GWOU ADMINISTRATIVE RECORD
SECTION TITLE:
GW-300-304-1.04

E_#89679

APR 1 2 2001

Mr. Dan Wall
Project Manager
Superfund Division
U.S. Environmental Protection Agency
Region VII
901 N. 5th Street
Kansas City, KS 66101

Dear Mr. Wall:

IN SITU CHEMICAL OXIDATION 90% DESIGN SPECIFICATIONS

Enclosed is the subject design package. This information is being sent primarily to keep you and the MDNR up to date on our design progress. If you have any questions, please call me at (636)441-8978.

Sincerely,

Original Signed By
Angela Pickett for

Thomas C. Pauling
Environmental Engineer

Enclosure:
As stated

cc w/enclosure:
Brandon Doster, MDNR
Ben Moore, MDNR

PAI:YDeyo:x7034:emh:4/12/01 (m:Insitu Chemical Oxidation)

CONCURRENCES/ REVIEWED BY:	
RTG SYMBOL	PAI
INITIALS/SIG.	YDeyo
DATE	4/12/2001
CONCURRENCE: RTG SYMBOL	FM-95
INITIALS/SIG.	TPauling
DATE	4/ /2001
CONCURRENCE: RTG SYMBOL	
INITIALS/SIG.	
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INITIALS/SIG.	
DATE	
CONCURRENCE: RTG SYMBOL	
INITIALS/SIG.	
DATE	

ENGINEERING

FILE NUMBER

12-12-568

MK-FERGUSON
A MORRISON KNUDSEN COMPANY

U.S. DEPARTMENT OF ENERGY
CONTRACT NO: DE-AC05-86OR21548
WELDON SPRING SITE REMEDIAL ACTION PROJECT

ENG-1.1, Rev. 6, 6/96

DESIGN DOCUMENT REVIEW REQUEST
(Request for Review by the Design Review Board)

TO BE COMPLETED BY THE REQUESTING ENGINEER

Review No: **568.2**

Work Package Number: **568**

Date: **8-28-01**

Work Package Title: **In Situ Chemical Oxidation of TCE in Groundwater**

Subject (Purpose of Review): **90% Review**

Review Date Friday, August 31, 2001 Conference Room 3A Time: 10:30 to 11:30	Design Review: [ ] Document Review: [X]	Site Originated: [ ] Off-Site Originated: [X]	Quality Assurance Level _1 X 2 _3 _4

Requestor: **Joe Kazemi/Barb Duletsky**

Title: Project Engineer

Design Document Number(s):

Spec. 01010 – Summary of work package
Spec. 01025 – Measurement and Payment
Spec. 01300 – Submittals
Spec. 01400 – Quality Assurance
Spec. 01500 – Temporary Facilities and Controls
Spec. 01503 – Equipment Decontamination
Spec. 01600 - Material Storage and Handling
Spec. 02050 – In Situ Chemical Oxidation
Spec. 02733 – Well Installation and Abandonment
Submittal Checklist

Reference Documents:

Additional information, special instructions, etc.

Please review and document your comments on the enclosed RCR forms before the scheduled review meeting of 8-31-01.

DISTRIBUTION W/ATTACHMENTS

J. Kazemi
B. Duletsky
B. Cato
T. Uhlmeyer
N. Deyong
G. Valett
D. Gill
D. Fleming
V. Logan
M. Oaks
D. Hixson
B. Tumbarello
B. Johnson
M. Mitchell
S. Anderson
P. Cate
S. Warren
R. Thompson
[redacted]

DOE
T. Pauling
B. Ballew
Y. Deyo

THIS REQUEST HAS BEEN REVIEWED AND APPROVED BY THE ENGINEERING MANAGER

Signature: [signature]

Date: 8/28/01

REVIEW COMMENT RECORD FORM

MK-FERGUSON
A MORRISON KNUDSEN COMPANY

WELDON SPRING SITE REMEDIAL ACTION PROJECT (WSSRAP)

CONTRACT NO.: DE-AC05-86OR21548

ENG-1, Rev. 6, 6/96

DESIGN REVIEW BOARD
REVIEW COMMENT RECORD (RCR)

Date:		Work Package No.:	
Attach. No:		Page: 1 of ____	

Document Number and Title	RECORD COPY: [ ] YES [ ] NO			
	Agreement with Comment Disposition(s):		Verification:	
	Date:	Design Review Manager:	Date:	DRM:
	Date:	Project Engineer:	Date:	PE:

Item	Comment(s). (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve.)		Status

REVIEW COMMENT RECORD FORM (Continued)

MK-FERGUSON
A MORRISON KNUDSEN COMPANY

WELDON SPRING SITE REMEDIAL ACTION PROJECT (WSSRAP)

CONTRACT NO.: DE-AC05-86OR21548

ENG-1, Rev. 6, 6/96

DESIGN REVIEW BOARD REVIEW COMMENT RECORD (RCR) CONTINUATION RECORD COPY: [ ] YES [ ] NO	Work Package Number:	Page: ____ of ____

Item	Comment(s). (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve.)	Disposition (Provide justification if not accepted).	Status

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:HG-S-05-4859-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Hydrogeology

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 01010
Summary of Work
Issued for Review
Revision B

	PRINT/TYPE NAME	SIGNATURE	DATE
PREPARED:	K. Ohsiek		
REVIEWED:	P. Patchin		
APPROVED MKES:			
- LEAD TASK ENGINEER	P. Patchin		
- LEAD DISCIPLINE DEPT. MGR.	S. Vincent		
- DESIGN MANAGER	R. Rager		
- ENGINEERING MANAGER			
APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SCOPE

A. The Subcontractor shall design, furnish, install, and operate a pilot-scale treatment system for in situ chemical oxidation of trichloroethene (TCE) in the groundwater at the Weldon Spring Site Remedial Action Project (WSSRAP) Chemical Plant site. The Work includes:

1. Mobilization
2. Pilot-scale system installation and operation including, as necessary, installation of monitoring wells, installation of injection wells, field instrumentation, electrical systems, temporary facilities, piping systems, and appurtenant features and systems.
3. Groundwater monitoring, sampling, and analysis
4. Progress reporting
5. Preparation and submittal of Pilot-Scale Testing completion report.
6. Preparation and submittal of the Final Full-Scale Work Plan and Design based on incorporation of pilot-scale test results into the Conceptual Full-Scale Design submitted with the bid package
7. Injection point and observation well abandonment
8. Demobilization

B. The Subcontractor shall also:

1. Provide all submittals required by these specifications
2. Comply and coordinate with Contractor's witness and hold points
3. Provide a Quality Assurance/Quality Control Program, as defined in Section 01400

4. Provide required temporary facilities not already provided by the Contractor, as defined in Section 01500

5. Install, maintain, and remove temporary access roads and drilling pads necessary for well installations, as described in Section 02733.

6. Install temporary decontamination facilities, as described in Section 01503.

7. Decontaminate equipment, as described in Sections 01503 and 02733.

8. Collect and store contaminated drilling-derived, development, decontamination and/or purge water, as described in Section 01600.

9. Collect, treat, and store wastewater containing detectable levels of chemicals introduced by the Subcontractor.

10. Handle, store and dispose of Subcontractor-generated contaminated and hazardous material, and treatment-derived wastes, as described in Section 01600

11. Implement waste minimization practices to reduce the volume of contaminated and non-contaminated wastes generated from the work

C. The following activities are not included in the Work:

1. Restoration and reestablishment of vegetation on areas and surfaces disturbed by the Subcontractor with Contractor approval

2. Surveying

1.02 DEFINITIONS

A. DOE: U.S. Department of Energy

B. Contractor: As used in these Technical Specifications, the Contractor is the Project Management Contractor (PMC), as defined in the Special Contract Requirements Section H.002-C.

C. Hold Point: Unless otherwise indicated in these specifications, a key item of fabrication and/or manufacturing or field activity that will require stoppage of the work and inspection by the Contractor. The inspection may include sampling and testing by the Contractor. The Contractor may also require stoppage of the work until the inspection is complete and may require written approval or notice to proceed from the Contractor prior to the Subcontractor resuming work. The Subcontractor shall give five days advance notice to the Contractor prior to the day that such hold point activity will take place.

D. ES&H: Environmental Safety and Health

E. Site: The U.S. Department of Energy's property known as the Weldon Spring Chemical Plant, which is shown on Figure 1.

F. TCE Impact Area: The southwest area of the Site and adjacent property where monitoring wells show a detection for Trichloroethene at 5μg/L (MCL) or greater.. The TCE impact area is shown on Figure 2.

G. Witness Point: Unless otherwise indicated in these specifications, a key item of fabrication and/or manufacturing or field construction activity that will require inspection by the Contractor. The Subcontractor shall give five days advance notice to the Contractor prior to the day that such inspection activity will take place. A written notification by the Contractor shall be required to waive a witness point.

H. MCL: Maximum contaminant level

I. ppb: Parts per billion

J. μg/L: Micrograms per liter (10^{-6} grams per liter)

1.03 SPECIFICATIONS AND CONSTRUCTION DRAWINGS

A. Work shall be performed according to the following Sections:

Work Package	Section No.	Title
568	01010	Summary of Work
568	01025	Measurement and Payment
568	01300	Submittals
568	01400	Quality Assurance
568	01500	Temporary Facilities and Controls
568	01503	Equipment Decontamination
568	01600	Material Storage and Handling
568	02050	In Situ Chemical Oxidation
568	02733	Well Installation and Abandonment

B. The Figures listed below supplement the specifications, define the location and details of the Work to be performed and provide specific information related to the hydrogeology and contaminant distribution at the site.

Figure No.	Title
1	Weldon Spring Chemical Plant - Site and Vicinity
2	TCE Impact Area , March 2001

Figure No.	Title
3	Potentiometric Surface of the Shallow Aquifer, March 2001
4	Bedrock Topography

1.04 PLANS AND REPORTS

A. The Subcontractor shall prepare plans and reports describing sequencing, scheduling, procedures, and coordination limited to the Subcontractor's scope of the Work. All plans and reports shall be subject to review and approval by the Contractor as a minimum. The DOE and regulatory agencies will review certain plans and reports as defined in the various Sections. The plans and reports to be submitted for review and approval are listed below:

1. Section 01400 – Quality Assurance Program
2. Section 01503 – Equipment Decontamination Plan
3. Section 02050 – Pilot-Scale Work Plan and Design (to be included with bid)
4. Section 02050 – Conceptual Full-Scale Design (to be included with bid)
5. Section 02050 – Safe Work Plan
6. Section 02050 – Emergency Response Plan
7. Section 02050 – Sampling and Analysis Plan
8. Section 02050 – Interim Progress Reports
9. Section 02050 – Pilot-Scale Testing Completion Report
10. Section 02050 - Full-Scale Work Plan and Design
11. Section 02733 – Injection Well Plan

1.05 OPERATIONAL CRITERIA

A. Chemical reagents shall be covered and stored in such a way as to prohibit exposure to the weather, prevent dissolution or mobilization of the chemical in runoff water, and prevent airborne emissions due to wind erosion. Volumes of chemicals stored at the site for the purpose of treatment shall be limited to the amount necessary to perform the Work. All chemicals used shall be reviewed for their compatibility and storage requirements and shall be stored, protected, handled and used according to the manufacturer's, vendor's, or supplier's recommendations.

B. Discharging of water without a valid Contractor Disposition Documentation Form (DDF) permit shall not be permitted.

C. During shutdown periods, Subcontractor shall have sufficient staff on site for shutdown activities. During snow removal, shutdowns or non-working periods including overnights, weekends, holidays and periods of inclement weather, the Subcontractor shall:

1. Maintain a fire watch for all operating power equipment, including generators not provided by the Contractor, pumps, and combustion engines.

2. Ensure erosion and surface water controls, traffic control devices, and barricades are in place and working properly.

3. Perform fueling and maintenance on all operating power equipment including pumps, combustion engines, and Subcontractor-supplied generators.

4. Ensure all containers are intact and securely covered to prevent water accumulation, infiltration, and discharge of the material.

5. Ensure safe storage of chemicals used for treatment.

D. The Subcontractor shall allow for work activities to be conducted by the Contractor and other subcontractors within or near the TCE impact area. . The following Contractor activities may be conducted concurrently with Subcontractor activities and will require interface and coordination with the Subcontractor:

1. Contractor water quality sampling activities .

2. Construction water access (to the 2-inch Contractor-supplied water line).

3. Contractor inspection of equipment and materials.

4. Waste characterization, transfer, and disposal including contaminated groundwater from well development or sampling.

5. Installation and monitoring of wells not included in this scope.

E. The Subcontractor shall coordinate with the Contractor any required interruption of facility access, shutdown of water supply, or shutdown of electrical power.

F. Scheduling the performance of operations is the sole responsibility of the Subcontractor and shall ensure completion of the Work in accordance with the schedule established in the approved Subcontractor's Pilot-Scale Work Plan. This includes a determination of the availability of all specified or accepted substitute

products, and the scheduling of their deliveries in order to allow sufficient time for installation during orderly and timely progress of the Work.

Subcontractor shall attend a sufficient number of meetings with the Contractor and provide information (possibly additional to the Pilot-Scale Work Plan and Design) that will allow the Contractor's ES&H Department to prepare Hazard Categorization/Safety Analysis documents. These meetings may be in addition to other required meetings.

1.06 CONDITIONS OF WORK IN PLACE

A. Special restrictions apply to all work performed within the WSSRAP property boundaries. Requirements for this work shall include, but not be limited to, the following restrictions:

1. All workers shall receive necessary site-specific training as required by the HASP and HASP Checklist regarding worker training and safe work planning.

2. No materials originating from or brought into a posted Controlled Area or a posted Restricted Area shall be released for off-site disposal or salvage without Contractor's approval.

3. Contaminated materials encountered during drilling and well installation or development as identified by the Contractor shall be dispositioned as directed by the Contractor.

4. No materials shall be burned on site.

1.07 CONTRACTOR WITNESS AND HOLD POINTS

A. Specific Contractor witness and hold points are listed in the Sections to which they apply.

1.08 CONSTRUCTION DOCUMENTS

A. Only controlled current copies of Construction Documents marked "Revision 0" (Rev. 0) and subsequent numeric revisions shall be utilized for construction by the Subcontractor.

1.09 SITE CONDITIONS

A. The subsurface profile consists of overburden soils overlying Burlington-Keokuk Limestone. Overburden thickness varies but generally ranges between 20 and 50 feet. Depth to water varies with location as well as with seasonal and climatic conditions, but generally ranges between 25 and 50 feet below ground surface. A

groundwater divide occurs roughly coincidental with the topographic divide that traverses the southern portion of the site. In the area of TCE impact, the groundwater flows to the northwest (Figure 3).

B. The Burlington-Keokuk Limestone is a fine-to coarse-grained, thinly to massively bedded limestone containing 60% chert as nodules and interbeds. The weathered limestone exhibits relatively thin, highly conductive zones, consisting of fracture zones and solution features. There is a general decrease with depth in the degree of weathering, intensity of fractures, and number and size of solution vugs and voids in the limestone. Figure 4 is an updated map of the bedrock surface beneath the site that incorporates recent drilling data.

C. The shallow bedrock aquifer has been conceptualized as a diffuse flow system with superimposed conduit flow. Hydraulic conductivity of the weathered Burlington-Keokuk Limestone as determined from packer testing ranges from 3×10^{-6} to 1×10^{-3} cm/sec. Values determined from constant discharge aquifer tests in a highly conductive zone of the TCE-impacted area range from 3×10^{-3} to 8×10^{-1} cm/sec.

D. Trichloroethene (TCE) contamination in varying concentrations is present in the groundwater primarily within weathered and fractured limestone (Figure 2). The TCE contamination in the groundwater is localized, primarily in the southern to southwestern part of the Chemical Plant area in the vicinity of the recently removed raffinate pits. TCE concentrations measured in late February and early March 2001 range from the detection limit of 1 μg/L to 1000 μg/L. The MCL is 5 μg/L.

E. TCE is the predominant contaminant of concern at the site although tetrachloroethylene (PCE), dichloroethylene (DCE), uranium, nitroaromatic compounds, and nitrate have also been identified. Remediation of the uranium, nitroaromatics, and nitrate is being addressed under separate treatment studies (see part F. below) being performed in 2001 in the TCE-impact area. Maximum concentrations for these contaminants measured in the first quarter of 2001 within the area of TCE impact are54 pCi/L uranium, 34 μg/L nitroaromatics, and665 mg/L nitrate

F. A feasibility study for the pumping of groundwater using artificial recharge has been completed in the area of TCE impact. Approximately 1.9 million gallons of water were pumped from two extraction wells (MW-3028 and MW-3033) in this area during the 6 month study. In addition, injection of potable water into the aquifer via two injection wells (MW-2037 and MW-3032) was conducted to augment recharge to the pumping well. Approximately 1.4 million gallons of water were injected into the aquifer over a 4 month period. During stages of the study involving pumping but no injection, the sustainable yield in MW-3028 was less than 6 gallons per minute (gpm). (A sustainable yield for MW-3033 was not determined.)

During stages involving introduction of 5 gpm of potable water into each injection well, the sustainable extraction rate in MW-3028 was 9.7 gpm and 304 gpm in MW-3033. During stages with injection rates of 10 gpm in each well, the sustainable extraction rate in MW-3028 was 16 gpm. MW-2037 accepted 10 gpm with a slight (i.e., 2- to 3-foot) increase in the water level inside the well casing. MW-3032 initially accepted only about 1 gpm; however, when the water level in the well casing was increased to about 5 feet below the ground surface, an injection rate of 3.5 gpm could be maintained. In order to achieve an injection rate of 10 gpm in MW-3032, a packer was installed above the well screen and water was introduced at a pressure of 30 psi(measured at the top of the well).

G. Results of laboratory bench-scale studies performed in April 2001 showed that the following oxidants effectively destroyed TCE in site groundwater: potassium permanganate, sodium persulfate, and Fenton's reagent. Natural oxidant demand was shown to be less than 1 gram of potassium permanganate per kilogram of aquifer material. Reports from each of the four vendors conducting bench-scale studies are included in this bid package.

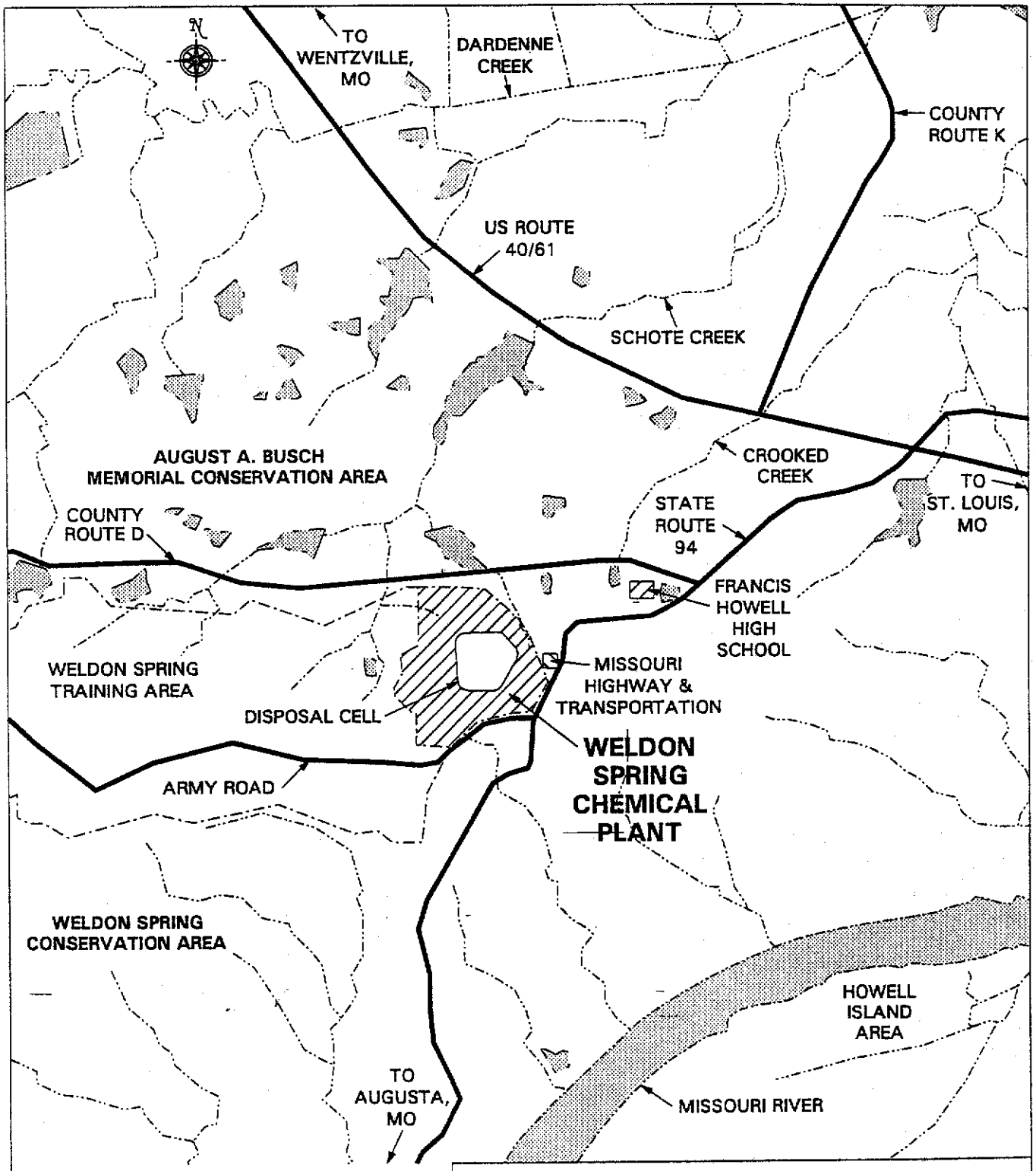
PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01010



LEGEND

CREEK OR SURFACE DRAINAGE

POND OR LAKE

0 1 MI

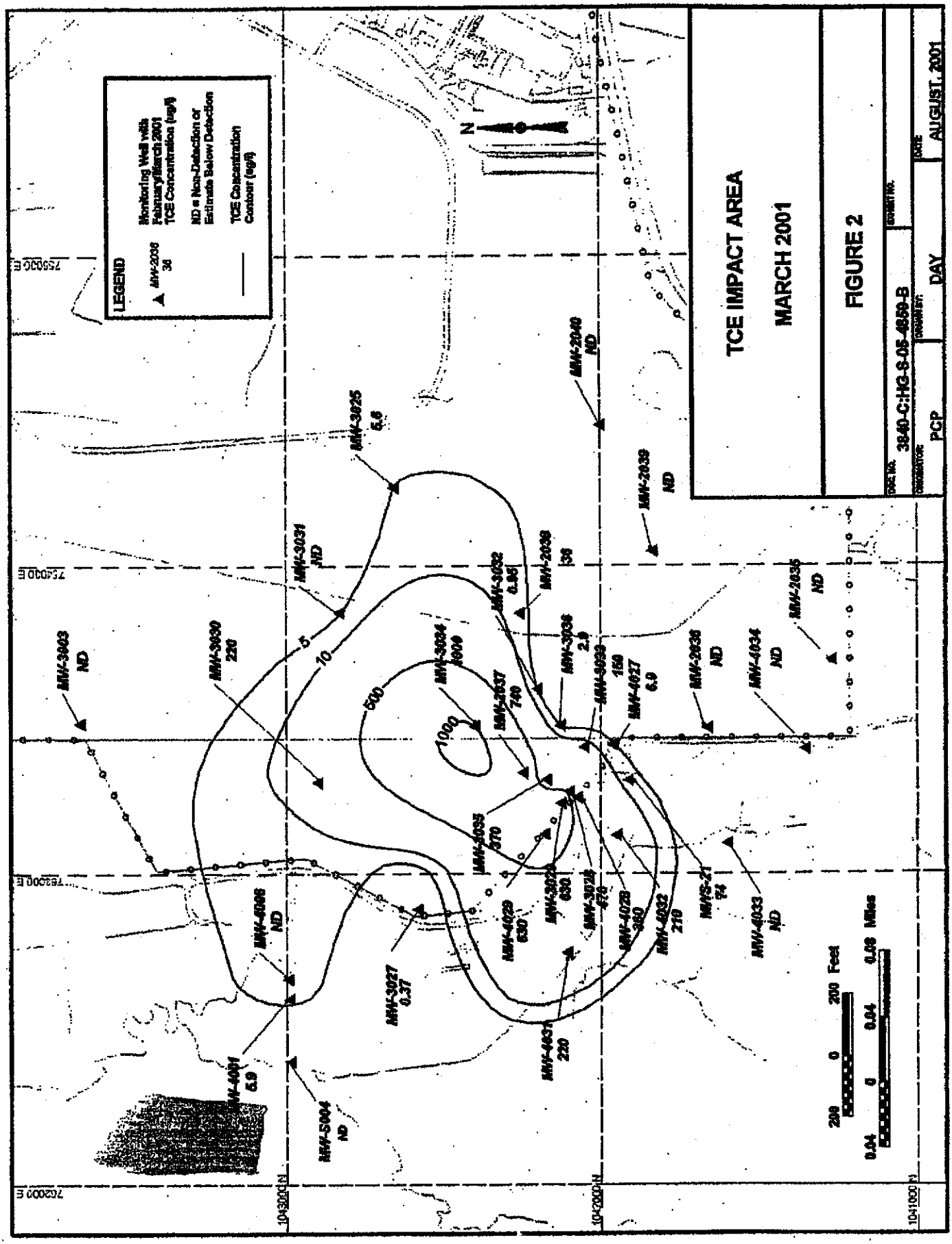
0 1.6 KM

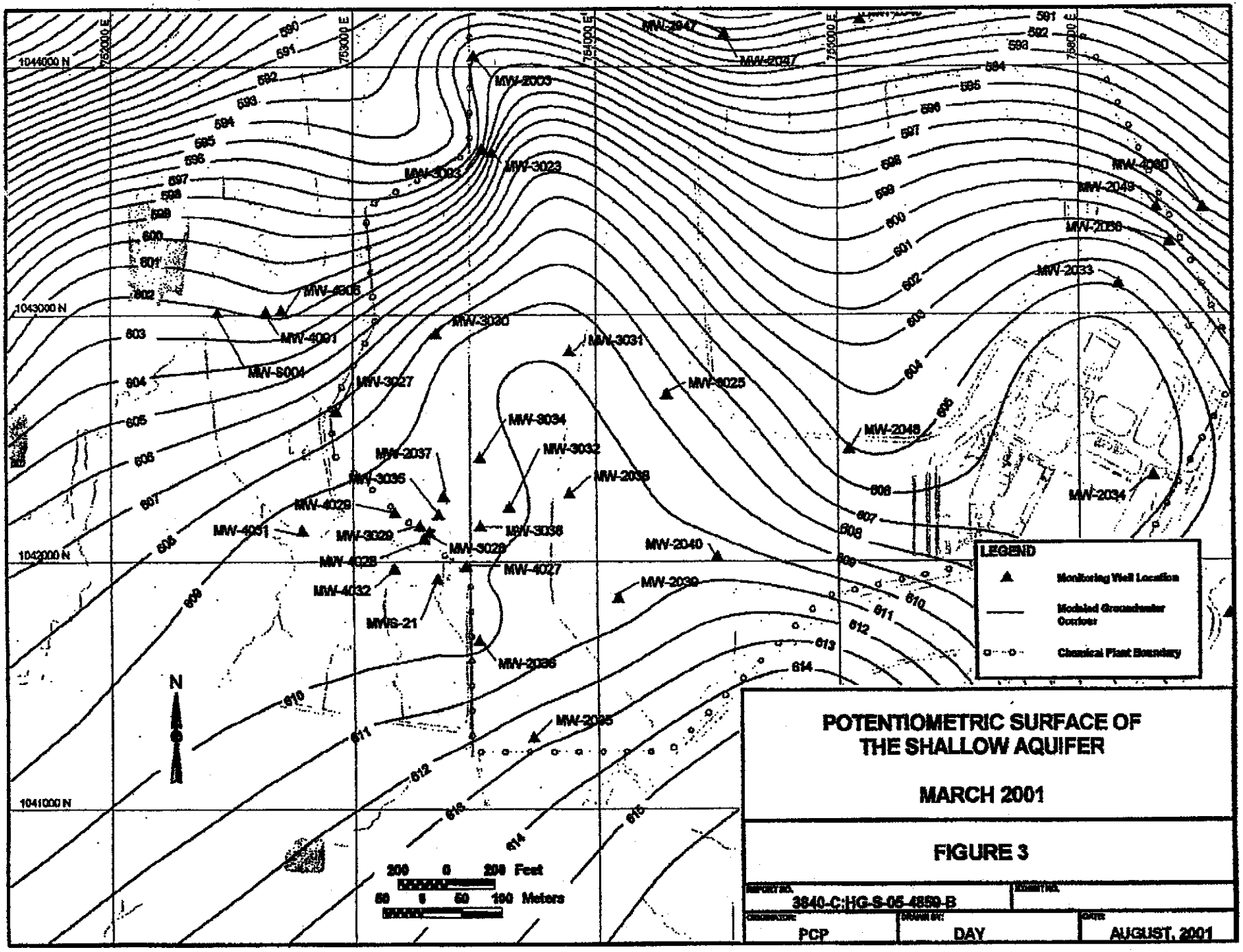
SCALE

WELDON SPRING CHEMICAL PLANT SITE AND VICINITY

FIGURE 1

REPORT NO.: WP-~~580~~ 568 SPEC 01010		EXHIBIT NO.: A/VP/008/0401	
ORIGINATOR: BWD	DRAWN BY: GLN	DATE: 4/30/01	


LEGEND
MW-2038 36
Monitoring Well with February/March 2001 TCE Concentration (ug/l)
ND = Non-Detection or Estimate Below Detection
TCE Concentration Contour (ug/l)
N
TCE IMPACT AREA
MARCH 2001
FIGURE 2
DOC. NO. 3840-C:HG-S-05-4850-B
DRAWN BY: PCP
DATE: AUGUST, 2001
DAY
MW-3003 ND
MW-3030 220
MW-3031 ND
MW-3025 5.6
MW-2040 ND
MW-2039 ND
MW-2038 36
MW-3032 0.95
MW-3036 2.9
MW-3033 150
MW-4027 6.9
MW-2036 ND
MW-4034 ND
MW-2035 ND
MW-3034 1000
MW-2037 740
MW-3035 370
MW-3029 630
MW-3028 470
MW-4028 360
MW-4032 210
MWS-21 74
MW-4033 ND
MW-4029 630
MW-4031 220
MW-3027 0.37
MW-4006 ND
MW-4001 5.9
MW-5004 ND
5
10
500
1000
200 0 200 Feet
0.04 0 0.04 0.08 Miles
1043000 N
1042000 N
1041000 N
762000 E
763000 E
764000 E
765000 E

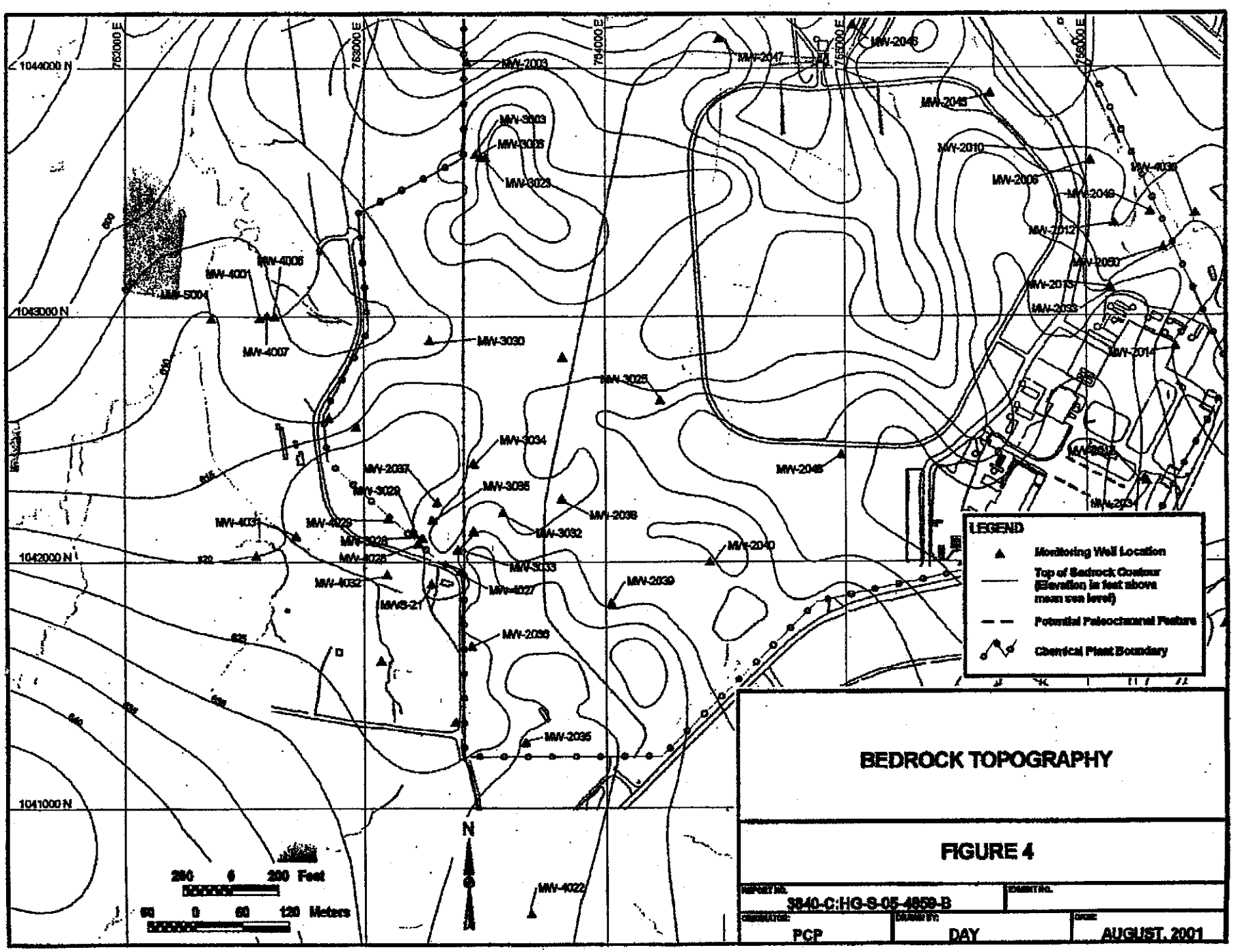


POTENTIOMETRIC SURFACE OF THE SHALLOW AQUIFER

MARCH 2001

FIGURE 3

REPORT NO.		EXHIBIT NO.
3840-C:HG-S-05-4859-B		
ORIGINATOR: PCP	DRAWN BY: DAY	DATE: AUGUST, 2001



BEDROCK TOPOGRAPHY

FIGURE 4

REPORT NO.		EXHIBIT NO.
3840-C:HG-S-05-4859-B		
ORIGINATOR: PCP	DRAWN BY: DAY	DATE: AUGUST, 2001

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:HG-S-05-4860-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Hydrogeology

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 01025
Measurement and Payment
Issued for Review
Revision B

	PRINT/TYPE NAME	SIGNATURE	DATE
PREPARED:	K. Ohsiek		
REVIEWED:	P. Patchin		
APPROVED MKES:			
- LEAD TASK ENGINEER	P. Patchin		
- LEAD DISCIPLINE DEPT. MGR.	S. Vincent		
- DESIGN MANAGER	R. Rager		
- ENGINEERING MANAGER			
APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SCOPE

A. This Specification Section includes descriptions of measurement and payment as they apply to this Subcontract.

B. The Contractor will perform all measurements for payment.

1.02 RELATED WORK

A. General Provisions – Payments to Subcontractor.

B. General Conditions – Progress Schedules and Reports; Progress Payment Estimate.

C. Special Conditions.

D. Applicable Subcontract Drawings.

E. Layout of Work and Surveys.

F. Section 01010 – Summary of Work

G. Section 01300 – Submittals

H. Section 01400 – Quality Assurance

I. Section 01500 – Temporary Facilities and Controls

J. Section 01503 – Equipment Decontamination

K. Section 01600 – Material Storage and Handling

L. Section 02050 – In Situ Chemical Oxidation

M. Section 02733 – Well Installation and Abandonment

N. Pricing Schedule

1.03 DEFINITIONS

A. Lump Sum (LS): A unit of measure for the entire item, unit of work, structure or combination thereof.

1.04 PAYMENT

A. Payment will be full compensation for furnishing all labor, materials, tools, equipment, transportation, services, and incidentals, as specified in the Subcontract Documents, and for performing all work necessary for completing the item or work classification, including all adjusting and balancing, testing, cleaning, and all other incidental work.

B. Full compensation for all costs involved in conforming to the requirements for measuring materials or work shall be considered as included in the lump-sum prices paid for the work, and no additional compensation will be permitted.

1.05 MEASUREMENT AND PAYMENT

A. Measurement: Measurement for payment for the Work will be by lump sum (LS).

B. Payment: Payment for the Work will be made at the lump sum price quoted in the Pricing Schedule, and will include all items specified herein. Payment will be made as follows:

1. Payment of the lump sum price will be made upon completion of the Work except as authorized for progress payments. Work items included in the pilot-scale testing are:

    a. Submittal of all required submittals, (e.g. work plans, designs, reports, permits, certifications, insurance and bond premiums).

    b. Training of Subcontractor labor.

    c. Mobilization

    d. Installation of temporary utilities and temporary facilities not provided by the Contractor.

    e. Drilling, installation, and development of injection points and monitoring wells.

    f. Equipment decontamination.

g. Contaminated water storage and treatment of residual oxidation reagent in contaminated water during pilot-scale testing.

h. Execution and completion of the pilot-scale in situ chemical oxidation injection

i. Monitoring and sampling of groundwater to evaluate the effects of pilot-scale injection.

j. Completion of a pilot-scale testing summary report.

k. Completion of the final full-scale work plan and design.

l. Abandonment of injection points and monitoring wells.

m. Demobilization.

2. Separate measurement will not be made for payment for the items listed below which will be considered incidental to the Work:

   a. Physical exams and drug tests.

3. All costs for such work will be included in the lump sum prices quoted for work activities specified in the Subcontract Documents relative to this pay item.

4. Progress payments will be made as follows:

   a. 20% of the lump sum price upon mobilization and completion of road, staging area, and drilling pad construction.

   b. 30% of the lump sum price upon completion of all work resulting in the installation of the pilot-scale in situ chemical oxidation remediation system, but prior to the first injection.

   c. 30% of the lump sum price upon completion of the pilot-scale injection and fieldwork including monitoring and sampling.

   d. 10% of the lump sum price upon completion and submittal of the Pilot-Scale Testing Completion Report and the Full-Scale Work Plan and Design.

e. 10% of the lump sum price upon completion of well abandonment and demobilization.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION 01025

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:HG-S-05-4861-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Hydrogeology

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 01300
Submittals
Issued for Review
Revision B

	PRINT/TYPE NAME	SIGNATURE	DATE
PREPARED:	K. Ohsiek		
REVIEWED:	P. Patchin		
APPROVED MKES:			
- LEAD TASK ENGINEER	P. Patchin		
- LEAD DISCIPLINE DEPT. MGR.	S. Vincent		
- DESIGN MANAGER	R. Rager		
- ENGINEERING MANAGER			
APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SCOPE

A. This Specification Section describes the requirement and procedures for submittals as identified and listed in the Technical Specifications. To ensure that the specified products are furnished and installed in accordance with technical requirements, procedures have been established for advanced submittal of design data and for its review and acceptance or rejection by Contractor.

1.02 SUBMITTAL DRAWINGS

A. Scale Required: Unless otherwise specifically directed by Contractor, all submittal drawings shall be of such scale as to clearly show all pertinent features of the item and its method of connection to the work.

B. Certification of Submittal Drawings: When submittal drawings are required to be prepared either by or under the direct supervision of a registered professional engineer or geologist, these submittal drawings shall bear the seal of that registered professional engineer or geologist appropriate for the subject matter of submittal.

C. Status of Submittal Drawings: Submittal drawing submittals processed by Contractor, or by Contractor's Representative or consultants, become Construction Documents and will be reviewed and approved accordingly.

D. Drawing Revisions: A revision block shall be included on shop drawings identifying current revision. Shop drawing changes shall require a resubmittal of the drawing and an update of the revision block for Contractor's review and acceptance.

1.03 AS-BUILT DRAWINGS

A. The Subcontractor shall maintain and submit marked-up prints of as-built drawings for all Work performed. The prints shall be marked up by redlining. The submittal of as-built drawings shall be completed prior to final acceptance of the Work by the Contractor. The Subcontractor shall maintain and submit as-built drawings of the work as completed for different areas, phases, and disciplines. The as-built drawings shall be prepared in accordance with the following requirements:

1. The Construction Drawings shall be utilized as the drawing base for Subcontractor as-built drawings.

2. The as-built drawings shall be to scale, of good quality, and legible.

3. The as-built drawings shall include all approved field modifications made during construction.

4. The as-built drawings shall include consolidated information provided by vendor data and drawings, Subcontractor and Contractor sketches and drawings.

5. The as-built drawings shall reflect final as-built field conditions.

B. The Subcontractor shall mark up one set of controlled prints to show the as-built conditions as work progresses including the accurate location of all Subcontractor-installed underground utilities. These as-built marked prints shall be kept current and available on the jobsite at all times. All changes that are made in the work or additional information that might be uncovered in the course of construction, shall be accurately and neatly recorded as they occur by means of details and notes. As work progresses, the Subcontractor shall submit as-built marked prints for each drawing superseded by revision on a monthly basis or as otherwise required by the Contractor.

C. The as-built marked prints will be jointly reviewed for accuracy and completeness by the Contractor's representative and a responsible representative of the Subcontractor on a monthly basis. The Subcontractor shall correct any inaccuracies and complete mark-up of any omissions noted in this review. Completed as-built drawings shall be subject to approval by the Contractor.

1.04 MANUFACTURER'S CERTIFICATES

A. Submit certificates to the Contractor according to the requirements of each Specification Section.

1.05 IDENTIFICATION OF SUBMITTALS

A. Subcontractor shall completely identify each submittal and resubmittal by showing at least the following information.

1. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.

2. Name of Project as it appears on the Construction Documents.

3. Drawing number or Specification Section number to which the submittal applies.

4. Submittal number, numerically serialized and sequential beginning with the number 1 (one).

5. Resubmittals shall be designated with numeric suffixes to the original submittal number (e.g., Submittal No. 32R-1).

B. Each submittal shall be submitted using the Contractor's "Construction Submittal Transmittal and Disposition Form."

1.06 COORDINATION OF SUBMITTALS

A. General: Prior to submittal for Contractor's review, the Subcontractor shall use all means necessary to fully coordinate all material, including the following requirements:

1. Determine and verify all field dimensions and conditions, materials, catalog numbers, availability with respect to Project Schedule, and similar data.

2. Coordinate as required with all trades.

B. Groupings of Submittals: Unless otherwise specifically permitted by Contractor, the Subcontractor shall make all submittals in groups containing all associated items. Contractor may reject partial submittals as not complying with the Construction Documents.

1.07 SCHEDULES

A. Initial Submittal:

1. The scheduling and progress reporting of construction is the responsibility of the Subcontractor.

2. A complete construction schedule shall be submitted for review and approval before start of work. The construction schedule shall consist of the following:

a. Barchart Schedule: The selection and number of activities will be left to the discretion of the Subcontractor but subject to the Contractor's approval. Unless otherwise approved by the Contractor, the construction schedule shall consist of the following items and shall be represented on the same diagram. The activities shall be shown sequentially by major work area. Upon approval by the Contractor, the complete construction schedule will be classified as the Baseline Schedule and will be the

schedule against which system progress will be measured. The barchart schedule shall include the following:

1) Identification number for each activity (activity code), coded in such a manner to reflect the major project work areas.
2) Description of each activity.
3) Baseline start and finish dates for each activity (early/late start and finish dates which are derived from logic ties in the critical path method [CPM]).
4) Duration for each activity.
5) Manpower assigned to each activity.
6) Arrange in order of forecast start dates.
7) Activities grouped by major work area.

b. Logic Diagram: The Subcontractor shall submit a critical path method (CPM) logic diagram, using precedence notation. The CPM diagram shall be structured following the same criteria detailed in Items (1) - (4), (6) and (7) of Article A.2.a above.

B. Monthly Transmittals:

1. The construction schedule(s), as described above, shall show monthly status and shall be transmitted on or about the 15th of every month. This monthly transmittal shall consist of the following reports:

a. Barchart Diagram: Show fully progressed update, (actual or forecast start/finish dates) for each activity, laid against the original Baseline Schedule. Include all items as described in Article A.2.a. in addition to the following:

1) Arrange in order of actual/forecast start dates.
2) Show new, approved field modification activities resulting from baseline reschedule process and their respective scheduled dates.
3) Percent complete for each activity with updated status for EAC dates.
4) Total float for each activity.

b. Schedule Reports: List all activities in tabular format with the same information included on the updated Barchart Diagram and sorted as follows:

1) In the same order as the updated barchart diagram.
2) In order of activity code.

c. Narrative Report: Discuss accomplishments, goals/milestones met, current or anticipated problem areas, delaying factors and potential impacts. Also describe current or proposed corrective action or recovery

plans that would be required to ensure meeting the completion date. Address individual activities as required.

1.08 SUBMITTAL REQUIREMENTS

A. Submittals such as catalog cuts, material certifications, shop drawings, Subcontractor drawings, operating/maintenance manuals, samples, special procedures, and/or other types of data as may be specified or listed in these documents shall be submitted to the Contractor as specified herein.

B. The Subcontractor shall submit all data identified in these specifications, to the Contractor with such promptness as to cause no delay in the Work or that of any other subcontractor. Unless otherwise specified, submittals for all material and equipment requiring approval shall be submitted, reviewed, and approved prior to receipt, inspection, installation, and/or incorporation of the item into the Work.

C. The Subcontractor shall furnish copies of such data requiring approval sufficiently in advance of the date that the material/equipment is required to meet the approved schedule so that, if the item is disapproved, no delay will be occasioned to the schedule.

D. The Contractor will review and generally return submittals within ten days of receipt, but in no case will this process take longer than 30 days.

E. Following a review, the Contractor will indicate, by stamping upon each submittal, the appropriate approval category:

1. Categories:

   A - Approved

   B - Approved as Noted, Work May Proceed, Revise and Resubmit

   C - Not Approved, Work May Not Proceed, Revise and Resubmit

   D - Rejected

   E - Receipt Acknowledged, Approval Not Required

F. The applicable blocks of the Construction Submittal Transmittal and Disposition Form will be completed by the Contractor showing the disposition action for each item listed on the form. When submittals are returned marked with either "Revise and Resubmit," or "Rejected," the Subcontractor shall make such revisions and corrections as required and resubmit the submittal with the same submittal number followed by a sequential revision number as specified in Article 1.05.A.5.

G. One copy of the stamped Submittal will be returned to the Subcontractor. If further actions are required, the Subcontractor shall perform such actions as directed. The

required submittal and resubmittal sequence shall be repeated until no further action is required.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01300

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:EN-S-05-4862-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Hydrogeology

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 01400
Quality Assurance
Issued for Review
Revision B

	PRINT/TYPE NAME	SIGNATURE	DATE
PREPARED:	K. Ohsiek		
REVIEWED:	P. Patchin		
APPROVED MKES:			
- LEAD TASK ENGINEER	P. Patchin		
- LEAD DISCIPLINE DEPT. MGR.	S. Vincent		
- DESIGN MANAGER	R. Rager		
- ENGINEERING MANAGER			
APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 01400

QUALITY ASSURANCE

PART 1 - GENERAL

1.01 SCOPE

A. Applicable Standards

B. Quality Assurance

C. Submittals

D. Workmanship

E. Record Retention

1.02 APPLICABLE STANDARDS

A. *Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Program,* ANSI/ASQC E4:1994 (guidance only).

B. DOE Order 414.1A, *Quality Assurance*

1.03 QUALITY ASSURANCE

A. The Subcontractor shall develop a Quality Assurance Program meeting the applicable requirements of DOE Order 414.1A as noted in the attached applicability checklist (Attachment 1). The Subcontractor shall within thirty (30) days after contract award, submit a Quality Assurance Program to the Contractor for review and approval. The Quality Assurance Program shall be approved and accepted by the Contractor PRIOR to performing any on-site activities.

B. The Contractor reserves the right of access to Subcontractor's facilities or contracted laboratories for the purpose of inspection, surveillance, review, and/or audit.

C. The Subcontractor's Quality Assurance Program shall maintain control of suppliers, analytical laboratories, manufacturers, products, services and workmanship, to produce work of specified quality as required by the technical specifications of the contract.

D. The Subcontractor shall submit for review and approval the qualifications of the Subcontractor's designated Quality Assurance Representative, a letter defining his

authority, and a description of assigned responsibilities. The Subcontractor shall also submit to the Contractor the name and qualifications of an alternate QA representative who could assume the responsibilities of the primary representative, if the primary representative should become unavailable for any reason.

E. Procedures for the collection, preservation, handling, shipping, analytical testing and documentation of environmental samples established by the Subcontractor, shall be submitted to the Contractor for review and approval. These procedures shall be followed during Subcontractor groundwater sampling events.

F. Any laboratory that provides analytical services to the Subcontractor shall have the applicable laboratory accreditation, certifications, and/or registrations for those services which are utilized. The analytical testing laboratory shall process and submit all required analytical reports within the required time limits identified in the technical specifications to ensure timely completion of the work. The analytical testing laboratory may NOT further subcontract laboratory testing without first obtaining written approval from the Contractor.

1.04 SUBMITTALS

The Subcontractor shall submit the following to the Contractor for approval.

A. Subcontractor Quality Assurance Program.

B. Qualifications of the Subcontractor's Quality Assurance Representative and alternate accompanied by a letter defining this authority and responsibilities.

1.05 SUBMITTAL SCHEDULE

A. The following submittals are required in accordance with this specification.

Specification Reference	Requirements	Period
01400 (1.04.A)	Quality Assurance Program	Thirty (30) days after award
01400 (1.04.B)	Qualifications of QA representative and alternate	Thirty (30) days after award
01400 (1.06.A) (1.06.B)	Quality related records	Upon completion of the contract

1.06 RECORD RETENTION

A. A list of all quality-related records shall be maintained by the Subcontractor. All quality-related records shall be protected in a 1-hour fire-rated file cabinet; alternately, quality-related records shall be stored in two separate locations until such time that the records are submitted to the Contractor.

B. All quality-related records which are generated during this contract shall be submitted to the Contractor upon completion of the contract.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01400

■ APPLICABLE ELEMENT

DOE ORDER 414.1A
APPLICABILITY CHECKLIST

PO NO. N/A
CONTRACT NO. N/A
WP NO. WP-568

Phil D. Coate — PQM SIGNATURE
8/15/2001 — DATE

The REQUIREMENTS checked below apply to this procurement. Clarifications are provided when the extent of coverage varies or when exceptions are taken. If no clarification is provided, the requirement applies as written.

See Page 2 for clarification(s).

REQUIREMENTS	
■ **Criterion 1 - Program**	☐ **Criterion 6 - Design**
■ Quality Assurance Program Document	☐ Design Input/Output
■ Organizational Chart	☐ Design Changes
■ **Criterion 2 - Personnel Training and Qualification**	☐ Design Interfaces
■ QA/QC Representative	☐ Design Verification
☐ Assessment Personnel	☐ Design Records
■ Independent Testing Laboratory	☐ Design Computer Program Validation
■ **Criterion 3 - Quality Improvement**	■ **Criterion 7 - Procurement**
☐ Performance Trending	☐ Supplier Evaluation
■ Nonconformance Item Control	☐ Source Inspection
☐ Stop Work Authority	■ Receipt Inspection
■ Corrective Action Program	☐ Pre/Post Installation Tests
☐ Root Cause Analysis	■ Certificates of Conformance
☐ Lessons Learned Program	■ **Criterion 8 - Inspection and Acceptance Testing**
■ **Criterion 4 - Documents and Records**	■ Inspection/Test Reports
■ Controlled Document Maintenance	■ Hold/Witness Points
■ Quality Assurance Records/Storage	■ Test Procedures
■ As-Built Record Drawings	☐ **Criterion 9 - Management Assessment**
■ **Criterion 5 - Work Processes**	☐ Management Assessment Schedule
■ Work Instructions/Procedures	☐ Management Assessment Reports
■ Identification and Control of Items	☐ **Criterion 10 - Independent Assessment**
■ Handling, Storage, and Shipping	☐ Independent Assessment Schedule
■ Calibration and Maintenance of Monitoring and Data Collection Equipment and Measuring and Test Equipment	☐ Independent Assessment Reports

DOE ORDER 414.1A
APPLICABILITY CHECKLIST

PO NO. N/A
CONTRACT NO. N/A
WP NO. WP-568

CLARIFICATION

The selection of the aforementioned DOE Order 414.1A Applicability Checklist Requirements is based upon a review of Work Package No. 568 and associated specifications.

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:EN-S-05-4863-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Civil

SUBJECT: WSSRAP – Chemical Plant
Technical Specification Section 01500
Temporary Facilities and Controls
Issued for Review
Revision B

	PRINT/TYPE NAME	SIGNATURE	DATE
PREPARED:	K. Ohsiek		
REVIEWED:	P. Patchin		
APPROVED MKES:			
- LEAD TASK ENGINEER	P. Patchin		
- LEAD DISCIPLINE DEPT. MGR.	K. Ohsiek		
- DESIGN MANAGER	R. Rager		
- ENGINEERING MANAGER			
APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. This Specification Section specifies the requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities not provided by the Contractor and necessary for execution of the Work. This Section also lists and describes the existing facilities that are available for use.

B. Figure 1 depicts the existing site features and facilities that will be in place at the start of the fieldwork and available for the Subcontractor's use with the Contractor's approval.

C. Temporary utilities include, but are not limited to, the following:

1. Water service
2. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
3. Electric power service and portable generators
4. Portable work zone lighting
5. Telephone service

D. Support facilities include, but are not limited to, the following:

1. Staging and equipment set-up and lay-down areas
2. Office trailer
3. Chemical mixing equipment
4. Temporary decontamination pad
5. Contaminated water storage tanks
6. Temporary water treatment unit

7. Temporary roads and drilling pads necessary for well installations, as described in Section 02733.

E. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection, including hazards from dust emissions and chemicals

2. Stormwater, sediment, and erosion control

3. Protection of existing features, including site perimeter fencing, survey benchmarks, monitoring wells, and drainage structures

4. Work zone security (e.g., tool sheds, fencing)

5. Field communication system

6. Fire protection, including storage shed for flammable materials

1.02 APPLICABLE STANDARDS

A. American National Standards Institute (ANSI), Z358.1-1998 "Emergency Eyewash and Shower Equipment".

B. National Electric Code

1.03 TEMPORARY UTILITIES

A. The Contractor will furnish the following temporary utilities:

1. Potable water

2. Electric power service

B. The water service available to the Subcontractor is a 2-inch line (see Figure 1) capable of delivering potable water at a static pressure of 45 psi and maximum flow of 36 gpm. The Contractor will provide freeze protection for this line up to the yard hydrant. The Subcontractor shall provide freeze protection for any lines downstream of this point.

C. Electric power service available to the Subcontractor consists of a 30-kW propane-fired generator with a 10-kW backup. All maintenance and refueling of the generator will be the responsibility of the Contractor. Any electric power needs in addition to this generator shall be provided by the Subcontractor.

D. The Subcontractor shall provide utility service to all emergency facilities required by the HASP (e.g. eye wash station, emergency shower). The water temperature, flow rate, and capacity of showers and eye wash stations shall be in accordance with ANSI standards and approved by the Contractor.

E. The Subcontractor shall provide sanitary facilities for Subcontractor personnel.

F. The Subcontractor shall provide all lighting and mobile light plants necessary for the work.

G. The Subcontractor shall furnish and maintain a communication system (e.g., cellular telephones or radios) for the duration of the work.

1.04 SUPPORT FACILITIES

A. Subcontractor staging and equipment lay-down areas shall be kept to the minimum practical. The Contractor will allow use of an existing staging and laydown area (see Figure 1).

B. The Contractor will furnish and install a field office trailer for Subcontractor use (see Figure 1).

C. The Subcontract shall furnish and install temporary access roads and drilling pads necessary for well installations, as described in Section 02733..

D. Subcontractor shall furnish and install separate storage tanks for decontamination-derived water and contaminated groundwater derived from drilling operations, well development, and well purging. The tanks shall be installed in a Contractor-approved area and shall have sufficient capacity to manage all contaminated and treated water produced during the course of the Work. The Subcontractor shall supply enough storage tanks to allow for a 10-day storage period during which the Contractor will test and determine the ultimate disposition of water as described in Section 01600, Articles 3.03 and 3.04.

E. The Subcontractor shall furnish and install a temporary decontamination facility. The final location shall be approved by the Contractor prior to construction. The facility shall be constructed entirely above-ground and shall be completely lined and bermed so as to prevent decontamination water from infiltrating into the underlying soil and to facilitate pumping and containerizing the decontamination water. The design for this temporary facility shall be included in the Equipment Decontamination Plan as described in Section 01503.1.03.A.

1.05 SECURITY AND PROTECTION FACILITIES

A. The Subcontractor shall implement environmental protection measures to control hazards, including hazards from emissions, man-made fibers (MMF), chemicals, buried debris, Resource Conservation and Recovery Act (RCRA) materials, and Toxic Substances Control Act (TSCA) materials.

1. If suspect materials are encountered, the Subcontractor shall notify the Contractor immediately and suspend work in the immediate area to allow Contractor evaluation. The Subcontractor shall follow the procedures detailed in the Health and Safety Plan (HASP).

2. The Contractor will perform emission monitoring within the work zones and along roads. If action levels are exceeded, mitigative measures shall be implemented. These measures may include stopping work temporarily. The Contractor will perform road wetting to mitigate dust emissions. Other potential emissions include volatile organic compounds (VOCs). Action levels are identified in the HASP.

3. Dust emissions shall be controlled during operations, and no visible emissions shall be allowed past a posted Controlled Area or a posted Restricted Area boundary. Dust emissions shall be controlled to less than 1 mg/cubic meter on site. Dust emissions shall be maintained at or below the acceptable limits, as defined in the HASP. No visible emissions will be allowed by the Contractor in situations where monitoring is not possible.

4. Noise emissions shall be kept within requirements of the HASP.

B. The Subcontractor shall not disturb existing stormwater, sediment, and erosion control in the areas impacted by the Work unless approved by the Contractor.

1. Existing stormwater drainage patterns and structures shall not be altered unless approved by the Contractor.

2. Sediment and erosion control measures, including silt fences, straw bales, drainage ditches, and temporary seeding, will be furnished, installed, and maintained by the Contractor as needed to prevent effluent settleable solids measured at the NPDES structure at the site boundary from exceeding 1 ml per liter.

C. The Subcontractor shall protect existing features, including fencing, survey benchmarks, monitoring wells, and drainage structures (e.g. culverts, weirs, berms, pipes).

D. The Contractor will install a temporary fence (4 to 5 ft plastic construction fence) around the in situ treatment area when the Chemical Plant perimeter fence is removed. The Subcontractor shall furnish and install all other necessary temporary work zone security measures with the exception of a Contractor-provided Conex tool shed as shown on Figure 1.

E. The Subcontractor shall furnish, install, and maintain field communications (e.g., radios or cellular phones). The system must be approved by the Contractor. If a radio system is used, the Subcontractor shall provide four radios to the Contractor.

F. The Subcontractor shall be responsible for fire protection, including furnishing and installing a storage facility for flammable materials, and other requirements as defined in the HASP.

1.06 RELATED WORK

A. Section 02050 – In Situ Chemical Oxidation

PART 2 - PRODUCTS

2.01 WATER

A. Application of water is an acceptable method of suppressing dust and other emissions.

PART 3 - EXECUTION

3.01 TEMPORARY FACILITIES INSTALLATION

A. Subcontractor shall install those required temporary facilities not provided by the Contractor as approved by the Contractor.

B. All temporary structures shall be blocked and tied down the same day that they are installed. Four-foot long or longer helical-type anchors shall be used.

C. Steps and handrails shall be installed in accordance with the HASP, applicable OSHA requirements, and other federal, state, and local requirements.

D. Electrical receptacles shall be installed in accordance with the National Electric Code and equipped with ground fault circuit interrupter (GFCI) devices.

3.02 SUSPECT HAZARDOUS MATERIALS

A. The Subcontractor shall notify the Contractor immediately if suspect hazardous materials are encountered.

B. The Contractor will determine the boundary of the hazard and the control measures to be implemented.

C. The Contractor will notify the Subcontractor to stop work in the affected work area. The Subcontractor may then relocate operations to another work area.

D. Control measures to be implemented by the Subcontractor at the direction of the Contractor include, but are not limited to:

1. Place Contractor-provided signs, barricade affected area, and restrict access.
2. Ensure surface water controls are sufficient to prevent run-on and runoff at all work areas.
3. Remove, package, and relocate hazardous materials.
4. Cover area with tarps or HDPE liner material.

E. In all cases, the spread of contamination and hazardous materials shall be prevented.

F. Waste generation shall be minimized.

3.03 CHEMICAL SPILLS

A. The Subcontractor shall notify the Contractor of accidental spills or other accidental releases to the ground, and immediately suspend work in the area.

B. Prior to resuming operations, the Contractor will utilize direct reading air monitoring equipment to assess airborne chemical hazards, and may collect bulk samples for analysis. Personal exposure sampling of Subcontractor personnel may be required in accordance with the HASP. Contractor monitoring requirements are delineated in the HASP.

C. Subcontractor field personnel shall be trained in spill response for the chemicals being used during the treatment and shall provide evidence of this training to the Contractor.

D. The Subcontractor shall clean up spills in accordance with the requirements of the HASP and as directed by the Contractor. The Subcontractor shall follow the written procedures for spill response included in the approved Emergency Response Plan.

E. Waste generation shall be minimized.

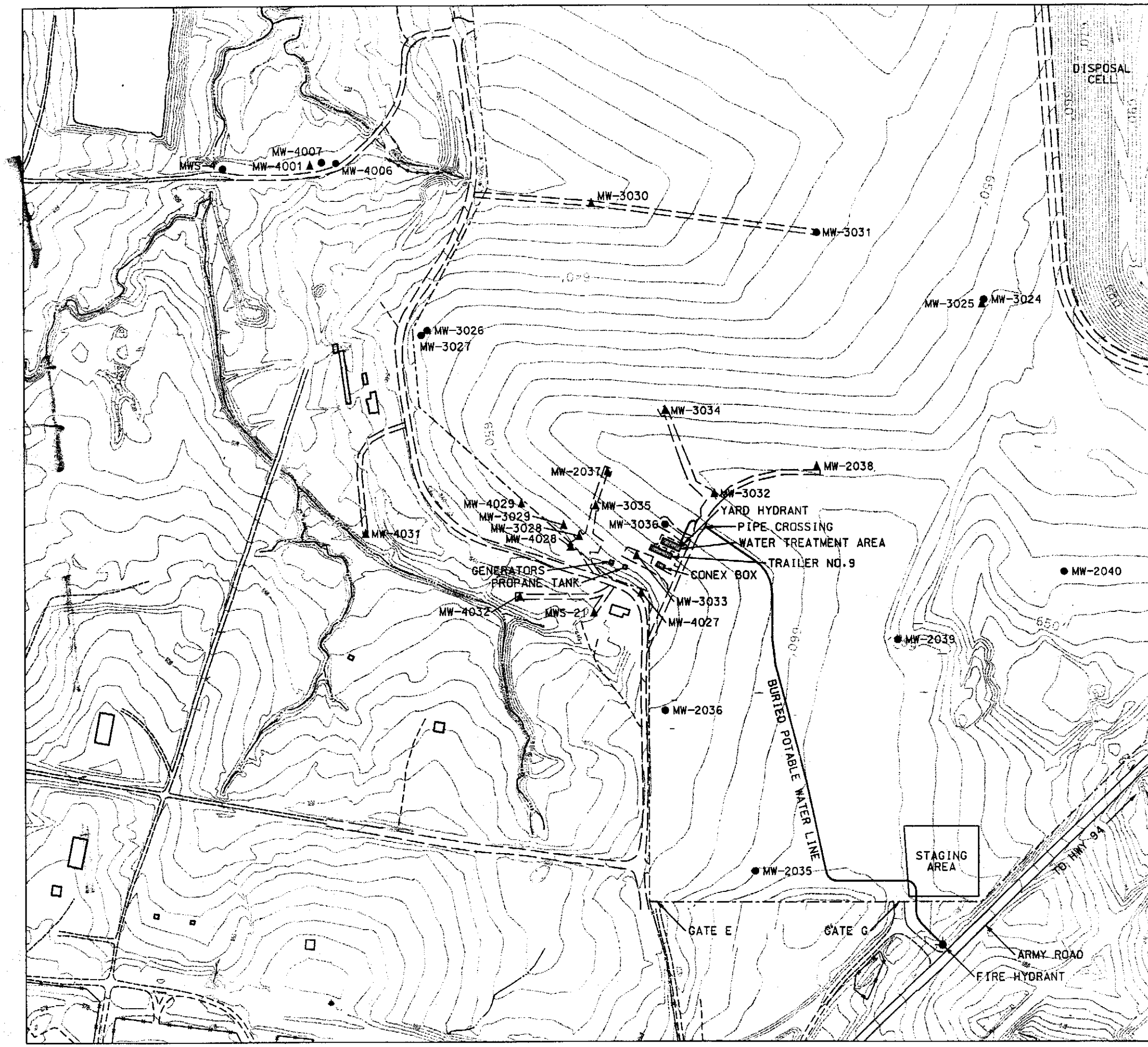
3.04 EMISSIONS CONTROL

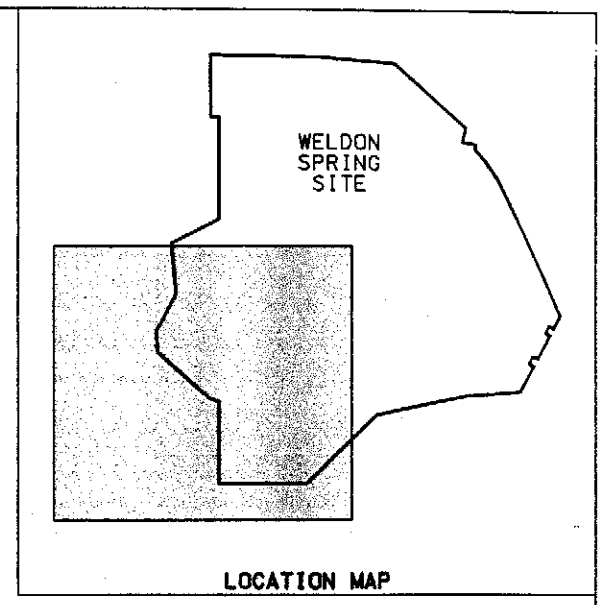
A. Immediate action shall be taken when emissions above the action levels specified in the HASP are identified. Work shall be stopped any time these action levels are exceeded.

B. If emission action levels are exceeded, the Contractor will not permit work to resume until the Subcontractor submits a plan for review and approval by the Contractor that describes specific methods of maintaining concentrations of each of the constituents below the specific action level.

C. Off-gas produced during the in situ chemical oxidation treatment process shall be controlled in accordance with the HASP.

END OF SECTION 01500





N

LEGEND

▲ - MONITORING WELL WITH WITH ≥ 1 ug/l TCE

● - OTHER MONITORING WELL

= = = - GRAVEL ROAD

0 250 500

SCALE FEET

LAYOUT OF THE GENERAL TCE WORK AREA

FIGURE 1

REPORT NO.: WP-~~550~~ 568 SPEC 01500		EXHIBIT NO.: B/CP/039/0401	
ORIGINATOR: BWD	DRAWN BY: GLN	DATE: 5/~~4~~/01	

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:HG-S-05-4864-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Hydrogeology

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 01503
Equipment Decontamination
Issued for Review
Revision A

	PRINT/TYPE NAME	SIGNATURE	DATE
PREPARED:	K. Ohsiek		
REVIEWED:	P. Patchin		
APPROVED MKES:			
- LEAD TASK ENGINEER	P. Patchin		
- LEAD DISCIPLINE DEPT. MGR.	S. Vincent		
- DESIGN MANAGER	R. Rager		
- ENGINEERING MANAGER			
APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 01503

EQUIPMENT DECONTAMINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Specification Section describes the requirements and procedures for equipment decontamination.

B. Equipment to be decontaminated includes drilling equipment, chemical injection equipment, and other contaminated equipment prior to leaving the site.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals

B. Section 02050 – In Situ Chemical Oxidation

C. Section 02733 – Well Installation

1.03 SUBMITTALS

A. The Subcontractor shall prepare an Equipment Decontamination Plan for Contractor review and approval. The plan shall describe the materials and construction of the temporary decontamination facility, which the Subcontractor shall use for equipment decontamination. The plan shall also describe the decontamination procedures to be followed and the dismantlement of the facility. Sketches, plans, and other information shall be included as appropriate.

1.04 SUBMITTAL SCHEDULE

The following submittal is required in accordance with this specification.

Specification Reference	Requirements	Period
01503 (1.03.A)	Equipment Decontamination Plan	30 days prior to work

1.05 PROJECT SITE CONDITIONS

A. The areas of the site where the work will be performed are at final grade, and temporary vegetation has been established.

B. TCE is the major contaminant of concern in groundwater beneath the site although tetrachloroethylene (PCE), dichloroethylene (DCE), uranium, nitroaromatic compounds, and nitrate have also been identified

C. A staging area near Gate G (see Section 01500 Figure 1) shall be used by the Subcontractor for the construction of a temporary decontamination facility.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 PREPARATION

A. All equipment or materials that will come into contact with subsurface materials shall be decontaminated or certified clean prior to bringing on site.

B. Contamination of equipment shall be minimized to the extent practical through barriers, engineering controls, and administrative controls.

C. All contaminated equipment shall be decontaminated at a Subcontractor-furnished decontamination facility located at the staging area near Gate G. The pad shall be constructed in accordance with the approved Equipment Decontamination Plan and shall be constructed entirely above ground.

3.02 DECONTAMINATION

A. All contaminated material removed from equipment shall be contained and controlled. The spread of contamination shall be prevented.

B. Waste generation shall be minimized.

C. All contamination shall be handled and disposed in accordance with the requirements of the HASP.

D. Decontamination water shall constitute a contaminated wastewater stream and shall be handled in accordance with the approved Work Plan and Section 01600.

END OF SECTION 01503

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:EN-S-05-4865-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Civil

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 01600
Material Storage and Handling
Issued for Review
Revision B

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SECTION 01600

MATERIAL STORAGE AND HANDLING

PART 1 - GENERAL

1.01 SCOPE

A. This Specification Section describes the requirements for material storage, protection, handling, transportation, and disposal.

B. Materials addressed by this Section include all chemicals, reagents, oxidants, and other hazardous or potentially hazardous materials furnished by the Subcontractor or created during execution of the Work.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals

B. Section 01503 – Equipment Decontamination

C. Section 02050 – In Situ Chemical Oxidation

D. Section 02733 – Well Installation and Abandonment

1.03 SUBMITTALS

A. The Subcontractor shall submit:

1. Material Safety Data Sheet (MSDS) for each chemical, reagent, oxidant, and other hazardous or non-hazardous material prior to bringing on site and shall be the latest available version.

2. Supplier or manufacturer requirements and recommendations for material storage, handling, protection, and transportation for each chemical, reagent, oxidant, and other potentially hazardous material brought on site.

1.04 SUBMITTAL SCHEDULE

A. The following submittals are required in accordance with this specification.

Specification Reference	Requirements	Period
01600 (1.03.A.1)	Most current Material Safety Data Sheet (MSDS) for each chemical, reagent, oxidant, and other hazardous material brought on site	5 days prior to bringing material on site
01600 (1.03.A.2)	Supplier or manufacturer requirements and recommendations for material storage, handling, protection, and transportation for each chemical, reagent, oxidant, and other potentially hazardous material brought on site	5 days prior to bringing material on site

1.05 PROJECT SITE CONDITIONS

A. The areas of the site where the work will be performed are at final grade and temporary vegetation has been established. Trichloroethene (TCE) is present in certain locations in the shallow groundwater. Other contaminants known to be present in the groundwater include dichloroethylene (DCE), tetrachloroethylene (PCE), uranium, nitroaromatics, and nitrate.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 GENERAL

A. All materials shall be stored, protected, transported, handled, and disposed in accordance with applicable local, state, and federal rules and regulations.

B. The Subcontractor shall provide trained labor and the proper equipment (in good working order) to load, unload, and transport all materials.

C. If the Subcontractor during execution of the Work encounters any unexpected hazardous or potentially hazardous material, chemical, or contaminant, the Contractor shall be notified immediately.

3.02 STORAGE, PROTECTION, AND HANDLING

A. All materials shall be stored, protected, and handled in accordance with the requirements and recommendations of the material supplier and/or manufacturer.

B. Volumes of chemicals stored at the site for the purpose of treatment shall be limited to the amount necessary to perform the Work.

C. All materials shall be stored, protected, and handled in accordance with the requirements of the WSSRAP Health and Safety Plan (HASP). Chemicals may not be stored in the office trailer.

D. The Subcontractor is responsible for freeze protection for chemicals, hazardous materials, and solutions, as well as stored water awaiting reagent-neutralization treatment by the Subcontractor and subsequent treatment by the Contractor.

E. All necessary and appropriate enclosures, security, barricades, and other measures for proper material storage, protection, and handling shall be furnished and provided by the Subcontractor. Enclosures shall meet applicable OSHA standards, DOE orders, and National Fire Protection Association codes.

F. The Subcontractor shall maintain and submit to the Contractor an inventory of all on-site chemicals, hazardous materials, potentially hazardous materials, potentially contaminated drilling cuttings and fluids, potentially contaminated groundwater, and other materials associated with the Work. All such materials shall be kept separate and shall not be consolidated, combined, or mixed without prior approval by the Contractor.

3.03 GROUNDWATER

A. The Subcontractor shall limit the quantity of groundwater brought to the ground surface to the minimum necessary to execute the Work. The Subcontractor shall prevent the spread of potentially contaminated groundwater onto the ground surface or surface drainages, and shall capture and collect all groundwater brought to the ground surface. The collected groundwater shall be protected from precipitation.

B. Groundwater brought to the ground surface by drilling, well development, sampling, or other activities shall be considered and handled as RCRA waste due to TCE contamination. The Subcontractor shall mark any containers used to transport this water to the treatment area as "RCRA Waste."

C. The Subcontractor shall treat all collected groundwater that is characterized as containing residual oxidation reagent. (the Contractor will treat all collected groundwater that is characterized as RCRA hazardous due to TCE contamination or exceeds the site's NPDES permit limitations for any other parameter).

D. The Subcontractor shall notify the Contractor when a wastewater storage tank has been filled. Following notification, the Contractor will transfer the contents of the tank to the Contractor wastewater treatment area. The Contractor will then have 10

calendar days after notification to transfer the water to the Contractor's water treatment area.

3.04 DECONTAMINATION WATER

A. The Subcontractor shall collect and store decontamination water. Water generated by decontamination activities shall be considered and handled as potentially contaminated material The Subcontractor shall treat the decontamination water for residual oxidation reagent.

B. The Subcontractor shall identify in the Work Plan all contaminants that may be present in the decontamination water from the residual oxidation reagent and have the potential to enter the effluent stream so that the Contractor can provide a 30-day notice to the State.

C. Disposition of treated decontamination water shall be addressed as described in part 3.03 E.

3.05 OTHER CONTAMINATED WASTES

A. All contaminated soil wastes generated by chemical spills, leaks, or other releases shall be handled in accordance with RCRA regulations as applicable. The Subcontractor shall clean up, neutralize if necessary, and containerize all spill residues in clean, Subcontractor-provided, compatible containers. The Subcontractor shall label and store the containers in accordance with RCRA regulations (as applicable) at the staging area near Gate G to await characterization by the Contractor.

B. The Subcontractor shall handle all contaminated non-aqueous waste generated as a byproduct of the residual reagent treatment process in accordance with RCRA regulations as applicable. The Subcontractor shall containerize all such wastes in clean, Subcontractor-provided, compatible containers. The Subcontractor shall label and store the containers in accordance with RCRA regulations (as applicable) at the staging area near Gate G to await characterization by the Contractor.

C. The Contractor will characterize the containerized contaminated wastes and approve their ultimate disposition The Subcontractor shall be responsible for the cost of sampling, testing, shipping, treatment, and/or disposal of the wastes that are the result of the Subcontractor's treatment processes (see Special Conditions for cost details).

3.06 DISPOSAL

A. All unused chemicals, reagents, oxidants, and other hazardous or potentially hazardous originally brought on site by the Subcontractor shall be removed from the site by the Subcontractor and/or disposed of off-site in accordance with all local, state, and federal rules and regulations.

END OF SECTION 01600

Morrison Knudsen Corporation
Engineering, Construction & Environmental Group

WSSRA PROJECT REVIEWS AND APPROVALS

W.P. NO. 568 TASK NO. 541GW.900 DOC. NO. 3840-C:HG-S-05-4866-B

W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Hydrogeology

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 02050
In Situ Chemical Oxidation

Issued for Review
Revision B

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PREPARED:	K. Ohsiek		
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- ENGINEERING MANAGER			
APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 02050

IN SITU CHEMICAL OXIDATION

PART 1 - GENERAL

1.01 SCOPE

A. The Subcontractor shall perform pilot-scale in situ chemical oxidation treatment of groundwater at the WSSRAP Chemical Plant for dissolved TCE contamination.The design of the pilot-scale testing shall incorporate results from the previously performed bench-scale testing, which are provided in the bid documents.. The testing shall be performed at two locations within the TCEimpact area of the site, as shown on Figure 1. Full-scale application of the in situ chemical oxidation technology to the entire TCE-impacted area may be performed at a later date, but is not included in this scope of work.

B. This Specification Section describes the requirements for in situ chemical oxidation, (i.e., treatment) of trichloroethene (TCE) in groundwater at the Chemical Plant site including:

1. Pilot-scale treatment system design
2. Pilot-scale testing of treatment concept
3. Groundwater monitoring and testing before, during and after injection to evaluate progress of in situ oxidation of TCE in groundwater
4. Full-scale treatment system design

1.02 RELATED WORK

A. Section 01300 – Submittals

B. Section 01503 – Equipment Decontamination

C. Section 01600 – Material Storage and Handling

D. Section 02733 – Well Installation and Abandonment

1.03 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only:

1. Missouri CSR – Code of State Regulations

   10 CSR 23 – Missouri Well Construction Rules

   10 CSR 50 – Underground Injection Control Rules

2. MDNR – Missouri Department of Natural Resources

   Missouri Well Construction Rules. Authorizing Statutes – 256.600 to 256.640 RSMo, Division of Geology and Land Survey, Rolla, Missouri.

3. National Electric Code

1.04 DEFINITIONS

A. DOE: U.S. Department of Energy

B. TCE: Trichloroethene

C. DCE: Dichloroethylene

D. PCE: Tetrachloroethylene

E. Treatment system: All necessary well installation(s), field instrumentation, electrical systems, temporary facilities, piping systems, and appurtenances necessary for the introduction of reagent(s) into and/or transport of potentially contaminated groundwater.

F. PPE: Personal protective equipment

G. ppb: Parts per billion

H. µg/L: Micrograms per liter (10^{-6} grams per liter)

I. MCL: Maximum contaminant level

J. SAP: Sampling and Analysis Plan

1.05 PROTECTION

A. The Subcontractor shall protect the following:

   1. Benchmarks and monuments

   2. Existing structures and fences

3. Monitoring wells

4. All areas outside of immediate work area

5. Existing features not part of this Work

1.06 SUBMITTALS

A. In accordance with the schedule given in this Section, the Subcontractor shall submit the following to the Contractor for approval in accordance with Section 01300.

1. Pilot-Scale Testing Work Plan and Design. The Pilot-Scale Testing Work Plan and Design prepared in accordance with Article 3.02 shall be submitted with the bid package. The Pilot-Scale Testing Work Plan shall describe implementation of in situ chemical oxidation and shall include a schedule for completion of pilot testing milestones. The plan shall address mobilization of Subcontractor equipment and personnel; site preparation and infrastructure needs; construction and installation of the delivery system; construction of temporary roads and facilities; installation of wells and/or injection points; operation of the system; oxidant (and associated reagent) application rates and pressures; operational and performance monitoring; system optimization; decontamination of equipment, necessary water treatment, and waste handling methods.

2. Conceptual Full-Scale Design. As part of the bid package, a conceptual design for full-scale implementation of in situ chemical oxidation treatment shall be submitted. This document shall clearly state all assumptions upon which the conceptual design is based (e.g., radius of influence, reaction rate, etc.), as well as how the results of the pilot scale test may potentially impact the full-scale design.

3. Safe Work Plan. A Safe Work Plan shall be submitted to the Contractor prior to mobilization of Subcontractor personnel to the site. Health and safety aspects of the project including but not limited to the use of PPE, material handling and storage requirements, and job hazard analysis, shall be described in this plan. The Safe Work Plan shall identify all potential hazards associated with the implementation of the treatment system and must follow the outline provided in the WSSRAP Health and Safety Plan which is included in these Subcontract documents.

4. Emergency Response Plan. An Emergency Response Plan shall be submitted to the Contractor prior to mobilization of the Subcontractor personnel to the site. This plan shall describe procedures to be followed in the event of an emergency, and shall address medical emergencies, fires, explosions, spills and releases.

5. Sampling and Analysis Plan. Prepare and submit for approval a Sampling and Analysis Plan which addresses the Subcontractor's approach to monitoring the groundwater impact of the treatment process. The Plan shall include a sampling schedule for all locations to be sampled, and shall address methodology to be used for sample collection, preservation, handling, shipping, chain-of-custody, analytical test methods, quality control, and data reporting formats. The Sampling and Analysis Plan shall be submitted prior to conducting analytical sampling.

6. Analytical Laboratory Certification. The analytical testing laboratory qualifications and certifications shall be submitted to demonstrate that the laboratory is certified according to applicable RCRA regulations and qualified to perform the analytical testing required as part of the Work.

7. Interim Progress Reports. Prepare and submit Interim Progress Reports informing the Contractor of significant activities conducted as part of the Work. The reports shall be submitted monthly following the notice to proceed and shall contain a list of project milestones completed to date, as well as a look-ahead schedule to indicate upcoming activities.

8. Pilot-Scale Testing Completion Report. Upon completion of pilot-scale testing, prepare and submit a report describing all field activities performed as part of the pilot-scale testing program and present the testing results. The report shall contain all field and laboratory documentation generated during the project, including well installation logs, boring logs, chemical injection logs, field monitoring logs, and sample analytical results. The report shall discuss any unexpected conditions encountered in the field, as well as any subsequent modifications to the Pilot-Scale Work Plan and Design. The report shall include an evaluation of all data obtained during pilot-scale testing, particularly with respect to reaction rate, radius of influence, and efficiency of TCE destruction. The report shall also address any other effects of the chemical oxidation process on aquifer conditions (e.g., changes in permeability, mobilization of contaminants other than TCE, etc.).

9. Final Full-Scale Work Plan and Design. The Final Full-Scale Work Plan and Design shall be submitted following the completion of pilot-scale testing and concurrent with analysis and documentation of the pilot-scale testing. The plan shall refer to and incorporate the results of the pilot-scale testing and describe how these results affect the design of the full-scale treatment. The Final Full-Scale Work Plan and Design shall include the same elements that were addressed in the Pilot-Scale Work Plan and Design as they pertain to the full-scale system. A preliminary construction schedule and cost estimate shall be included with the Final Full-Scale Work Plan and Design.

1.07 SUBMITTAL SCHEDULE

The following submittals are required in accordance with this specification.

Specification Reference	Submittal	Schedule
02050 (1.06.A.1)	Pilot-Scale Work Plan and Design	With bid package
02050 (1.06.A.2)	Conceptual Full-Scale Design	With bid package
02050 (1.06.A.3)	Safe Work Plan	Prior to mobilization of Subcontractor personnel to the site
02050 (1.06.A.4)	Emergency Response Plan	15 days prior to performing field work
02050 (1.06.A.5)	Sampling and Analysis Plan	Prior to pilot-scale work.
02050 (1.06.A.6)	Analytical Laboratory Certification	Prior to pilot-scale work
02050 (1.06.A.7)	Interim Progress Report	Monthly after notice to proceed
02050 (1.06.A.8	Pilot-Scale Testing Completion Report	Completion of pilot-scale testing
02050 (1.06.A.9)	Final Full-Scale Work Plan and Design	Completion of pilot-scale testing
02050 (1.08.A)	Registered Geologist License (copy) and resume	Prior to pilot-scale work

1.08 PERSONNEL QUALIFICATION

A. All work that involves characterization, testing, analysis, or interpretation of the geology or hydrogeology of the site shall be performed or directly supervised by a geologist registered in the State of Missouri. A copy of the registered geologist's resume and license shall be submitted to the Contractor for approval prior to starting work.

1.09 WITNESS AND HOLD POINTS

A. Contractor witness points are listed below:

1. During injection well or monitoring well installations.

2. During chemical reagent injection episodes.

B. Contractor hold points, including the estimated time needed for the Contractor to conduct the necessary review, inspections, sampling and tests, are listed below:

1. Safe Work Plan review and comment – 10 working days.

2. After installation of the pilot-scale system, prior to injection – 5 working days.

3. Pilot-Scale Test Completion Report review and make a decision whether to dismantle the pilot scale system–25 working days.

4. Final Full-Scale Work Plan and Design review and comment – 15 working days.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The materials used for the treatment system shall be chemically compatible with the oxidant used.

B. Oxidant chemicals and reagents shall be obtained from a reputable chemical supplier. Impurities present in the oxidant chemicals shall not be of high enough concentration to cause the groundwater to exceed drinking water MCLs as measured at the end of the performance period.

C. The Subcontractor shall obtain a laboratory analysis of the oxidant chemical solution. This analysis shall include manganese and TOX metals (i.e., As, Ba, Cr, Cd, Hg, Pb, Ag, Se).

PART 3 - EXECUTION

3.01 GENERAL

A. The Subcontractor shall design, furnish, install, and operate a pilot-scale in situ chemical oxidation treatment system at the Chemical Plant site. Pilot-scale treatment shall focus on the shallow aquifer that includes the weathered upper portion of the Burlington-Keokuk Limestone and any saturated overburden material in the impacted area. The system shall be located in the area of TCE impact where concentrations exceed an MCL of 5 μg/L.

B. The Subcontractor's pilot-scale design shall include containment systems in accordance with RCRA requirements. Static water testing of all tanks and storage units and hydro testing of delivery systems (pipes/hoses, tubing) shall also be included in the design and work plan.

C. The pilot-scale treatment system shall introduce the chemical oxidant into the full thickness of the weathered upper portion of the Burlington-Keokuk Limestone and within the zone of saturation. The concentration of oxidant and the rate of delivery

shall be designed to deliver enough oxidant to satisfy both the TCE demand and the natural oxidant demand of the aquifer in order to preclude insufficient degradation of TCE and creation of undesirable reaction by-products.

D. The pilot-scale treatment system shall be designed and operated in such a manner as to minimize eruptions or leakage of the oxidant chemicals. The Subcontractor shall clean up and containerize all soil waste generated by such a release as described in Section 01600.

E. Injection of excessive amounts of residual reagent that may be discharged in the surface water at down-gradient springs shall be prevented.

F. The Subcontractor shall provide justification for the design treatment duration. Up to two treatment injections shall be performed. Groundwater TCE concentrations in the treatment area shall be monitored for a period of one month following the initial treatment injection. If concentrations remain above the MCL after the one-month monitoring period, a second treatment shall be injected.

G. The Subcontractor shall define the reaction by-products and breakdown products that result from application of the treatment. In any case, by-products and breakdown products that create additional groundwater contamination (e.g., vinyl chloride, manganese, or hexavalent chromium), or significantly affect the aesthetic quality (color) for an extended period, are not allowed.

H. The operation of the in situ oxidation system shall not create reaction by-products (e.g. precipitated metal compounds) or residual reagent to a degree that will adversely affect the water chemistry or aquifer permeability (aquifer plugging) in a way that will make conventional water treatment more difficult.

I. Testing and operation of the treatment system shall not facilitate migration of TCE beyond the March 2001 defined limits of contamination.

J. Uranium, nitrate, and nitroaromatic contaminants are present in the subsurface environment. The Subcontractor shall account for their presence and chemical properties in the treatment system design. Long-term mobilization of these contaminants by the in situ chemical oxidation of TCE shall be prevented.

K. The level of impurities in the reagent shall not result in further contamination of the aquifer following injection.

L. The Subcontractor shall attend meetings with the Contractor as necessary to present progress reports and/or discuss immediate needs.

3.02 PILOT-SCALE WORK PLAN AND DESIGN

A. The Subcontractor shall prepare and submit a Pilot-Scale Work Plan and Design with the bid. This Work Plan and Design shall provide information and details on the pilot-scale testing, including test objectives, schematic diagram of the oxidant delivery system, location and layout design of the system, types and concentrations of chemicals to be used, oxidant mixing methods, injection technique, special contingencies, and performance monitoring.

B. The required oxidant concentration, introduction rate, and duration shall be determined by the Subcontractor from results of previous bench-scale testing, which are included in these bid documents. These parameters shall be delineated in the Pilot-Scale Work Plan and Design.

C. The Pilot-Scale Work Plan and Design submitted by the Subcontractor will be reviewed by the Contractor, the DOE, and regulatory agency(s). The Subcontractor shall attend a meeting on-site to discuss implementation of the Pilot-Scale Work Plan and Design prior to proceeding with the fieldwork.

3.03 PILOT-SCALE TESTING

A. The Subcontractor shall perform pilot-scale testing of the treatment system in accordance with the approved Pilot-Scale Work Plan and Design. The Subcontractor shall furnish, install, and operate the treatment system and appurtenances.

B. The Subcontractor shall perform pilot-scale testing at two locations selected by the Contractor within the TCE-impact area to account for variations in aquifer permeability. One location shall be in the area of highest aquifer permeability and the other location in the area of lowest permeability so that best- and worst-case conditions can be evaluated. These locations are shown in Figure 1.

C. The Subcontractor shall provide a means for monitoring and controlling off-gas to comply with emission limits and worker exposure limits identified in the HASP.

D. The Subcontractor shall provide freeze protection for all exposed plumbing related to the treatment system.

E. The Subcontractor shall prepare a Pilot-Scale Testing Completion Report detailing the pilot-scale testing operations and resulting degree of success in reducing dissolved TCE in groundwater.

3.04 FULL-SCALE WORK PLAN AND DESIGN

A. The Subcontractor shall prepare and submit a Final Full-Scale Work Plan and Design concurrent with the analysis and documentation of the pilot-scale testing. The Work

Plan shall incorporate the results of the pilot-scale testing and describe modifications to the Conceptual Full-Scale Design necessary for effective full-scale operation of the system. The same elements that are addressed in the Pilot-Scale Work Plan and Design for the pilot-scale testing shall be addressed in the Full-Scale Work Plan and Design as they pertain to the full-scale system.

B. The required oxidant concentration, introduction rate, and duration shall be determined by the Subcontractor from the pilot-scale testing, and shall be sufficient to treat the entire area of TCE impact and reduce groundwater concentrations of TCE to 5 μg/L. Results of the pilot-scale testing shall be used to determine the radius of influence achieved at each injection point. Proposed injection points shall be placed at optimal intervals to achieve full coverage of the TCE impact area without overdosing the aquifer.

C. The Full-Scale Work Plan and Design will be reviewed by the Contractor and off-site regulatory agencies. The review and comment process duration is fifteen working days. The Subcontractor must account for the review and comment period in the project schedule. and incorporate revisions as directed into the Work Plan and Design.

3.05 GROUNDWATER MONITORING AND TESTING

A. The Subcontractor shall prepare and submit a Sampling and Analysis Plan (SAP) in conjunction with the Pilot -Scale Work Plan for operation of the chemical oxidant delivery system. The SAP shall address the number and locations of groundwater monitoring points, frequency of monitoring, collection methods, preservation techniques, target compounds, analytical test methods and detection limits for the Subcontractor-performed sampling. Samples may be taken from the existing groundwater monitoring well system, or from new wells, probes, injection points, or other features installed for monitoring or as part of the delivery system prior to, during, and after operation of the treatment system. The Subcontractor is responsible for all handling and shipping of these samples in accordance with all state and federal requirements.

B. The Subcontractor shall monitor and document the rate, total volume, and concentration of the oxidant delivered, during and after operation of the treatment system to demonstrate that delivery is in accordance with the approved Work Plan. The Subcontractor may modify these parameters based on analytical test results in order to optimize performance of the treatment system. All modifications that deviate from the Work Plan shall be approved by the Contractor prior to implementation.

C. The Subcontractor shall measure groundwater levels in existing and new wells prior to, during, and after operation of the treatment system.

D. The Subcontractor shall sample groundwater from new and/or existing monitoring wells prior to, during, and following injection. At a minimum, the following parameters shall be monitored: TCE, uranium, nitrates, and TOX metals (i.e., As, Ba, Cr, Cd, Hg, Pb, Ag, Se).

E. Groundwater samples collected during the pilot-scale testing may contain above-background concentrations of uranium. Based on historic site data,these levels are expected to be below 60 pCi/l and will not pose a radioactive health hazard to anyone contacting or handling them. Neither the Subcontractor nor the analytical laboratory will require a specific license from the U.S. Nuclear Regulatory Commission (NRC) (see 10 CFR 40.13) to handle these samples. In addition, the samples will not contain sufficient radioactivity to meet the U.S. Department of Transportation (DOT) definition of radioactive material (see 49 CFR 173.403). The samples will, however, be likely to contain TCE concentrations that exceed RCRA characteristic levels, and should be packaged, handled, and shipped in accordance with applicable RCRA and DOT regulations.

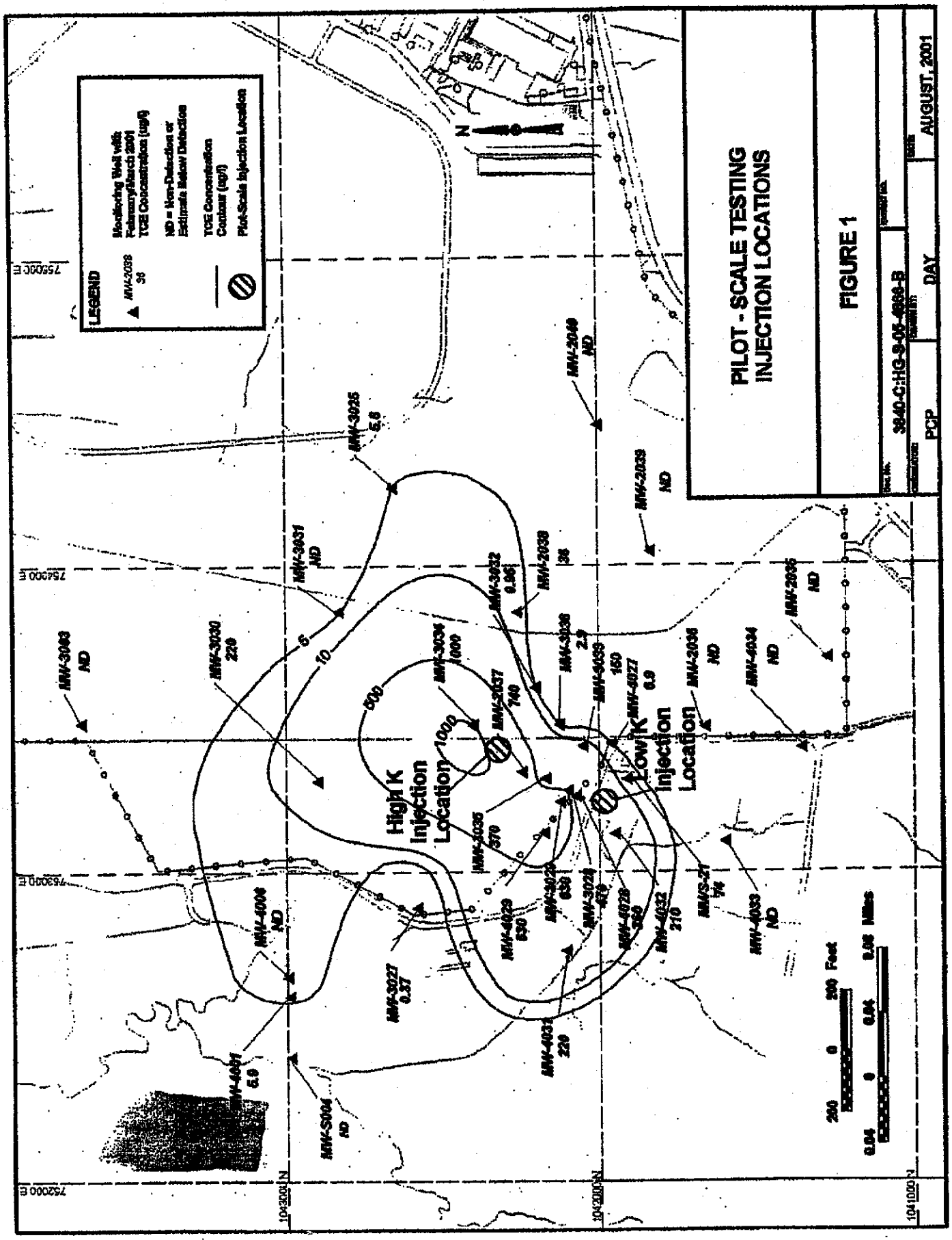
F. The Subcontractor shall monitor and document concentrations of off-gasses and other potentially hazardous conditions during operation of the treatment system. If necessary, the Subcontractor shall modify operations to avoid or mitigate the creation of hazardous conditions for workers and the environment.

3.06 EVALUATION OF THE EFFECTIVENESS OF TREATMENT

A. The Contractor will make the final determination of the effectiveness of the treatment of TCE based on Contractor-obtained and analyzed samples.

B. The Contractor will sample and analyze groundwater from the monitoring well network both prior to and following pilot-scale testing to track potential changes in TCE.

END OF SECTION 02050


PILOT - SCALE TESTING
INJECTION LOCATIONS
FIGURE 1
3840-C:HG-9-05-4866-B
PCP
DAY
AUGUST, 2001
LEGEND
Monitoring Well with February/March 2001 TCE Concentration (ug/l)
ND = Non-Detection or Estimate Below Detection
TCE Concentration Contour (ug/l)
Pilot-Scale Injection Location
High K Injection Location
Low K Injection Location
MW-3003 ND
MW-3030 220
MW-3031 ND
MW-3025 5.6
MW-2040 ND
MW-2039 ND
MW-2038 36
MW-3032 0.96
MW-3034 1000
MW-2037 740
MW-3036 2.9
MW-4027 6.9
MW-2036 ND
MW-4034 ND
MW-2035 ND
MW-3035 370
MW-4006 ND
MW-4029 630
MW-4032 210
MW-4033 ND
MW-4031 220
MW-3027 0.37
MW-4001 5.9
MW-S004 ND
MW-S-21 74
5
10
500
1000
200 0 200 Feet
0.04 0 0.04 0.08 Miles
755000 E
754000 E
753000 E
752000 E
1043000 N
1042000 N
1041000 N

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W.P. TITLE: In Situ Chemical Oxidation of TCE in Groundwater

QUALITY LEVEL 2

LEAD DISCIPLINE Hydrogeology

SUBJECT: WSSRAP – Chemical Plant
Technical Specifications Section 02733
Well Installation and Abandonment

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PREPARED:	K. Ohsiek		
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APPROVED:			
- OFF-SITE QUALITY MANAGER			

SECTION 02733

WELL INSTALLATION AND ABANDONMENT

PART 1 - GENERAL

1.01 SCOPE

A. This Specification Section describes the requirements for:

1. Monitoring well installation
2. Injection well installation
3. Monitoring well abandonment
4. Injection well abandonment

B. The work includes mobilization and demobilization of equipment; drilling and sampling; installation of monitoring and injection wells at both on-site and off-site locations, including well protection; packer testing; development of wells; abandonment of monitoring and injection wells; site restoration; and equipment and personnel decontamination. This Specification shall be adhered to by the Subcontractor and lower-tier subcontractors for such operations.

C. All new wells shall be installed at locations previously staked by the Contractor's surveyor. Location coordinates and approximate depths shall be specified in the Work Plan.

D. The Subcontractor shall provide all equipment, supplies, materials, transportation, and labor needed to provide all services as described in this Specification. The Subcontractor shall be able to mobilize one additional crew with the equipment and training necessary for work at the WSSRAP as required to meet the project schedule.

E. The Subcontractor shall be responsible for complying with any and all applicable boring, well installation, and well abandonment plans, permit requirements, and procedures. The Subcontractor shall comply with the State of Missouri Geologist Registration Act, 4 CSR 145. The Subcontractor shall comply with the State of Missouri Monitoring Well Construction Rules (10 CSR 23). The Subcontractor shall submit for Contractor approval a copy of their State of Missouri well drilling license and drilling permit prior to Notice to Proceed.

1.02 RELATED WORK

A. Section 01503 – Equipment Decontamination

B. Section 01600 – Material Storage and Handling

C. Section 02050 – In Situ Chemical Oxidation

1.03 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification to the extent referenced using the most current version available at the time the work is awarded. The publications are referred to in the text by the basic designation only.

1. ASTM D1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils

2. ASTM D1587 Standard Practice for Thin-Walled Tube Sampling of Soils

3. ASTM D2113 Method for Diamond Core Drilling for Site Investigations

4. ASTM D2487 Standard Test Method for Classification of Soils for Engineering Purposes

5. ASTM D3550 Standard Practice for Ring-Lined Barrel Sampling in Soils

6. ASTM D4220 Standard Practices for Preserving and Transporting Soil Samples

7. U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, 1986

8. Missouri Department of Natural Resources' Division of Geology and Land Survey, *Missouri Well Construction Rules*, 10 CSR 23, June 1996.

9. EPA-570/975-001, *EPA Manual of Water Well Construction Practices*

10. EPA 600/489/034/1989, *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*

11. U.S. Department of Interior, *Groundwater Manual*, A Water Resources Technical Publication, First Edition, 1977.

12. Missouri Geologist Registration Act, 4 CSR 145.

13. Applicable provisions of OSHA CFR 1910 and 1926.

14. Weldon Spring Site Remedial Action Project Health and Safety Plan, (most current version).

1.04 PROTECTION

A. The Subcontractor shall protect the following:

1. Benchmarks and monuments
2. Existing structures and fences
3. Monitoring wells
4. All areas outside of immediate work area
5. Existing features not part of this Work

1.05 SUBMITTALS

A. In accordance with the schedule given in this Section, the Subcontractor shall submit the following to the Contractor for approval in accordance with Section 01300.

1. Injection Well Plan detailing the location(s) and construction details for injection well(s).
2. Missouri Well Driller License (copy).
3. All documentation required to certify new monitoring and injection wells.
4. Daily Field Activity Report.
5. Field borehole logs, well construction diagrams, well development, and well abandonment forms.
6. Final typed borehole logs and as-built well diagrams.

1.06 SUBMITTAL SCHEDULE

The following submittals are required in accordance with this specification.

Specification Reference	Requirements	Period
02733 (1.01.E)	Missouri Well Driller License	Prior to Mobilization
02733 (1.05.A.1)	Injection Well Plan	30 days prior to installation
02733 (1.05.A.3)	All documentation required to certify new monitoring wells and injection wells.	14 days after completion of well installation
02733 (3.01.E)	Daily Field Activity Report	Daily upon commencement of work
02733 (3.09.A.2)	Field borehole logs, well construction diagrams, well development, and well abandonment forms.	Five working days after well completion or abandonment
02733 (3.09.A.2)	Final typed borehole logs and as-built well diagrams.	30 days after well completion.

1.07 PERSONNEL QUALIFICATIONS

A. The driller performing the work shall be a well driller licensed in the State of Missouri.

B. All drilling, well installations, and well abandonment shall be under the direct supervision of a geologist registered in the State of Missouri. Also see Section 02050.1.08.A.

1.08 SITE CONDITIONS

A. Stratigraphic Units and Soil Characteristics at the Weldon Spring Chemical Plant Site:

1. Bedrock:

a. The Burlington-Keokuk Limestone (Mississippian) comprises the uppermost bedrock stratigraphic unit at the Weldon Spring site. Because the Burlington-Keokuk Limestone was the only bedrock unit encountered during the previous investigations, it is the only unit discussed here. This unit is a thin to thick bedded, argillaceous, fine to coarsely crystalline limestone containing abundant chert as nodules and beds. On the basis of borehole stratigraphic data, the formation has been primarily divided into two sub-units according to the degree of weathering. The upper sub-unit is referred to as the weathered unit; the lower one is referred to as the unweathered unit.

1) The weathered unit is typically grayish orange to yellowish gray, and argillaceous. It contains up to 60% chert as nodules and interbeds. It is fossiliferous, moderately to highly fractured, and slightly to severely weathered. Solution features are common.
2) The unweathered unit is light gray, finely to coarsely crystalline, stylolitic, and fossiliferous, with less chert (20% - 40%) than the weathered limestone. This unit is much less fractured than the weathered limestone.

2. Overburden Soil:

a. Unconsolidated soil units overlying the limestone bedrock in the Weldon Spring site area are typically Pleistocene to Holocene glacial and periglacial sediments capped by a layer of organic topsoil. At the base of the sequence is the residuum, which has been interpreted as resulting from pre-Quaternary weathering of the youngest bedrock formation. The residuum is generally a reddish-brown gravelly clay to clayey gravel. Thickness and areal extent are variable.

1) The basal till (early Pleistocene) overlies the residuum. This unit is a yellowish-brown, sandy, clayey, silty gravel with angular chert pebbles in a loosely bound matrix. The thinness or absence of this unit in areas of high bedrock elevations suggests that the deposition of this unit may have been affected by bedrock topography. The basal till is found in the western and north central areas of the site.
2) The clay till unit overlies the basal till. This early Pleistocene deposit is composed of yellowish-brown silty clay to clayey silt. Clay till sediments are massive, very stiff, and moderately to highly plastic. Pebbles in the till are subrounded chert and igneous and metamorphic detritus in contrast with the coarse fraction of the basal till. This may indicate a different source area for the unit. The clay till is widely spread beneath the site.
3) Overlying the clay till is the Ferrelview Formation, a mid-Pleistocene glacial till plain sediment. This unit is a mottled gray and dark yellowish-orange silty clay to clayey silt. It is usually very stiff and plastic. This unit is also found throughout the site subsurface.
4) Overlying the Ferrelview Formation is a loess unit (late Pleistocene) that occurs sporadically across the site. The spotty distribution may be due to predepositional topography, post depositional erosion, and/or extensive reworking of the upper soils during site construction activities. The loess is primarily silt to clayey silt, with very minor amounts of sand, and has a low plasticity.

5) The uppermost soil unit is the combined topsoil/fill unit. The topsoil is generally a black, organically rich silt to silty clay. The fill fraction varies in thickness and composition across the site, but is primarily a clayey silt.

B. Trichloroethene (TCE) contamination in varying concentrations is present in groundwater at some locations.

1.09 PREPARATION

A. The Subcontractor shall be responsible for providing access to and construction of suitable drill pads as approved by the Contractor, as follows:

1. Because most of the work area is at final grade, the preparation of access roads from existing roads will involve only the placement of aggregate directly on the ground surface without any excavation. The aggregate used to construct these temporary access roads and drill pads shall be clean material.

2. Following completion of the drilling work, the Subcontractor shall remove the temporary access roads and drill pads.

PART 2 - MATERIALS, EQUIPMENT, AND METHODS

2.01 MATERIALS

A. Lubricants: Only teflon tape or vegetable-based lubricants shall be used on the threads of downhole drilling equipment. Oils, greases, or pipe dope shall not be used on pipe threads, drilling rods, downhole hammer bits, or other downhole tools. Similarly, no hydrocarbon-based oils or greases shall be used on other open, lubricated surfaces of the drilling rig.

B. Antifreeze: If antifreeze is added to any pump, hose, etc., in an area in contact with drilling fluid, this antifreeze shall be completely purged and containerized for safe disposal and the system flushed by the Subcontractor prior to equipment use in drilling, mud mixing, or any other part of the overall drilling operation. Only polypropylene based antifreeze without rust inhibitors and/or sealants shall be used. The dates, equipment, quantities, and brand names of antifreeze shall be noted on the Daily Field Activity Report. An MSDS must be submitted and approved for antifreeze, and all other hazardous chemicals brought on site, per Section 3 of the WSSRAP Health and Safety Plan.

C. Drilling Fluids: Drilling operations shall be performed with no drilling fluids other than air or potable water without approval from the Contractor. The Subcontractor shall be responsible for providing hoses, tanks, and other equipment and transporting

water to drilling locations. All tanks, hoses, and other water-handling equipment shall be decontaminated as specified in Article 3.10 of this Specification prior to commencing work. Hoses, valves, and other fittings shall be decontaminated between drilling locations. If bentonite-based drilling fluids are used, the bentonite shall be a certified sodium bentonite type.

D. Grout: Grout for well installation and/or abandonment shall be a bentonite slurry grout, a neat cement grout specifically designed for sealing subsurface openings, or an approved cement/bentonite grout mixture. The ratio of grout to fresh potable water shall be consistent with the manufacturer's instructions with respect to weights and measures and shall also comply with 10 CSR 23.

E. Potable Water: A potable water source will be supplied by the Contractor. The Subcontractor shall use potable water as needed to ensure that cuttings are removed from boreholes. Potable water must also be used for decontamination procedures as specified in Article 3.10.

F. Inert Gas: If packer testing is performed, the Subcontractor shall be prepared to supply inert gas as needed to properly and completely fill inflatable packers during packer testing.

G. Filter Sand: The Subcontractor shall be prepared to supply clean, uniform silica sand sized appropriate to the screen size, for use in well installation operations.

H. Well materials shall be compatible with the in situ chemical oxidation treatment process used.

I. Well materials shall be certified clean or decontaminated in accordance with Section 01503. Well casing, screens, and accessories shall be stored in a non-contaminated area, elevated off the ground, and covered with clean, new plastic sheeting. Any well casing, screens, or accessories that are subsequently contaminated by contact with the groundor other potentially contaminated media, shall without exception be cleaned again prior to use.

2.02 DRILLING EQUIPMENT AND METHODS

A. All drilling and grouting equipment to be used in the work shall be clean and free of chemical or radioactive contamination All equipment must be inspected and approved by the Contractor prior to entering the site.

B. The drilling method and equipment used during well installations shall be described in the appropriate Work Plan and approved by the Contractor. The following are requirements for common drilling methods previously used at the site:

1. Water Rotary: If water rotary equipment and methods are proposed, the Subcontractor shall:

a. Use portable recirculation tanks. The use of dug sumps/pits (lined or unlined) is expressly prohibited.

b. Perform drilling operations without the use of any additives.

2. Air Rotary: If air rotary equipment and methods (including reverse-circulation air rotary) are proposed, the Subcontractor shall:

a. Specify the type and capacity of air compressor and lubricating oil to be used in the compressor, and retain a pint sample of each oil, along with a record of oil consumption on the boring log, for evaluation in the event of future problems.

b. Use an air line oil filter maintained in accordance with Manufacturer's recommendations. This maintenance activity shall be recorded by the Subcontractor on the boring log. Filter changes shall be done on a basis that is sufficient to eliminate oil from filtered air.

c. Perform drilling operations without the use of additives for bit lubrication and cuttings removal.

d. Fully describe, on the boring logs, air usage to include equipment description(s), manufacturer(s), model(s), air pressures used, frequency of oil filter change, and evaluations of the system performance.

e. Use a cuttings deflector shield or tube during operations to direct cuttings to a lined surface impoundment or a roll-off bin for containment.

3. Hollow-stem Augers: If hollow-stem auger equipment and methods are used, the Subcontractor shall use the appropriate-sized auger inner diameter to drill through the soil formations and allow installation of the well materials. The specific size of the hollow-stem auger shall be specified in the appropriate Work Plan.

4. Direct Push Method: If appropriate, the Subcontractor shall use direct-push equipment to place injection or monitoring wells. A Geoprobe® or equivalent system capable of sampling and installing wells to the required depths shall be utilized.

C. Drilling equipment shall be capable of drilling in clayey or granular soils and consolidated bedrock, above or below the water table. The Subcontractor shall maintain circulation and ensure that all cuttings are removed from the hole. Rig capabilities may be combined on a piece of equipment, or separate rigs with specialized functions may be used.

D. Packer Testing Equipment: If packer testing is performed, the packer testing method, equipment, and setup shall be approved by the Contractor prior to use.

E. Soil samples shall be collected when indicated in the Work Plan. Sampling methods and equipment shall be described in the Work Plan.

PART 3 - EXECUTION

3.01 GENERAL

A. The drilling, installation, and abandonment methods shall be described by the Subcontractor in detail in the Pilot-Scale Work Plan including, but not limited to, the type of equipment to be used and dimensions of bits, augers, and core barrels. The methods proposed must be approved by the Contractor prior to starting field operations and must include techniques which:

1. Minimize subsurface contamination or cross-contamination.

2. Minimize waste generation in the form of drill cuttings or contaminated groundwater.

B. Drilling for monitoring and injection well installations shall avoid penetration into the unweathered portion of the Burlington-Keokuk Limestone to prevent downward migration of contaminants.

C. The Contractor will provide any applicable estimates of approximate overburden thickness, depth to unweathered portion of the Burlington-Keokuk Limestone, or other pertinent information to the Subcontractor.

D. The Subcontractor shall develop and submit to the Contractor for review and approval a Safe Work Plan as described in Section 02050 Article 1.06.A. The Safe Work Plan must follow the outline provided in the WSSRAP Health and Safety Plan which is included in these Subcontract documents.

E. The Subcontractor shall submit to the Contractor at the end of each day a Daily Field Activity Report covering all activities.

3.02 WELL CONSTRUCTION AND INSTALLATION

A. All wells shall comply with Missouri Well Construction Rules (10CSR23). Alternate designs or installation methods require approval in advance from the Contractor and from the Missouri Department of Natural Resources Division of Geology and Land Survey (MDNR-DGLS). Obtaining approval from the MDNR-DGLS shall be the responsibility of the Subcontractor and drilling subcontractor.

B. Equipment and tools to be used in the well construction shall be steam cleaned or high-pressure washed on a temporary on-site decontamination pad immediately prior to their use unless certified clean and sealed. Decontamination shall be performed in accordance with Article 3.11 and Section 01503.

C. All depths and thicknesses including total depth of hole, filter pack thickness, and depth to top of bentonite seal shall be checked and recorded by the Subcontractor geologist by use of a stainless steel weighted tape and verified by the Contractor. The depth of the well shall be sounded and recorded. The static water level in the well shall also be measured and recorded prior to and after well development. The Subcontractor geologist shall complete record forms in accordance with Article 3.10 of this Specification.

D. Protective surface casing, well cap, traffic barriers, and concrete pad shall be installed by the Subcontractor.

E. The Subcontractor shall submit a completed as-built well diagram to the Contractor and shall conform to all quality assurance requirements in Section 01400.

3.03 PACKER TESTING

A. If packer testing is performed, the testing shall be executed by isolating a drill hole interval, as specified in the Pilot Scale Work Plan. Typical test intervals shall be provided.

B. The Subcontractor is responsible for providing the appropriate equipment to perform packer testing. The packer testing configuration shall be approved by the Contractor.

C. Tests shall be conducted using either a single inflatable packer capable of achieving internal pressures necessary to completely seal the borehole. Water flow and pressure shall be monitored using a flow meter and pressure gauge, respectively. After a test section has been cored, the hole shall be flushed with potable water and the drill string will be removed. The packer assembly and associated piping shall be lowered and set at the interval to be tested and the packer shall be inflated with inert gas. After the packer is securely seated, the hole shall be pressurized with potable water to the desired pressure, allowed to stabilize, and the flow rate shall be monitored. Recording of monitoring data shall be the responsibility of the Subcontractor.

3.04 WELL DEVELOPMENT

A. The Subcontractor shall develop each well in accordance with Missouri State Regulations 10 CSR 23-4.0 and the following techniques and criteria unless a waiver is obtained from State regulators and the Contractor that is consistent with the drilling method and the use of the well. This development shall begin no sooner than 24 hours after installation is complete.

1. Development must be conducted using downhole pumps (hand operated or mechanically driven). The use of bailers must be approved by the Contractor. The use of air-lift methods for development is prohibited. All development equipment must be constructed of stainless steel, Teflon®, PVC, or tygon. No glues, solvent, pipe dope, or adhesive tape shall be used on any downhole equipment. The development technique shall utilize a large surge block periodically during the development cycle to properly develop the filter pack.

2. Static water levels must be measured using an electronic water level indicator.

3. A well volume shall consist of the water in the well casing and the hole annulus.

4. Development shall be considered complete when all of the following conditions have been met after removing at least three times the volume added during drilling and installation or three well volumes, whichever is greater.

   a. Three consecutive electrical conductivity measurements are stable within ±20%;

   b. Three consecutive pH measurements are stable within ±0.2 standard units;

   c. Three consecutive temperature measurements are stable within 1°;

   d. Three consecutive turbidity measurements are stable within 10% and below 100 NTUs. If these measurements do not stabilize and/or if the required amount of water is not removed, the Contractor must make a determination as to the completeness of the development.

   All well development parameters shall be recorded on the Monitoring Well Development Form (Attachment 4) throughout the development.

5. Development and purge water shall be dispositioned as described in Article 3.08 of this document.

6. The development of all wells must be approved by the Contractor. If this approval is not obtained, the Subcontractor shall, at his own expense, return to perform any work deemed necessary to properly complete the development.

3.05 PROTECTIVE CASING, GUARD POSTS, AND CONCRETE PAD

A. The Subcontractor shall provide and install a steel protective casing for each monitoring well and if necessary, each injection well. Other well protection means must be approved by the State regulators and the Contractor. Protective casings shall be a minimum of five feet in length and have an overlapping, locking cap. The

protective casing and pad shall be installed prior to well development. Protective casings shall be anchored a minimum of three feet into the upper annulus by a concrete aggregate pad. The pad dimensions shall be two feet in diameter and shall extend three feet downhole. The pad shall be finished four inches above grade, with its surface sloping away from the protective casing (Figure 1).

B. Each well shall be protected from damage in accordance with the Missouri Well Construction Rules.

3.06 CROSS-CONTAMINATION PREVENTION MEASURES

A. The Subcontractor shall at all times prevent the contamination or cross-contamination of all wells and borings. Prevention measures include appropriate drilling and well installation procedures and decontamination of drilling equipment and well screens and casing in accordance with Article 3.10 of this Specification. Potential contaminants include, but are not limited to, oils, greases, hydraulic fluids, fuels, and contaminated soils.

B. If the rig or any other equipment becomes contaminated due to equipment breakdown or the Subcontractor's negligence, decontamination shall be at the Subcontractor's expense. Drill bits, drilling rods, other downhole tools, and hand tools shall be decontaminated between boreholes. Any inadvertent introduction of contaminants to the borehole shall require the hole to be abandoned and replaced at the Subcontractor's expense.

C. Cross-contamination shall be minimized by thoroughly cleaning all external and internal surfaces of all drilling equipment, tools, drill bits, drilling stem, hoses, and all other pertinent equipment after each hole is completed and before moving to the next drilling location. Cleaning shall be accomplished by completely removing all soil from the equipment. Gross removal of soil can be performed at the drill site before moving.

D. During the performance period, the Subcontractor shall prevent soils and liquids from entering the borehole. Decontamination procedures for surface casings may be performed at the drilling locations.

3.07 COLLECTION AND DISPOSITION OF DRILL CUTTINGS

A. The Subcontractor shall dispose of any resultant cuttings as indicated by the Contractor. Upon direction by the Contractor, the Subcontractor shall spread uncontaminated cuttings in the immediate area of the well or collect contaminated cuttings in Subcontractor-provided containers and transport them to the Gate G staging area for disposition by the Contractor.

3.08 COLLECTION AND DISPOSITION OF DRILLING FLUIDS, DEVELOPMENT WATER, AND DECONTAMINATION WATER

A. The Subcontractor is responsible for collecting, containing, and, as necessary, treating of all wastewater produced during a drilling, development, or decontamination activity as directed by the Contractor. The Subcontractor shall treat for residual reagent and store this water as described in Section 01600.

3.09 RECORD KEEPING, LOGS, AND OTHER DOCUMENTATION

A. Preparation of Drilling, Lithologic, and Abandonment Logs:

1. The Subcontractor shall supply a Contractor-approved geologist with each drill rig to prepare lithologic logs, well completion forms, well development forms, and well abandonment forms (see attachments for Subcontractor use or provide an equivalent). The minimum qualifications for geologist approval include a 4-year degree in geology or geological engineering and recent relevant experience in preparing lithologic logs in unconsolidated and consolidated materials. The geologist or geological engineer shall be responsible at each operating drill rig for the logging of samples, sample recovery, measurement of grout density, monitoring of drilling operations, recording of water losses/gains and groundwater data, preparing the boring logs and well construction diagrams, and recording the well installation procedures. Particular emphasis shall be placed on recording stratigraphic features and discontinuities that could affect contaminant or reagent transport and facilitate selection of screened intervals for monitoring and injection wells.

2. All depths and thicknesses, including total depth of the hole, filter pack thickness, and depth to top of bentonite seal, shall be checked and recorded by the Subcontractor and verified by the Contractor. Copies of field logs, well diagrams, and well abandonment forms shall be submitted to the Contractor within five working days of individual well completion or abandonment. Typed lithologic logs and as-built well completion diagrams shall be submitted within 30 calendar days of well installation completion.

B. Logbooks: The Subcontractor shall maintain a detailed logbook for all field activities. The logbooks shall be bound, shall have waterproof paper, and shall be completed using waterproof ink or marker. This logbook shall contain, at a minimum, a listing of all personnel at the sampling location and their affiliation; the time of arrival and departure from the site; each sampling location; personnel visiting and/or inspecting and/or auditing the sampling crews; accidents, unusual occurrences or observations; weather conditions; all water losses until development is achieved; and other relevant information necessary to allow a complete recreation of events. These logbooks shall be signed daily by the recording individual. All errors shall be deleted by a single strike mark through the error, with the initials of the person

correcting the error, and the date by the strike mark. Copies of the logbooks shall be delivered to the Contractor upon completion of field work.

C. Completion of Daily Field Activity Reports and Other Documentation:

1. The Subcontractor shall complete a Daily Field Activity Report detailing the work performed on that particular date. These forms shall be signed daily by the Subcontractor's on-site supervisor and the Contractor.

2. Other documentation to be completed by the Subcontractor upon the completion of well installations are packer test forms (if packer testing is performed), and MDNR Certification forms.

3.10 EQUIPMENT DECONTAMINATION PROCEDURES

A. All coring, sampling, augering, and other drilling equipment and tools used by the Subcontractor shall be decontaminated by hot water steam cleaning and air drying after mobilization, prior to use on-site, between installations and abandonments, and prior to demobilization. The Subcontractor shall perform decontamination of the above-mentioned equipment at an on-site, Subcontractor-constructed, temporary decontamination pad. Subcontractor-supplied decontamination equipment shall receive a safety inspection by the Contractor prior to use.

B. All decontamination fluids shall be collected and treated as described in Section 01600. All solid decontamination materials (i.e., rags, brushes, loose soil, PPE, etc.) shall be collected, packaged or containerized, and delivered to a disposal area as directed by the Contractor.

C. Screens and casing, including protective casing, shall be decontaminated using a high-pressure steam cleaner, unless wrapped in plastic or otherwise covered and accompanied by the manufacturer's certification of decontamination prior to installation. The Subcontractor shall supply all equipment, including a high-pressure steam cleaner and materials necessary to perform adequate decontamination procedures.

3.11 INJECTION WELL ABANDONMENT

A. The injection wells to be abandoned and all drilled holes that do not receive permanent monitoring equipment shall be abandoned in compliance with Missouri State Regulations 10 CSR 23.

B. All casing material and associated hardware (i.e., caps, plugs, riser pipe, centralizers), filter pack, annular seal, protective casing including concrete pad, and protective posts shall be removed during abandonment. The Contractor must be notified if any material cannot be removed prior to plugging the hole. The well

casings, concrete, and rubble shall be taken to an off-site disposal location after approval is received from the Contractor.

C. Where it has been determined that removal of the well materials is impractical, the Subcontractor shall present options and obtain concurrence from the Contractor on the selected option prior to contacting the State regulators to request a variance.

D. Drilling shall be concentric to the casing to ensure removal of all well construction material and loose unconsolidated/consolidated material.

E. To ensure removal of all well construction material, the hole shall be reamed at a minimum of the original hole diameter.

F. After monitoring equipment (screen and/or riser casing) has been removed (leaving an open hole), the hole must be grouted simultaneously with casing removal to prevent hole collapse. If the well cannot be abandoned in one day, the Subcontractor shall cap the hole with the rig and drill stem to maintain the integrity of the hole.

G. The preferred abandonment method shall be to tremie-place a bentonite slurry grout specifically designed for sealing boreholes to the ground surface. Any other 10 CSR 23 approved grout method may be used with Contractor prior approval. The grout shall be mixed according to the manufacturer's specifications. If bentonite grout is used, the ratio of clay grout to fresh potable water must achieve a weight of at least 9.4 pounds/gallon. The grout shall be mixed by jetting through the hopper and circulated through the rig's mud pump and tremied with a positive displacement pump. This ratio shall be verified and properly documented by the Subcontractor in the field using a mud balance. Native topsoil shall be applied at the surface to a depth of approximately two feet.

H. As an option to the rig's pump, the Subcontractor may also use a portable grout mixer or pump for the mixing and placing of grout by tremie pipe into the well boreholes.

I. Where complete removal of steel casings is required and unlikely to be achieved by overdrilling and pulling on the casing, a hydraulic casing cutter shall be used. This method shall be pre-approved by the Contractor and described in the Work Plan submitted. The cutter shall be lowered into the hole to a depth specified by the PMC representative and the casing shall be cut. The cutter shall be retrieved and the casing below the cut line grouted as outlined above. The steel casing above the cut line shall then be removed as outlined above.

3.12 COMPLETION

A. Site Restoration: The Subcontractor shall be responsible for site cleanup and restoration not provided by the Contractor and required as a result of activities associated with this Specification. This shall include:

1. Immediate measures to prevent erosion resulting from Subcontractor activity.

2. Removal of all work-derived trash and debris.

3. Repairing of any damaged structures or fences.

END OF SECTION 02733

ATTACHMENT 1

Borehole Log for Soil

PMC INSERT

MORRISON KNUDSEN CORPORATION

ENVIRONMENTAL SERVICES DIVISION

BOREHOLE LOG

Sheet _____ of _____	
Project Number:	
Hole Number	

Project:		Location:	
Coordinates:		Drilling Contractor:	
Drill Make and Model:	Depth Top of Rock:	Depth Casing & Size:	Hole Size:
Elevation:	Angle from Vert. and Bearing:	Depth Bottom of Hole:	
Water Level:	Fluid & Additives:	Date Start:	Date Finish:	Logger:

ELEVATION	DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS	SYMBOLIC LOG	SOIL DESCRIPTION
		INTERVAL	TYPE & NUMBER	RECOVERY	6"-6"-6" (N)		Name, Gradation or Plasticity, Particle Size Distribution, Color, Moisture Content, Relative Density or Consistency, Soil Structure, Mineralogy, USCS Group Symbol

ATTACHMENT 2

Borehole Log for Rock Cores

PMC INSERT

WELDON SPRING REMEDIAL ACTION PROJECT

BOREHOLE LOG

Sheet _____ of _____

Project Number:

Hole Number

Project:	Location:
Coordinates:	Drilling Contractor:

Drill Make and Model:	Depth Top of Rock:	Depth Casing & Size:	Hole Size:

Elevation:	Angle from Vert. and Bearing:	Depth Bottom of Hole:

Water Level:	Fluid & Additives:	Date Start:	Date Finish:	Logger:

DEPTH	COMMENTS TESTS/MONITORING INSTRUMENTATION CORING RATE AND SMOOTHNESS CORING FLUID LOSS CONTAMINATION	CORE RUN LENGTH AND RECOVERY (%)	CORE LOSS ZONE	BOX NUMBER	DISCONTINUITIES RQD	FRACTURES PER FOOT	DESCRIPTION TIGHTNESS PLANARITY SMOOTHNESS FILLING, STAINING ORIENTATION	GRAPHIC LOG	LITHOLOGY MINERALOGY CLASSIFICATION COLOR GRAIN SIZE ALTERATION	CEMENTATION HARDNESS WEATHERED STATE

ATTACHMENT 3

Monitoring Well Installation Diagram

PMC INSERT

WELDON SPRING SITE REMEDIAL ACTION PROJECT
MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME _____ WORK PACKAGE NO. _____

WELL NO. _____ WELL LOCATION _____

DATE _____ TIME _____ COORDINATES N: _____ E: _____

GROUND SURFACE ELEVATION _____

TOP OF SCREEN ELEVATION _____

REFERENCE POINT ELEVATION _____

TYPE FILTER PACK _____ GRADATION _____

FILTER PACK MANUFACTURER _____

SCREEN MATERIAL _____

MANUFACTURER _____

SCREEN DIAMETER _____ SLOT SIZE _____

RISER MATERIAL _____

MANUFACTURER _____

RISER DIAMETER _____

DRILLING TECHNIQUE _____

AUGER/BIT SIZE AND TYPE _____

BENTONITE TYPE _____

MANUFACTURER _____

GROUT TYPE _____

MANUFACTURER _____

GROUT WEIGHT _____

BOREHOLE DIAMETER _____

FIELD REPRESENTATIVE _____

DRILLING CONTRACTOR _____

AMOUNT BENTONITE USED _____

AMOUNT CEMENT USED _____

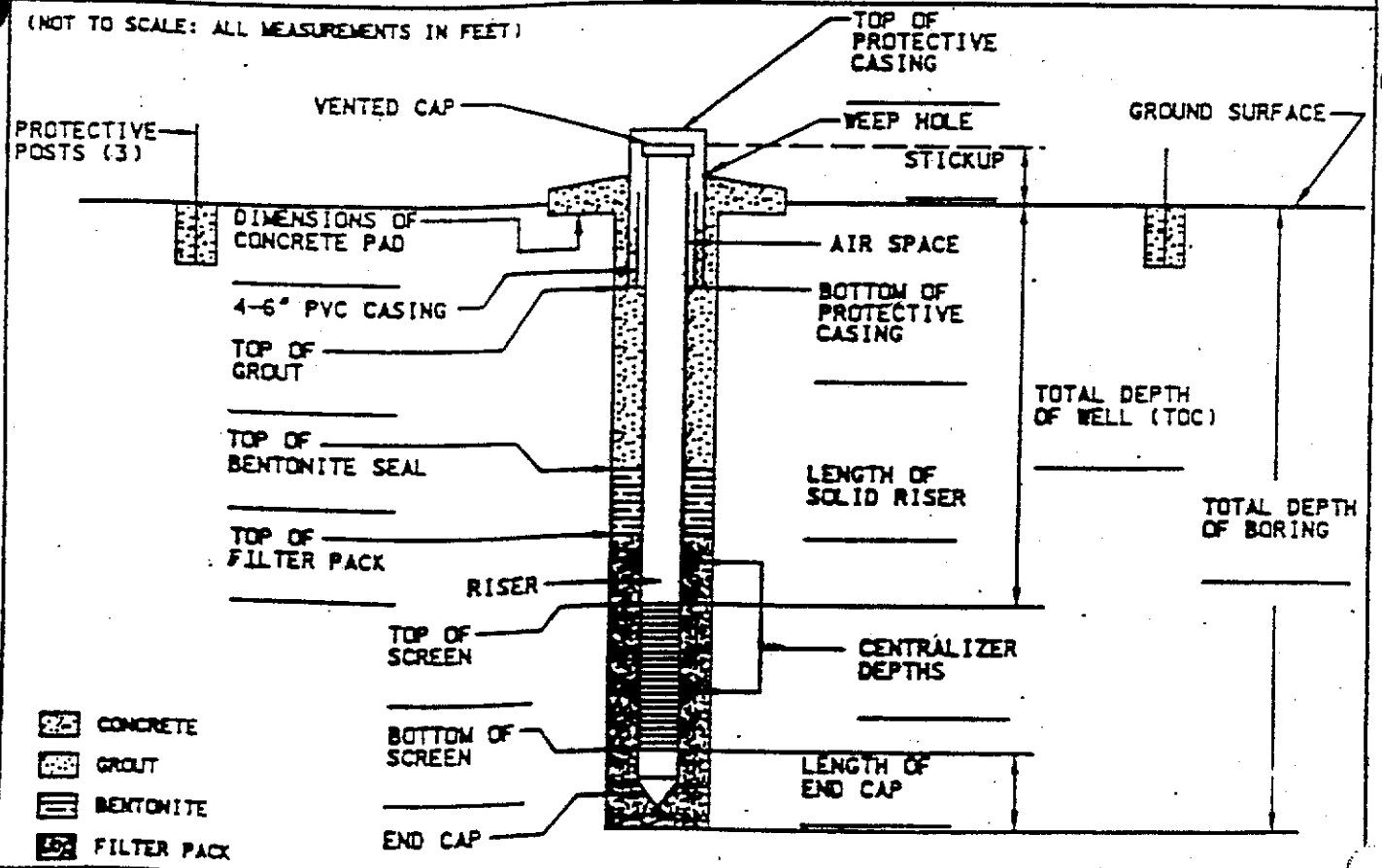
AMOUNT SAND USED _____

STATIC WATER LEVEL (>24 hrs. after dev.) _____

MEASURED ON (date/time) _____

REMARKS _____

(NOT TO SCALE: ALL MEASUREMENTS IN FEET)



QA/QC	DRILLER: _____ INSPECTOR: _____
	DISCREPANCIES: _____ CHECKED BY: _____ DATE: _____

A/P1/052/0495
04/03/95

ATTACHMENT 4

Monitoring Well Development Form

PMC INSERT

WELDON SPRING SITE REMEDIAL ACTION PROJECT

MONITORING WELL DEVELOPMENT FORM

ES&H 4.4.8.2, Rev. 1, 7/96

PROJECT NAME _____ WORK PACKAGE NO. _____

SHEET 1 OF 2

DEVELOPED BY _____

1. Well Number.: _____ Well Location: _____

2. Date of Installation: _____

3. Date of Development: _____

4. Static Water Level: Before Development _____ft.; At least 24 hrs. after _____ft.

5. Organic Vapor: Before development _____ppm; After development _____ppm.

6. Quantity of water loss during drilling, if used: ____ gal.

7. Quantity of standing water in well and annulus before development: _____gal.

8. Depth from top of well casing to bottom of well: _____ft. (from Well Installation Diagram)

9. Well diameter: _____in.

10. Screen length: _____ft.

11. Minimum quantity of water to be removed: _____gal.

12. Depth to top of sediment: Before development _____ft.; After development _____ft.

13. Physical character of water (before/after development): _____

14. Type and size of well development equipment:

15. Description of surge technique: _____

_____

16. Height of well casing above ground surface: _____ft. (from Well Installation Diagram).

Quantity of water removed: _____gal. Time for removal: _____ hr./min.

ATTACHMENT 5

Well Abandonment Form

PMC INSERT

MK-FERGUSON
A MORRISON KNUDSEN COMPANY

Weldon Spring Site Remedial Action Project

WELL PLUGGING AND ABANDONMENT LOG FORM

ES&H Form 4.4.4.1, Rev. 4, 7/96

Date of Abandonment: _____

ORIGINAL WELL DATA

Identification Number _____
Survey Coordinates _____
Ground Elevation _____
Screened or Open Hole? _____
Total Depth of Borehole _____
Total Depth of Well _____
Length of Filter Pack (If Applicable) _____
Depth to Bed Rock (If Appropriate) _____
Borehole Diameter _____
Casing Diameter _____
Length of Grout Column _____
Top of Filter Pack Elevation (If Applicable) _____

Comments: _____

DRILLING AND PLUGGING INFORMATION

Well Casing Extracted: ☐ Yes ☐ N/A ☐ No

Extraction Method: ☐ Pulled ☐ Drilled

Depth Drilled: _____ Feet

Complete Removal Achieved: ☐ Yes ☐ No

If partial extraction, explain: _____

Grout Type Used (Mix) _____

Volume Used (Describe Zones of Less): _____

Grout Specific Weight _____

Sketch Grouting Profile:

Problems (Bit Deviation, etc.): _____

Subcontractor Name: _____

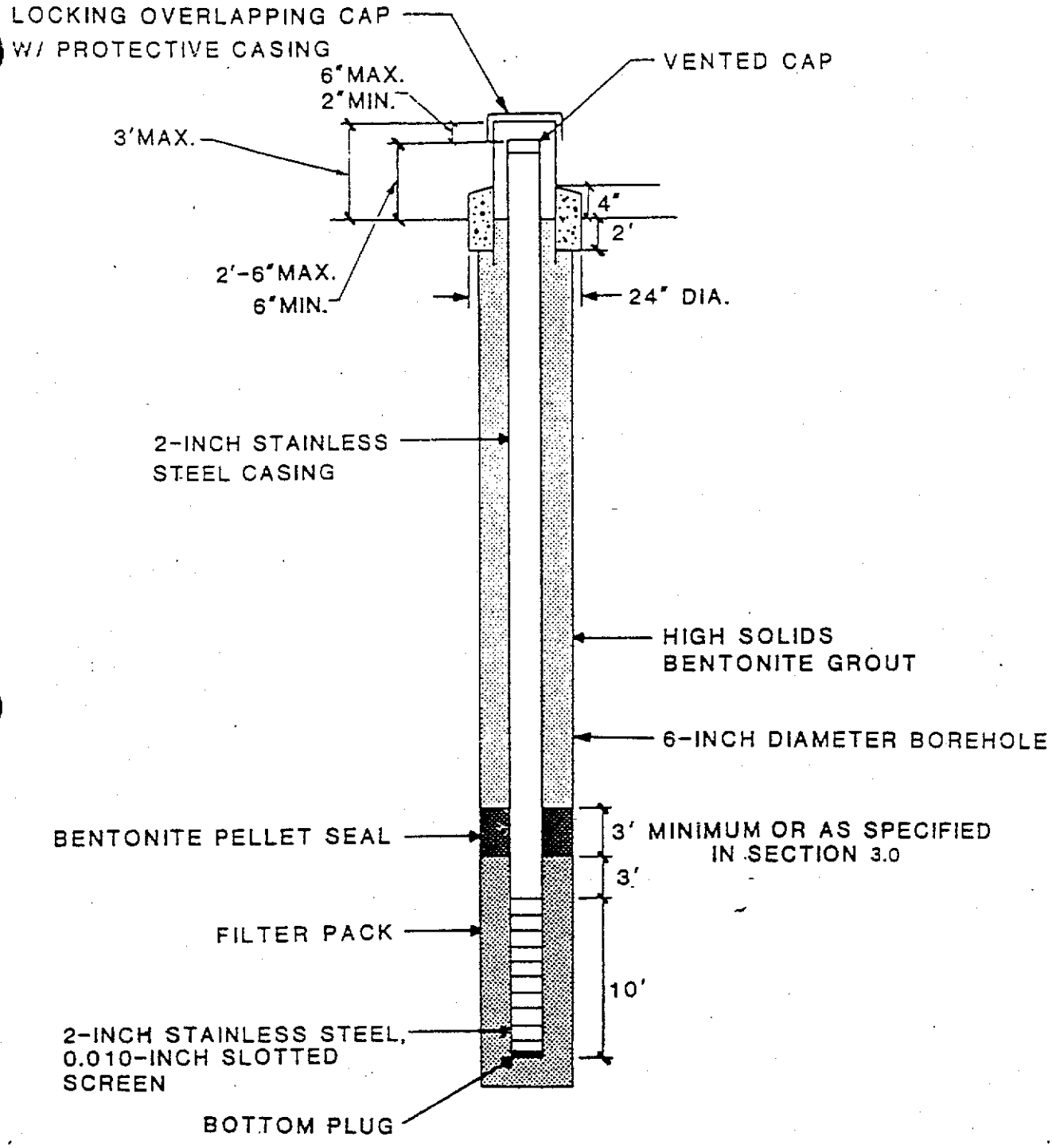
Drilling Coordinator Signature: _____

Date: _____

FIGURE 1

Typical Monitoring Well Construction

PMC INSERT THIS FIGURE



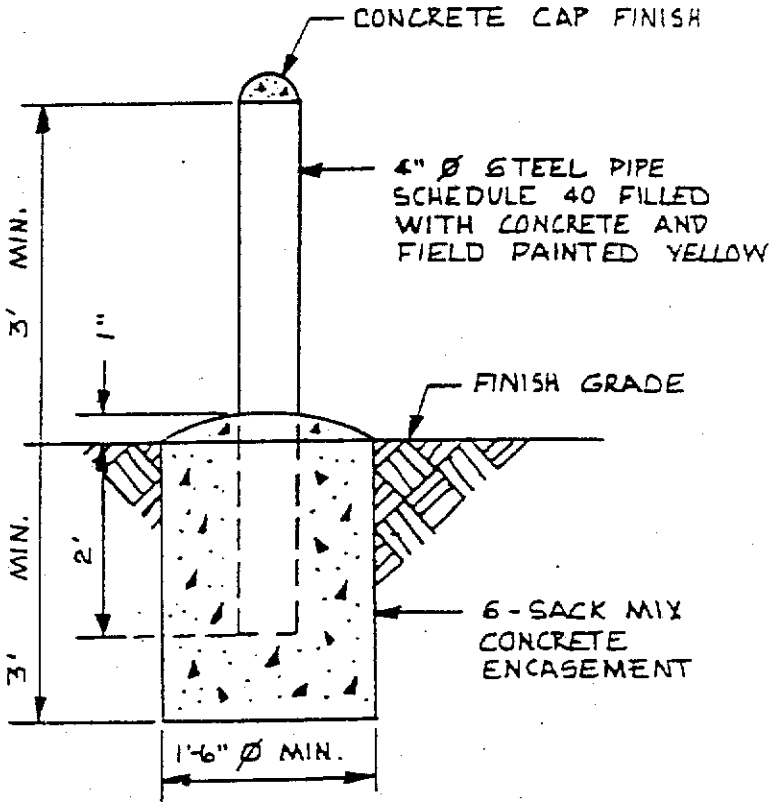
NOTE: THIS FIGURE DEPICTS A TYPICAL 2" STAINLESS STEEL MONITORING WELL. SOME DIMENSIONS AND MATERIALS MAY VARY AS THE SPECIFICATION ALLOWS.

NOT TO SCALE

TYPICAL MONITORING WELL CONSTRUCTION

FIGURE 3

REPORT NO.: WP-487		DRAWING NO.: A/PI/216/1191	
ORIGINATOR: SDG	DRAWN BY: GLN	DATE: 6/11/97	



GUARD POST

FIGURE 4

REPORT NO.: WP-487		DRAWING NO.: A/PI/217/1191	
ORIGINATOR: SDG	DRAWN BY: GLN	DATE: 1/24/95	

NOT TO SCALE

SUBMITTALS CHECKLIST - WP 568 Rev. A
In Situ Chemical Oxidation of TCE in Groundwater

Notes:

1. The submittals listed below do not relieve the Subcontractor of submitting any information required by the terms and conditions of the Subcontract that is not listed.
2. Items underlined are not required to be on a submittal form. These items can be transmitted by letter or given directly to the Construction Engineer.

DELIVER TO:	REFERENCE SECTION	DESCRIPTION/ DELIVERABLE	SUBCONTRACTOR SUBMITTED	COMMENTS	Date Submitted	Date Returned
GENERAL PROVISIONS						
ENGR	GP-4	Shop drawings.	Timely manner to support project.	Mandatory approval.		
CM&O	GP-11	Invoices and payments.	By the 15th of each calendar month.	Properly completed invoice in duplicate.		
ENGR	GP-27	Material Safety Data Sheets.	5 working days prior to bringing materials on site.	See Health and Safety Plan.		
CM&O	GP-29	Temporary Buildings & Utilities.	Timely manner prior to need.	Mandatory approval.		
PROC	GP-74	Substance Abuse Program.	Within 10 days of contract award.	Mandatory approval.		
PROC	GP-75	Certificate of insurance.	7 days after award.	Mandatory approval.		
GENERAL CONDITIONS						
ENGR	GC-2	As-built drawings.	Prior to final payment.	Mandatory approval.		
ENGR	GC-3	Construction schedule.	Submit Construction Schedule within ten days after Notice of Award.	Mandatory approval.		
ENGR	GC-3	Schedule of Values	Prior to receiving notice to proceed.	Mandatory approval		
CM&O	GC-3	Monthly schedule analysis and update.	By 15 of each month.	Mandatory approval. Submit with Progress Payment Request.		
ENGR	GC-7	Lower tier subcontracts.	Within 30 days after award and prior to subtier arrival on-site.	Mandatory approval. Furnish list of references.		
PROC	GC-8	Labor and equipment rates.	Within 15 days after award.	Mandatory approval.		
CM&O	GC-9	Daily construction report form.	Daily.	Mandatory approval.		
PROC	GC-10	Weekly man-hour report/employee roster form.	Weekly.	Mandatory approval.		
CM&O	GC-11	Overtime Request.	48 Hours in Advance.	Mandatory approval.		

DELIVER TO:	REFERENCE SECTION	DESCRIPTION/ DELIVERABLE	SUBCONTRACTOR SUBMITTED	COMMENTS	Date Submitted	Date Returned
ENGR	GC-12	Company logo.	Prior to on-site work.	Mandatory approval.		
ENGR	GC-19	Quality assurance.	Prior to any work.	Mandatory approval.		
ENGR	GC-21	Subcontractor supervision for off-hour emergencies.	Prior to on-site work.	Mandatory approval.		
CM&O	GC-24	Interruption of existing service/utilities.	2 days prior to use.	Mandatory approval Submitted on outage request form.		
PROC	GC-28	Use by S/C of facilities, utilities and equipment furnished under the S/C.	2 days prior to use.	Mandatory approval Written request to Contractor.		
HEALTH AND SAFETY PLAN						
ENGR	Section # 1.3.3	Safe Work Plans.	30 days after Notice of Award for Subcontracts greater than 90 days. 15 days after Notice of Award for Subcontracts of 90 days or less.	Mandatory approval.		
CM&O	Section # 1.4	Task Specific Safety Assessments.	Prior to performing tasks. If in conjunction with an ES&H Review Forms, submit 24 hours prior to performing the task.	Mandatory approval.		
CM&O	Section # 1.8	Incident Reports.	Immediately after incident.	Mandatory submittal.		
CM&O	Section # 1.8	Foreman-Report-of-Injury Form.	Within 3 days of the injury.	Mandatory submittal.		
ENGR	Section # 3.1	Permit Required Confined Space Entry Program.	Required by this section.	Mandatory approval.		
ENGR	Section # 3.1	Designation of Individuals responsible for confined space program implementation, including competent persons and rescue personnel.	Prior to performing confined space entries.	Mandatory review and acceptance.		
ENGR	Section # 3.4.1	Material Safety Data Sheets.	5 working days prior to bringing materials on site.	Mandatory approval.		
ENGR	Section # 3.4.1	Chemical Inventories	Monthly	Mandatory review and acceptance.		
ENGR	Section # 3.4.1	Written procedures for controlling exposures to carcinogens as low as reasonably achievable.	5 working days prior to bringing materials on site which contain A1 or A2 carcinogens as identified by the American Conference of Governmental Industrial Hygienists.	Mandatory approval.		
CM&O	Section #5.1.23	Monitoring Results.	24 hrs. After receipt of results.	Mandatory submittal		
ENGR	Section # 6.13	Drawings of job-built jigs & tools.	Prior to use onsite.	Mandatory approval.		
CM&O	Section # 6.14	Cutting/Welding/Open Flame Permit	Prior to cutting burning, open flame work.	Mandatory approval.		
ENGR	Section # 6.25	Owners manual for heavy equipment.	Prior to use onsite.	Mandatory submittal.		

DELIVER TO:	REFERENCE SECTION	DESCRIPTION/ DELIVERABLE	SUBCONTRACTOR SUBMITTED	COMMENTS	Date Submitted	Date Returned
ENGR	Section # 6.25	Operator qualifications for heavy equipment.	Prior to operating equipment onsite.	Mandatory submittal.		
ENGR	Section # 7	Medical evaluation reports.	10 days prior to on-site work.	Mandatory approval.		
CM&O	Section # 8	Training Authorization Forms.	On the day of or before Contractor provided training.	Mandatory submittal.		
ENGR	Section # 8.1.2.1	Training and Fit Testing documentation for respirators per OSHA standard.	10 days prior to performing work requiring respirators on site.	Mandatory submittal.		
CM&O	Section # 8.1.3	Training records for Safe Work Plans and TaSSAs.	At the end of each work shift.	Mandatory submittal.		
ENGR	Section # 8.1.6	Names and qualifications of on site supervisory personnel, including alternates, having overall responsibility for employee safety and health.	10 days prior to performing work on site.	Mandatory submittal.		
ENGR	Section # 8.2.1.1	24 Hour Hazardous waste site health and safety training certification and 1 day of documented field experience.	10 days prior to on-site work.	Mandatory approval.		
ENGR	Section # 8.2.1.1	Supervisor training documentation meeting requirements of 29 CFR 1910.120(e).	10 days prior to on-site work.	Mandatory approval.		
ENGR	Section # 8.2.1.2	40 hour hazardous waste site health and safety training certification and 3 days of documented field experience.	10 days prior to on-site work.	Mandatory approval.		
ENGR	Section # 8.2.1.2	Supervisor training documentation meeting requirements of 29 CFR 1910.120(e).	10 days prior to on-site work.	Mandatory approval.		
ENGR	Section # 8.4	Fire watch training.	Prior to conducting fire watch.	Mandatory upon request.		
CM&O	Section # 9.4.1	List of names of all employees required to be badged, including subtiers.	10 days prior to on-site work.	Mandatory submittal.		
CM&O	Section # 9.4	WSSRAP Security Badge Information and Tracking Forms.	Prior to on-site work.	Mandatory submittal.		
CM&O	Section # 9.4.2	Name and description of duty of temporary employees.	Prior to or at the time of arrival on site.	Mandatory submittal.		
CM&O	Section # 9.4.4	Security Badges returned.	Whenever a subcontract employee is terminated or the subcontract is completed.	Mandatory submittal.		
ENGR	Section # 11.1	Emergency Action Plan.	Prior to the commencement of work on site.	Mandatory submittal.		
ENGR	Section # 11.2	Name of the Subcontractor medical response personnel and associated first aid and CPR training documentation.	10 days prior to on-site work.	Mandatory submittal.		
TECHNICAL SPECIFICATION SUBMITTAL REQUIREMENTS						
	01300 (1.03.A,B, & C)	As-built drawings reflecting final as-built conditions	With completion report.			
	01300 (1.07.A.2)	Complete Construction Schedule including Barchart Schedule and Logic Diagram	Prior to start of work			
	01300 (1.07.B.1)	Construction Schedule including Barchart Diagram, Schedule Reports, and Narrative Report	Monthly on or about the 15th.			

DELIVER TO:	REFERENCE SECTION	DESCRIPTION/ DELIVERABLE	SUBCONTRACTOR SUBMITTED	COMMENTS	Date Submitted	Date Returned
	01300 (1.08.)	Catalog cuts, material certifications, shop drawings, Subcontractor drawings, operating/maintenance manuals, samples, special procedures, and/or other types of data as may be specified or listed	Such as to cause no delay in work and allow review and approval prior to receipt, inspection, installation, and/or incorporation of the item into the Work.			
	01400 (1.04.A)	Quality Assurance Program	21 days after award			
	01400 (1.04.B)	Qualifications of QA representative and alternate	21 days after award			
	01400 (1.06.A) (1.06.B)	Quality related records	Upon completion of the contract			
	01500 (3.03.C)	Subcontractor personnel spill response training evidence.	Prior to bringing chemicals on site.			
	01503 (1.04.A)	Equipment Decontamination Plan	14 days prior to work			
	01600 (1.03.A.1)	Material Safety Data Sheet (MSDS) for each chemical, reagent, oxidant, and other hazardous material brought on site	5 days prior to bringing material on site			
	01600 (1.03.A.2)	Supplier or manufacturer requirements and recommendations for material storage, handling, protection, and transportation for each chemical, reagent, oxidant, and other potentially hazardous material brought on site	5 days prior to bringing material or chemical reagent, oxidant, or hazardous material on site.			
	02050 (1.06.A.1)	Pilot Scale Work Plan and Design	With bid			
	02050 (1.06.A.2)	Conceptual Full-Scale Design	With bid			
	02050 (1.06.A.3)	Safe Work Plan	10 days prior to mobilizing for pilot-scale field work			
	02050 (1.06.A.4)	Emergency Response Plan	10 days prior to performing pilot-scale field work			
	02050 (1.06.A.5)	Sampling and Analysis Plan	Prior to start of pilot-scale work			
	02050 (1.06.A.6)	Analytical Laboratory Certification	Prior to start of pilot-scale work			
	02050 (1.06.A.7)	Interim Progress Report	Monthly after notice to proceed			
	02050 (1.06.A.8)	Pilot-Scale Testing Summary Report	Completion of pilot-scale testing			
	02050 (1.06.A.9)	Final Full-Scale Work Plan and Design	Completion of pilot-scale testing			
	02050 (1.08.A)	Missouri Registered Geologist License (copy) and resume	Prior to start of pilot-scale work			
	02733 (1.01.E)	Missouri Well Drillers' License	Prior to mobilization			
	02733 (1.05.A.1)	Injection Well Plan	21 days prior to installation			
	02733 (1.05.A.3)	All documentation required to certify new monitoring wells and injection wells	14 days after completion of well installation			
	02733 (3.01.E)	Daily Field Activity Report	Daily upon commencement of work			
	02733 (3.09.A.2)	Field borehole logs, well construction diagrams, well development forms, and well-abandonment forms	Five working days after well completion or abandonment			
	02733 (3.09.A.2)	Final typed borehole logs and as-built well diagrams	30 days after well completion			