolds
Assistant Regional Counsel, Region 9
U.S. Environmental Protection Agency
75 Hawthorne St.
San Francisco, CA 94105

Signature Page for Consent Decree regarding the Tucson International Airport Area Superfund Site

FOR THE STATE OF ARIZONA:

6/8/15
Date

Laura Malone

LAURA MALONE
Division Director
Waste Programs Division
Arizona Department of Environmental Quality
110 West Washington Street
Phoenix, AZ 85007

Signature Page for Consent Decree regarding the Tucson International Airport Area Superfund Site

FOR TEXAS INSTRUMENTS TUCSON CORPORATION

May 14, 2015
Date

Bart T. Thomas
Secretary
Texas Instruments Tucson Corporation

Agent Authorized to Accept Service on Behalf of Above-signed Party:

CT Corporation
3800 North Central Ave., Suite 460
Phoenix, AZ 85012
(602) 248-1145

SDMS DOCID# 1132884

RECORD OF DECISION AMENDMENT

TUCSON INTERNATIONAL AIRPORT AREA SUPERFUND SITE AREA B

United States Environmental Protection Agency
Region 9
San Francisco, CA

EPA ID: AZD980737530

April 2012

Contents

Appendixes

Figures

Tables

Acronyms and Abbreviations

µg/L	micrograms per liter
1,1-DCE	1,1-dichloroethene
A&Ww	Aquatic and Wildlife (warm water fishery)
A.R.S	Arizona Revised Statutes
AAC	Arizona Administrative Code
AANG	Arizona Air National Guard
ADEQ	Arizona Department of Environmental Quality
APP	Arizona Aquifer Protection
ARARs	applicable or relevant and appropriate requirements
AWQS	Aquifer Water Quality Standards
bgs	below ground surface
BHHRA	Baseline Human Health Risk Assessment for the Tucson International Airport Area Site
CAA	Clean Air Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
COC	Contaminants of Concern
COPC	Contaminant of Potential Concern
CWA	Clean Water Act
ELCR	excess lifetime cancer risk
EPA	United States Environmental Protection Agency
EPC	exposure point concentrations
FAA	Federal Aviation Administration
GAC	granular activated carbon
GWETRS	groundwater extraction, treatment and recharge system
HBGL	Human Health-Based Guidance Levels
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
ISCO	in-situ chemical oxidation
LSU	lower subunit

MCL	maximum contaminant level
MCLG	maximum contaminant level goals
MNA	monitored natural attenuation
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
O&M	operation and maintenance
PCE	tetrachloroethene
PRB	permeable reactive barrier
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RSL	regional screening levels
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SGZ	shallow groundwater zones
SIP	State Implementation Plans
SRL	soil remediation level
SVE	soil vapor extraction
TBC	to be considered
TCE	trichloroethene
TI	Texas Instruments (former Burr-Brown facility)
TIAA	Tucson International Airport Area
UCAB	Unified Community Advisory Board
UIC	Criteria and standards for the Underground Injection Control
USU	upper subunit
VGAC	vapor-phase granular activated carbon
VOC	volatile organic compounds
WQARF	Water Quality Assurance Revolving fund

PART I. DECLARATION FOR THE RECORD OF DECISION AMENDMENT

1) Site Name and Location

- Tucson International Airport Area (TIAA) Superfund Site
- CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Act of 1980) ID: AZD980737530
- TIAA Superfund Site Area B is the Site Name and it is collectively the groundwater project areas known as the West-Cap Site, Texas Instruments Site formerly known as Burr Brown, Arizona Air National Guard (AANG) 162nd Fighter Wing Site, and West Plume B Site
- Tucson, Arizona

2) Statement Basis and Purpose

This decision document amends the original Record of Decision (ROD) that was signed on August 22, 1988, for the TIAA Superfund Site which is a mixture of Federal Facilities, private, and Fund lead sites. The original 1988 ROD addresses groundwater contamination north of Los Reales Road in Area A and all of the contamination in Area B. This ROD Amendment presents a revised U.S. Environmental Protection Agency (EPA) Remedial Action that amends EPA's Selected Remedy for the Area B portion of the TIAA Superfund Site in accordance with the Comprehensive Environmental Response Compensation and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) and to the extent practicable the National Contingency Plan (NCP). The decisions set forth in this document are based on information contained in the Administrative Record for this Site. The State of Arizona concurs with the selected remedy.

3) Assessment of the Site

The original response action for the Site included the pumping and treating of contaminated groundwater and was successful in containing the groundwater and inhibiting the migration of contaminated groundwater to other areas. However, the response action was not effective in treating the source areas of contamination in a timely manner. Source areas with residual contamination mass have persisted in the groundwater at the Site and contamination levels in groundwater remain above clean-up standards.

The response actions selected in this ROD Amendment are necessary to protect human health from actual or threatened releases of hazardous substances in the environment.

4) Description of the Revised Remedy

The main components of the original 1988 remedy, which applied to all of Area B, included:

- Groundwater pumping from extraction wells;
- Air stripping and Granular Activated Carbon for treatment of contaminated groundwater;

- Beneficial use of treated groundwater either through use of treated water in industrial operations, irrigation, or reinjection into the aquifer; and
- Groundwater Monitoring.

The revised remedy replaces the original remedy in TIAA Superfund Site Area B (groundwater extraction and treatment) with:

- In-Situ Chemical Oxidation (ISCO) using potassium permanganate injected in source areas of contamination and other strategic locations described in the Decision Summary as residual volatile organic compound (VOC) areas at the West-Cap Site, Texas Instruments (TI) Site, and Arizona Air National Guard (AANG) Site;
- Monitored Natural Attenuation (MNA) at the West Plume B;
- Groundwater Monitoring; and
- Institutional Controls.

5) Statutory Determinations

The revised remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. The revised remedy satisfies the statutory preference for treatment as a principal element of the remedy as it uses potassium permanganate that permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substances.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure, the statutory review cycle triggered by the original remedial action will continue to ensure that the remedy is protective of human health and the environment. The next Five-Year Review for the Site is required in 2013.

6) ROD Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of concern and their respective concentrations
- Baseline risk represented by the chemicals of concern
- Cleanup levels established for chemicals of concern and the basis for these levels
- How source materials constituting principal threats are addressed
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD

- Potential land and ground-water use that will be available at the Site as a result of the Selected Remedy
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected
- Key factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision)

7) Authorizing Signature

Claire Trombadore acting for 4/20/2012

Clancy Tenley, Assistant Director — Date

Superfund Division

Partnerships, Land Revitalization, and Clean Up Branch

U.S. Environmental Protection Agency, Region 9

PART II: DECISION SUMMARY

This Decision Summary provides a description of the TIAA Superfund Site and the analyses that led to the amendment of the selected remedy for the Site. It includes background information about the Site, the nature and extent of contamination found at the Site, the assessment of human health and environmental risks posed by the contaminants at the Site, and the identification and evaluation of remedial action alternatives for the Site.

1) Site Name, Location, and Brief Description

In 1981, volatile organic compounds (VOCs) were detected in City of Tucson drinking water wells in the vicinity of the Tucson Airport that resulted in the establishment of the Tucson International Airport Area (TIAA) Superfund Site (Figure 1). For the purpose of investigating and remediating groundwater contamination, EPA divided this Site into two geographic areas: (1) TIAA Superfund Site Area A, which comprises the main groundwater contamination plume located to the west of the Airport, and (2) TIAA Superfund Site Area B, which includes the West Plume B, Arizona Air National Guard, Texas Instruments and former West-Cap project areas, located to the north and west of the airport (Figure 2). This ROD Amendment is restricted to TIAA Superfund Site Area B. EPA is the lead agency for TIAA Superfund Site Area B with the Arizona Department of Environmental Quality (ADEQ) in the support role. The CERCLIS ID is AZD980737530.

2) Site History and Enforcement Activities

In 1981, VOCs, including trichloroethene (TCE), which had been used as solvents by industries at and near the Airport, were detected in the City of Tucson drinking water wells. In 1982, EPA began investigating groundwater contamination in the proposed TIAA Site area. In September 1983, EPA placed the TIAA Site on the National Priorities List.

In 1985, the U.S. Air Force adopted a remedy to address the groundwater contamination associated with Air Force Plant 44, which is located south of Los Reales Road. Three years later, in August 1988, EPA signed a Record of Decision (ROD) identifying groundwater extraction and treatment as the remedy to address the groundwater contamination for the balance of the TIAA Superfund Site, which includes both Area A and Area B. The 1988 ROD explained that the assumptions made regarding Area B were preliminary and were subject to further investigation (Table 1). The ROD indicated that the ground water extraction and treatment remedy for Area B could require some modification as additional information was gathered as the same level of protection of human health and the environment and the same level of compliance with applicable or relevant and appropriate requirements (ARARs) as the remedy selected in the 1988 ROD. Remedial Investigations for Area B were not completed.

The major CERCLA milestones for the Area B portion of the TIAA Superfund Site work are summarized below in Table 1.

TABLE 1
Summary of CERCLA Milestones for Area B
Tucson International Airport Area Superfund Site—Area B

Year	Document or Milestone	Key Points
1988	Record of Decision for the TIAA Superfund Site	Pump-and-treat technology was selected as the remedial action for treatment of TCE to 1.5 micrograms per liter (µg/L) at Area B.
1992	TI Remedial Action	Pump-and-treat system was installed at TI.
1994/1995	AANG Remedial Investigation	Investigation of all potential TCE sources at the AANG. Results identified an upgradient source for TCE-impacted groundwater, and a confirmed source at Site 5.
1996	ROD for AANG Site 5 Soils	Soil vapor extraction (SVE) was selected as the remedy for Site 5 soils.
1996/1997	West-Cap RI and Phase II RI	Results indicated a TCE source near former Building A on West-Cap property.
1997	AANG Groundwater Remedial Action	Pump-and-treat system was installed at the AANG to prevent offsite migration of TCE-impacted groundwater.
1997	AANG Site 5 Remedial Action	SVE system was installed at Site 5 to remediate TCE-impacted soil.
1997	Explanation of Significant Differences	Remedial action for the AANG was modified and the federal Safe Drinking Water Act MCLs were adopted as the standards for groundwater re-injected into the regional aquifer.
1998	AANG Site 5 Closure Report	Remediation of Site 5 soils was determined to be complete and the closure recommendation was approved by EPA and Arizona Department of Environment Quality (ADEQ).
1998	West-Cap Groundwater Treatment Pilot Test	Pump-and-treat of TCE-impacted groundwater at West-Cap was pilot tested by the installation of a several extraction wells and a pipeline to the TI pump-and-treat system. The pilot test ran intermittently for several years.
1999	West-Cap Soil Vapor Extraction Pilot Test	A pilot-scale SVE system was implemented to address TCE-impacted soil.
2002	West Plume B RI/FS	Results identified an upper subunit TCE plume. Source of contamination identified south of Los Reales at the AANG. No sources were identified within West Plume B.
2004	ROD Amendment	Remedial action for West-Cap was modified, and pump-and-treat was selected as the remedial action for West Plume B. RAOs for Area B were documented.
2009-2012	ISCO (in-situ chemical oxidation) Pilot Tests at 162nd Fighter Wing, West-Cap, and TI	ISCO pilot tests that evaluated the effectiveness of potassium permanganate at treating TCE were conducted at the AANG, West-Cap, and TI Sites.

FIGURE 1
Map of Tucson International Airport Area Superfund Site
Tucson International Airport Area Superfund Site—Area B

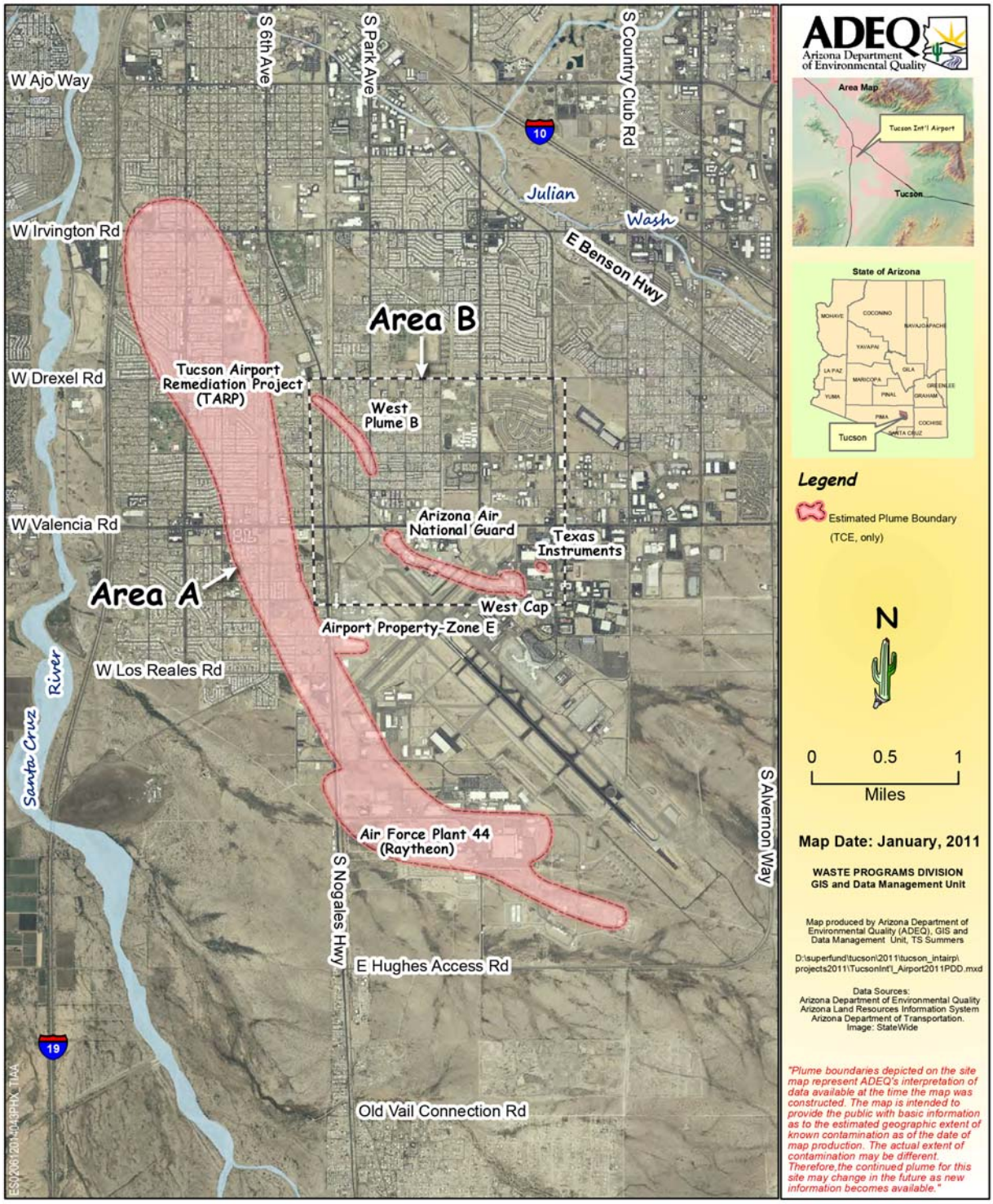
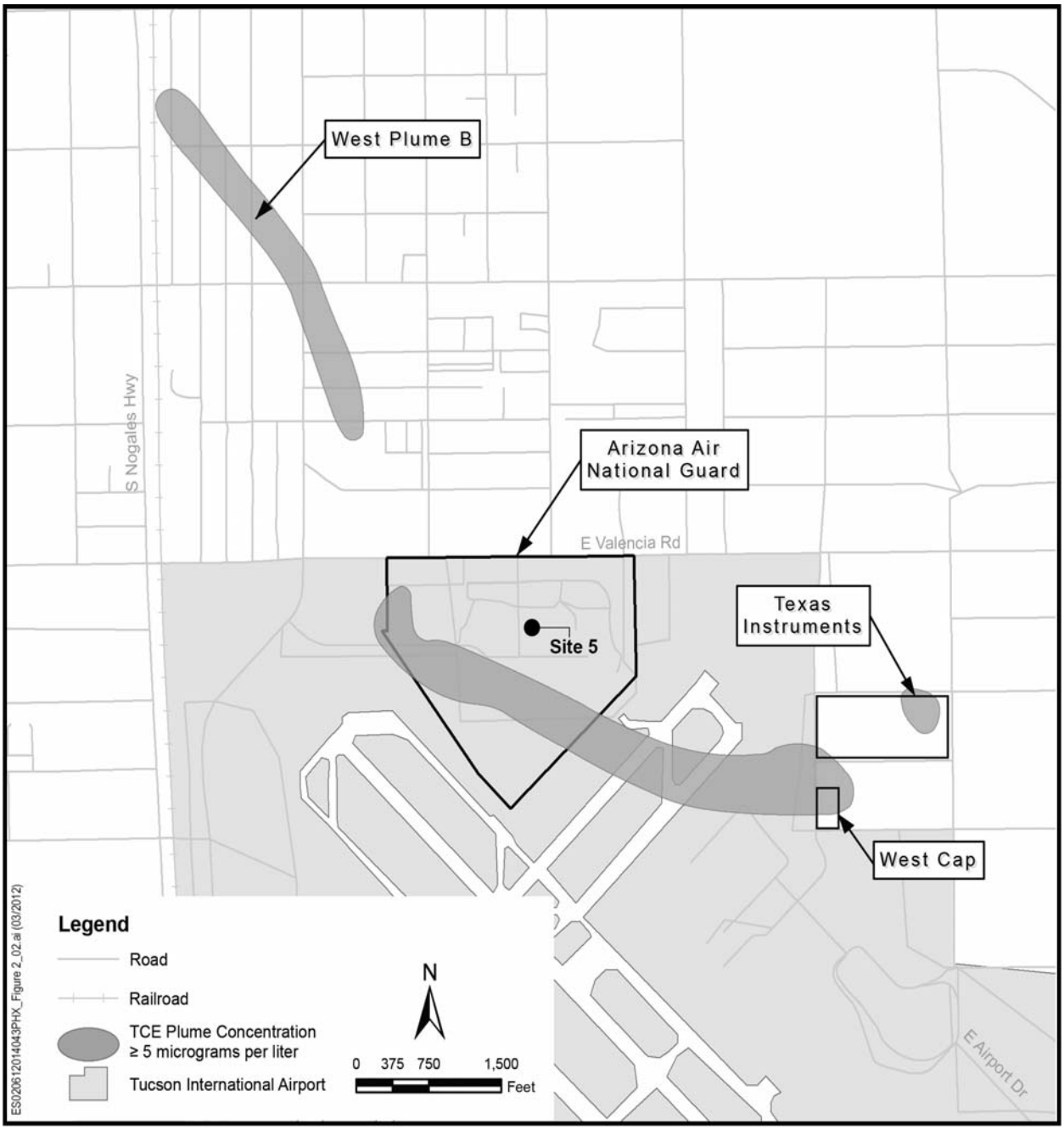


FIGURE 2
Map of Area B of the TIAA Superfund Site
Tucson International Airport Area Superfund Site—Area B



The history of the individual Sites within the TIAA Superfund Site Area B are as follows:

- **West Plume B:** This site includes elevated levels of VOCs in the groundwater and is considered to be the result of past migration of VOCs downgradient from the Arizona Air National Guard property. Operation of a groundwater extraction and treatment system at the Arizona Air National Guard has stopped this continued migration from the property and separated the Arizona Air National Guard and West Plume B plumes. No active treatment has taken place at the West Plume B Site. Remediation of upgradient Sites has removed the input of VOCs to the West Plume B area and VOC concentrations have been decreasing for almost 10 years due to natural attenuation. In 2004, a ROD Amendment for TIAA Superfund Site Area B was issued which recognized that MNA was a potential remedy for West Plume B and required more data to be collected. This ROD Amendment identifies MNA as the final remedy for the West Plume B Site.
- **Arizona Air National Guard 162nd Fighter Wing:** The base became operational in 1956. The property is currently used to provide aircraft training to fighter pilots from around the world. Operations also include aircraft and ground vehicle maintenance. Remedial investigations performed in 1987 identified TCE-impacted groundwater at the West Base Parking Lot, the Old Wash Rack Area A (also known as Site 5), and near the edges of the Aircraft Parking Area. A source of VOC contamination was identified at Site 5. These investigations were unable to determine potential historical contamination impacts at other locations. An extended soil vapor extraction (SVE) pilot test was conducted at Site 5 between April and November 1997. Results of soil gas samples collected after operations of the vapor extraction system indicated that VOC levels in soil gas were reduced to concentrations below the target cleanup goal, and Site 5 was closed in October 1998.

  A Federal Facilities Agreement with EPA, the Arizona Department of Environmental Quality, and the National Guard Bureau was signed in 1994. The groundwater extraction, treatment, and recharge system (GWETRS) was installed at the Arizona Air National Guard (AANG) property in May 1997 to capture and treat elevated levels of the TCE in groundwater and to prevent offsite migration. Groundwater is removed from up to 11 extraction wells, treated with an air stripping system, and re-injected into the vadose zone (the soil layer above the saturated groundwater zone). The air stripping system transfers the VOCs from the groundwater as a vapor and treats the vapor with a carbon adsorption vessel that removes the TCE before discharging the vapor into the atmosphere.

  An in-situ chemical oxidation pilot test was initiated in 2009 to evaluate the effectiveness of potassium permanganate in mitigating TCE in groundwater. The results of the pilot test between 2009 and 2012 indicated that the permanganate effectively mitigated TCE in groundwater, as TCE concentrations decreased in both the upper and lower subunits of the pilot test area. Continued monitoring will be necessary to assess the long-term performance of in-situ chemical oxidation.

- **Texas Instruments (TI):** The TI Site, formerly operated by Burr-Brown Corporation, operated a microchip manufacturing facility between 1969 and 2009. The presence of VOCs in soil and groundwater beneath the manufacturing facility has been attributed to past operational and disposal practices, particularly those related to former chemical storage areas. A consent decree between EPA and Burr Brown Corporation for the obligations of the response action was entered in 1990. A groundwater extraction and treatment system operated at the Texas Instruments (TI) Site between 1992 and 2009. A pilot test using permanganate was initiated in 2009, and the results between 2009 and 2012 indicated the successful delivery and the oxidation of VOCs in the target zone.

- **West-Cap:** From the early 1960s to the late 1980s the former West-Cap property, located adjacent to the Tucson International Airport, was occupied by the West-Cap of Arizona Corporation, which used solvents during manufacturing of small film capacitors and magnets. It is believed that West-Cap disposed of solvents into floor drains, which subsequently leaked into the soil. The West-Cap of Arizona Corporation dissolved through bankruptcy.

  In early 1998, EPA initiated a time critical removal action for the remediation of the groundwater plume below the West-Cap project area, as the plume was migrating off-site. Contaminated groundwater was extracted and pumped to the treatment system at the Texas Instruments property. Groundwater extraction was discontinued because the existing system was not designed to treat the additional volume and increases in concentrations of contamination that resulted from the installation of additional extraction wells at West-Cap. The use of permanganate to break down TCE in groundwater was tested beginning in 2009 and the results between 2009 and 2012 indicated the successful delivery of potassium permanganate and the oxidation of the contaminants of concern (COCs) in the target zone.

3) Community Participation

A 30-day public comment period was held from October 26, 2011, to November 30, 2011. At an October 19, 2011 public meeting, EPA discussed the proposed changes to the selected remedy for portions of TIAA Superfund Site Area B from pump and treat to in-situ chemical oxidation with the members of the Unified Community Advisory Board (UCAB) for the TIAA Superfund Site on October 19, 2011. A draft of the Proposed Plan document was also distributed to the UCAB. An announcement of the Proposed Plan was printed in the Arizona Daily Star on October 18, 2011, and a Spanish language version was printed in the La Estrella on October 21, 2011. There were 1,251 copies of the Proposed Plan mailed out to the community and interested parties of the TIAA Superfund Site.

Copies of the Focused Feasibility Study for TIAA Superfund Site Area B, as well as the Proposed Plan, were made available at the El Pueblo Public Library located at 101 W. Irvington Road in Tucson, Arizona and the U.S. EPA Region 9 Records Center located at 95 Hawthorne Street in San Francisco, California. Electronic copies of the Proposed Plan and the Focused Feasibility Study were posted on the EPA website for the TIAA Superfund Site: www.epa.gov/region9/tucsonairport.

The Public Meeting for the Proposed Plan was held on November 16, 2011, at the office of the Arizona Department of Environmental Quality Southern Regional Office at 400 West Congress Street, Tucson, Arizona. Four comments were received on the Proposed Plan. The comments and EPA's responses are presented in a Responsiveness Summary attached to this ROD amendment.

4) Scope and Role of Response Action

The response action presented in this ROD amendment is an amendment to the Area B portion of the selected remedy described in the 1988 TIAA Superfund Site-Wide ROD and also replaces portions of the 2004 TIAA Superfund Site ROD Amendment, which identified that more analysis was needed for the determination of an MNA remedy for the West Plume B Site. The basis for this action is the existing pump and treat remedy was not effective in treating the source areas in groundwater. This proposed action will be the final action for Area B. The goals of this action are to address the residual VOC contamination that exists in the groundwater and minimize migration of contaminants in groundwater away from industrial areas. The selected remedy replaces the existing remedy with in-situ chemical oxidation using potassium permanganate to treat VOCs and also selects monitored natural attenuation for West Plume B.

5) Site Characteristics

A summary of site characteristics is presented below.

- **Physical Characteristics:** Based on historical data, the total length of the axis of the Area B Site as it is currently understood is over 2 miles long. It is located from West-Cap Site near the intersection of Plumer Avenue and Elvira Street to just south of East Drexel Avenue. The known width of the Area B plume is less than 1,000 feet at its widest point and more often interpreted to be 400 feet wide.
- **Site Hydrogeology:** The Tucson Basin is described as saturated alluvial sediments that compose a single regional aquifer system and all aquifers are considered to be drinking water aquifers in the State of Arizona. In the vicinity of the Site, the regional aquifer system is hydrogeologically complex because of lateral and vertical stratigraphic changes. The hydrogeology of Area B is divided here into three units below the vadose zone—the Upper Zone, the Middle Aquitard, and the Lower Zone. The Upper Zone is further divided into the Upper Unit and Lower Unit, which are separated by the Upper Aquitard. It should be emphasized that the designation of these subunits and intervening aquitards is made on a relatively local basis (i.e., within project areas and between adjacent project areas where sufficient hydrogeologic data exist). Because of the heterogeneous nature of the aquifer system, subunit correlation is generally difficult between areas where large hydrogeologic data gaps exist.

  Within Area B, the Upper Unit occurs between approximately 85 and 145 feet below ground surface (bgs) and could contain one or two coarse-grained layers (subunits) in some areas, or consist entirely of fine-grained sediments. The coarse-grained subunits are termed the Upper Subunit (USU) and the Lower Subunit (LSU) based on their relative depths. The fine-grained sediments may be termed Shallow Groundwater

Zones (SGZ). SGZs are present within the Upper Unit where unconfined saturated silt- and clay-rich sediments exist above the coarse-grained subunit(s) (the USU and/or the LSU). In these areas, continuously saturated conditions exist between the water table of the SGZ and the underlying subunit(s). SGZs consist predominately of saturated, fine-grained sediment, but may be locally interbedded with very thin (less than 1 foot), discontinuous, lenses of coarser-grained material.

Regional groundwater movement is generally from southeast to northwest across Area B. However, the direction and magnitude of the groundwater gradient vary significantly, in part because of hydrogeologic heterogeneity and in part because of groundwater extraction and reinjection at the AANG property, which began in 1997. Groundwater extraction at the TI and West-Cap areas has also influenced groundwater flow during the times in which the extraction systems were operational.

In the northeast part of the AANG property, groundwater extraction and reinjection have caused significant localized changes in the magnitude and direction of the groundwater gradient in the USU. The most-significant change is a northwest-trending groundwater divide (i.e., hydraulic pressure ridge) at the eastern boundary of the AANG property. Groundwater to the southwest of the divide flows to the west-northwest, while groundwater to the northeast of the divide flows to the north until it is outside the influence of the reinjection wells, where it presumably again flows to the northwest in the natural direction of the regional gradient.

The regional groundwater flow in the LSU, under pumping and non-pumping conditions, is also generally to the north-northwest across Area B. In contrast to the USU, the groundwater reinjection to the vadose zone on AANG property has not hydraulically influenced the potentiometric surface of the LSU to a significant degree.

- **Contaminant Distribution:** Various remedial investigations and actions have been performed since 1982 to establish the Contaminants of Concern (COC) for the Site (Table 2) and their distribution within Area B. The 2004 ROD Amendment listed TCE, tetrachloroethene (PCE), 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride as the Contaminants of Concern. Only TCE and PCE routinely exceed Maximum Contaminant Levels at the Site (Table 3). The presence of PCE is generally limited to a small area near the former West-Cap facility. TCE and PCE are industrial solvents previously used by entities in the vicinity of the TIAA Superfund Site.

TABLE 2
Maximum Contaminant Levels are clean up levels for the Primary Contaminants of Concern
Tucson International Airport Area Superfund Site—Area B

Parameter	Primary MCL (µg/L)
1,1,-DCE	7
cis-1,2-DCE	70
PCE	5
TCE	5
Vinyl Chloride	2

TABLE 3
Summary Statistics for VOCs in Groundwater
Tucson International Airport Area Superfund Site—Area B

Compound	Number of Detections	Number of Analysis	Minimum Detected Value (µg/L)	Maximum Detected Value (µg/L)	Arithmetic Mean (µg/L)
1,1-DCE	49	279	0.061	8.7	0.83
1,1,2-Trichloroethane	9	279	0.1	2.1	0.49
1,1,2-Trichloro-1,2,2-Trifluoroethane	12	279	0.11	0.62	0.35
1,2-Dichloropropane	2	279	0.62	0.66	0.64
1,3-Dichlorobenzene	1	279	0.11	0.11	0.11
1,4-Dichlorobenzene	1	279	0.1	0.1	0.10
2-Butanone, Methyl Ethyl Ketone	29	279	1.8	29	8.61
2-Hexanone	2	278	1.2	18	9.60
4-Methyl-2-Pentanone	2	278	2.2	5	3.60
Acetone	81	279	0.72	120	16.18

Important characteristics of contaminant distribution in TIAA Superfund Site Area B are summarized as follows. A map showing the distribution of TCE in groundwater in February 2009 is shown on Figure 3.

- **West Plume B:** The VOC plume at West Plume B is shrinking in area and has no further input of VOCs. The plume is approximately 2,000 feet in length, is located to the northwest of the Arizona Air National Guard Site, and is located at a depth of approximately 85 to 135 feet below ground surface. Concentrations of TCE have been less than 20 µg/L since 2002, and the most recent sampling confirms the maximum TCE concentration in West Plume B to be 8 µg/L. In addition, concentrations have been steadily decreasing without treatment. The attenuation mechanisms observed and confirmed by EPA to be occurring at West Plume B include hydrodynamic dispersion, sorption, and biodegradation. Together, these mechanisms are decreasing VOC concentrations over time and distance from the source area. Dispersion decreases VOC concentrations by moving molecules farther apart as groundwater moves through subsurface media. As subsurface soils contain low amounts of organic carbon, sorption is not a major attenuation factor. Biodegradation of chlorinated solvents can be slow in oxidative conditions, but is likely occurring based on collected data. The presence of compounds such as 1,1-DCE and cis-1,2-DCE, which are products of biological reductive dechlorination, indicate that some biological degradation is occurring. A copy of the Technical Memorandum supporting Monitoring Natural Attenuation for West Plume B is included in the Appendix A of this document.

- **Arizona Air National Guard:** The existing groundwater extraction and treatment has been successful in capturing and containing VOC contamination to the area south of Valencia Road. The VOCs in groundwater at this Site are confined to the property at a depth of approximately 90 to 120 feet bgs. Concentrations of TCE at the Arizona Air National Guard Site are below 10 µg/L but this is under conditions associated with the operation of the groundwater extraction system. A rebound test is needed to evaluate the effectiveness of the groundwater extraction system in removing contaminants. The majority of the Site 5 soil contamination has been treated by the SVE system.
- **West-Cap:** Residual VOCs that are located in a deep clay layer (about 100 feet bgs) at the former West-Cap facility continue to contribute to a groundwater plume that extends approximately 500 feet to the north and at least 2,500 feet to the west. The depth of this plume is approximately 110 to 140 feet bgs. Prior to the permanganate pilot test, the maximum concentrations of TCE were 790 µg/L in the clay layer directly underneath the West-Cap property and less than 30 µg/L to the west of the property.
- **Texas Instruments:** Residual VOCs are found in a deep clay layer at the Site, which contributes to a groundwater plume that has remained on-site and was previously contained but not effectively treated by the groundwater extraction and treatment system. Prior to the permanganate pilot test, the groundwater plume extended less than 400 feet from the former chemical storage areas, at a depth of approximately 110 to 130 feet bgs. Concentrations of TCE have been below 10 µg/L since 2001 in all wells except Extraction Well BB-2, which rebounded up to 76 µg/L when the groundwater extraction system was turned off. This well currently contains permanganate from the permanganate pilot test and is not sampled for VOC analysis but surrounding wells are showing trends of decreasing concentrations of contaminations.

6) Current and Future Site and Resource Use

The land use in Area B is currently commercial/light industrial near West-Cap and Texas Instruments, an active military base at the Arizona Air National Guard, and mostly residential with some light commercial activity in West Plume B (Figure 4). The Site overlies the Tucson groundwater basin, which provides up to 80% of the municipal drinking water for over 1 million residents of the City of Tucson and surrounding communities. In addition to the municipal supply of drinking water, there are private wells found throughout the area in and near the City of Tucson. The anticipated future land us is the same as the current use as the location of the Tucson Airport and the Arizona Air National Guard base is not likely to be moved.

FIGURE 3
TCE Concentrations in Groundwater, January-March 2009
Tucson International Airport Area Superfund Site—Area B

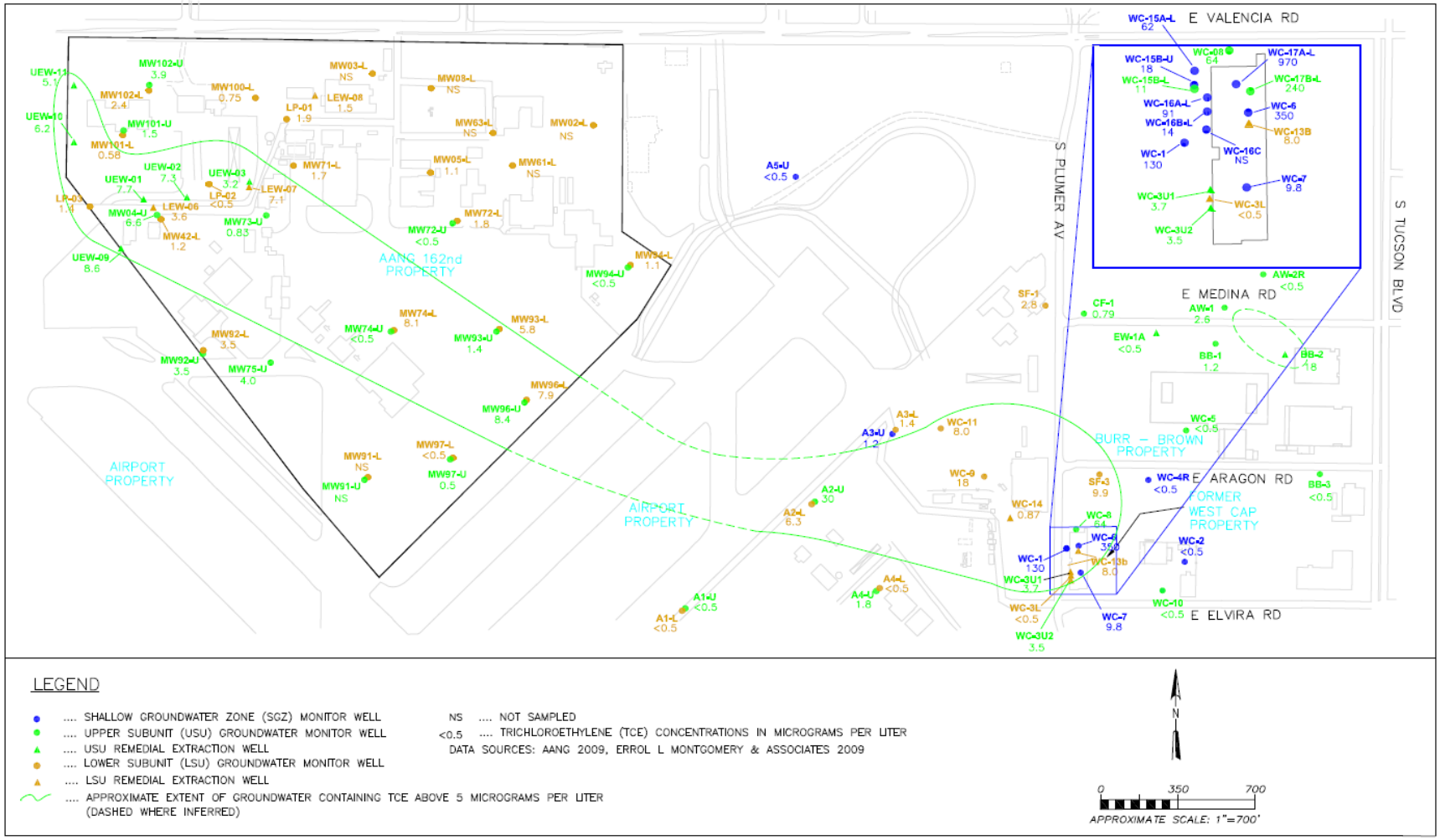
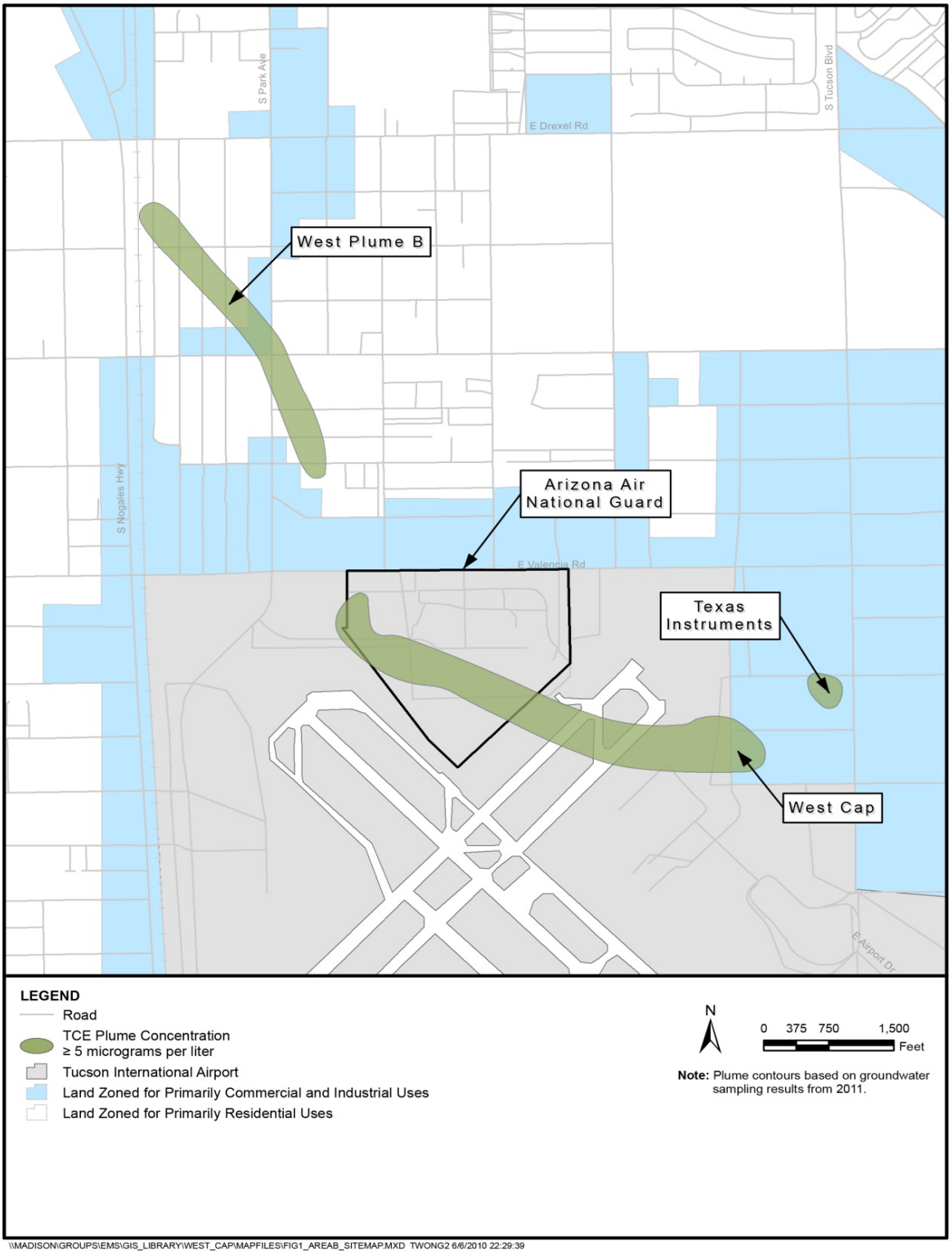


FIGURE 4
General Land Use Zoning Classifications
Tucson International Airport Area Superfund Site—Area B



7) Summary of Site Risks

The summary of Site risks for soil and groundwater is based on the *Baseline Human Health Risk Assessment for the Tucson International Airport Area Site* (BHHRA; Arizona Department of Health Services [ADHS], 1996), but has been updated based on recent contaminant concentration data in groundwater. The BHHRA evaluated risks associated with soil, groundwater, and soil gas exposures to residential and/or industrial receptors under potential current/future land use conditions to chemicals from sources at the Site, the former Burr-Brown facility (TI), the former West-Cap property, and off-Site residential properties. This risk assessment used validated data from the Airport property RI/FS and focused RI, Burr-Brown investigations, and investigations conducted at the former West-Cap property to evaluate health risks from potential exposure to contaminants in groundwater and soil gas. The exposure area evaluated encompasses the Site bounded by Valencia Road (north), Hughes Access Road (east and south), and Nogales Highway (west), including the West-Cap property.

There is no new data that would change the previous studies that evaluated the risk for surface soil under current and future residential scenarios. The previous results showed excess lifetime cancer risk (ELCR) less than EPA's risk management range of 10^{-6} (1E-06) - 10^{-4}(1E-04).

An updated screening-level risk evaluation for groundwater was performed in the 2011 TIAA Superfund Site Area B Focused Feasibility Study using the latest groundwater monitoring data at West-Cap for current and future residential scenarios (Table 4). All chemicals detected in the groundwater were defined as contaminants of potential concern (COPCs). For groundwater, the maximum detected concentrations and tap water regional screening levels (RSL) (EPA, 2010) were used as exposure point concentrations (EPC) in the calculations. The highest TCE (970 µg/L) and PCE (110 µg/L) concentrations were found at the West-Cap site in January 2009. The ELCR for groundwater exceeded EPA's risk management range of 10^{-6} to 10^{-4}. The potential future ELCR associated with using groundwater from the West-Cap project area for drinking water is approximately 2E-03 which exceeds EPA's point of departure for taking action (1E-04). The primary contributors to the risk are PCE (1E-03), and TCE (5E-04). The action level for clean up in these areas are MCLs for drinking water. This document relies on the 1996 Risk Assessment for conclusions for inhalation/absorption risk.

TABLE 4
Groundwater Risk Evaluation
Tucson International Airport Area Superfund Site—Area B

Contaminants of Potential Concern	Maximum Concentration (µg/L)	Tap Water Cancer RSL (µg/L)	Tap Water Noncancer RSL (µg/L)	Cancer Risk	Noncancer Hazard
1,1-DCE	8.7		3.40E+02	NA	2.56E-02
1,1,2-Trichloroethane	2.1	2.40E-01	1.50E+02	8.75E-06	1.40E-02
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.62		5.90E+04	NA	1.05E-05
1,2-Dichloropropane	0.66	3.90E-01	8.30E+00	1.69E-06	7.95E-02
1,3-Dichlorobenzene	0.11	NA	NA	NA	NA

TABLE 4
Groundwater Risk Evaluation
Tucson International Airport Area Superfund Site—Area B

Contaminants of Potential Concern	Maximum Concentration (µg/L)	Tap Water Cancer RSL (µg/L)	Tap Water Noncancer RSL (µg/L)	Cancer Risk	Noncancer Hazard
1,4-Dichlorobenzene	0.1	4.30E-01	1.00E+03	2.33E-07	1.00E-04
2-Butanone, Methyl Ethyl Ketone	29		7.10E+03	NA	4.08E-03
2-Hexanone	18		4.70E+01	NA	3.83E-01
4-Methyl-2-Pentanone	5		2.00E+03	NA	2.50E-03
Acetone	120		2.20E+04	NA	5.45E-03
Benzene	1.5	4.10E-01	4.40E+01	3.66E-06	3.41E-02
Bromodichloromethane	0.13	1.20E-01	7.30E+02	1.08E-06	1.78E-04
Bromoform	1.1	8.50E+00	7.30E+02	1.29E-07	1.51E-03
Carbon Disulfide	1.6		1.00E+03	NA	1.60E-03
Chlorobenzene	0.82		9.10E+01	NA	9.01E-03
Chloroform	1.9	1.90E-01	1.30E+02	1.00E-05	1.46E-02
Chloromethane	0.77		1.90E+02	NA	4.05E-03
Cis-1,3-Dichloropropene	0.15	4.30E-01	4.00E+01	3.49E-07	3.75E-03
Cis-1,2-Dichloroethene	7.2		3.70E+02	NA	1.95E-02
Cyclohexane	0.5		1.30E+04	NA	3.85E-05
Dichlorodifluoromethane	0.15		3.90E+02	NA	3.85E-04
Ethylbenzene	0.38	1.50E+00	1.30E+03	2.53E-07	2.92E-04
Methyl Acetate	0.71		3.70E+04	NA	1.92E-05
Methylene Chloride	2.1	4.80E+00	1.10E+03	4.38E-07	1.91E-03
Methyl Tert-Butyl Ether (MTBE)	0.5	1.20E+01	6.30E+03	4.17E-08	7.94E-05
Toluene	3.6		2.30E+03	NA	1.57E-03
Trichlorofluoromethane	0.2		1.30E+03	NA	1.54E-04
Vinyl Chloride	0.12	1.60E-02	7.20E+01	7.50E-06	1.67E-03
Trichloroethylene	970	2.00E+00		4.85E-04	NA
Tetrachloroethylene	110	1.10E-01	2.20E+02	1.00E-03	5.00E-01
Total Cancer Risk/Hazard				**2.E-03**	**1**

Note**:**
NA = not available

The cancer risk estimates for the individual COPCs were then summed to provide a cumulative cancer risk estimate. The Hazard Quotient (HQ) for individual COPCs was calculated taking the EPC and dividing it by the EPA's RSL. The HQs for the individual COPCs were summed to provide the hazard index (HI). The cumulative risk is compared against a risk management range of 10^{-6} to 10^{-4} (EPA, 1989) for carcinogens and HI is compared against a threshold HI of 1 for non-carcinogens. The overall HI for drinking water is 1, which is equal to the non-cancer threshold of 1. However, individual COPCs have HQs

less than 1. Based on the most recent data, the Site is not within EPA's acceptable risk range for Superfund Sites and remedial action is required.

8) Remedial Action Objectives

The Remedial Action Objectives in the 2004 ROD Amendment have been combined into the following three objectives:

- Reduce the risk of potential exposure to contaminants.
- Restore contaminated groundwater to support existing and future uses, i.e. drinking water.
- Prevent or reduce migration of groundwater contamination above maximum contaminant levels.

9) Description of Alternatives

Below is a list of alternatives evaluated in this revised remedy with the exception of the selection of MNA for West Plume B. In the 2004 ROD Amendment, it was stated that MNA could be the selected remedy for West Plume B if the data supported it. The Technical Memorandum supporting the selection of MNA for West Plume B is attached as an Appendix A to this document.

EPA evaluated 5 alternatives in this revised remedy:

Alternative 1: No Further Action

Alternative 2: Groundwater Extraction and Treatment in West-Cap, Texas Instruments, Arizona Air Natural Guard and MNA in West Plume B

Alternative 3: In-Situ Chemical Oxidation (ISCO) at West-Cap, Texas Instruments, Arizona Air National Guard, and MNA in West Plume B (EPA's Preferred Alternative)

Alternative 4: ISCO at West-Cap, Texas Instruments, Permeable Reactive Barrier in Arizona Air National Guard, and MNA in West Plume B

Alternative 5: ISCO at West-Cap and Texas Instruments and MNA in Arizona Air National Guard and West Plume B

Alternative 1: No Further Action

EPA is required to consider the no further action alternative. Under this alternative, no additional treatment would be implemented, and monitoring would cease. The estimated cost for this alternative is $0, and this alternative would never achieve RAOs.

Alternative 2: Groundwater Extraction and Treatment in West-Cap, Texas Instruments, Arizona Air Natural Guard and MNA in West Plume B

This alternative involves the extraction, treatment, and injection of groundwater at the West-Cap, Texas Instruments, and Arizona Air National Guard Sites to remove VOCs. Groundwater extraction would target the source areas at the West-Cap and Texas Instruments

Sites. Groundwater extraction and treatment would prevent migration of contamination north of Valencia Road at the Arizona Air National Guard Site.

Treatment of extracted groundwater at the Arizona Air National Guard and Texas Instruments Sites would be accomplished by upgrading the existing air stripping systems present at those locations, and a new liquid-phase granular-activated carbon treatment system would be constructed at the former West-Cap facility. Treated water would be re-injected back into the aquifer. Concentrations of VOCs at the West Plume B Site have been decreasing through natural attenuation, and no groundwater extraction is proposed for this area. MNA would be used to remediate the groundwater in the West Plume B area. The MNA in West Plume B is discussed in further detail in the common elements of the alternatives in this section. The estimated cost for this alternative is $19 million and estimated time to achieve RAOs is in excess of 30 years.

Alternative 3: ISCO at West-Cap, Texas Instruments, Arizona Air National Guard, and MNA in West Plume B (EPA's Preferred Alternative)

Alternative 3 involves ISCO through the injection of potassium permanganate solution into VOC source areas in the groundwater plume at the West-Cap Site and the Texas Instruments Site and injection into the residual VOC areas in the groundwater plume at the Arizona Air National Guard Site. Specifics of the residual plume areas at Arizona Air National Guard will be better defined through the rebound test that will commence after the cessation of the active groundwater extraction system. The groundwater extraction system will be used as a contingency during the test for rebound on the Arizona Air National Guard portion of the Site but will be discontinued when full scale ISCO implementation is in place. The trigger for operating the groundwater extraction system would be the observation of 10 ppb TCE in any of the monitoring wells identified in Appendix B of this document during the rebound test.

At the Area B Sites, potassium permanganate has been successfully tested and is proposed for continued use for ISCO. The injected permanganate solution has been shown to break down the VOCs in place. The pilot studies of ISCO did result in minor increases in by-products resulting from the higher oxidation states affecting the minerals in the source areas. However, the slight increases in these by-products (chromium, selenium) were reduced to normal levels outside of the areas of treatment where normal oxidation levels in the subsurface are found. Treatment of the residual VOCs in the source areas and residual VOC areas would prevent further contamination of the aquifer and allow for plume reduction through an enhanced attenuation processes.

The use of ISCO with permanganate was considered during development of the 2004 ROD Amendment. At the time, it was not considered a cost-effective alternative, as injection methods had not been developed. The permanganate injection pilot tests conducted in 2009 demonstrated that permanganate can be effectively delivered to the target treatment zones. The estimated cost for this alternative is $7.4 million. The cost estimates for this remedy assumes a single injection event after completion of Remedial Design. If multiple injections are needed, it is expected that the cost estimates would increase by less than 25%. The estimated time to achieve RAOs is 13-20 years.

Monitored natural attenuation would be used to manage the VOCs remaining in the West Plume B.

Alternative 4: ISCO at West-Cap and Texas Instruments, Permeable Reactive Barrier at Arizona Air National Guard, and MNA at West Plume B

Alternative 4 is similar to Alternative 3 with ISCO accomplished by injecting permanganate solution into the subsurface at the West-Cap and Texas Instruments areas. However, Alternative 4 involves the installation of a subsurface permeable reactive barrier to prevent off-Site plume migration at the Arizona Air National Guard property. The permeable reactive barrier would be constructed to allow groundwater to flow through, but would contain zero-valent iron, which destroys TCE and PCE contaminants as contamination flows through the barrier. MNA would be used to manage the VOCs present in the West Plume B area as in Alternatives 2 and 3. The estimated cost for this alternative is $19 million and estimated time to achieve RAOs is 20 years.

Alternative 5: ISCO at West-Cap and Texas Instruments and MNA at Arizona Air National Guard and West Plume B

Alternative 5 is similar to Alternative 3, as it involves ISCO with injection of potassium permanganate solution into the subsurface at the West-Cap and Texas Instruments areas and MNA to address VOCs in the West Plume B area. However, under Alternative 5, no active treatment would take place at the Arizona Air National Guard Site and groundwater in this area would be allowed to remediate through natural attenuation processes. This alternative would not prevent migration of the VOC plume from the Arizona Air National Guard property north of Valencia Road. The estimated cost for this alternative is $6 million and estimate time to achieve RAOs is 13-20 years.

Common Elements: With the exception of the "No Action" alternative, all of the alternatives evaluated at the four different project areas (West-Cap, Texas Instruments, Arizona Air National Guard, and West Plume B) include common components combined in various ways. All of the alternatives include active treatment of VOCs in source areas and residual zones. Attenuation parameters outside of the treatment zones would be monitored to ensure the effectiveness of the remedy. All active alternatives are expected to attain the Remedial Action Objectives.

The active alternatives also include institutional controls to limit or prevent public access to areas where treatment of residual VOCs will be ongoing, such as industrial property, the Tucson International Airport property, or the Arizona Air National Guard property. Consistent with expectations set out in the Superfund regulations, none of the remedies rely exclusively on institutional controls to achieve protectiveness.

Finally, other than "No Further Action," all of the alternatives evaluated here contain MNA for West Plume B. This is consistent with the 2004 ROD Amendment, which proposed that West Plume B be changed to MNA if sufficient data is collected and the analysis supported the remedy change. The analysis for MNA for West Plume B is included in an appendix to this ROD Amendment.

10) Comparative Analysis of Alternatives

EPA evaluates each of the alternatives based on nine standard criteria. The first two criteria are *threshold criteria*: overall protection of human health and the environment, and compliance with federal and state ARARs. The next five criteria are *balancing criteria* and include long-term effectiveness and permanence; reductions in toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost. The final two criteria are *modifying criteria* and include state and community acceptance, which were evaluated after the close of the public comment period on the proposed remedy. Figure 5 illustrates how each alternative compares to the threshold and balancing criteria.

Threshold Criteria

- *Overall Protection of Human Health and Environment:* Each of the five alternatives evaluated here are protective of human health and environment with the exception of Alternative 1, the "No Further Action" alternative. Without some form of treatment in source areas, there would be an unacceptable level of risk remaining at the Site. The other four alternatives provide for treatment of the areas of highest concentration of TCE.

- *Compliance with ARARs*: ARARs can be chemical specific, action specific, or location specific. The 5 µg/L MCL for TCE is a relevant and appropriate chemical-specific requirement. The "No Further Action" Alternative does not comply with ARARs because it would leave concentrations of TCE at the Site above the MCL. Alternatives 2-5 will reduce the TCE concentrations below the MCL, and will comply with ARARs. Alternative 2 is essentially the existing remedy which has air and water discharges that result from groundwater extraction and treatment would need to meet the additional ARARs associated with these activities. Alternatives 3-5 are all remedies are essentially the same remedy with respect to ARARs. In each of these remedies, there are no surface discharges so the MCL is the relevant and appropriate requirement.

Balancing Criteria

- *Long-term effectiveness and permanence:* Alternative 1 will not be effective in the long term for restoring ground water to its beneficial use. For Alternative 2, there are questions about the long-term effectiveness of groundwater extraction. Alternative 2 is currently being implemented at the AANG, and if groundwater extraction continues, will be implemented for an estimated additional 20 years. At the West-Cap and TI Sites, because of the limited rate of diffusion of VOCs out of the source areas, continued groundwater extraction may be required in excess of 30 years. It is probable that substantial rebound of VOC concentrations would be observed upon turning off the groundwater extraction systems at the West-Cap and TI Sites as residual VOCs continue to diffuse into the groundwater, and continued operation of the systems would be necessary to meet the cleanup goals. Continuing groundwater extraction indefinitely would provide protectiveness, but is not sustainable.

FIGURE 5

Nine Criteria Analysis (excluding State and Community Acceptance)
Tucson International Airport Area Superfund Site—Area B

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
Former West-Cap Facility							
WC1--No Action	–	–	–	–	–	●	●
WC2--Groundwater Extraction and Treatment	●	●	○	○	○	●	–
WC3--ISCO	●	●	●	●	○	●	●
Arizona Air National Guard Project Area							
AANG1—Groundwater Extraction and Treatment	●	○	●	●	●	●	–
AANG2—MNA	○	–	●	○	–	●	●
AANG3—ISCO	●	●	●	●	●	○	●
AANG4—Permeable Reactive Barrier	○	○	●	●	○	○	–
Texas Instruments Project Area							
TI1—Groundwater Extraction and Treatment (Sewer-Discharge)	○	●	○	●	●	●	–
TI1—Groundwater Extraction and Treatment (Reinjection)	○	●	○	●	●	●	–
TI3—ISCO	●	●	●	●	●	●	○
West Plume B Project Area							
WPB1—Monitored Natural Attenuation	○	○	○	○	○	●	●

Notes:
● = Alternative effectively satisfies the criterion
○ = Alternative moderately satisfies the criterion
— = Alternative poorly satisfies the criterion

Alternative 3 has been previously implemented and proven effective in pilot tests at the AANG, West-Cap, and TI project areas. Alternative 3 has a shorter estimated time to achieve cleanup than Alternative 2, with an estimated time of 13 to 20 years. Diffusion of permanganate into the source areas is a difficult and time-consuming process, and might not be completed through a single injection at each location. Additional injection events or recirculation of permanganate within the source areas to increase the contact time between the permanganate and the clay might be necessary to fully treat the source areas. After treatment, residual risk will continue to be posed by the contaminants until enhanced attenuation is complete.

Alternative 4, which would use a Permeable Reactive Barrier rather than ISCO at the AANG, is expected to permanently reduce VOCs at the northern boundary of the AANG property. However, there have been no pilot studies using a Permeable Reactive Barrier at the TIAA Superfund Site and therefore its effectiveness is questionable. The rest of the Area B is expected to meet cleanup goals within an estimated 20 years through ISCO and MNA.

Alternative 5, which would use MNA rather than ISCO at the AANG, will permanently reduce VOCs in groundwater through ISCO at West-Cap and Texas Instruments Sites. But MNA on AANG property may result in VOCs increasing north of Valencia Road, which would decrease the long-term effectiveness.

- *Reduction in toxicity, mobility, or volume through treatment:* Alternative 1 would not result in reduction of toxicity as there is no treatment. Alternative 2, Groundwater Extraction and Treatment would use carbon adsorption and air stripping treatment systems to remove contaminants at an efficiency of 95 percent or greater. The migration of VOCs to the northwest would be eliminated by establishing hydraulic capture zones through the operation of the extraction wells. Groundwater extraction and treatment is currently being implemented at the AANG. Alternative 2 would continue to decrease TCE concentrations in groundwater, as well as prevent offsite migration. However, Alternative 2 would contain but not treat the source areas at the West-Cap and TI Sites due to the slow rate of diffusion of VOCs out of the source areas.

  Alternatives 3 and 4 have the potential of reducing the highest VOC concentrations much faster than Alternative 2, since the source zones and residual treatment areas would be treated more quickly. Because the existing containment system south of Valencia Road would not be in use under either of these alternatives, offsite migration of VOCs onto the downgradient West Plume B area would be prevented by the injection of permanganate at the leading edge of the TCE plume (Alternative 3) or through the use of a permeable reactive barrier (PRB) (Alternative 4).

  Alternative 5 would also treat the source areas at West-Cap and Texas Instruments. However, the mobility of VOCs in groundwater north of Valencia would increase because the containment system on AANG would be turned off and would not be replaced with another treatment or containment system.

  None of the alternatives generate hazardous waste.

- *Short-Term Effectiveness:* Alternate 1 is no further action which is not effective in the short term. For Alternatives 2 and 3, treatment has been at least partially implemented at the AANG, West-Cap, and TI Sites. All three Sites have had groundwater extraction and treatment systems in place, and all three had permanganate injections in 2009. It is anticipated that either of these alternatives could be implemented across Area B within 6 to 12 months. Hydraulic containment would be achieved shortly after implementation of Alternative 2, and treatment of the source zones at West-Cap and TI would be achieved multiple injections over a span of ten years under Alternatives 3 and 4.

  Alternative 4 would be effective in the short term if the groundwater extraction and treatment system continued to operate during design and construction of the PRB, which would take about 1 year.

  Alternative 5 would be effective in the short term at all Sites except the AANG Site and West Plume B, because there would be no active treatment or prevention of plume migration in these areas. At West-Cap and Texas Instruments, the source zones would be treated rapidly by the permanganate. At West Plume B, attenuation of VOCs would continue because the plume is not migrating.

  There is a potential for exposure to Site workers by the permanganate during implementation of Alternatives 3, 4 and 5. This potential would be of limited duration and extent and would not affect the public. The permanganate used in these alternatives is anticipated to completely degrade and/or dilute before it reaches groundwater underneath residential properties within the West Plume B area.

  In addition to the period of time needed to implement the remedy, short-term effectiveness criteria is used to evaluate the risks to workers and community during the construction and implementation of the remedy. Short-term risks to workers associated with normal construction hazards and potential contact with contaminated water in Alternatives 2 through 5 would be eliminated through appropriate controls and adherence to proper health and safety protocols. Due to the limited potential for exposure to contaminated groundwater, no risk to residents is expected during implementation of any of the alternatives.

- *Implementability:* Alternative 1 is no further action and there is no implementation. Alternatives 2 and 3 are common remediation methods and have been implemented previously at Area B as either a remedy or pilot test. Both alternatives are expected to be readily constructed and operated using reliable technologies.

  Alternative 2 at West-Cap would require design and construction work for installation of conveyance piping and the treatment system. Alternative 2 is currently in operation at the AANG, and was used until 2009 at Texas Instruments. All necessary equipment and personnel for continued operation is readily available at these Sites. The treatment system at the Texas Instruments project area would be moved to a more accessible location.

  Alternative 3 at West-Cap would require minimal design calculations and would use existing wells for the injection system. Construction associated with Alternative 3 at

the AANG would require considerable coordination, space, and access permissions with AANG personnel, as the Site is an operating facility. Infrastructure for implementing Alternative 3 at TI is in place, and minor additions to the pilot test currently underway would be the only requirements to implement this alternative as a remedy.

Construction associated with Alternative 4 with the PRB would require considerable coordination, space, and access permissions with AANG personnel. The implementability of this alternative is uncertain because no pilot tests have been performed at the TIAA Superfund Site.

Construction associated with Alternative 5 at the AANG would involve the installation of several monitoring wells, but no other infrastructure. MNA analysis procedures for groundwater samples are well developed and widely available.

- *Cost:* EPA compares each alternative based on upfront capital cost, annual operation and maintenance cost, and overall present value cost, which is a measure of the total future project cost over a 30-year timeframe. There is no cost for Alternative 1. Estimated costs for the Area B remedial alternatives are summarized in Table 5. Alternatives 3 and 5 are the most cost-effective alternatives as they provide for source area treatment and natural attenuation processes. The estimated cost of these alternatives is approximately $6.2 million to $7.8 million. Alternatives 2 and 4 are the least cost effective, with an estimated cost of $19 million to $20 million. The following table summarizes the estimated costs of the remedy alternatives for each Site.
- *State Acceptance:* The Arizona Department of Environmental Quality submitted comments to the EPA on the Proposed Plan in a letter dated November 28, 2011 supporting EPA's revised remedy for Area B of the TIAA Superfund Site. ADEQ also provided concurrence of this Record of Decision Amendment in a letter dated April 6, 2012 (Appendix C).
- *Community Acceptance:* There were two comments from the community submitted on the Proposed Plan. One verbal comment supporting EPA's proposed remedy was delivered at the Public Meeting for the Proposed Plan. A written comment letter did not specifically support it but did not raise any objections or concerns with the revised remedy. All of the comments are included in Part 3 Responsiveness Summary of this ROD Amendment along with EPA responses to the comments.

11) Principal Threat Waste

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a Site wherever practicable. The principal threat concept is applied to the characterization of source materials at a Superfund Site. Contaminated groundwater generally is not considered to be a source material, thus no principal threat waste exists in Area B of the TIAA Superfund Site.

TABLE 5
Remedy Alternatives and Estimated Cost by Site
Tucson International Airport Area Superfund Site—Area B

Alternative Number	Arizona Air National Guard	West-cap	Texas Instruments	West Plume B	Total Cost
Alternative 2	**Groundwater Extraction and Treatment**	**Groundwater Extraction and Treatment**	**Groundwater Extraction and Treatment**	**Monitored Natural Attenuation**	
Estimated Capital	$350,350	$1,630,000	$522,300	$0	$2,502,650
Annual Operation and Maintenance	$620,150	$322,967	$85,100	$26,370	$1,054,587
Total Cost (Net Present Value)	$8,513,386	$8,445,716	$1,993,400	$546,948	$19,499,450
Alternative 3	**In-Situ Chemical Oxidation**	**In-Situ Chemical Oxidation**	**In-Situ Chemical Oxidation**	**Monitored Natural Attenuation**	
Estimated Capital	$2,074,800	$394,188	$422,500	$0	$2,891,488
Annual Operation and Maintenance	$499,200	$55,452	$55,000	$26,370	$636,022
Total Cost (Net Present Value)	$4,963,358	$1,486,311	$971,700	$546,948	$7,968,317
Alternative 4	**Passive Reactive Barrier**	**In-Situ Chemical Oxidation**	**In-Situ Chemical Oxidation**	**Monitored Natural Attenuation**	
Estimated Capital	$11,861,850	$394,188	$422,500	$0	$12,678,538
Annual Operation and Maintenance	$406,667	$55,452	$55,000	$26,370	$543,489
Total Cost (Net Present Value)	$17,232,445	$1,486,311	$971,700	$546,948	$20,237,404
Alternative 5	**Monitored Natural Attenuation**	**Monitored Natural Attenuation**	**Monitored Natural Attenuation**	**Monitored Natural Attenuation**	
Estimated Capital	$310,310	$394,188	$422,500	$0	$1,126,998
Annual Operation and Maintenance	$240,000	$55,452	$55,000	$26,370	$376,822
Total Cost (Net Present Value)	$3,469,431	$1,486,311	$971,700	$546,948	$6,474,390

Note: Alternative 1 (No Action) is not included in this analysis because there is no cost associated with this Alternative and it does not meet the threshold criteria.

12) Selected Remedy

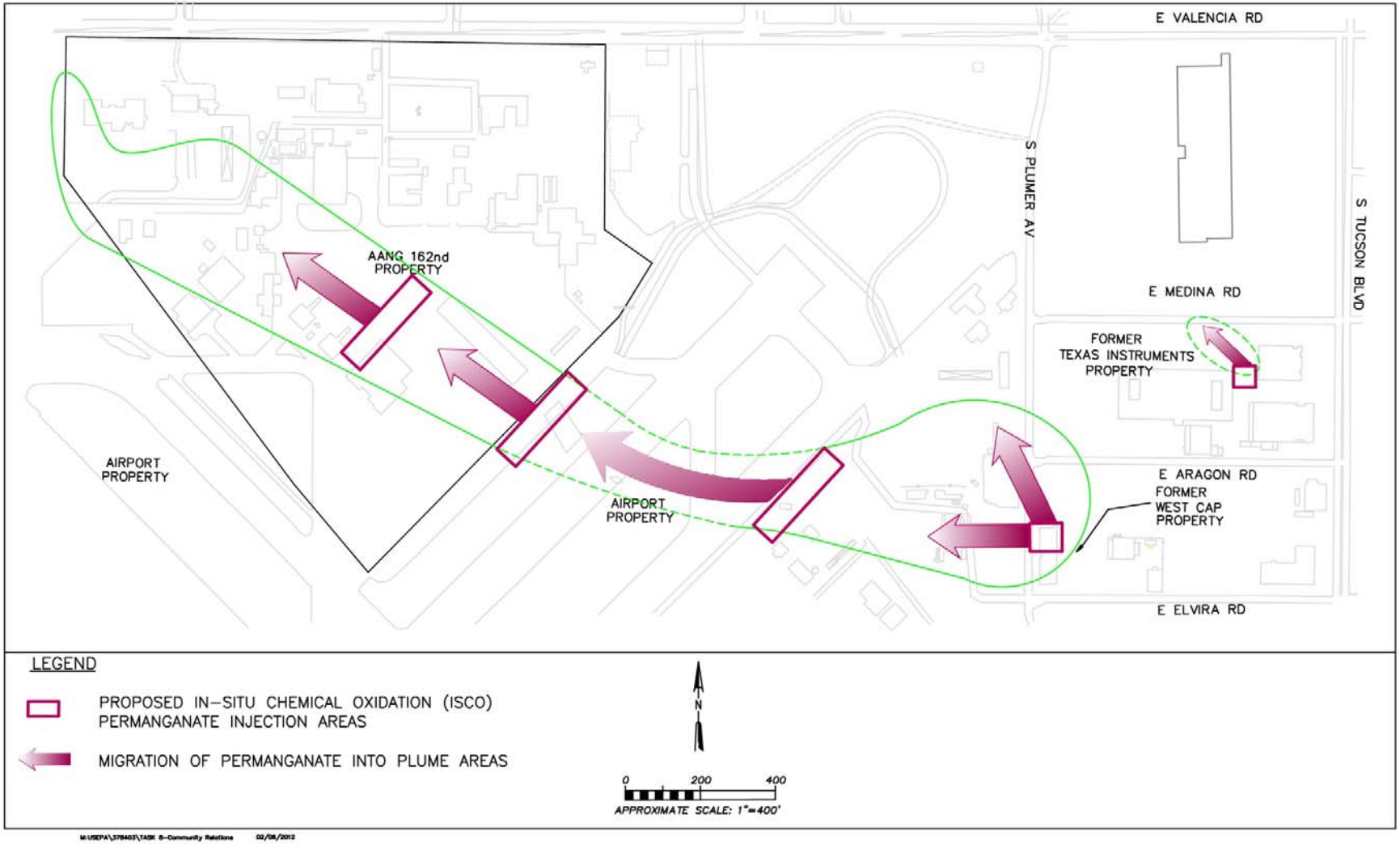
EPA's selected remedy is Alternative 3, permanganate injection at the AANG, West-Cap, and TI Sites and MNA at West Plume B (Figure 6). Based on information currently available, the EPA believes the selected remedy meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The EPA expects the selected remedy to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element.

Alternative 3 was selected because it is expected to achieve substantial environmental and human health risk reduction and comply with ARARs. The combination of treating the residual VOCs with potassium permanganate at the Site and safe management of remaining off-Site material using cost-effective enhanced attenuation reduces environmental and human health risk sooner than the other alternatives. Alternative 3 also meets the statutory preference for the selection of a remedy that involves treatment as a principal element because ISCO, through the use of potassium permanganate, would treat the residual VOCs present in the source areas.

Based on information currently available, EPA also believes the selected remedy provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The pilot studies at the Sites have shown that ISCO, through the use of potassium permanganate, is effective in reducing the toxicity of the contaminants of concern in a timely manner in the Sites in Area B of the TIAA Superfund Site.

The selected remedy uses ISCO as a permanent solution and alternative treatment technologies to the maximum extent practicable. Potassium permanganate will be applied to the known source areas of contamination and the residual VOC areas. The residual VOC areas will be identified through additional data collection, including the performance of a rebound test and the installation of additional wells. A rebound test is performed by turning off the existing groundwater extraction treatment system and monitoring the ground water as it returns to natural equilibrium. The rebound test is expected to take place over a period of six months to a year and will assist in identifying strategic VOC residual areas to be considered in Remedial Design to maximize the remediation efforts. The groundwater extraction system will remain as a contingency in the event that higher than expected residual VOC contamination is encountered during the rebound test. In Appendix B there is a list of wells that will be monitored during the rebound test that will be used to trigger the contingency of restarting the GWETRS. If any of the wells listed in Appendix B exceed 10 µg/L or ppb of TCE, then the GWETRS shall operate until the ISCO remedy is operational and functional. After the rebound test on AANG property, the ISCO remedy will be designed to ensure the RAOs are met.

FIGURE 6
Conceptual Design of the Selected Remedy
Tucson International Airport Area Superfund Site—Area B



EPA believes the selected remedy is more cost effective than all of the other alternatives except the "No Further Action" Alternative, which does not meet the Threshold Criteria and Alternative 5, which includes MNA at AANG. EPA is concerned that MNA at the AANG will result in plume migration, which then will affect the remediation at West Plume B. This alternative may not be effective in the long term and is not cost effective as it is likely to create additional work in the future. EPA believes the balance of slight increase in cost of the selected remedy over Alternative 5 is needed to assure the remedy is protective.

13) Statutory Determinations

This section provides a brief description of how the selected remedy satisfies the CERCLA statutory requirements. Under CERCLA § 121 and the NCP § 300.430(f)(5)(ii), the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), and are cost-effective. EPA also must use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, or contaminants as a principal element, and a bias against off-Site disposal of untreated wastes.

Protection of Human Health and Environment

The exposure of the public to contaminated groundwater through public water supplies or private water wells is the potential risk. The Selected Remedy will be protective of human health by reducing the COCs in groundwater through ISCO treatment and MNA at West Plume B to below drinking water standards. The remedy will not have detrimental cross-media impacts such as air emissions or surface water discharges.

Compliance with Applicable or Relevant and Appropriate Requirements

The NCP § 300.430(f)(5)(ii)(B) and (C) require that a ROD describe the federal and state ARARs that the selected remedy will attain, and that any ARARs the remedy will not meet, the waiver invoked, and the justification for any waivers. All federal and state ARARs will be met upon completion of the Selected Remedy and no ARARs are being waived.

Section 121 (e) of CERCLA, U.S.C. § 9621(e), states that no federal, state, or local permit is required for remedial actions conducted entirely on-Site. Therefore, actions conducted entirely on-Site must meet only the substantive, not the administrative, requirements of the ARARs. Any action conducted off-Site is subject to the full requirements of federal, state, and local regulations.

The most significant ARARs are discussed below.

- Chemical-Specific ARARs

The major statutes and regulations that contribute to the list of potential chemical-specific ARARs are the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), the Arizona Water Quality Standards (A.A.C Title 18, Chapter 11), and the Arizona Soil Remediation Levels (A.A.C, Title 18, Chapter 7). If an Arizona Water Quality Standard (AWQS) does not

exist for a specific compound, the ADEQ Human Health-Based Guidance Levels for Contaminants in Drinking Water (HBGL) are To Be Considered (TBC) standards. The chemical-specific ARARs that have been evaluated are those that affect groundwater and vadose zone remedial goals.

MCLs are applicable to the quality of drinking water at the tap pursuant to the SDWA and are ARARs for treated groundwater when the end use is for purposes of human consumption. Pursuant to 40 Code of Federal Regulations (CFR) § 300.430(e)(2)(i)(B), MCLs and non-zero maximum contaminant level goals (MCLG) are relevant and appropriate as in situ aquifer standards for groundwater that is or may be used for drinking water. The MCLs are presented in Table 2. The State of Arizona has adopted the federal MCLs by reference as stated in A.A.C§§18-4-108 and 109.

TABLE 6
Chemical-Specific Groundwater ARARs and TBCs for Area B of the Tucson International Airport Superfund Site
(Concentrations in μg/L)
TIAA Superfund Site, Area B Project Area, , Tucson, Arizona

Parameter	Applicable or Relevant and Appropriate				To Be Considered
	Primary MCL[a]	MCLG[b]	A&Ww[c] Acute	A&Ww[c] Chronic	HBGL[d] for Water
Organics					
1,1-Dichloroethene	7	7	15,000	950	0.06
cis-1,2-Dichloroethene	70	70	-	-	
Tetrachloroethene (PCE)	5	-	6,500	680	0.7
Trichloroethene (TCE)	5	-	20,000	1,300	3.2

Notes:

The Arizona AWQS for 1,1-dichloroethene,cis-1,2-dichloroethene, PCE and TCE, are identical to the federal MCLs

[a] MCL = Maximum Contaminant Level.

[b] MCLG = Maximum Contaminant Level Goal

[c] A&Ww = Aquatic and Wildlife (warm water fishery).

[d] HBGL = Human Health-Based Guidance Levels are only applicable in the absence of an MCL or AWQS (March 1991 Update).

There are four contaminants identified as COCs for this Site. The MCL for the most prevalent contaminant in the shallow groundwater zone, TCE, is 5 micrograms per liter (μg/L). The MCLs for other contaminants of concern in the shallow groundwater zone are set forth in Table 6.

The Arizona Aquifer Water Quality Standards (AWQS) AAC §R18-11-401 et seq., are standards developed to protect groundwater by preventing discharges of pollutants above certain concentrations to aquifers that endanger human health, or that impair the uses of the aquifer. The AWQS applied to aquifers classified as sources of drinking water for the primary contaminants of concern are currently identical to the federal SDWA MCLs. At this Site, all aquifers are identified as drinking water aquifers. As is the case with MCLs, the

AWQSs are relevant and appropriate as in situ aquifer cleanup standards for groundwater that may be used for drinking water at the Site.

Groundwater from CERCLA actions may be treated as non-Resource Conservation and Recovery Act (RCRA) waste if the waste contains chemicals in concentrations below health-based levels (i.e., MCLs) selected by EPA Region IX as set forth in Table 6 or exhibits no hazardous characteristics.

- Location-Specific ARARs

The Location-Specific ARARs for the Site are listed in Table 7. Location-specific ARARs differ from Chemical-Specific or Action-Specific ARARs in that they are not closely related to the characteristics of the wastes at the Site or to the specific remedial alternative under consideration. Location-Specific ARARs are concerned with the area in which the Site is located. Actions may be required to preserve or protect aspects of the environment or cultural resources of the area that could be threatened by the existence of the Site or by the remedial actions to be undertaken at the Site.

- Action-Specific ARARs

The Action-Specific ARARs for this Site are listed in Table 8. The RCRA is a federal statute passed in 1976 to meet three goals: the protection of human health and the environment; the reduction of waste and the conservation of energy and natural resources; and the elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions, and technical requirements. Substantive RCRA requirements are applicable to response actions at CERCLA Sites if contaminants are characterized as hazardous waste.

Untreated groundwater at the Site containing VOCs is not a listed waste. The groundwater is not a characteristic waste because the contaminants in the groundwater are below the levels established for the characteristic of toxicity. Consequently, the RCRA requirements triggered by the hazardous nature of waste are not applicable and not relevant and appropriate with respect to the groundwater.

Because the untreated groundwater is not a RCRA hazardous waste, the groundwater that has been treated to health-based standard (i.e., MCLs) would not be a RCRA hazardous waste, and the RCRA requirements again would not be triggered.

TABLE 7
Location-Specific ARARs for VOC-Contaminated Shallow Groundwater
TIAA Superfund Site, Area B Project Area, , Tucson, Arizona

Source	Standard, Requirement, Criteria, or Limitation	Applicable or Relevant and Appropriate	Description of Standard, Requirement, Criteria, or Limitation	Manner in Which ARAR Applies to Alternative
Archaeological Discoveries, Historic Preservation	41 Arizona Revised Statutes ("A.R.S.") §§ 841, 843 – 845, and substantive portions of 865	Applicable	Preserves archaeological artifacts and remains.	If any archaeological artifacts, human remains, or funerary objects are discovered during construction, excavation or other onsite activities, the activity must cease temporarily to allow for investigation and preservation of such artifacts, remains, or objects in accordance with these procedures.
National Historic Preservation Act	16 CFR Part 470	Applicable	Requirements for identification and preservation of historic or cultural resources.	If any archaeological artifacts, human remains, or funerary objects are discovered during construction, excavation or other onsite activities, the activity must cease temporarily to allow for investigation and preservation of such artifacts, remains or objects in accordance with these procedures.

TABLE 8
Action-Specific ARARs for VOC-Contaminated Shallow Groundwater
TIAA Superfund Site, Area B Project Area, , Tucson, Arizona

Source	Standard, Requirement, Criteria, or Limitation	Applicable or Relevant and Appropriate	Description of Standard, Requirement, Criteria, or Limitation	Manner in Which ARAR Applies to Alternative
Clean Water Act §402, 33 U.S.C. §1342	AZPDES General Permit AZG2008-001 (Discharge requirements for Discharges of Storm Water from with Construction Activities)	Applicable to construction activities affecting more than 1 acre; relevant and appropriate to such activities affecting less than 1 acre	Discharges of stormwater associated with construction activity from soil disturbance of more than five acres is regulated as industrial activity.	The substantive portions of the general permit are action-specific ARARs for activities associated with construction of the groundwater system.
40 CFR Section 262.11; (Arizona Administrative Code) AAC § R18-8-262	40 CFR Section 262.11 and AAC § R18-8-262	Applicable	Regulation of waste from construction & operation of remedial action requires waste generators to determine whether wastes are hazardous wastes and establishes procedures for such determinations.	These requirements are applicable to management of waste materials generated as a result of construction of the selected remedial action or operation of any groundwater treatment units.
40 CFR § 144.12 – 144.16	40 CFR § 144.12 - 144.16	Applicable	Criteria and standards for the Underground Injection Control (UIC) Program. These criteria include current and future use, yield and water quality characteristics and regulate the reinjection of groundwater.	These criteria are applicable for determining exempt aquifers. Injection wells will comply with these design, construction, operation and maintenance requirements.
Safe Drinking Water Act, 42 U.S.C. §300f *et seq*.	40 CFR 144.24(a), 146	Applicable	Establishes criteria for determining exempt aquifers, including current and future use, yield and water quality.	Applies to design, construction, operation and maintenance of Class V injection wells, if selected to return treated groundwater to the aquifer.

The RCRA program is a delegable program: a state may manage the program in lieu of the EPA if the state statutes and regulations are equivalent to or more stringent than the federal statutes and regulations. In some cases, the applicable or relevant and appropriate RCRA requirement will be cited as state law and in other cases as federal law. The substantive requirements of RCRA's regulations found in 40 CFR Part 264, as incorporated into or modified by AAC R18-8-264, may be relevant and appropriate to the storage and disposal of hazardous wastes generated on-Site, such as waste generated during field operations. This includes requirements for container storage, secondary containment, and leak detection. Any off-Site storage of hazardous wastes would be subject to administrative requirements as well. Any off-Site disposal of hazardous waste must be met, and this includes requirements for notification, disposal methods, and transport.

Federal regulations that govern underground injection programs are found in 40 CFR §144.12 and §144.13. According to these regulations, no injection operation can allow movement of contaminants into underground sources of drinking water, which may result in violations of MCLs or adversely affect health. Injection of oxidants is allowed as part of a CERCLA corrective action as its goal is to restore contaminated water to MCLs.

The substantive requirements of the Arizona Aquifer Protection (APP) Permits (ARS §49-241, et seq. and AAC §R18-9-101 et seq.) will be relevant and appropriate to injection onsite. The APP program requires that any discharges to the aquifer must not cause or contribute to a violation of AWQS.

Arizona's state Superfund program, known as the Water Quality Assurance Revolving Fund (WQARF), provides for cleanup of hazardous substances in groundwater. (ARS § 49-281 et seq.) Section 49-282.06 of WQARF, requires groundwater remedial actions to assure the protection of public health, welfare, and the environment; to manage and cleanup hazardous substances, to the extent practicable, so as to allow for the maximum beneficial uses of the waters of the state; and to be reasonable, necessary, cost effective, and technically feasible. These criteria are very similar to criteria applicable to response actions under CERCLA and the NCP. Those authorities require that remediations be protective of human health and the environment, meet ARARs, and consider advancing numerous other factors, including: long-term permanence; the reduction of toxicity, mobility or volume; implementability; and cost effectiveness. In addition, the NCP requires that groundwater remedial actions generally attain federal MCLs and non-zero MGCLs where relevant and appropriate; the NCP also requires remedial alternatives to take into account the expectation that the remedial action will return groundwater to its beneficial uses wherever practicable within a reasonable timeframe for the site circumstances. The WQARF provisions do not appear to be more stringent than those in the NCP and therefore are not ARARs. Any remedy that EPA selects will meet the WQARF statutory criteria by meeting the NCP requirements.

Cost Effectiveness

A cost-effective remedy is defined as one in which "costs are proportional to its overall effectiveness" (40 C.F.R. § 300.430(f)(1)(ii)(D). Assessing cost-effectiveness involves comparing costs to overall effectiveness, which is determined by evaluating the following three of the five balancing criteria: 1) longer-term effectiveness and permanence; 2) reduction in toxicity, mobility and volume through treatment; and 3) short-term effectiveness.

The selected remedy is cost effective. Although Alternative 5 met the threshold criteria and was slightly less expensive, the selected remedy suggests higher levels of long term effectiveness and permanence, demonstrated higher levels in reduction of toxicity and mobility through treatment, and is considered as having higher levels of long-term effectiveness that the other Alternatives.

Utilization of Permanent Solutions and Alternative Treatment Technologies

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner in Area B of the TIAA Superfund Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance in terms of the five criteria, while also considering the statutory preference for treatment as a principal element, bias against off-Site treatment and disposal, and considering state and community acceptance. All of the ISCO remediation will take place at the Site. The selected remedy treats the groundwater contaminants in-situ and will result in a permanent cleanup of groundwater. The groundwater will be treated in-situ, thereby avoiding the water chemistry issues and complications that arise when groundwater is extracted and treated. There will be no ancillary environmental concerns that can be associated with the operations or any discharges from a treatment plant.

Preference for Treatment as a Principal Element

EPA has determined that the selected remedy meets the statutory preference for treatment as a principal element. The contamination is not highly toxic when compared to the EPA standard definition of principal threat waste. Furthermore, the selected remedy uses ISCO in known source areas which meets the preference for treatment as a principal element.

Five-Year Review Requirements

The NCP §300.430(f)(4)(ii) requires a five-year review if a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. Because this remedy will result in contaminants remaining on-Site and the future property use will be limited, EPA will conduct the required statutory five-year reviews to ensure that the remedy is, and will continue to be, protective of human health and the environment. The first Five year Review for Area B of TIAA Superfund Site will occur in the year 2013.

Documentation of Significant Change

The Proposed Plan for amending the TIAA Superfund Site ROD was released for public comment in October 2011. The Proposed Plan identified ISCO at West-Cap, TI, and AANG and MNA at West Plume B as the preferred alternative for groundwater remediation. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

PART III: RESPONSIVENESS SUMMARY

This Responsiveness Summary provides EPA's response to written and oral comments received from the public and governmental agencies on EPA's October 2011 Proposed Plan for the TIAA Superfund Site ROD Amendment for Area B.

On October 15, 2011, the Proposed Plan was mailed to the persons and organizations on the TIAA Superfund Site mailing list, including local residents. The Proposed Plan summarized EPA's proposed amended remedy for the Site and invited citizens to attend a November 16, 2011, public meeting in Tucson at which EPA presented the proposed amended remedy and received one oral public comment. In addition to the public meeting, there was a 30-day comment period on the proposed amended remedy from October 26 to November 30, 2011. During the public comment period EPA received one written comment letter from an individual member of the public, one comment letter from the contractors representing the Arizona Air National Guard, and one comment letter from the Arizona Department of Environmental Quality. A transcript of the public meeting and copies of the written comments are included in the Administrative Record for this ROD Amendment.

The comments received during the public comment period show that the public and the State supports efforts to clean up groundwater at the Site.

COMMENTS ON EPA'S PREFERRED ALTERNATIVE

1. **Comment:** One commenter suggested that although the community may not fully understand the details of the clean up process, there is a cooperative relationship with EPA and the Unified Community Advisory Board (UCAB) and he supports the selection of the Preferred Alternative.

   EPA Response: EPA fully appreciates the long standing support of the community and the UCAB for the clean-up activities at the Tucson International Airport Area Superfund Site.

2. **Comment:** One commenter proposed that a specific innovative low cost air stripper be considered for implementation in the remediation operations.

   EPA Response: EPA supports the use of innovative technologies when applicable, but the proposed use of wellhead treatment is not relevant to the Preferred Alternatives identified in the Proposed Plan.

3. **Comment:** Environmental Resources Management, on behalf of the AANG, provided a letter that provided several editorial comments on the Proposed Plan document.

   EPA Response: EPA appreciates the efforts by the contractors of AANG to review and propose edits to the Proposed Plan document. The document was already printed and distributed to the public before these comments were received. The Proposed Plan document went to the printer on October 24, 2011 and the comment letter from the AANG contractor was dated November 3, 2011.

4. **Comment:** Several of the AANG comments on the Proposed Plan note it is written in a manner to imply that all of the contamination at West Plume B originates from AANG. It was proposed that references should be added that some of the contamination in West Plume B comes from West-Cap.

EPA Response: The 2002 Remedial Investigation Report for West Plume B states that the contamination from West Plume B originates from AANG property. The Proposed Plan as written is consistent with this determination. It has also been generally accepted that there is a commingled plume on AANG Property. The issues of allocation of responsibility do not factor into the selection of the remedy and these comments are not relevant.

5. **Comment:** The AANG commented that there should be some reference to the recent EPA revisions to the toxicity evaluation of TCE.

   EPA Response: There has not been any change in the MCL for TCE at this time. The MCL is the ARAR used to develop the clean-up standards. Any future changes to the MCL for TCE and other COCs will be evaluated during future Five-Year Reviews.

6. **Comment:** The AANG commented that there should be discussion of whether injections are planned between project Sites (particularly between AANG and West-Cap properties), as this would account for a large portion of the defined plume and contaminated media.

   EPA Response: EPA considered including specific injection locations in the figures and the discussion in the Proposed Plan, but decided it would be premature and misleading to try to identify specific locations for the injection of potassium permanganate. Data collected through the addition of two monitoring wells and the rebound test on the AANG property will be used to determine the most strategic locations for the implementation of the ISCO remedy.

7. **Comment:** The AANG commented that the conditions for shut down of the existing pump and treat system should be identified in the discussion of the Preferred Remedy.

   EPA Response: EPA considers discussions for the details regarding the shut-down of the pump and treat system to be too detailed for the purposes of the Proposed Plan. The discussions in the selected remedy in the ROD Amendment do provide more details on the shutdown of the pump and treat system in relation to the rebound test, which will be used to identify strategic locations for ISCO treatment of residual VOC areas at the Site.

8. **Comment:** The Arizona Department of Environmental Quality supports the selection of ISCO at West-Cap, Texas Instruments, and AANG with MNA at West Plume B as the selected remedy.

   EPA Response: EPA appreciates the support and high level of cooperation of the Arizona Department of Environmental Quality in the remediation efforts at the TIAA Superfund Site.

9. **Comment:** ADEQ believes there are data gaps that need to be closed before implementation of the selected remedy that include a rebound test on AANG and the installation of additional monitoring wells. ADEQ is currently using EPA grant money to install additional wells to obtain any missing data.

   EPA Response: EPA agrees that certain data gaps need to be resolved and supports ADEQ using the EPA grant money to install the monitoring wells.

Appendix A
Monitored Natural Attenuation Technical Memorandum

Evaluation of Monitored Natural Attenuation within Area B of the Tucson International Airport Area Superfund Site

PREPARED FOR: Martin Zeleznik/USEPA

PREPARED BY: CH2M HILL

DATE: September 14, 2011

1.0 Introduction

This memorandum evaluates whether using Monitored Natural Attenuation (MNA) is a viable alternative for remediation within Area B of the Tucson International Airport Area (TIAA) Superfund Site. Area B includes multiple plumes of trichloroethene (TCE) groundwater contamination; the plumes of contamination are managed as the West Plume B (WPB), Arizona Air National Guard (AANG), West Cap, and Texas Instruments project areas (Figure 1). The focus of this evaluation will be the WPB area because contaminant concentrations are relatively low and no active remediation has been implemented in this area. A more limited qualitative analysis of whether MNA could be a feasible alternative for AANG, West Cap and Texas Instruments project areas will also be discussed in the conclusions.

This MNA assessment was conducted within the framework outlined in the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (the Technical Protocol) (Unites States Environmental Protection Agency (USEPA), 1998). The basis for this analysis consists of the review of data presented in two previous MNA evaluations conducted in 2000 and 2006, as well as review of additional site data collected since the previous evaluations were conducted. This information was used to identify and quantify attenuation mechanisms taking place in the WPB area according to methods proposed in the Technical Protocol. If review of available data indicates insufficient information is available to quantify specific attenuation mechanisms, data gaps and methods of obtaining the missing information are identified.

This technical memorandum includes:

- 1.0 Introduction, which presents the purpose and organization of the memorandum.
- 2.0 Site Hydrogeology, which presents a brief description of hydrogeological conditions at the site.
- 3.0 Previous MNA Evaluations, which summarizes the findings presented in previous MNA evaluations conducted in 2000 and 2006.

- 4.0 New Site Data, which presents new data collected between 2006 and 2009 and compares the new TCE concentration trends and distribution to those presented in the 2006 MNA evaluation.
- 5.0 Attenuation Mechanisms, which identifies mechanisms responsible for the observed attenuation within WPB, and their relative significance compared to one another.
- 6.0 Quantification of Attenuation Mechanisms, which presents mathematical methods used to estimate the effect each attenuation mechanism has on the overall attenuation of the WPB contamination plume.
- 7.0 Enhanced Attenuation, which presents methods of enhanced attenuation (EA) which can be used in conjunction with MNA to achieve site remedial goals.
- 8.0 Conclusions, which summarizes the findings of this MNA evaluation.
- 9.0 References, which presents the cited references.

2.0 Site Hydrogeology

In the vicinity of the TIAA Site, the regional aquifer system is hydrogeologically complex due to lateral and vertical stratigraphic changes. This technical memorandum focuses on the Upper Unit of the aquifer, where VOC contamination has been observed. A complete description of the hydrogeology of the TIAA site is provided in the *Feasibility Study of Former West-Cap Property and West Plume B with Supplemental West-Cap Remedial Investigation Results* (CH2M HILL 2002).

Within Area B, the Upper Unit occurs between approximately 85 and 145 feet bgs, and contains one or two coarse-grained layers (subunits) in some areas of the Site, or consists entirely of fine-grained sediments. The coarse-grained subunits are termed the Upper Subunit (USU) and the Lower Subunit (LSU) based on their relative depths. The fine-grained sediments are termed Shallow Groundwater Zones (SGZs) when saturated. SGZs occur within the Upper Unit where unconfined saturated silt- and clay-rich sediments exist above or within the USU and/or the LSU. In these areas, continuously saturated conditions exist between the water table of the SGZ and the underlying subunit(s). SGZs consist predominately of saturated, fine-grained sediment, but may be locally interbedded with very thin (less than 1 foot), discontinuous, lenses of coarser-grained material.

The water table occurs about 110 feet below ground surface (bgs). Groundwater in Area B generally flows from southeast to northwest. The West Cap and Texas Instruments project areas appear to have distinct source zones, while the WPB and AANG project areas do not. These source areas are believed to be residual contaminants within fine-grained sediments at the base of the vadose zone, within the capillary fringe, and in the upper SGZ.

3.0 Previous MNA Evaluations

Previous MNA evaluations related to TCE groundwater contamination in the WPB project area of the TIAA Superfund Site were conducted by CH2M HILL in 2000 and by the

Arizona Department of Environmental Quality (ADEQ) in 2006. These evaluations are discussed below.

2000 MNA Evaluation

CH2M HILL conducted an evaluation of the potential use of MNA as a remedial treatment for the WPB area in 2000. The evaluation was based on data collected from fourteen monitoring wells in the WPB area (WPB-1 through WPB-14); the locations of these wells are presented in Figure 2. Historical groundwater sampling results from these monitoring wells were reviewed to evaluate temporal and spatial changes in TCE concentrations. MNA screening parameters including total petroleum hydrocarbons (TPH), oxidation-reduction potential (ORP), dissolved oxygen, pH, total organic carbon (TOC), methane, sulfate, and nitrate concentrations were measured to compare observed values in the WPB area to those values known to be conducive to biodegradation of TCE. The results of this evaluation are summarized below; the complete report is presented in *Using Monitored Natural Attenuation as a Potential Remedial Alternative for West Plume B* (CH2M HILL, 2000).

Three mechanisms for the biodegradation of chlorinated aliphatic hydrocarbons were presented, including reductive dechlorination, direct oxidation, and co-metabolism. Based on the chemical and physical properties of chlorinated hydrocarbons, reductive dechlorination was reported as the mechanism most likely to cause the biodegradation of TCE. However, reductive chlorination takes place in anaerobic conditions (e.g., dissolved oxygen concentration less than 1 milligram per liter (mg/L)), and the dissolved oxygen concentrations measured in monitoring wells studied in this evaluation ranged from 1.53 to 9.88 mg/L. Based on the observed dissolved oxygen concentrations, the WPB area was reported "not likely to support reductive chlorination on a widespread basis."

Despite the reportedly aerobic conditions observed in samples collected during this study, breakdown products of TCE, including primarily cis-1,2-dichloroethene (cis-1,2-DCE) and, to a lesser extent vinyl chloride, were detected in monitoring wells WPB-5, WPB-6, and WPB-8. The detections of these compounds provided evidence that the anaerobic biodegradation of TCE by reductive dechlorination was occurring in some areas. One hypothesis presented to explain a mechanism which could create the conditions necessary for the anaerobic degradation of TCE was the presence of underground storage tanks (USTs) in the WPB area which may have leaked petroleum hydrocarbons to the subsurface, resulting in the consumption of oxygen through the direct oxidation of petroleum hydrocarbons.

TCE concentrations in the WPB area were observed to be decreasing over time and down-gradient of the suspected source. Based on this information, CH2M HILL reported that further evaluation could be carried out to quantify the mobility of the contaminant to more accurately assess how dispersion, dilution, and adsorption affect MNA at the site.

The evaluation concluded that biological degradation was likely not occurring to a great enough extent to degrade all TCE by reductive dechlorination. It was concluded, however, that physical and geochemical processes may reduce TCE concentrations to less than the maximum contaminant levels (MCLs), and that MNA should be retained as a potentially viable remedial alternative for further evaluation in the future Feasibility Study process.

2006 MNA Evaluation

ADEQ conducted an evaluation of the potential use of MNA as a remedial treatment for the WPB area in 2006. The evaluation was based on review of (1) sources of TCE contamination, (2) extent and degree of TCE contamination, (3) mass attenuation of TCE contamination, (4) TCE attenuation mechanisms, and (5) TCE risk management in the West Plume B area. The results of this evaluation are summarized below; the complete report is presented in *Monitored Natural Attenuation (MNA) Technical Memorandum, West Plume B – TIAA CERCLA Site* (ADEQ, 2006).

Sources of TCE contamination were evaluated for Area B of the TIAA Superfund Site, including the WPB, AANG, West Cap, and Texas Instruments project areas. No sources of TCE were identified in the WPB area. Sources of TCE contamination were identified at project areas south of Valencia Road (hydraulically upgradient of WPB); however, ADEQ reported that the AANG operates a groundwater pump, treat, and injection system to contain TCE contamination south of Valencia Road.

TCE distribution plumes were presented for 1999, 2002, 2004, and 2005 for TCE concentration contours of 5, 10, and 20 parts per billion (ppb). Based on the change in distribution of the TCE concentration contours over time, the extent and degree of TCE contamination was reported to be "steadily decreasing due to attenuation." Concentration trend analysis was also performed for each monitoring well in the WPB project area; this concentration trend analysis showed that TCE concentrations in "nearly all monitor wells have declined steadily between 1999 and 2005." ADEQ reported that the head of the TCE plume is not advancing and concentrations in the central and tail of the plume are decreasing. ADEQ projected TCE concentrations in the WPB project area should be below the MCL for TCE (5 ppb) in approximately 10 years if capture of sources south of Valencia Road continues through the ongoing operation of the AANG treatment system.

ADEQ reported that the mass of dissolved-phase TCE decreased 42% from 1.6 kg in 1999 to 0.9 kg in 2005. Based on the assumption that the fraction of organic carbon (F_{oc}) in soil at the site is 0.001, the total mass of TCE (including sorbed-phase TCE) was estimated to be 1.2 kg in 2005.

The relative importance of TCE attenuation mechanisms (e.g., advection, dispersion, retardation, biodegradation) was not quantified in the evaluation. ADEQ reported that previous groundwater flow and contaminant transport modeling conducted for WPB, which assumed source control south of Valencia Road, no contaminant retardation or degradation, and transport by advection and dispersion, predicted TCE plume attenuation in 30 to 60 years. Based on the information presented above, ADEQ also reported that attenuation is occurring significantly faster than previously predicted through modeling. Attenuation mechanisms were reportedly a combination of (1) dilution due to diffusion and dispersion, (2) retardation due to sorption and diffusion into dead-end pore spaces, and (3) anaerobic biodegradation. Similar to the 2000 MNA evaluation, the detection of TCE breakdown products was presented as evidence of anaerobic biodegradation as cis-1,2-DCE was detected in monitoring wells WPB-8 and PW-002. WPB-8 was reported to exhibit detectable levels of cis-1,2-DCE in the previous MNA evaluation (CH2M HILL, 2000); however, the detection of TCE breakdown products in monitoring well PW-002 provided

new information not available in 2000 which indicated more widespread anaerobic biodegradation of TCE than previously observed.

ADEQ reported that risk management for the WPB project area includes coordination with the Arizona Department of Water Resources (ADWR) and private well owners on issues such as the installation of new wells, the monitoring of active private wells, reporting analytical groundwater sampling results to well owners, and providing municipal water supply to well owners whose wells have been impacted by contamination associated with WPB. These actions were recommended to continue until all portions of the aquifer in the vicinity of WPB exhibit chlorinated hydrocarbon concentrations below drinking water standards.

Based on the information summarized above, ADEQ recommended that MNA be the selected remedy for the WPB project area. ADEQ recommended continued monitoring of existing wells and the installation of one additional groundwater monitoring well in the southern portion of the site to confirm the plume between AANG and WPB was discontinuous. ADEQ also recommended that the AANG install additional groundwater monitoring wells west of the AANG property to confirm containment and capture of TCE south of Valencia Road. Continued risk management and communication with private well owners was recommended. ADEQ also recommended that if any localized hotspots of TCE contamination persist longer than expected, treatment of these areas with potassium permanganate *in-situ* oxidation may be performed in order to reduce exposure risk and remediation timeframes. Review of the MNA remedy was recommended to occur once every 5 years to verify protectiveness.

4.0 New Site Data

The MNA evaluations described in Section 3 included data from 1998 through 2005. On June 22, 2009, ADEQ provided CH2M HILL with groundwater sampling data for 173 monitoring wells within Area B, including the WPB, AANG, West Cap, and Texas Instruments project areas. The locations of each of the 173 monitoring wells included in the database are presented in Figure 2. The data included groundwater samples collected from February 1997 through March 2009. This database of analytical results was used to evaluate changes in the extent and degree of TCE contamination in the WPB project area which have occurred since the previous MNA evaluation was conducted, and also to review the behavior of TCE concentration trends among WPB monitoring wells over the entire period of record. The results of these evaluations are presented below.

As stated in the Technical Protocol, the definition of monitored natural attenuation includes:

> *"…a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil and ground water."* (USEPA, 1998)

Pump and treat groundwater remediation systems have been operated at the AANG, West Cap, and Texas Instrument project areas for the majority of the period for which analytical data are available for these sites. This human influence on the reduction of mass, toxicity, mobility, volume, and concentration of contamination at these project areas makes

evaluation of the mechanisms and performance of MNA as a stand-alone remedy at these sites problematic. MNA is best evaluated under more steady-state conditions and over long periods of time. The conditions at AANG, West Cap, and Texas Instruments have been transient due to various active remediation efforts in operation. Therefore, the new site data has been used in this evaluation to assess possible mechanisms responsible for the observed attenuation at the WPB project area only, where no active remediation has taken place. Conclusions regarding the applicability of MNA at WPB will be evaluated to determine if the findings from WPB apply to other project areas within Area B. As stated in the Technical Protocol and the *Technical and Regulatory Guidance, Enhanced Attenuation: Chlorinated Organics* (Interstate Technology Regulatory Counsel (ITRC), 2008), when MNA is not an appropriate stand-alone remedy, successful application of MNA can be performed in conjunction with active remedies such as source control. The application of MNA in conjunction with active remedies is discussed further in Section 7.

Extent and Degree of TCE Contamination at WPB

The extent and degree of TCE contamination at WPB was evaluated graphically with TCE concentration contours of 5, 10, and 20 micrograms per liter (µg/L) for the years 1999, 2004, and 2009 to determine how the spatial distribution and magnitude of TCE concentrations has changed through time (Figures 3 through 5). Comparison of Figures 3 through 5 shows that the magnitude of TCE concentrations in WPB has decreased between 1999 and 2009. The overall findings from TCE concentration contour plots from 1999 through 2009 indicate that the TCE plume is not advancing, the size of the plume is reducing slowly, but more importantly the magnitude of TCE concentrations is decreasing towards the MCL of 5 µg/L. These findings are consistent with the TCE plume distributions presented in the 2006 MNA evaluation. The decreasing concentration trends graphically presented in Figures 3 through 5 are evaluated in more depth in the Concentration Trends in WPB Monitoring Wells section below.

Concentration Trends in WPB Monitoring Wells

The TCE concentration trends were evaluated for wells in the WPB project area. Duplicate samples were not considered in the concentration trend evaluation, and in instances of non-detect results, a value of one half the reporting limit was used.

Figures 6 and 7 present TCE concentrations for groundwater samples collected from wells in the southern and central portions of the WPB project area, respectively. All wells in these areas show decreasing or stable concentration trends below the MCL of 5 µg/L. The new data for the period between 2006 and 2009 indicate no change from conditions previously reported by ADEQ in 2006. Because all groundwater samples collected from these wells have exhibited TCE concentrations below 5 µg/L since at least February 2003, no further concentration trend analysis was performed for these locations.

Figure 8 presents TCE concentrations for groundwater samples collected from wells in the northern portion of the of WPB project area. Monitoring well WPB-19 exhibited an increasing concentration trend from June 2004 through November 2005 when the maximum concentration of 5.1µg/L was measured; since November 2005, WPB-19 has shown a decreasing concentration trend with all subsequent samples exhibiting TCE concentrations below the MCL of 5µg/L. All other wells presented in Figure 8 have exhibited stable

concentration trends below the MCL. The new data for the period between 2006 and 2009 did provide additional information on the concentration trend of WPB-19. At the time of the previous MNA evaluation, this monitoring well was exhibiting an increasing concentration trend with the most recent sample result equal to the MCL. Because this monitoring well is located in the northern portion of WPB, the concentration trend could be interpreted as the migration of WPB in the direction of groundwater flow to the northwest. However, seven consecutive samples collected subsequent to the 2006 MNA evaluation indicate that TCE concentrations in WPB-19 are both decreasing and have been below the MCL since at least February 2006. Because groundwater samples collected from these wells have consistently exhibited TCE concentrations below 5 µg/L, no further concentration trend analysis was performed for these locations.

Figure 9 presents TCE concentrations for groundwater samples collected from wells located in the zone of highest TCE concentrations in the WPB project area. Groundwater samples collected from these wells consistently exhibit TCE concentrations above 5 µg/L. Monitoring wells WPB-05, WPB-08 and WPB-11 have exhibited decreasing concentration trends since at least August 2000. Monitoring well PW-002 exhibited an increasing concentration trend from February 1997 to November 2000 after which time this well has exhibited a decreasing concentration trend. The new data for the period between 2006 and 2009 indicate the decreasing concentration trends (for all wells shown in Figure 9) previously reported by ADEQ in 2006 have persisted in the approximately three year period since the 2006 MNA evaluation. Projections regarding the attenuation rates in these wells which consistently exhibit TCE concentrations above the MCL will be discussed in Section 6.

The concentration trends of monitoring wells with fewer than three reported samples were not presented in Figures 6 through 10. This included monitoring well WPB-14 which was sampled once on August 2, 2006 and exhibited a TCE concentration of 4.7 µg/L, and monitoring well PW-021 which was sampled once on February 5, 2004 and exhibited a non-detect TCE result of less than 0.5 µg/L. In addition, monitoring wells MWAF-01 through MWAF-03 were each sampled on two occasions (August 2007 and February 2009). Both samples from monitoring well MWAF-01 contained less than or equal to 1.5 µg/L on both occasions. Samples collected from monitoring well MWAF-02 contained 6.3 µg/L TCE in August 2007 and 6.7 µg/L in February 2009. Samples collected from monitoring well MWAF-03 contained 7.6 µg/L TCE in August 2007 and 10 µg/L in February 2009.

The concentration trend analysis discussed above was made based on data collected over a time period when the water table elevation did not change significantly in WPB. Substantial increases in groundwater table elevation, while not anticipated, could lead to changes in concentration trends due to mobilization of contaminants historically located in the vadose zone.

Evidence of TCE Biodegradation

As presented in Section 3, both the 2000 and 2006 MNA evaluations reported detections of cis-1,2-DCE and/or vinyl chloride as evidence that anaerobic biodegradation of TCE was occurring within the WPB project area. Among the new data reviewed for WPB and Area B from 2006 to 2009, continued detections of cis-1,2-DCE continue to support the hypothesis that biodegradation of TCE is occurring despite the generally aerobic groundwater conditions present in the area. Among samples collected from February 2006 through March

2009, the TCE breakdown product cis-1,2-DCE was detected in 3 monitoring wells within the WPB project area (MWAF-03, PW-002, and WPB-08). The 2000 and 2006 MNA evaluations previously reported the detection of TCE breakdown products in monitoring wells PW-002 and WPB-08; however the detection of cis-1,2-DCE in monitoring well MWAF-03 provides evidence of a larger spatial distribution of locations where biodegradation of TCE is occurring than was previously reported.

Vinyl chloride was detected on one occasion between 1997 and 2009 in wells WPB-06, WPB-08 and WPB-10. The limited detections of vinyl chloride suggest that once this compound is formed, it is rapidly oxidized in the aerobic aquifer to form carbon dioxide, water and chloride ions.

5.0 Attenuation Mechanisms

As described in Section 1.3 of the Technical Protocol, several lines of evidence can be used to demonstrate attenuation of chlorinated aliphatic hydrocarbons, and include the following:

- Demonstrating clear and meaningful decreasing concentration trends over time at appropriate sampling locations; this trend shall not be the result of contaminant migration.
- Indirectly demonstrate the types of attenuation processes active in a study area, and determine the rate at which such processes will lower contamination levels to the remediation goals.

The distribution and concentration trend evaluations discussed in the first bullet above were provided in the 2006 MNA evaluation for the WPB project area; additional concentration trend information gathered from data collected between 2006 and 2009 was presented in Section 4. Section 5 of this MNA evaluation expands upon information previously reported in the 2000 and 2006 MNA evaluations to demonstrate what mechanisms are responsible for the attenuation observed in the WPB project area. This information will be used in the context of the second bullet above to support any estimates made regarding the rate at which attenuation processes at WPB will lower contamination levels to the remediation goals at the site.

Attenuation mechanisms of chlorinated aliphatic hydrocarbons include destructive and non-destructive processes which result in the decrease in concentration of a contaminant in groundwater. Destructive attenuation mechanisms include biodegradation and abiotic chemical reactions such as hydrolysis. Non-destructive mechanisms include hydrodynamic dispersion, sorption, volatilization, and dilution due to groundwater recharge. Each of these mechanisms is discussed in further detail below to determine what primary mechanisms are responsible for the attenuation observed in the WPB area. Following the initial discussion of each mechanism, methods used in the quantification of attenuation mechanisms are presented.

Hydrodynamic Dispersion

Hydrodynamic dispersion is the combination of molecular diffusion and mechanical dispersion. Molecular diffusion is the movement of molecules from areas of high

concentration to areas of low concentration, and is driven by concentration gradients. Mechanical dispersion is the result of phenomena associated with the advective flow of water through porous media. Variability in pore sizes, variability in the length and direction of groundwater flow paths at the pore scale, and variability of the speed of groundwater flow through a single pore (i.e., flow rate in center of pore versus flow rate at edge of pore) are all contributing factors to the mechanical dispersion which occurs when water flows through porous media. The consequence of hydrodynamic dispersion on a contamination plume is that over time the plume spreads out in space and concentrations within the plume decrease.

While molecular diffusion can be a significant driver for the movement of contaminants from relatively high permeability materials such as sands and gravels into lower permeability materials such as silts and clays, the relative contribution of molecular diffusion to hydrodynamic dispersion compared to the contribution from mechanical dispersion is often insignificant and frequently neglected (Fetter, 1999). One situation where molecular diffusion would play a significant role in hydrodynamic dispersion would be in the case where no groundwater flow is occurring. In such a scenario, no mechanical dispersion would take place and molecular diffusion would be the sole mechanism contributing to hydrodynamic dispersion. However, this is not the case at WPB or in Area B; therefore attenuation due to hydrodynamic dispersion within WPB and Area B is assumed to be dominated by mechanical dispersion rather that molecular diffusion.

The relative importance of mechanical dispersion can be further evaluated by analyzing mechanical dispersion in three dimensions. The effects of longitudinal mechanical dispersion (i.e., the degree of mechanical dispersion which takes place in the direction parallel to groundwater flow) is significantly greater than the effects of transverse mechanical dispersion (i.e., the degree of mechanical dispersion which takes place in directions perpendicular to groundwater flow). Transverse mechanical dispersion results only from the divergence of groundwater flow paths at the pore scale. Longitudinal mechanical dispersion, on the other hand, occurs as a result of additional mechanisms such as variations in pore size and variations in the velocity of groundwater flow through a pore (i.e., flow rate in center of pore versus flow rate at edge of pore) (USEPA, 1998).

Based on the information above, hydrodynamic dispersion is considered to be a significant mechanism in the attenuation observed at WPB. Mechanical dispersion is considered to play a much more important role than molecular diffusion in this process. Furthermore, the effects of longitudinal mechanical dispersion are expected to result in more significant attenuation than those of transverse mechanical dispersion. Methods used to approximate the magnitude of hydrodynamic dispersion are presented in Section 6.

Sorption

Sorption is a reversible process in which dissolved-phase chemicals partition from groundwater and adhere to the surfaces of aquifer matrix particles such as clay particles or organic carbon material. Sorption can play a significant role in attenuation for several reasons. When sorption takes place, the contaminant is no longer in the groundwater dissolved-phase thus temporarily reducing the concentration of the contaminant in groundwater. The ongoing cycle of sorption and desorption also results in the slowing down of the transport of a contaminant through porous media compared to the

groundwater flow rate through the same porous media, a phenomena known as retardation. Various intra-molecular forces and other mechanisms drive sorption; however, hydrophobic bonding is a critical driving force in the sorption of chlorinated compounds (Devinny *et al.*, 1990). The F_{oc} in the aquifer matrix has a significant influence on the amount of sorption that takes place. Previous soil samples collected from the WPB area have been analyzed for F_{oc}, and indicate that sorption is an attenuation mechanism which should be considered in the MNA evaluation for WPB and Area B. These results are discussed further in Section 6.

Volatilization

At the interface between a body of water and air, the concentration of a chemical in the water is proportional to the concentration of that chemical in the air above. This relationship is given by Henry's Law:

$$C_a = HC_w,$$

where,

C_a = The concentration of a given chemical in air

C_w = The concentration of a given chemical in water

H = Henry's Law Constant, specific to each chemical of interest

While volatilization of chlorinated aliphatic hydrocarbons does occur from groundwater contamination plumes, and this volatilization does result in the removal of contaminant mass from the plume, several factors combine to limit the amount of mass that is removed from the dissolved-phase plume and transferred into soil vapor. These factors include (1) the relatively small surface area over which chemical exchange can take place in the subsurface, (2) the limited movement of soil vapor in the subsurface, and (3) the fact that TCE and other chlorinated aliphatic hydrocarbons exhibit low Henry's Law constants due to their physical and chemical properties (USEPA, 1998). The Technical Protocol states that the effect of volatilization on contaminant mass reduction from a contamination plume can be neglected for most compounds. Based on this information, volatilization is not believed to be a primary attenuation mechanism in WPB or in Area B of the TIAA Superfund Site.

Dilution

Dilution of a contamination plume can occur through the recharge of groundwater from precipitation percolating through the vadose zone to the aquifer below, and from recharge by surface water bodies such as lakes or streams. There are no lakes or perennial streams in the vicinity of WPB or any other project area within Area B. The AANG operates a groundwater pump, treat, and injection system south (hydraulically up-gradient) of WPB. While upgradient re-injection of groundwater which is also extracted from an upgradient location does not fit the traditional definition of dilution (i.e., by rainfall or surface water bodies), it is possible that the AANG treatment system could have a net diluting effect on the southern portion of the WPB TCE plume. In addition, Tucson receives approximately 12 inches of precipitation annually. The majority of precipitation in the vicinity of Area B falls on paved asphalt and concrete surfaces as well as building roofs. Stormwater runoff flows to ephemeral washes which flow out of Area B. Unpaved surfaces in Area B contain

vegetation which intercepts some percentage of precipitation and releases it back into the atmosphere through evapotranspiration. While some small amount of contamination plume dilution due to aquifer recharge is expected to occur at WPB and in Area B, the amount of plume dilution due to groundwater recharge is inherently difficult to estimate. Methods used to quantify attenuation mechanisms are largely unable to separate out the effects of plume dilution from more significant mechanisms such as hydrodynamic dispersion; consequently, the net effect of mechanisms such as hydrodynamic dispersion and dilution are typically calculated together. Such methods are presented in Section 6.

Biodegradation

Biodegradation represents a significant mechanism involved in the attenuation of many forms of subsurface contamination. The process of biodegradation involves the consumption (or breakdown) of contaminants such as TCE during metabolic processes of microorganisms present in soil and groundwater. Specific metabolic processes depend on conditions such as the presence or absence of oxygen. As presented in Section 3, the process most likely to lead to the biodegradation of TCE in groundwater is reductive dechlorination, which takes place in anaerobic conditions. While groundwater in WPB and Area B exhibit levels of dissolved oxygen which largely indicate aerobic groundwater, evidence of reductive dechlorination is observed by the detection of TCE breakdown products such as cis-1,2-DCE in groundwater samples collected from these areas. Based on the detection of TCE breakdown products within WPB, biodegradation is considered to be a potentially significant attenuation mechanism for this area.

Abiotic Chemical Reaction

Abiotic destructive chemical reactions are not thought to contribute significantly to the attenuation of TCE in groundwater. The half life of TCE in the vadose and saturated zones has been reported to be approximately 274 years (ADEQ, 1996). As a result, while it is recognized that this attenuation mechanism does account for a small decrease in TCE concentrations within WPB, the magnitude of abiotic chemical reaction compared to others attenuation mechanisms discussed above is small. Therefore, this attenuation mechanism can be neglected and is not included in the attenuation mechanism calculations presented in Section 6.

6.0 Quantification of Attenuation Mechanisms

Several methods were used to quantify the attenuation observed at WPB. These methods included the application of a curve-fitting model to data collected from monitoring wells which exhibit TCE concentrations above the MCL, and the use of mathematical methods for estimating the magnitude of select attenuation mechanisms described previously in Section 5 of this memorandum. The basis for these methods and calculations used in this Technical Memorandum were Appendices B and C of the Technical Protocol which provide guidance on applicable models and techniques which can be used in attenuation-related calculations. These analyses are presented below.

Overall Attenuation Rate

Figure 10 presents the projected attenuation of TCE in monitoring wells which consistently exhibit TCE at concentrations above the MCL. The attenuation projections are based on an exponential decay model of the form:

$$C = C_o e^{-kt},$$

where,

C = TCE concentration at time t

C_o = Initial TCE concentration

e = an irrational numerical constant approximately equal to 2.71828

k = overall attenuation rate

t = time

Based on the projected attenuations for each well shown in Figure 10, TCE concentrations in monitoring wells WPB-11 and WPB-08 are predicted to be less than 5µg/L between 2014 and 2016. The projected attenuation of TCE to concentrations below 5µg/L in monitoring well WPB-05 is predicted to have occurred in the past (in 2008). In fact, the first sample collected from WPB-05 which exhibited a TCE concentration less than 5µg/L was collected in February 2008. Since that time, two samples collected in July 2008 and February 2009 have exhibited TCE concentrations of 5.2 and 5.5µg/L, respectively; however, TCE concentrations in this well are expected to continue to decrease and stabilize at concentrations below 5µg/L in the near future. The projected attenuation of TCE to concentrations below 5µg/L in monitoring well PW-002 is predicted to occur in approximately 2032.

These projected attenuation periods are similar to those forecast by ADEQ in the 2006 MNA evaluation which appear to have been estimated using the same exponential decay function described above. TCE concentrations below 5µg/L were predicted by ADEQ to occur in monitoring well WPB-05 in 2008. Attenuation timeframes for WPB-11 and WPB-08 were predicted by ADEQ to occur several years after the 2014 – 2016 timeframe described above; the reduction in the predicted attenuation timeframe for WPB-11 and WPB-08 can be attributed to the relatively lower concentrations of TCE observed in these wells in samples collected between 2006 and 2009. No attenuation timeframe was proposed by ADEQ in 2006 for PW-002, so no comparison can be made for that well.

The attenuation projections described above are based on the measured TCE concentrations in groundwater samples collected from WPB. Decreases in TCE concentrations in these groundwater samples can be attributed to all applicable attenuation mechanisms described in Section 5. In other words, the curves shown in Figure 10 represent the combined effect of hydrodynamic dispersion, biodegradation, sorption, dilution from groundwater recharge, and all other acting attenuation mechanisms. In some cases, it is very difficult or impossible to accurately separate these mechanisms from one another and quantitatively predict their individual effect on a contamination plume. In other cases, it is possible to isolate the contribution of one mechanism over another. These methods are summarized below.

Biodegradation vs. Other Attenuation Mechanisms

As presented in Appendix C of the Technical Protocol, attenuation due to biodegradation can be separated out from attenuation due to other mechanisms if data for a suitable tracer compound are available. Tracer compounds suitable for this purpose include compounds with measurable concentrations which are resistant to biodegradation. The best tracer compounds will have physical properties such as a Henry's Law constant and a soil sorption coefficient which are the same as the contaminant of interest. In addition, when possible, it is recommended to use multiple tracers to compare results for consistency (USEPA, 1998). The Technical Protocol recommends selection of suitable tracer compounds for this purpose on a site by site basis with choices based on site-specific conditions. A suitable tracer has not been identified for the West Plume B.

Sorption

Several mathematical relationships describing the behavior of organic chemicals with regard to sorption are given in Appendix B of the Technical Protocol. The distribution coefficient, K_d, represents the distribution of an organic compound between the phase sorbed to the aquifer matrix and the phase dissolved in groundwater:

$$K_d = \frac{C_a}{C_l}$$

where,

K_d = Distribution coefficient (milliliters per gram (mL/g))

C_a = Sorbed concentration (mass contaminant in micrograms per mass of soil in grams)

C_l = Dissolved concentration (mass of contaminant in micrograms per volume of solution in milliliters)

The distribution coefficient can also be related to organic content of soil, as:

$$K_{oc} = \frac{K_d}{F_{oc}}$$

where,

K_{oc} = Soil Sorption coefficient

K_d = Distribution coefficient

F_{oc} = Fraction total organic carbon

The soil sorption coefficient (K_{oc}) is chemical specific, and the soil sorption coefficient for TCE is reported in literature between 87 and 150 mL/g (Knox *et al*., 1993; Jeng *et al*., 1992; Howard, 1990; USEPA, 1998). The fraction total organic carbon in soil at WPB was previously reported in the 2000 MNA evaluation as 0.0006. Assuming a K_{oc} value of the average of 87 and 150 mL/g (118.5 mL/g), the distribution coefficient can be calculated:

$$K_d = K_{oc} \times F_{oc} = 118.5 \times 0.0006 = 0.0711 mL/g$$

Using the original equation for the distribution coefficient from above:

$$K_d = \frac{C_a}{C_l} = \frac{0.0711}{1} = 0.0711$$

This is to say that based on the measured fraction of organic carbon in soil at WPB, and based on the values of K_{oc} reported in literature, out of every 1.0711 micrograms TCE in the WPB groundwater contamination plume, approximately 1 microgram will be dissolved in groundwater and approximately 0.0711 micrograms will be sorbed to the aquifer matrix. In other words, 6.6% of TCE in the WPB groundwater contamination plume is in a non-aqueous phase due to sorption; this results in the lower observed groundwater concentrations than would be present if sorption were not active.

Sorption also affects the speed with which a compound can flow through the aquifer matrix, with sorption resulting in the net reduction in transport velocity, also referred to as retardation. The retarded contaminant transport velocity can be calculated based on the distribution coefficient; this velocity is always lower than the advective velocity of groundwater through the aquifer matrix.

7.0 Enhanced Attenuation

EA is a plume remediation strategy to achieve groundwater remediation goals by providing a "bridge" between MNA and aggressive source zone or dissolved-phase treatment (ITRC, 2008). Treatment of project areas within Area B which exhibit ongoing sources of TCE to groundwater may require a more aggressive remedial treatment, rather than using MNA as a stand-alone remedy. At the same time, aggressive treatment methods such as pump and treat systems may not necessarily be appropriate in some of these areas. EA strategies such as MNA with source zone control are being studied to determine if EA may be the preferred remedial alternative at the other project areas within Area B.

The primary method of enhancing attenuation that has been evaluated at Area B is using in-situ chemical oxidation (ISCO) to control source areas or reduce VOC concentrations in dissolved plume areas. As reported in *In-Situ Chemical Oxidation Pilot Test, Former West-Cap Property, Tucson International Airport Area Superfund Site* (CH2M HILL, 2009), a pilot test was conducted between March 6, 2009 and May 4, 2009 at the West Cap project area using potassium permanganate (KP) injection as a method of source control for TCE contamination at that site. The ISCO process involves the delivery of KP to the zone of contamination where it oxidizes residual TCE, producing inert compounds. Similar ISCO pilot tests using KP injection are being planned, performed, or have been recently performed at other project areas within Area B, including the Texas Instruments and AANG project areas. Ongoing groundwater monitoring results will be used to evaluate the effect of KP injection on TCE concentration in groundwater. If ISCO is demonstrated to be an effective treatment of TCE source zones within Area B, continued ISCO treatment may be selected as an EA method for source zone control to be used in conjunction with MNA to reach remedial goals of Area B of the TIAA Superfund Site.

Enhancement Implementation

As discussed in the technical and regulatory guidance for EA (ITRC, 2008), remediation of a contaminated site is an iterative process whereby the methods of remediation may change over time due to changes in site conditions. In order to evaluate these changes in remedial strategy over time, a decision sequence can be performed to evaluate when MNA is a suitable stand-alone remedy, when EA should be considered, and what conditions would justify the transition from one treatment method to another. This decision sequence is presented in the Expanded MNA/EA Decision Flowchart (Figure 2-1, ITRC, 2008). In this decision sequence, site data are used to evaluate risk, system performance, remediation timeframe, and cost-benefit relationships to determine whether MNA alone is an appropriate remedial alternative. If the answer is no, then enhancements can be evaluated by stating the project goals, identifying technologies available to (1) increase attenuation or (2) reduce loading, and consider options available to meet the project goals. After implementing an enhancement, plume stability is evaluated through time and decision sequences are repeated (i.e., annually) to evaluate changes that justify transition from one remedial strategy to another.

The first step in implementing EA is to provide source area treatment. The current and planned ISCO pilot tests are intended to decrease the VOC loading from the source zone, although ISCO will likely be scaled up to a full-scale remedy before it can be considered a remedial enhancement. Once the enhancements have been implemented, data obtained through routine monitoring can be used to answer questions in the Decision Flowchart, and continue the iterative process. Questions in the Decision Flowchart include:

- Are the risks acceptable?
- Is the plume stable or shrinking?
- Are conditions sustainable?
- Is the remediation time frame acceptable?
- Are the cost-benefits acceptable? (ITRC, 2008)

Evaluation of these questions can help determine whether additional enhancement is required.

8.0 Conclusions

CH2M HILL conducted an evaluation to determine whether MNA is an appropriate remedial alternative for the treatment of TCE groundwater contamination found within Area B of the TIAA Superfund Site. The WPB project area was the primary focus of this evaluation based on the fact that active remediation techniques (such as pump and treat) have not taken place at the WPB project area. This allowed a clear evaluation of the effectiveness of MNA as a stand-alone remedy, and the specific mechanisms responsible for the attenuation observed in this area could also be identified. Conclusions drawn regarding the use of MNA at WPB were then considered in the context of other Area B project areas, including the AANG, Texas Instruments, and West Cap project areas, particularly in conjunction with attenuation enhancements such as ISCO.

Mechanisms identified that play an important role in the attenuation of TCE contamination within the WPB project area include hydrodynamic dispersion, sorption, and biodegradation. Of the mechanisms which contribute to hydrodynamic dispersion, longitudinal mechanical dispersion is the most influential mechanism, with transverse mechanical dispersion and molecular diffusion playing much less significant roles. Additional attenuation mechanisms which are thought to contribute on a very limited basis to the attenuation of WPB include dilution due to groundwater recharge, volatilization, and abiotic chemical reactions.

Based on the cumulative effect each of the attenuation mechanisms listed above have on TCE concentrations in groundwater, projections were made to predict the timeframe needed for MNA to achieve the remediation goal of lowering TCE concentrations below the MCL of 5 µg/L throughout the entire WPB project area. The data indicate that all but one monitoring well in the WPB area are expected to exhibit TCE concentrations below 5 µg/L by 2016, with one monitoring well (PW-002) expected to take until 2032. An alternate well head treatment method may be an alternative for this well if it remains in active use.

The time frames to reach the cleanup appear reasonable with respect to changes in current and foreseeable end use of the groundwater. Although the final remedial goal is to restore the aquifer to drinking water quality there appears to be no current or short-term end use that is limited by implementing an MNA strategy. However, it is always recommended that a regular review of changes in user needs along with the monitoring of remedial progress be established.

Overall, MNA appears to be an appropriate remedial alternative for the WPB project area because:

- The VOC plume in groundwater is shrinking over time, and is not migrating downgradient;
- There is no continuing source of VOCs to the WPB plume;
- Attenuation mechanisms have been identified; and
- The site is expected to meet remediation goals within a reasonable time frame.

Likewise, EA appears to be an appropriate remedial alternative for the lower concentration portion of the plumes in the West Cap, AANG and Texas Instruments project areas provided that certain criteria are met. For example, based on analogy with WPB, MNA is likely feasible for portions of the other TCE plumes that are below approximately 30 ug/L (the initial concentrations observed at WPB), while the higher concentration zones would remain under an active remedy until they reached the necessary threshold. It is recommended that if this strategy is pursued, a more quantitative evaluation be focused on each area to identify potential local conditions that may inhibit attenuation.

9.0 References

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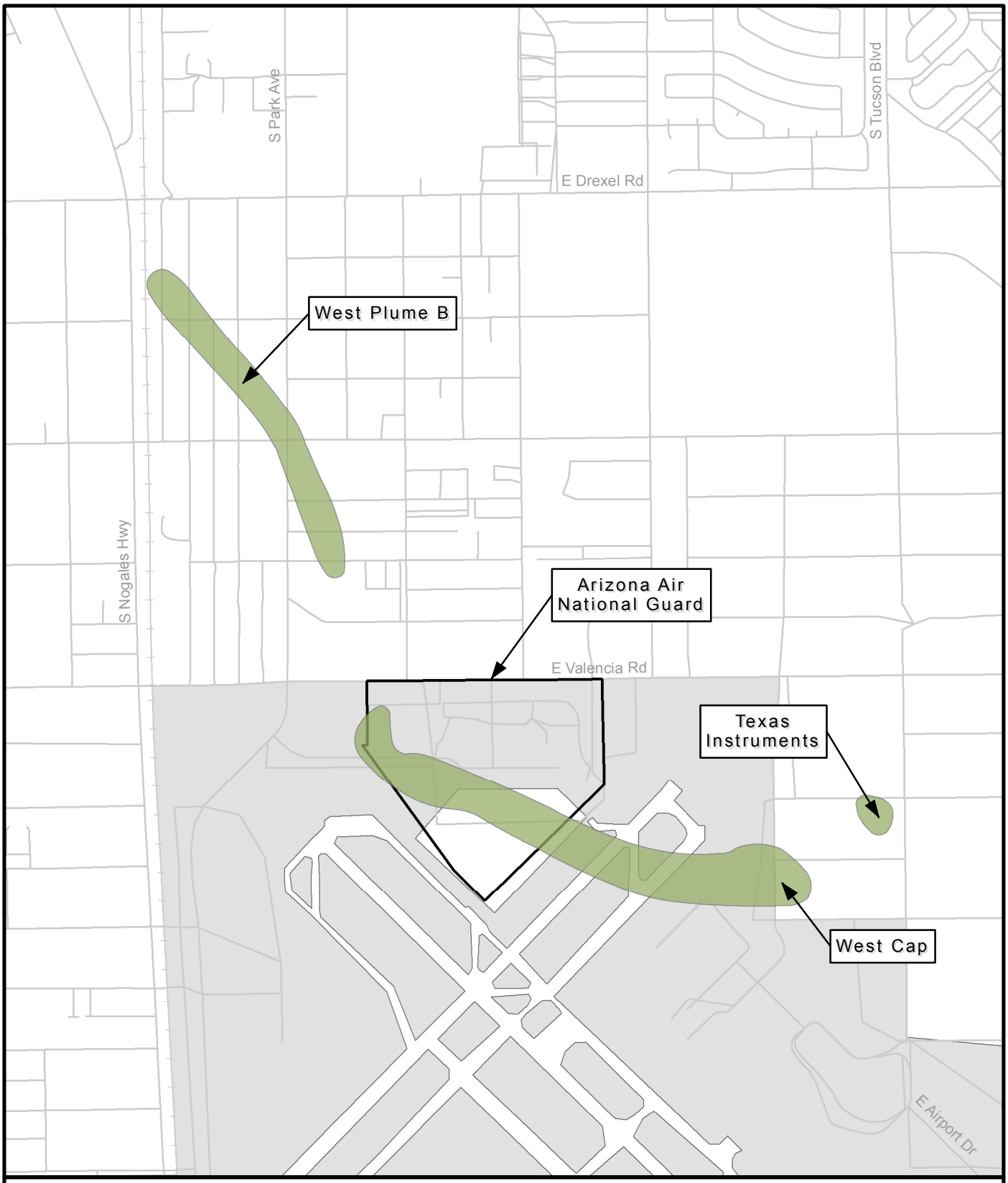
Figures



Legend

- Road
- Union Pacific Railroad
- TCE Plume Concentration ≥ 5 micrograms per liter
- Tucson International Airport

N

0 375 750 1,500 Feet

Note: Plume contours based on groundwater sampling results from February 2009.

FIGURE 1
Site Location Map and Project Areas

Area B
TIAA Superfund Site
Tucson, Arizona

\\MADISON\GROUPS\EMS\GIS_LIBRARY\TUC_OFFICE\TIAA\MAPFILES\CERCLA SITE\FIG1_SITELOCATION.MXD TWONG2 7/14/2009 11:40:33

Legend

- Groundwater Monitoring Well
- Road
- Union Pacific Railroad
- TCE Plume Concentration ≥ 5 micrograms per liter
- Tucson International Airport

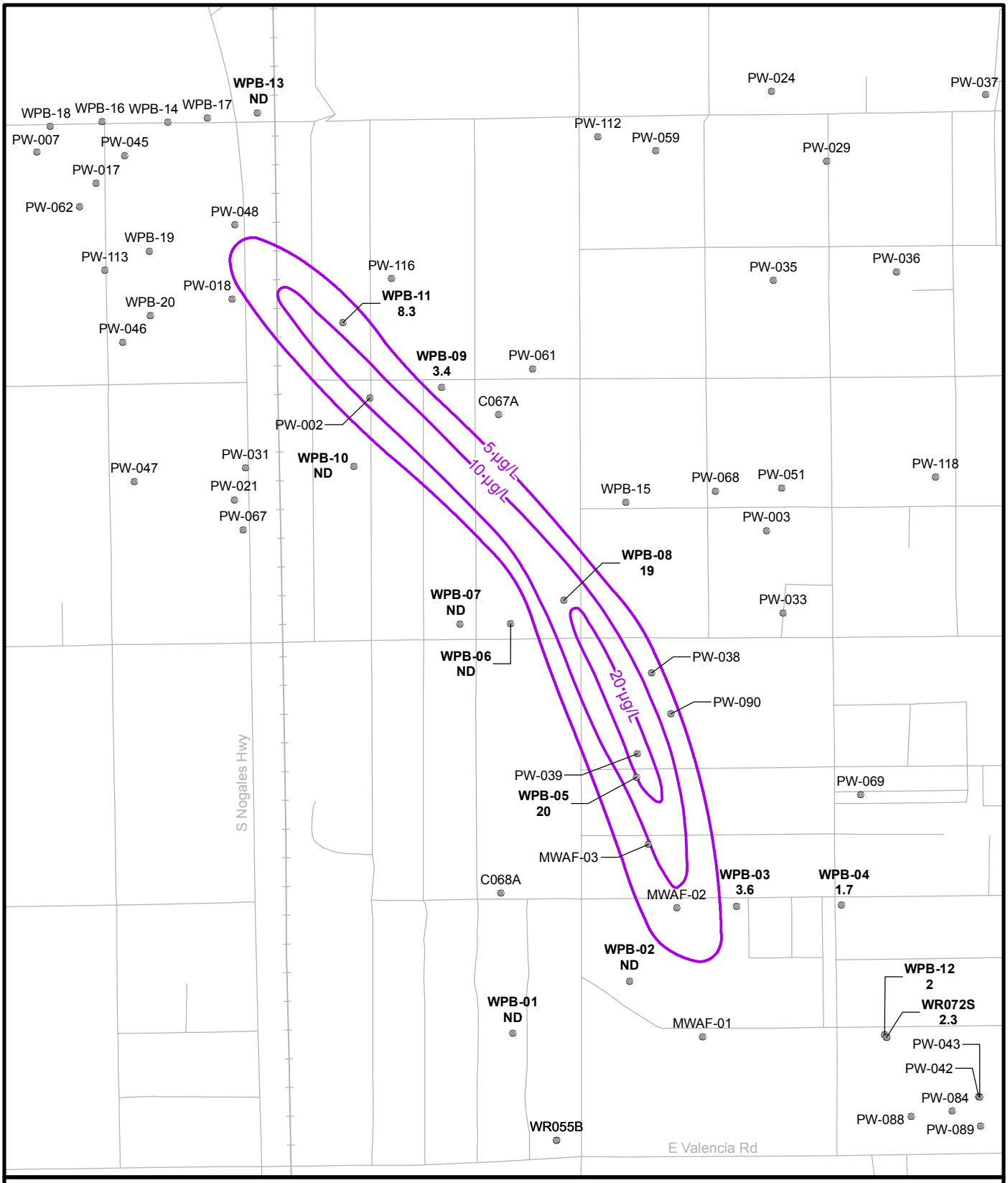
N

0 0.25 0.5 Miles

FIGURE 2
Groundwater Monitoring Well Locations

Area B
TIAA Superfund Site
Tucson, Arizona

\\MADISON\GROUPS\EMS\GIS_LIBRARY\TUC_OFFICE\TIAA\MAPFILES\CERCLA SITE\FIG2_GWMONITORINGWELLS.MXD TWONG2 7/15/2009 15:11:29



Legend

- Area B Well
- WPB-03 — Monitoring Well ID
- 3.6 — Trichloroethene Concentration
- Road
- Union Pacific Railroad
- Trichloroethene Plume

N

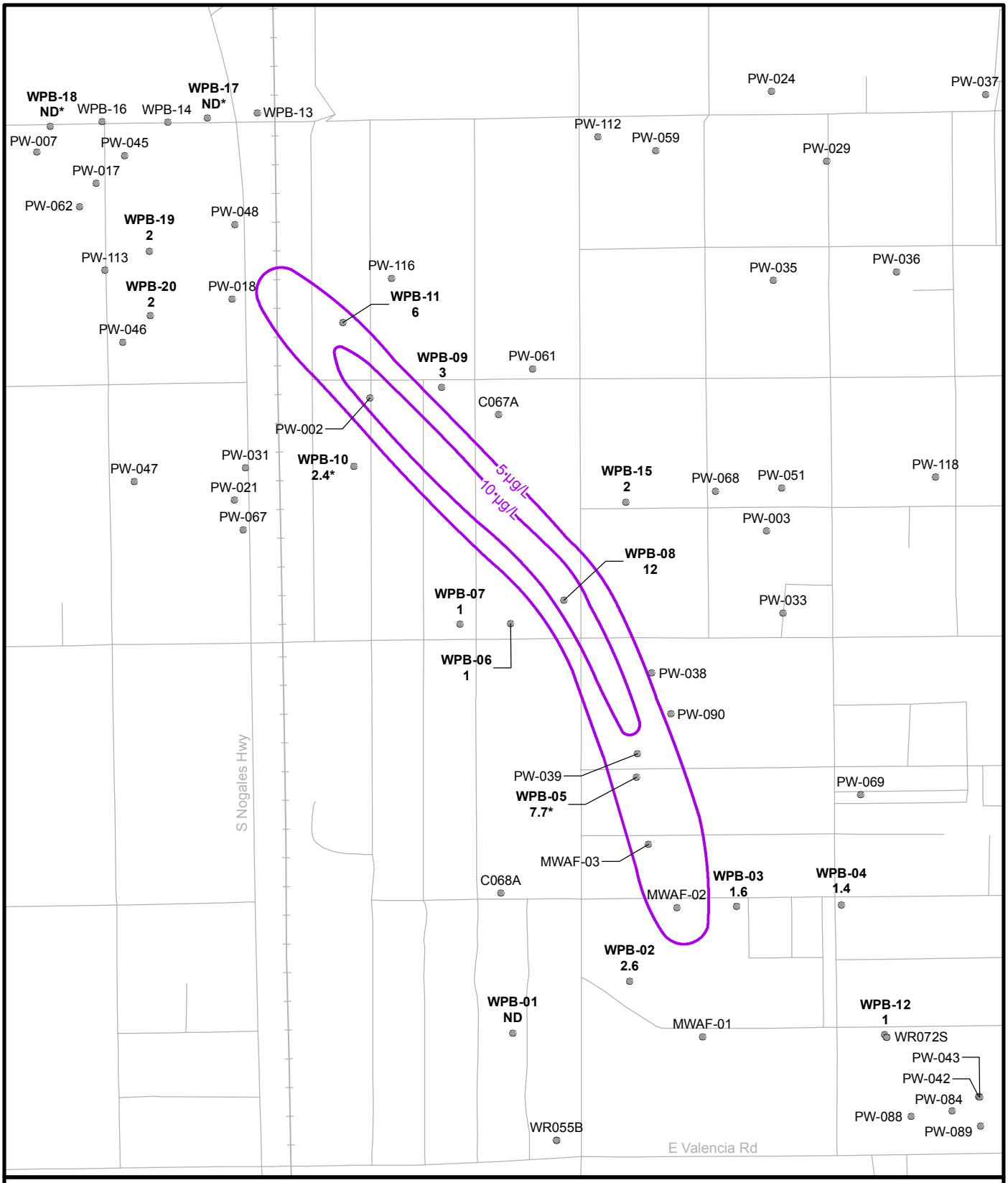
0 350 700 Feet

Notes: All concentrations in micrograms per liter (µg/L).
ND = Not Detected

FIGURE 3
West Plume B, August 1999
Trichloroethene Plume

Area B
TIAA Superfund Site
Tucson, Arizona

\\MADISON\GROUPS\EMS\GIS_LIBRARY\TUC_OFFICE\TIAA\MAPFILES\CERCLA SITE\FIG3_WESTPLUMEB_AUG99.MXD TWONG2 7/14/2009 11:42:14



Legend

- Area B Well
- WPB-03 — Monitoring Well ID
- 1.6 — Trichloroethene Concentration
- Road
- Union Pacific Railroad
- Trichloroethene Plume

N

0 350 700 Feet

Notes: All concentrations in micrograms per liter (µg/L).
* Results from sample collected in September 2004.
ND = Not Detected

FIGURE 4
West Plume B, August 2004
Trichloroethene Plume

Area B
TIAA Superfund Site
Tucson, Arizona

\\MADISON\GROUPS\EMS\GIS_LIBRARY\TUC_OFFICE\TIAA\MAPFILES\CERCLA SITE\FIG4_WESTPLUMEB_AUG2004.MXD TWONG2 7/14/2009 16:18:36

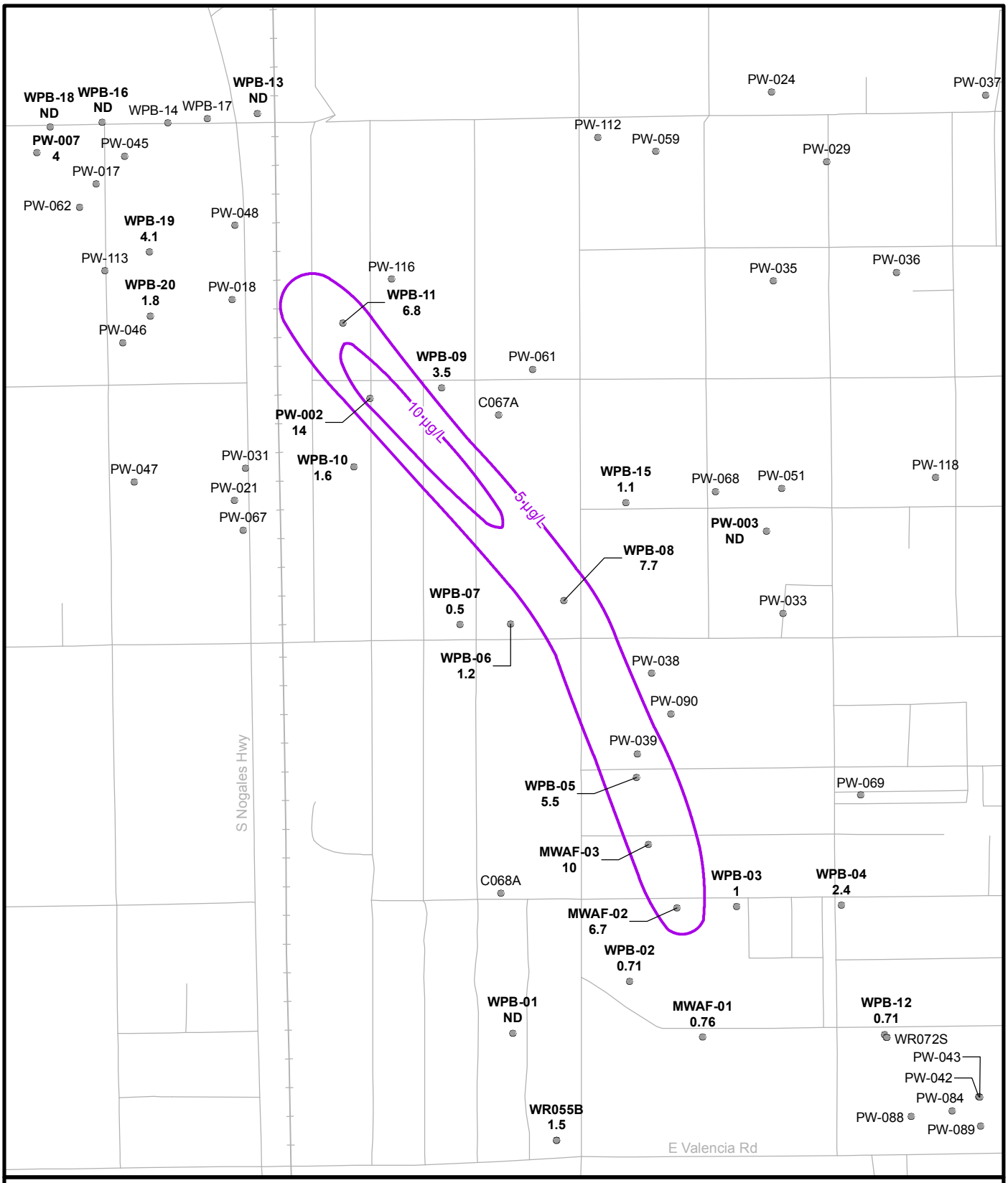


FIGURE 5
West Plume B, February 2009
Trichloroethene Plume

Area B
TIAA Superfund Site
Tucson, Arizona

\\MADISON\GROUPS\EMS\GIS_LIBRARY\TUC_OFFICE\TIAA\MAPFILES\CERCLA SITE\FIG5_WESTPLUMEB_FEB2009.MXD TWONG2 7/14/2009 18:27:10

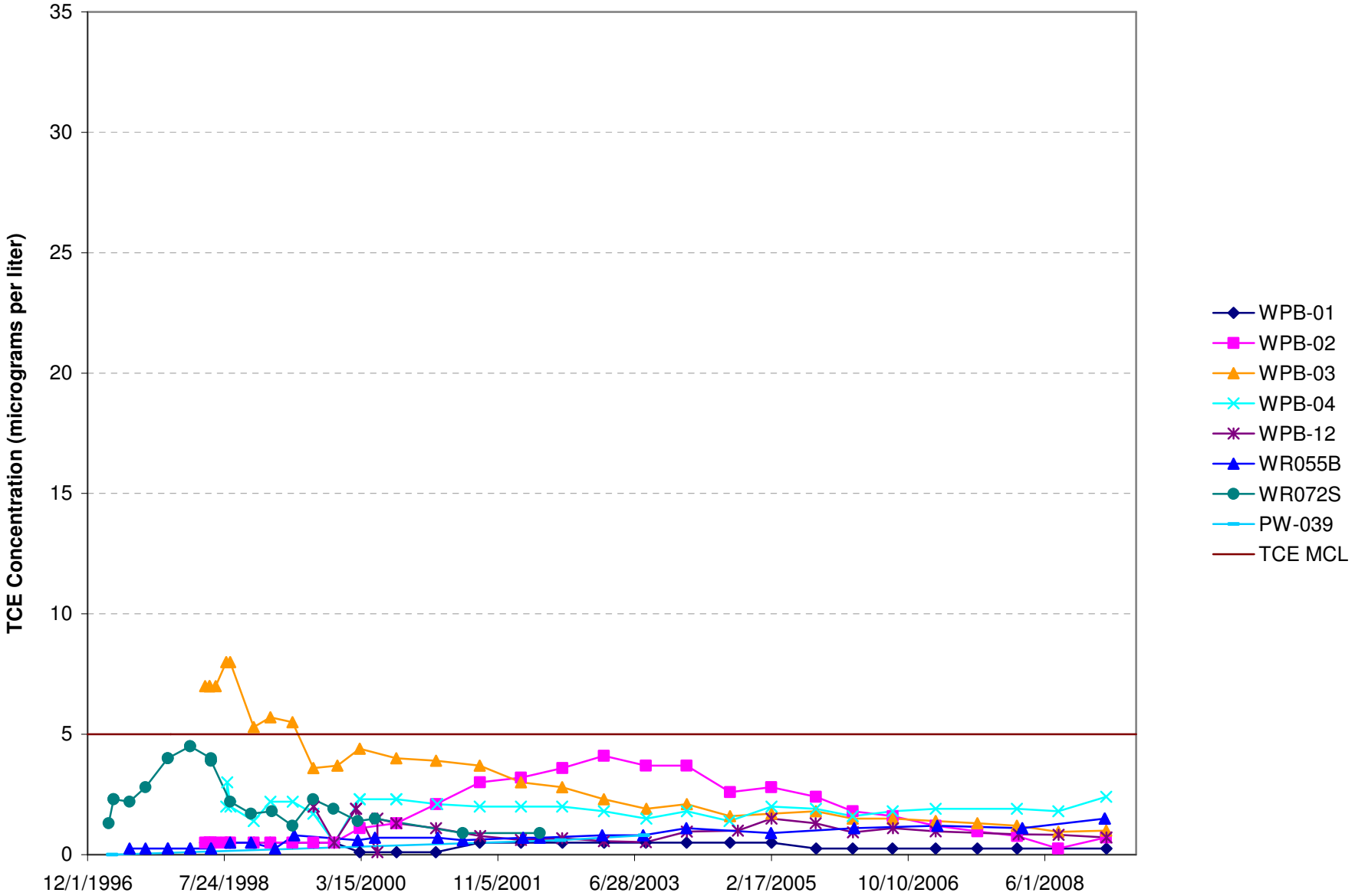


FIGURE 6
TCE CONCENTRATION VS TIME
SOUTHERN PORTION OF WEST PLUME B
West Plume B
TIAA Superfund Site, Tucson, Arizona

CH2MHILL

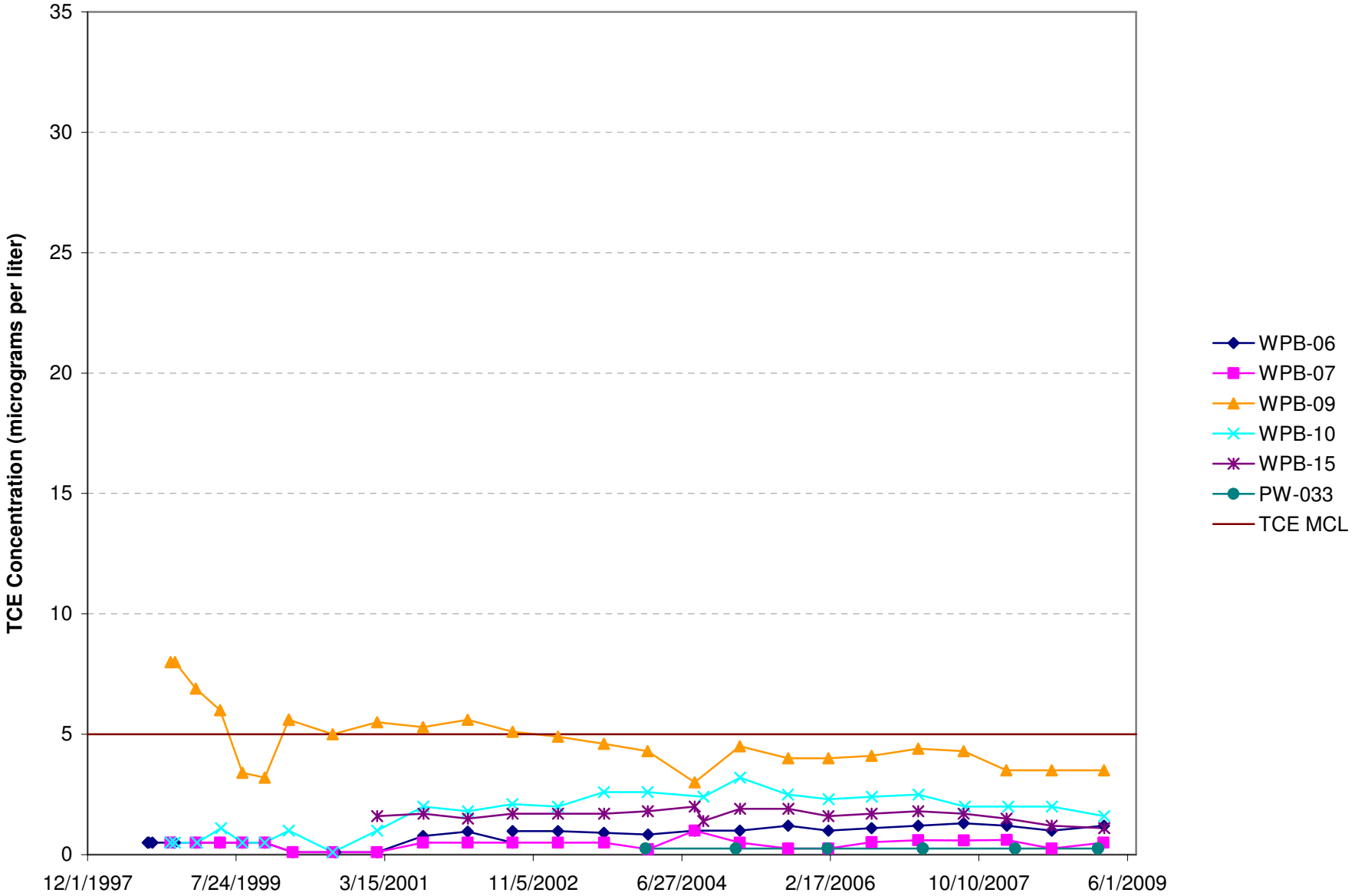


FIGURE 7
TCE CONCENTRATION VS TIME
CENTRAL PORTION OF WEST PLUME B
West Plume B
TIAA Superfund Site, Tucson, Arizona

CH2MHILL

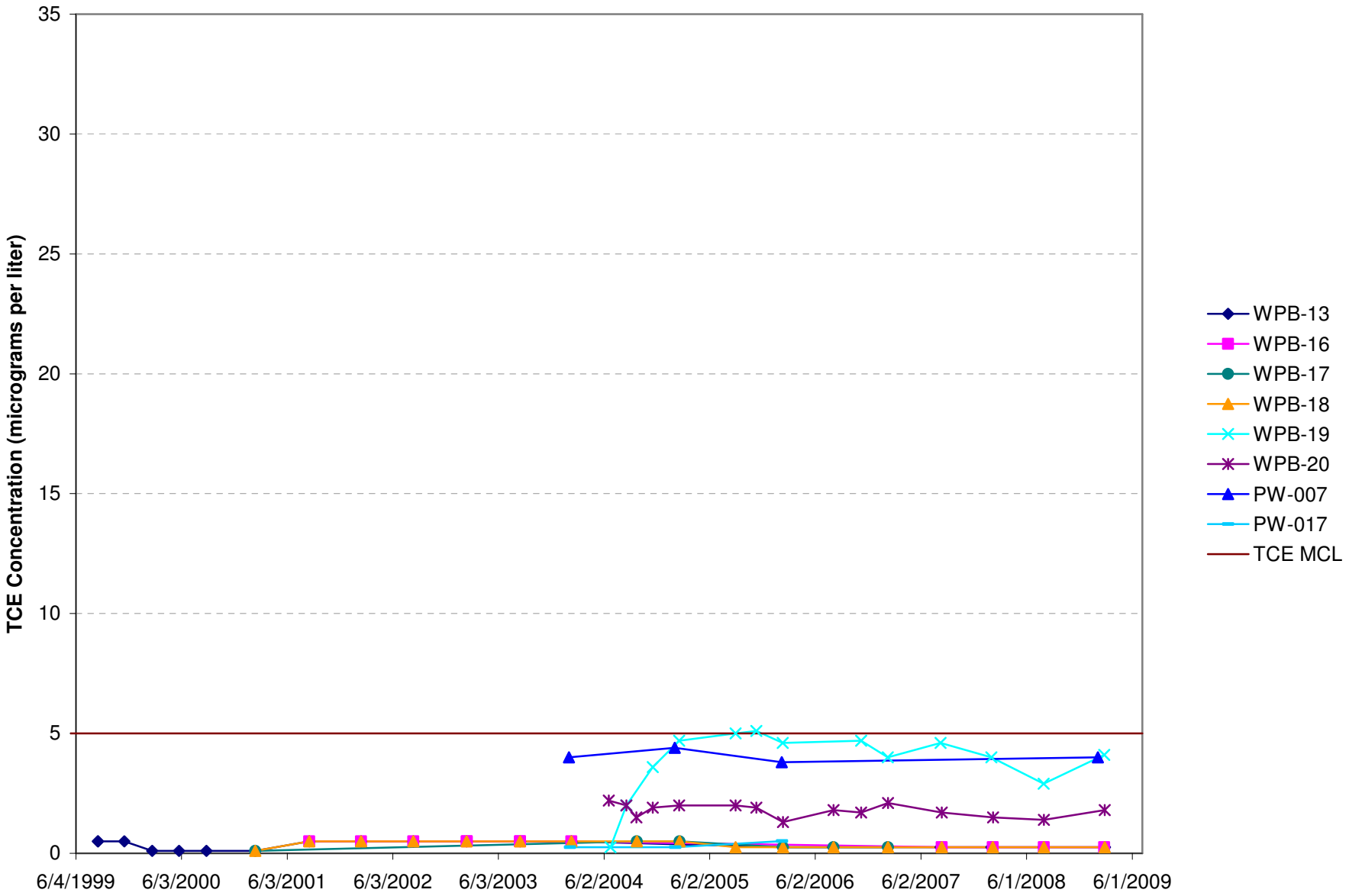


FIGURE 8
TCE CONCENTRATION VS TIME
NORTHERN PORTION OF WEST PLUME B
West Plume B
TIAA Superfund Site, Tucson, Arizona

CH2MHILL

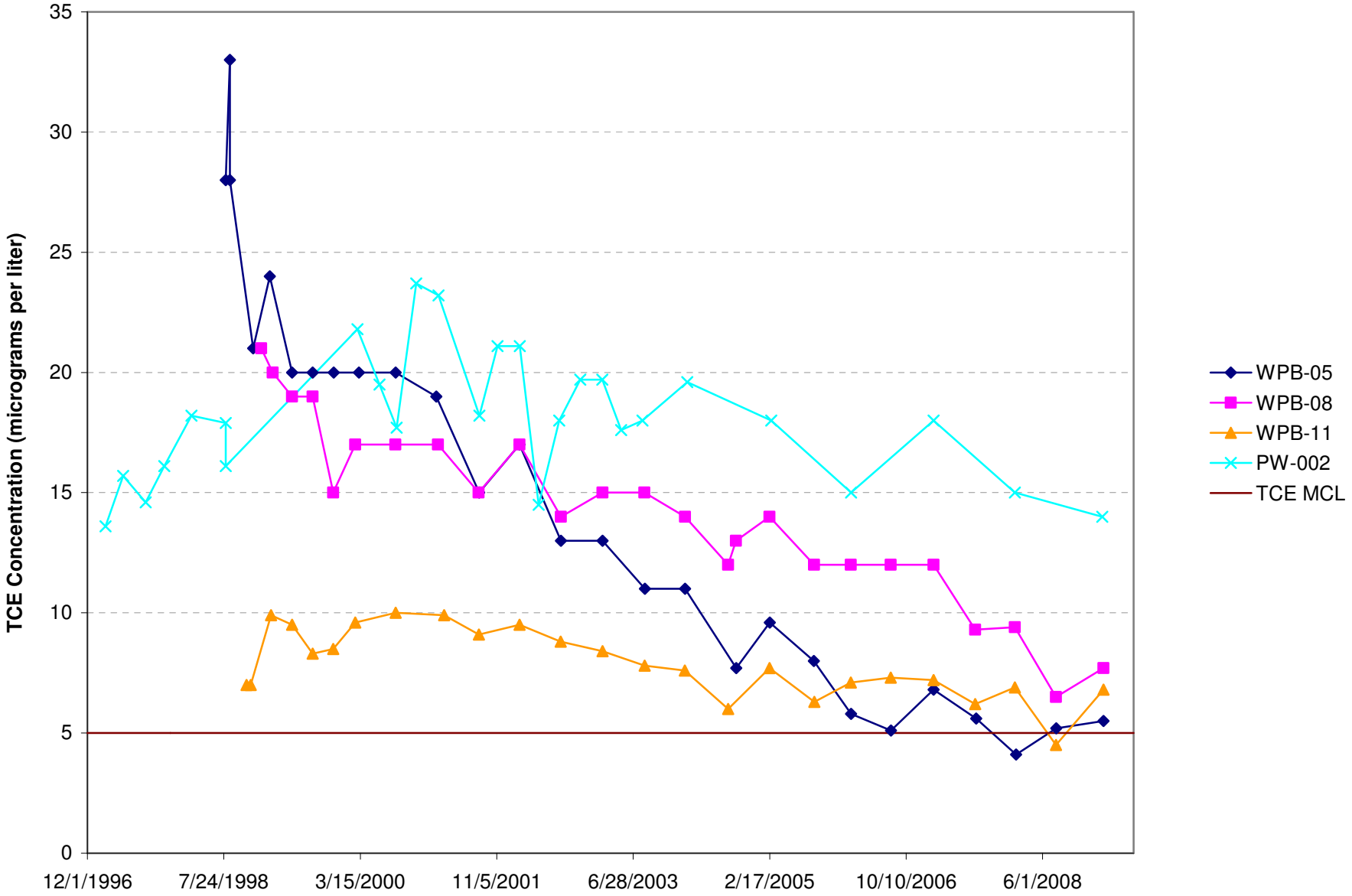


FIGURE 9
TCE CONCENTRATION VS TIME
IN-PLUME PORTION OF WEST PLUME B
West Plume B
TIAA Superfund Site, Tucson, Arizona

CH2MHILL

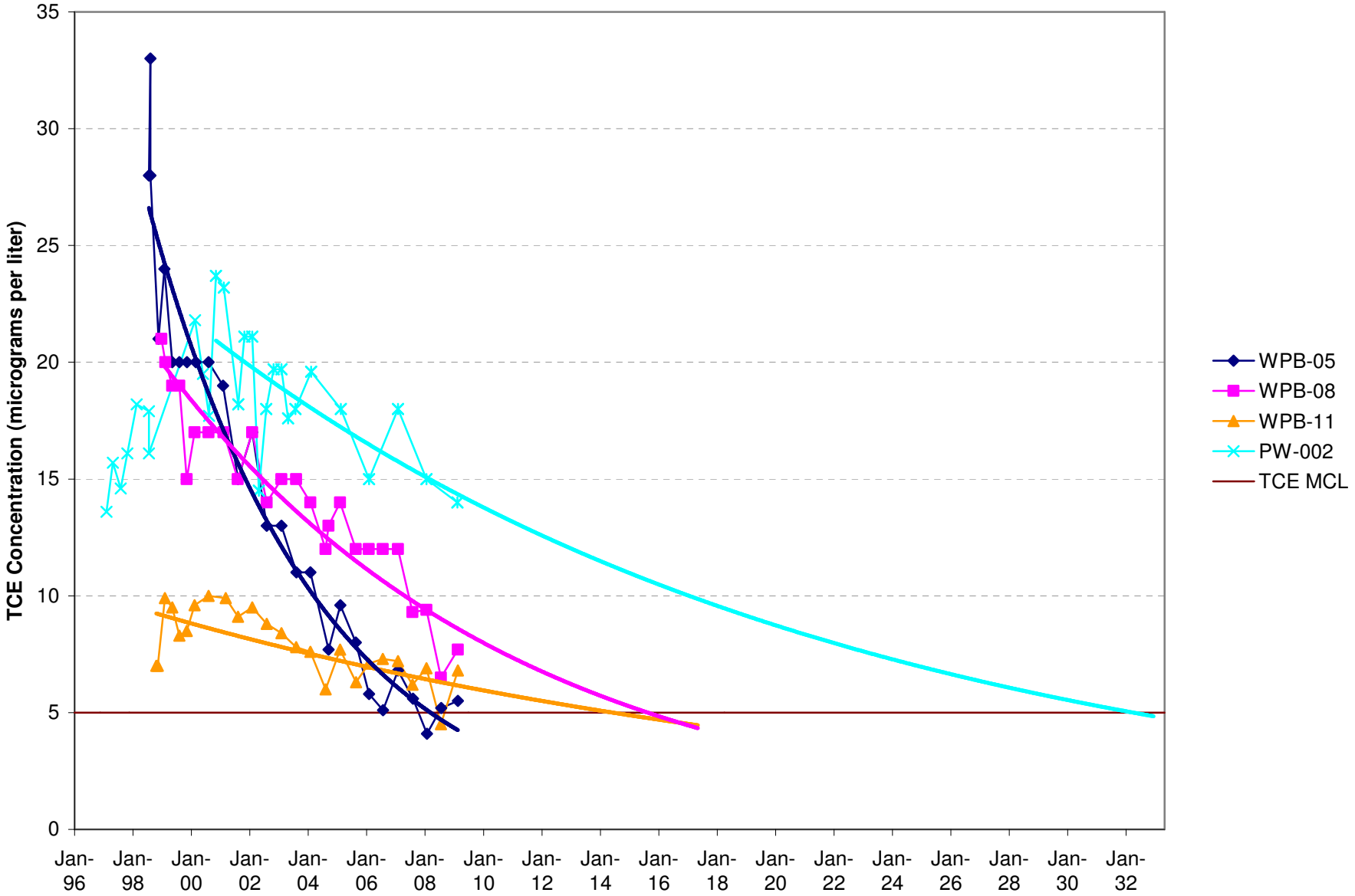


FIGURE 10
TCE ATTENUATION FORECAST
West Plume B
TIAA Superfund Site, Tucson, Arizona

CH2MHILL

Appendix B
Contingency Plan for Rebound Test on the 162nd Fighter Wing Arizona Air National Guard Property, Tucson, Arizona

APPENDIX B

CONTINGENCY PLAN FOR REBOUND TEST ON THE 162ND FIGHTER WING ARIZONA AIR NATIONAL GUARD PROPERTY, TUCSON, ARIZONA

A contingency plan is needed for the rebound test in the event that unanticipated increases of concentrations of contamination occur near the northern boundary of the Arizona Air National Guard property. To ensure that high levels of contamination do not migrate off AANG property, if any of the wells listed below shows analytical results greater than **10 micrograms per liter (µg/L) or parts per billion (ppb)** for trichloroethene (TCE), then the AANG will need to restart and operate the GWETRS until the ISCO remedy can be designed and installed.

- LP01
- MW05-L
- MW05-U
- MW100-L
- MW100-U
- MW101-L
- MW101-U
- MW102-L
- MW102-U
- MW104-L
- MW104-U
- WPB-02
- WPB-03
- WPB-04
- WPB-12
- MW-AF01
- MW-AF02
- MW-AF03

Appendix C
Letter of Concurrence from the Arizona Department of Environmental Quality

ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
(602) 771-2300 • www.azdeq.gov

Janice K. Brewer
Governor

Henry R. Darwin
Director

SROSPU12, 039

April 6, 2012

Mr. Martin Zeleznik
Remedial Project Manager
U.S. Environmental Protection Agency, Region 9
Mail Code SFD-6-2
75 Hawthorne Street
San Francisco, California 94105-3901

Re: **Tucson International Airport Area Superfund Site, Tucson, Arizona:** ADEQ Concurrence on the *Record of Decision Amendment, Tucson International Airport Area Superfund Site Area B*

Dear Martin:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the Area B Record of Decision (ROD) Amendment, dated March 2012, and hereby concurs with the ROD Amendment. If you have any questions, I can be reached at 520-628-6740.

Sincerely,

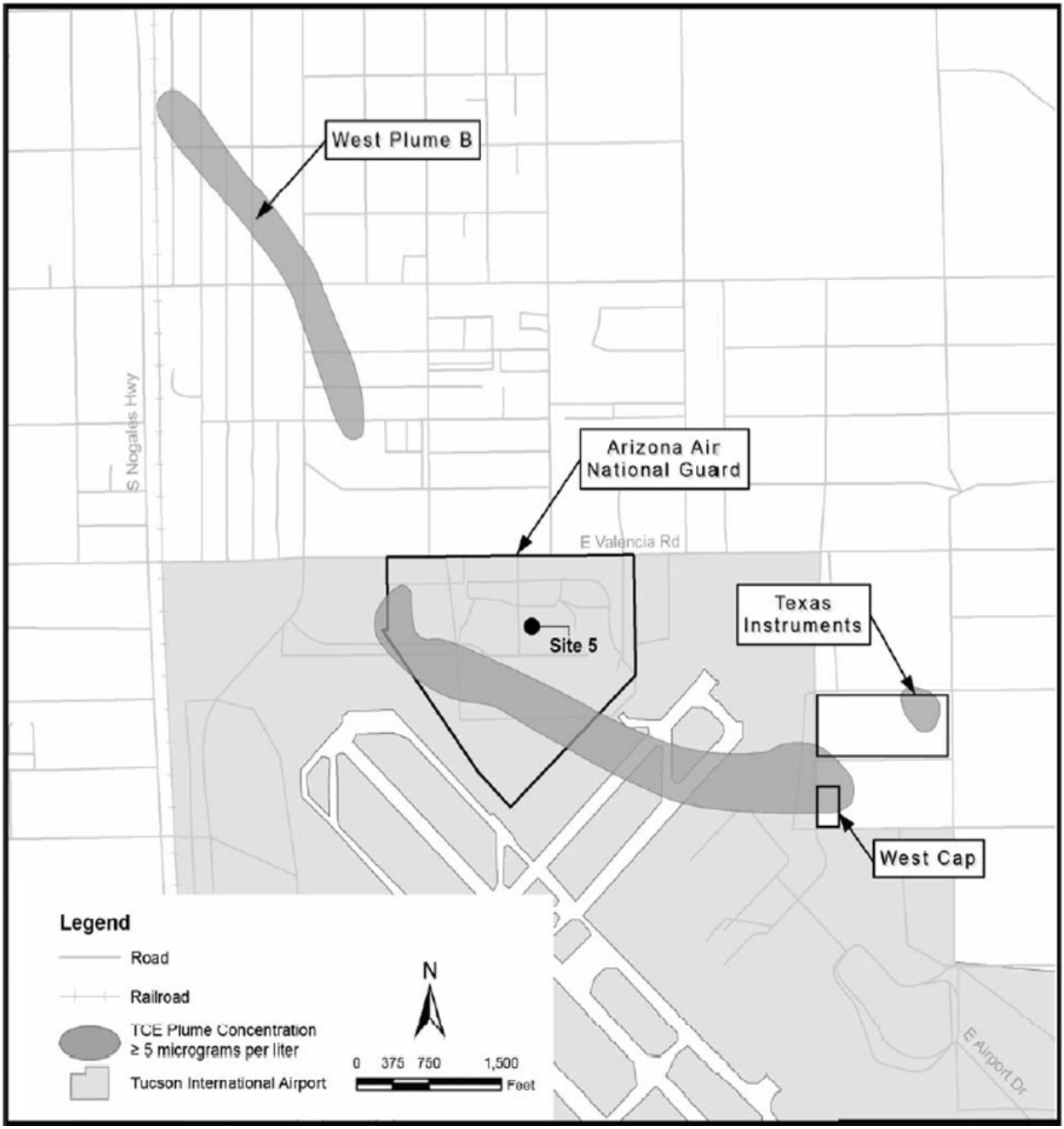
Marc E. Herman
Project Manager
Superfund Programs Unit

cc: William Ellett / ADEQ-SRO (reading file)
Craig Kafura / ADEQ-SRO (email)

Southern Regional Office
400 West Congress Street • Suite 433 • Tucson, AZ 85701
(520) 628-6733

Printed on recycled paper

Appendix B
Map of the Texas Instruments Project Area
Tucson International Airport Area Superfund Site - Tucson, Arizona



APPENDIX C

STATEMENT OF WORK

FOR THE REMEDIAL DESIGN AND REMEDIAL ACTION

Texas Instrument Project Area

TUCSON INTERNATIONAL AIRPORT AREA SUPERFUND SITE

Tucson, Arizona

EPA Region 9

TABLE OF CONTENTS

I. PURPOSE

This Statement of Work ("SOW") sets forth the tasks and requirements to be undertaken by Settling Defendant, in compliance with the Consent Decree ("CD"), for designing and implementing the remedy selected for the Texas Instruments Project Area ("Project Area") portion of Eastern Plume Area B within the Tucson International Airport Area ("TIAA") Superfund Site as set forth in the 2012 Amendment to the Record of Decision ("2012 ROD Amendment").

II. DEFINITIONS

Unless otherwise expressly provided in this SOW, the terms used in this SOW that are defined in the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), in regulations promulgated under CERCLA, or in the CD, shall have the meanings assigned to them in CERCLA, in such regulations, or in the CD.

III. SUMMARY OF THE REMEDIAL ACTION AND REQUIREMENTS

The Work to be performed under this SOW has been developed based on the remedy selected for Area B of the TIAA Superfund Site in the 2012 ROD Amendment ("Selected Remedy"). The Selected Remedy for the Project Area is in situ chemical oxidation ("ISCO") in groundwater contamination source areas. A full description of the Selected Remedy is presented in the 2012 ROD Amendment.

The Work shall be conducted in accordance with this SOW. The major components of the Work associated with the Selected Remedy are summarized below.

- Settling Defendant shall develop and implement a Work Plan which will propose the degree to which additional field sampling is conducted. As part of the Remedial Design ("RD"), Settling Defendant shall refine the extent of contamination requiring remediation as needed and conduct the additional sampling in accordance with the EPA-approved sampling plans.

- Settling Defendant shall design and implement an ISCO injection system and monitoring wells, if required, in and near the Project Area until the Performance Standards are achieved.

- Settling Defendant shall propose the methods required for monitoring system performance and achievements, including process monitoring, progress of the remediation, plume stability, compliance with Applicable or Relevant and Appropriate Requirements ("ARARs"), and the attainment of the clean-up goal.

- Settling Defendant shall conduct long term monitoring as part of the Selected Remedy and in accordance with an EPA-approved Performance Monitoring and Verification Plan ("PMVP") to provide sufficient data on a semi-annual basis to document compliance with the cleanup goals and verify that the remedy continues to be effective in the long-term for the purposes of the Five Year Review ("FYR") process.

IV. GENERAL REQUIREMENTS

A. Deliverables

All plans, reports and other deliverables required pursuant to this SOW are subject to review and approval by EPA pursuant to Section XI of the CD. All submittals required pursuant to this SOW shall be provided to both EPA and the State. Unless otherwise directed by EPA, all submittals should be directed to the EPA Project Coordinator and the State Project Coordinator. Unless otherwise directed by EPA, all submittals shall be prepared in accordance with all applicable guidance, as noted in Section VI of this SOW.

B. Standards

Settling Defendant shall conduct the Work to ensure that it meets all Performance Standards of the 2012 ROD Amendment, the CD, this SOW, and applicable guidance. The Performance Standards include the ARARs, cleanup standards, standards of control, quality criteria and other substantive requirements, criteria or limitations set forth below, in the 2012 ROD Amendment, the CD, and/or contained in any approved deliverable.

C. Supervising Contractor

Pursuant to Paragraph 10 of the CD, the Work shall be under the direction and supervision of the Supervising Contractor who is subject to disapproval by EPA after review and comment from the State.

D. Progress Reports

Settling Defendant shall prepare monthly progress reports.

1. Settling Defendant shall prepare these progress reports commencing with the month following lodging of the CD and shall continue until EPA issues the Certification of Completion of the Remedial Action ("RA").

2. Unless an alternate schedule is approved, Settling Defendant shall submit these progress reports to the EPA Project Coordinator and the State Project Coordinator by the tenth (10^{th}) day of every month following the lodging of the CD, in accordance with the Schedule in Section X of the CD ("Reporting Requirements"). Settling Defendant may submit a request for EPA approval to reduce the frequency of progress reports, if appropriate for the stage of Work that is being performed.

3. Settling Defendant shall submit the progress reports electronically.

4. The progress reports shall include the following elements:

    a) A summary of the Work that has been conducted during the previous month (or reporting period);

b) A summary of sampling and test results and all other data received or generated by Settling Defendant or its contractors or agents in the previous month (or reporting period);

c) A list of all plans, reports, and other deliverables required completed and submitted during the previous month (or reporting period);

d) A description of all actions that are scheduled for the next three months;

e) A description of all information regarding percentage of Work completion, unresolved delays encountered or anticipated that may affect the future schedule for implementation of the Work, and a description of efforts made to mitigate those delays or anticipated delays;

f) A description of any modifications to any work plan or other schedules that Settling Defendant has proposed to EPA, or that have been approved by EPA; and

g) A description of all activities taken in support of the requests made by the Unified Community Advisory Board for the Project Area.

E. Barriers

Settling Defendant shall erect barriers to prevent unauthorized access to any active remediation work area.

F. Long-Term Monitoring for Five Year Review

Unless an alternate frequency is approved by EPA, Settling Defendant shall conduct semi-annual groundwater monitoring of selected wells approved by EPA for the purposes of documenting the continued effectiveness of the remedy to meet Performance Standards, in accordance with an EPA-approved PMVP.

G. Best Efforts Green Remediation

Settling Defendant shall use best efforts to reduce short term impacts of the Work beyond minimum legal requirements, such as, but not limited to: use of rail transport rather than trucking, use of alternative fuels (e.g., biodiesel with ultra low sulfur diesel for off road and on road vehicles); idle reduction; and, use of equipment retrofitted with emissions controls (e.g., diesel oxidation catalyst, diesel multistage filter, or diesel particulate filter). Other examples include waste recycling, purchasing materials with post-consumer recycled content, and water usage reduction. Information and resources are available through Smart Energy Resources Guide ("SERG") and Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites.

H. Implementation

Settling Defendant shall implement all Work described in reports and plans and other documents in accordance with the approved schedule.

V. WORK TO BE PERFORMED

Settling Defendant shall perform the tasks set forth below in accordance with Section IV, Paragraph 11 of the CD.

A. Work Plan

Settling Defendant shall submit a Work Plan within thirty (30) days following the lodging of the CD. The Work Plan shall:

1. Include plans and schedules for implementation of all activities and any pre-design tasks identified in this SOW, or required by EPA to be conducted in order to implement the Selected Remedy;

2. Include the identity of, contact information for, and description of the roles of the members of Settling Defendant's project team, including the Project Coordinator, Quality Assurance Official ("QA Official"), and Supervising Contractor;

3. Document the overall management strategy for performing Design Investigations and RD, and present a general approach to construction, operation, maintenance, and long-term monitoring of the RA as necessary to implement the Selected Remedy and its effectiveness in meeting cleanup goals;

4. Document the responsibility and authority of all organizations and key personnel involved in implementing the Selected Remedy;

5. Identify any data gaps, and the approach to be used to address those data gaps;

6. Describe the proposed quality assurance approach (e.g., peer review, etc.);

7. Address permitting, ARARs and any other regulatory issues;

    a) Provide a process and schedule for compliance during RD and RA with any requirements that necessitate coordination with other entities (e.g., property owners, state agencies, local agencies, etc.), such as access, permitting, property acquisition, property leases, and/or easements required for implementation of the RD and RA; Methods for satisfying permitting requirements, including obtaining permits for off-Site activity and satisfying ARARs requirements; and

b) Provide methods for finalizing access agreements;

8. Provide a schedule for completion of all deliverables; and

9. Include a description of, and schedule for, deliverables to be submitted during the Work. The deliverables shall include:

    a) Progress Reports;

    b) Health and Safety Plan/Contingency Plan ("HASP/CP");

    c) Field Sampling Plan/Quality Assurance Project Plan ("FSP/QAPP");

    d) Design Investigation, if required;

    e) ISCO Work Plan;

    f) Operation and Maintenance Plan ("O&M") Plan;

    g) Construction Quality Assurance Project Plan ("CQAPP");

    h) Site-Wide Management Plan ("SWMP");

    i) PMVP; and

    j) Semi-annual Reports.

B. HASP/CP

Settling Defendant shall submit a HASP/CP within thirty (30) days after the notice of authorization to proceed under Paragraph 10 of the CD.

1. HASP – The HASP shall describe all efforts to be made to protect area residents and any potential future employees from physical, chemical and all other hazards posed by Settling Defendant's work at the Site. The HASP shall follow EPA guidance and all OSHA requirements, including but not limited to 29 CFR §§ 1910.120 and 1926. The HASP shall include the following elements:

    a) Facility description;

    b) Personnel;

    c) Levels of protection;

    d) Safe work practices and safe guards;

    e) Medical surveillance;

f) Personal and environmental air monitoring;

g) Personal protective equipment;

h) Personal hygiene;

i) Decontamination of persons and equipment;

j) Site work zones;

k) Contaminant control;

l) Logs, reports and record keeping; and

m) Training and safety audits.

2. CP – The CP shall describe procedures to be used in the event of an accident or emergency at the Project Area (e.g., power outages, water impoundment failure, spill, etc). The CP shall include the following elements:

a) Name of the person or entity responsible for responding in the event of an emergency incident;

b) Plan and schedule for meeting(s) with the local community, including local, State and Federal agencies involved in the cleanup, as well as local emergency squads and hospitals;

c) First aid medical information;

d) Air Monitoring Plan (if applicable); and

e) Spill Prevention, Control, and Countermeasures ("SPCC") Plan (if applicable), as specified in 40 CFR Part 109 describing measures to prevent, and contingency plans for, potential spills and discharges from the handling and transportation of materials.

The CP shall include notification activities compliant with Section XV of the CD.

C. FSP/QAPP

Settling Defendant shall submit a FSP/QAPP within thirty (30) days after the notice of authorization to proceed under Paragraph 10 of the CD. The FSP/QAPP will be developed to support the baseline, injection and post-injection sampling.

1. FSP – The FSP shall be written so that a field sampling team unfamiliar with the project would be able to gather the samples and field information required. The FSP shall describe:

a) Sampling objectives;

b) Analytical parameters, analytical methods, and holding times;

c) Sampling locations and frequencies;

d) Sampling procedures and equipment;

e) Sample preservation, sample packing, QA/QC samples;

f) Sample paperwork and chain-of-custody procedures;

g) Sample handling and shipping;

h) Management of investigation-derived wastes;

i) Planned uses of the data;

j) The sampling and data collection methods that will be used; and

k) A schedule for activities that must be completed in advance of sampling, including acquisition of property, access agreements, and arrangements for disposal of investigation-derived waste.

2. QAPP – The QAPP shall address all QA/QC requirements for the sampling efforts to which they apply. The QAPP shall cover sample analysis and data handling for all samples collected. The QAPP shall be consistent with the requirements of the EPA Contract Lab Program ("CLP") for laboratories proposed outside the CLP.

D. Design Investigation, if required

If directed by EPA, Settling Defendant shall plan and conduct a Design Investigation to address data gaps. The Design Investigation shall include, but is not limited to, extent of contamination, geochemistry parameters, contaminant concentrations in groundwater, and proposed locations of injections. Settling Defendant shall propose any other Design Investigations that it considers necessary, including, but not limited to, investigations to assess lithology, other soil physical parameters, or other groundwater parameters.

For any Design Investigation planned and conducted, Settling Defendant shall submit planning documents and reports for investigations necessary to support RD and shall perform the Design Investigations as approved by EPA.

For any Field Investigation conducted as part of Design Investigation, Settling Defendant shall submit a Field Investigation Work Plan and Field Investigation Evaluation Report as described in further detail below.

1. Field Investigation Work Plan. Settling Defendant shall submit a Field Investigation Work Plan within thirty (30) days of EPA's direction to conduct a Design Investigation or within an alternative amount of time approved by EPA.

a) FSP – The FSP shall supplement the approved FSP described in Section C, above, and address all sample collection activities specific to any Design Investigative work needed.

b) QAPP – The QAPP shall supplement the approved QAPP described in Section C, above, and address all QA/QC requirements for the sampling efforts to which they apply. The QAPP shall cover sample analysis and data handling for all samples collected. The QAPP shall be consistent with the requirements of the CLP for laboratories proposed outside the CLP.

c) Design Investigation HASP – if not covered in existing HASP previously included.

d) Schedule for conducting field investigation activities and submitting the Field Investigation Evaluation Report.

2. Field Investigation Evaluation Report, which includes:

a) Narrative summary of the investigations performed;

b) Narrative summary of the results of the investigations;

c) Narrative interpretation of data and results;

d) Resultant design parameters and criteria;

e) Conclusions and recommendations for RD;

f) Summary of validated data (i.e., tables and graphics);

g) Data validation reports and laboratory data reports;

h) Results of any statistical and modeling analyses;

i) Copies of field notes and log books; and

j) Photographs documenting the field investigation.

E. ISCO Work Plan

Settling Defendant shall submit an ISCO Work Plan within sixty (60) days after EPA approval of the Work Plan. The ISCO Work Plan submittal shall include the following elements:

1. Design assumptions and parameters, including design restrictions, process performance criteria, appropriate unit processes for any treatment train, and expected removal (concentration and volume);

2. Summary of results from 2009 Pilot Test, subsequent monitoring results and data interpretation;

3. Summary of Project Area characteristics including site-specific data, e.g., natural oxidant demand, needed to design the Selected Remedy;

4. Detailed hydrogeology of the expected radius of influence of injection area;

5. Injection strategy and dose calculations;

6. Monitoring program during injection including monitoring within the injection radius of influence;

7. Identification of volume and concentration of permanganate injected, radius of influence and rationale;

8. Discussion of expectation of permanganate movement over time;

9. Discussion of the potential impact of permanganate on the concentrations in groundwater of chromium, hexavalent chromium and arsenic;

10. Preliminary plans, drawings, and sketches, including design calculations;

11. Proposed cleanup verification methods, including compliance with ARARs;

12. Permit requirements;

13. Real estate acquisition through any purchases or easements that are necessary to implement the RA;

14. Expected long-term monitoring and operation requirements;

15. Project Delivery Strategy;

16. Construction schedule, including a schedule for permit requirements;

17. Site security measures;

18. Value Engineering Screen or Study, as necessary;

19. Plan for procurement that describes Settling Defendant's contracting strategy; and

20. O&M Plan, as further described below.

F. O&M Plan

Settling Defendant shall submit an O&M plan according to the schedule specified by the approved Work Plan (see Section V(A) of this SOW). The O&M Plan may be submitted as part of the ISCO Work Plan and shall describe O&M of the ISCO Remedy or may be submitted separately. The O&M Plan shall include the following elements:

1. Description of site security needs and provision;

2. Description of and schedule for each operation task and maintenance task;

3. Description of instrumentation and equipment monitoring;

4. Example checklists and descriptions of reports;

5. Waste transportation and plan for off-site disposal;

6. Health and safety requirements, including, descriptions of precautions, necessary equipment, etc., for site personnel, and safety tasks required in the event of a systems failure;

7. Description and analysis of potential operating problems, including common and/or anticipated remedies;

8. Description of routine monitoring, data collection and laboratory testing, and schedule and procedures for monitoring;

9. A FSP/QAPP for any field sampling required as part of the routine monitoring, data collection and laboratory testing (the required components of an FSP/QAPP are described in Section V(C) of this SOW);

10. Description of alternative operations and maintenance in case of systems failure, including (a) alternative procedures to prevent release or threatened releases of waste material which may endanger public health and the environment or exceed Performance Standards, (b) analysis of vulnerability and additional resource requirements should a failure occur; and, (c) notification and reporting requirements should O&M systems fail or be in danger of imminent failure;

11. Description of corrective action to be implemented in the event that cleanup or Performance Standards are exceeded, and a schedule for implementing such corrective action; and,

12. Description of records and reports, including daily operating logs, laboratory records, reports regarding emergencies, personnel and maintenance records; and monthly and semi-annual reports to State agencies.

G. CQAPP

Settling Defendant shall submit a CQAPP according to the schedule specified by the approved Work Plan (see Section V(A) of this SOW) and may be included as part of the ISCO Work Plan or may be submitted separately. The CQAPP shall detail the quality assurance program during injection activities, to ensure that the completed project meets or exceeds all design criteria, plans, and specifications. The CQAPP shall address sampling, analysis, and monitoring to be performed during the construction phase of the Work. The CQAPP shall include, at a minimum, the following:

1. Identification of a QA Official independent of the Supervising Contractor to conduct a quality assurance program during the RA phase of the project;

2. Qualifications of the QA Official to demonstrate he or she possesses the training and experience necessary to fulfill his or her identified responsibilities;

3. Responsibilities and authorities of all organizations and key personnel involved in the design and implementation of the RA;

4. Specific quality assurance systems to be used, if any;

5. Monitoring, measurement, sampling, testing and daily logging to establish whether the RA implementation is performed in compliance with design specifications, ARARs, and Performance Standards (this shall include identification of the sample size, locations, frequency of testing, acceptance and rejection data sheets, problem identification and corrective measures reports, evaluation reports, acceptance reports, and final documentation);

6. Protocols for monitoring, measurement, sampling and testing;

7. Inspection and certification of the Work; and

8. A detailed description of reporting requirements for CQAPP activities (this shall include such items as daily summary reports, inspection data sheets, problem identification and corrective measures reports, design acceptance reports, and final documentation).

H. SWMP

Settling Defendant shall submit a SWMP according to the schedule specified by the approved Work Plan (see Section V(A) of this SOW) and may be included as part of the ISCO Work Plan or may be submitted separately, which includes:

1. A description of site security needs and provisions; and

2. A description of the constraints and parameters imposed on the project by outside entities, including property owners, operating businesses, local agencies, etc., and a plan for accommodating these constraints in the implementation of the RA.

I. Contractor Selection

Within forty-five (45) days after EPA approval of the ISCO Work Plan, Settling Defendant shall notify EPA in writing of the name, title, and qualifications of any construction contractor proposed to be used in carrying out the RA under the CD and this SOW. Except as provided in the preceding sentence, the Settling Defendant shall demonstrate that the proposed construction contractor has a quality system that complies with American National Standards Institute ("ANSI"), by submitting a copy of the proposed construction contractor's Quality Management Plan ("QMP") within forty-five (45) days after EPA approval of the Final Design. If EPA disapproves of the selection of any contractor as the construction contractor, Settling Defendant shall submit its proposed replacement contractors within thirty (30) days after receipt of EPA's disapproval of the contractor previously selected. EPA shall thereafter provide written notice of the name(s) of the contractor(s) it approves, if any.

If at any time Settling Defendant proposes to change the construction contractor, Settling Defendant shall notify EPA and shall obtain approval from EPA as provided in this paragraph, before the new construction contractor performs any Work.

J. RA Implementation

Settling Defendant shall implement the RA as detailed in the approved ISCO Work Plan, the approved CQAPP, and the approved SWMP. Respondents shall notify EPA within ten (10) days prior to the completion of the RA.

K. PMVP

Settling Defendant shall submit a PMVP according to the schedule specified in the approved Work Plan. The purpose of the PMVP is to describe how the short-term and long-term Performance Standards for the RA will be measured and evaluated. The PMVP shall include the following elements:

1. A description of each of the Performance Standards;

2. A description of how each of the Performance Standards will be met; a description of how ongoing achievement of the Performance Standards will be measured and reported (a FSP and QAPP, the elements of which are described in Section V.C.1 of this SOW, shall be included for any environmental sampling required); and

3. A description of the selected wells, well monitoring network to be sampled and the analytes to be sampled. Sampling shall occur a minimum semi-annually once the remedy is determined to be complete, with the monitoring results included in an semi-annual report to be submitted to EPA to verify and document compliance with the cleanup goals and that the remedy continues to be effective in the long-term.

L. Inspections and Meetings during Remedy Implementation

1. Meetings. Within thirty (30) days after approval of the ISCO Work Plan and before the start of construction, Settling Defendant shall hold a preconstruction meeting with EPA and the State, and others as directed or approved by EPA. During the construction phase of the Work (i.e., the period during which the ISCO system is being built and ISCO is being injected), Settling Defendant shall hold weekly meetings or conference calls with EPA, and others as directed or approved by EPA, to discuss progress and issues. The Settling Defendant shall provide an agenda and attendees to EPA prior to all meetings and shall prepare draft minutes of the meetings which shall be sent to all parties in attendance at the meeting within five (5) days of the meeting.

2. Periodic Inspections. Settling Defendant shall provide access to EPA and the State during any and all periodic inspections and shall, as much as practicable, accompany EPA and the State during these inspections. EPA shall provide Settling Defendant with notice of any deficiencies in construction or construction not in substantial compliance with the approved ISCO Work Plan change notices, and the approved final Work Plan will be noted during periodic inspections. Upon such notice, Settling Defendant shall take all necessary steps to correct the deficiencies and/or bring the construction into compliance with the approved Final Design, any approved design changes, and/or the approved RA Work Plan.

M. Semi-annual Reports after Remedy Completion

Settling Defendant shall submit Semi-annual Reports commencing one (1) year after the notice of authorization to proceed under Paragraph 10 of the CD. The Semi-annual Reports shall include: work completed since the last report, operations and maintenance summary; description of monitoring activities including depth to water measurements and chemical analysis results; groundwater quality including chemicals of concern, residual permanganate and total metals; charts showing contaminant concentrations overtime at monitoring wells; assessments and statements as to whether Performance Standards are being satisfied at compliance monitoring wells; predictions, if appropriate, of possible future occurrences of noncompliance and of expected time to meet Performance Standards; relevant preliminary calculations and supporting data used to evaluate compliance; and any other relevant requirements.

N. Completion of RA

1. RA Report – Settling Defendant shall submit a RA Report within thirty (30) days after the Final Construction Inspection. The RA Report shall include a certification by Settling Defendant's Project Coordinator and by a registered professional engineer that the physical construction for the RA has been performed in satisfaction of the requirements of the CD and this SOW. The certification is as follows:

   > "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

2. Preliminary Close-out Report. Within ninety (90) days of EPA's determination that all clean-up goals have been achieved, Settling Defendant shall submit a Preliminary Close-out Report. The report shall comply with EPA Guidance "Close Out Procedures for NPL Sites" (see Section VI of this SOW) or any subsequent guidance issued by EPA on close-out procedures.

O. Completion of Work

1. Pre-Certification Inspection. Within sixty (60) days after Settling Defendant concludes that all phases of the Work, other than any remaining activities required under Section VII (Remedy Review) of the CD, have been fully performed, the Settling Defendant shall schedule and conduct a Pre-Certification Inspection to be attended by the Settling Defendant, EPA, and the State.

2. Pre-Certification Written Report. If, after the Pre-Certification Inspection, Settling Defendant still believes that the Work has been fully performed, Settling Defendant shall submit a written report by a Registered Professional Engineer or Registered Geologist stating that the Work has been completed in full satisfaction of the requirements of the CD. This report shall be submitted within thirty (30) days after completion of the Pre-Certification Inspection. The report shall contain the statement set forth in Paragraph 47 of the CD and Section V.N. of this SOW, signed by a responsible corporate official of Settling Defendant or Settling Defendant's Project Coordinator.

3. If, after review of the written report, EPA, after reasonable opportunity for review and comment by the State, determines that any portion of the Work has not been completed in accordance with the CD, EPA will notify Settling Defendant in writing of the activities that must be undertaken by Settling Defendant and Settling Defendant shall perform all activities described in the notice in accordance with the specifications and schedules established therein.

VI. REFERENCES/GUIDANCE DOCUMENTS

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

- *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), Parts 1, 2 and 3, EPA-505-B-04-900A, B and C, March 2005 (see Section V. A. of the Remedial Design SOW).*

- *Construction Specifications Institute's Manual of Practice, 1985 edition, available from the Construction Specifications Institute, 601 Madison Street, Alexandria, Virginia 22314.*

- *Greener Cleanups Policy - EPA REGION 9, issued September 14, 2009; found at:http://www. epa.gov/region09/climatechange/green-sites. html.*

- *Superfund Green Remediation Strategy, dated September 2010, http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.*

- *Smart Energy Resources Guide, EPA/600/R-08/049, March 2008*

- *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites, EPA 542-R-08-002 April 2008*

- *CERCLA Compliance with Other Laws Plan, Two Volumes, U. S. EPA, Office of Emergency and Remedial Response, August 1988 (DRAFT), OSWER Directive No. 9234. 1-01 and -02.*

- *EPA Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4, 2006).*

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

- *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., 1988*

- *Guide to Management of Investigation-Derived Wastes, U. S. EPA, Office of Solid Waste and Emergency Response, Publication 9345. 3-03FS, January 1992.*

- *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.*

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

- *Permits and Permit Equivalency Processes for CERCLA On-Site Response Actions, February 19, 1992, OSWER Directive 9355. 7-03.*

- *Quality in the Constructed Project: A Guideline for Owners, Designers and Constructors, Volume 1, Preliminary Edition for Trial Use and Comment, American Society of Civil Engineers, May 1988.*

- *Remedial Design/Remedial Action (RD/RA) Handbook, U. S. EPA, Office of Solid Waste and Emergency Response (OSWER), 9355. 0-04B, EPA 540/R-95/059, June 1995.*

- *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, U. S. EPA, EPA/240/B-01/003, March 2001, Reissued May 2006.*

- *Guidance for Quality Assurance Project Plans, U. S. EPA, EPA/240/R-02/009, December 2002.*

- *Scoping the Remedial Design (Fact Sheet), February 1995, OSWER Publ. 9355-5-21 FS.*

- *Standards for the Construction Industry, Code of Federal Regulations, Title 29, Part 1926, Occupational Health and Safety Administration.*

- *Standards for General Industry, Code of Federal Regulations, Title 29, Part 1910, Occupational Health and Safety Administration.*

- *Superfund Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties, April 1990, EPA/540/G-90/001.*

- *Value Engineering (Fact Sheet), U. S. EPA, Office of Solid Waste and Emergency Response, Publication 9355. 5-03FS, May 1990.*

- *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review, EPA-540-R-00-006, June 2001.*

- *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, EPA-540-R-08-01, June 2008.*

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

- *A Compendium of Superfund Field Operations Methods, Two Volumes, USEPA, Office of Emergency and Remedial Response, EPA/540/P-87/001a, August 1987, OSWER Directive No. 9355. 0-14.*

- *Data Quality Objectives for Remedial Response Activities, USEPA, 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.*

- *Engineering Support Branch Standard Operating Procedures and Quality Assurance Plan, USEPA Region IV, Environmental Services Division, April 1,1986 (revised periodically).*

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

- *Occupational Safety and Health Guidance Plan 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.*

- *Superfund Remedial Design and Remedial Action Guidance, USEPA, Office of Emergency and Remedial Response, June 1986, OSWER Directive No. 9355. 0-4A.*

- *EPA Region IX Sampling and Analysis Plan Guidance and Template (R9QA/002. 1, April, 2000).*

- *Draft: Region 9 Superfund Data Evaluation/Validation Guidance, USEPA, Quality Assurance Office, R9QA/006. 1, December 2001.*

- *Operation and Maintenance in the Superfund Program, EPA, May 2001, (OSWER 9200. 1-37FS, EPA 540-F-01-004).*

- *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (American National Standard, January 5, 1995), ANSI/ASQC E4-1994.*

- *EPA Requirements for Quality Management Plans (QA/R-2), EPA/240/B-01/002, March 2001, reissued May 2006.*

- *EPA Guidance for Data Quality Assessment, Practical Methods for Data Analysis (EPA QA/G-9, 1998).*

- *Close Out Procedures for National Priorities List Sites, EPA, January 2000 (OSWER Directive 9320.09A-P).*

VII. SCHEDULE FOR DELIVERABLES AND MILESTONES

	Major Deliverable	**Due Date**
SOW Sec IV(C)	Written Notification of and Quality Management Plan for proposed Supervising Contractor	10th day following lodging of CD
SOW Sec IV(D)	Progress Reports	10th day of every month following lodging of CD
SOW Sec V(A)	Work Plan	30th day following lodging of CD
SOW Sec V(B)	Health and Safety Plan/Contingency Plan (HSP/CP)	30 days after notice of authorization to proceed under Paragraph 10 of the CD
SOW Sec V(C)	Field Sampling Plan/Quality Assurance Project Plan (FSP/QAPP)	30 days after notice of authorization to proceed under Paragraph 10 of the CD.
SOW Sec V(D)	Field Investigation Work Plan for Design Investigation	Within 30 days of direction by EPA
SOW Sec V(E)	ISCO Work Plan	60 days after approval of Work Plan
SOW Sec V(F)	Draft Operation and Maintenance Plan (O&M Plan)	According to schedule specified in approved Work Plan
SOW Sec V(G)	Construction Quality Assurance Project Plan (CQAPP)	According to schedule specified in approved Work Plan
SOW Sec V(H)	Site-Wide Management Plan (SWMP)	According to schedule specified in approved Work Plan
SOW Sec V(I)	Contractor Selection	45 days after ISCO Work Plan approval
SOW Sec V(J)	RA Implementation	According to schedule specified in approved ISCO Work Plan
SOW Sec V(K)	Performance Monitoring and Verification Plan	According to schedule specified in approved Work Plan
SOW Sec V(L)	Pre-Construction Meeting	30 days after approval of the ISCO Work Plan and before the start of construction
SOW Sec V(L)	Draft minutes of Periodic Meetings	Within 5 days of the meeting
SOW Sec V(M)	Semi-annual Reports after Remedy Completion	Within 1 year after notice of authorization to proceed and continuing every six months

SOW Sec V(N)	Remedial Action Report	30 days after the Final Construction Inspection
SOW Sec V(N)	Preliminary Close Out Report	Within 90 days after all cleanup goals have been achieved
SOW Sec V(O)	Pre-Certification Inspection	Within 60 days after all phases of Work has been completed
SOW Sec V(O)	Pre-Certification Written Report	Within 30 days after completion of the Pre-Certification Inspection

APPENDIX D

Draft Performance Guarantee
FOR THE REMEDIAL DESIGN AND REMEDIAL ACTION
Texas Instrument Project Area
TUCSON INTERNATIONAL AIRPORT AREA SUPERFUND SITE
Tucson, Arizona
EPA Region 9

(Issued on The Bank of Tokyo-Mitsubishi UFJ, Ltd., New York Branch Letterhead)

IRREVOCABLE STANDBY LETTER OF CREDIT NUMBER: [_____]

ISSUANCE DATE: [_____]

MAXIMUM AMOUNT: U.S.$ 971,900.00 (Nine Hundred Seventy One Thousand Nine Hundred U.S. Dollars and no Cents)

BENEFICIARY:

United States Environmental Protection Agency
c/o Enrique Manzanilla
Director, Superfund Division, EPA Region 9
75 Hawthorne Street
San Francisco, CA, 94105

APPLICANT:

Texas Instruments Incorporated
12500 TI Boulevard
Dallas, Texas 75243
TIAA Site Project Manager

Dear Mr. Manzanilla:

We hereby establish our Irrevocable Standby Letter of Credit No. [___] in your favor, at the request and for the account of the Applicant, Texas Instruments Incorporated ("TI"), in the amount of exactly Nine Hundred Seventy One Thousand Nine Hundred U.S. Dollars and no Cents ($971,900.00) (the "Maximum Amount"). We hereby authorize you, the United States Environmental Protection Agency (the "Beneficiary"), to draw at sight on us, The Bank of Tokyo-Mitsubishi UFJ, Ltd., New York Branch, 1251 Avenue of the Americas, New York, NY 10020, up to an aggregate amount equal to the Maximum Amount upon presentation of:

(1) your sight draft, bearing reference to this Letter of Credit No. [____] (which may, without limitation, be presented in the form attached hereto as Exhibit A); and

(2) your signed statement reading as follows: "I certify that the amount of the draft is payable pursuant to that certain Consent Decree, dated _____ ___, 2015, by and among the United States, the State of Arizona and TI entered into by the parties thereto in accordance with the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) relating to the Tucson International Airport Area Superfund Site (the 'Site')."

This letter of credit is effective as of _____ and shall expire on _____ *(date at least 1 year later)*, but such expiration date shall be automatically extended for a period of one (1) year on _____ *(date)* and

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on each successive expiration date, unless, at least 120 days before the current expiration date, we notify both you and TI by certified mail that we have decided not to extend this letter of credit beyond the current expiration date. In the event you are so notified, any unused portion of the credit shall be available upon presentation of your sight draft for 120 days after the date of receipt by both you and TI, as shown on the signed return receipts, but on or before the expiration date.

All notifications, requests, and demands required or permitted hereunder shall be given in writing, identify Tucson International Airport Area Superfund Site as the Site, and provide a contact person (and contact information).

Multiple and partial draws on this letter of credit are expressly permitted, up to an aggregate amount not to exceed the Maximum Amount. Whenever this letter of credit is drawn on, under, and in compliance with the terms hereof, we shall duly honor such draft upon presentation to us, and we shall deposit the amount of the draft in immediately available funds directly into such account or accounts as may be specified in accordance with your instructions.

All banking and other charges under this letter of credit are for the account of the Applicant.

This letter of credit is subject to the most recent edition of the Uniform Customs and Practice for Documentary Credits, published and copyrighted by the International Chamber of Commerce.

Very Truly Yours,
The Bank of Tokyo-Mitsubishi UFJ, Ltd.
New York Branch

_____
Authorized Signatory
[Insert Bank of Tokyo contact person/info]

Date: _____

Exhibit A - Form of Sight Draft

United States Environmental Protection Agency

Sight Draft

TO: The Bank of Tokyo-Mitsubishi UFJ, Ltd., New York Branch
1251 Avenue of the Americas, New York, NY 10020
Attn: Trade Operations Dept. Standby L/C Section

RE: Letter of Credit No. [_____]

DATE: [Insert date that draw is made]

TIME: [Insert time of day that draw is made]

This draft is drawn under your Irrevocable Letter of Credit No. [_____]. I certify that the amount of the draft is payable pursuant to that certain Consent Decree, dated _____ ___, 2015, by and among the United States, the State of Arizona and TI entered into by the parties thereto in accordance with the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) relating to the Tucson International Airport Area Superfund Site (the "Site'). Pay to the order of the United States Environmental Protection Agency, in immediately available funds, the amount of _____ U.S. Dollars (U.S.$[_____])

Pay such amount as is specified in the immediately preceding paragraph by FedWire Electronic Funds Transfer (EFT) to the TIAA Special Account within the EPA Hazardous Substance Superfund in accordance with current EFT procedures, referencing File Number [_____], EPA Region and Site Spill ID Number AZD980737530, and DOJ Civil Action No. 89-594-TUC-RMB, as follows:

[Insert specific Special Account wiring instructions and information].

The total amount paid shall be deposited by EPA in the TIAA Burr Brown Special Account to be retained and used to conduct or finance response actions at or in connection with the Site, or to be transferred by EPA to the EPA Hazardous Substance Superfund.

This Sight Draft has been duly executed by the undersigned, an authorized representative or agent of the United States Environmental Protection Agency, whose signature hereupon constitutes an endorsement.

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By: _____ [signature]

_____ [name]

_____ [title]

_____ [insert contact info]