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June 11, 2004
PN: 101960

Mr. Joseph Martella, II
Rhode Island Department of Environmental Management
Office of Waste Management
235 Promenade Street
Providence, RI 02908-5767

Re: Revised Remedial Action Work Plan
Second Sodium Permanganate Injection
Former Gorham Manufacturing Facility
333 Adelaide Avenue, Providence, RI
Case No. 97-030

Dear Mr. Martella and Mr. Roy:

On behalf of Textron Inc. (Textron), Shaw Environmental, Inc. (Shaw) is proposing the following revisions to the Remedial Action Work Plan (RAWP) submitted to the Rhode Island Department of Environmental Management (RIDEM), by Shaw dated May 20, 2003, to perform a follow-on injection of sodium permanganate as part of the remediation of chlorinated solvent contaminated groundwater at the former Gorham Manufacturing Facility in Providence, Rhode Island (Site). The initial permanganate application was conducted in accordance with Shaw's RAWP dated November 28, 2001, RAWP Revisions dated January 28, 2002, and letters dated February 12 and March 5, 2002 as submitted to and approved by the RIDEM Waste Management and Water Resources Offices on March 15, 2002.

The purpose of this letter is to provide RIDEM with details of the proposed second or follow-on injection following pre-injection sampling including additional well installations, soil sampling, and groundwater sampling conducted at the site in March and April 2004 and to seek approval of the proposed modifications from both the Office of Waste Management and the Office of Water Resources/Underground Injection Control Program.

INTRODUCTION

A field application of sodium permanganate to groundwater was conducted in the spring of 2002 at the former Gorham Manufacturing Facility located at 333 Adelaide Avenue in

Providence, Rhode Island (Site) (Drawing 1). Shaw conducted preliminary soil matrix oxidation demand studies associated with the permanganate injections in October 2001. Monitoring well installations associated with the permanganate injection program were completed in February 2002. The permanganate additions were conducted during March and April 2002. The monthly status report submitted in January 2003 summarized these activities and incorporated groundwater monitoring information including baseline, interim, and post-injection groundwater data.

As discussed in the January 2003 status report, the post-injection groundwater concentration results indicate that an additional injection of permanganate is required in a reduced area around wells MW-205, MW-101S, MW-101D, MW-202S, and MW-202D. The January 2003 to April 2003 data indicated some changes in the tetrachloroethene (PCE) plume concentration has occurred at these well locations, but it is unlikely that the treatment goal of 7,700 µg/L can be achieved without further treatment.

This information has been further supplemented by additional data collected in March and April 2004. The additional data has been provided to RIDEM in the monthly status report submitted in June 2004. These results are summarized below.

Pre-Injection Sampling Program

Prior to the follow-on injection, baseline groundwater samples and soil samples were collected in March and April 2004. Baseline wells in the treatment area are MW-112, MW-101S&D, and MW-202S&D, which were analyzed for volatile organic compounds (VOCs). Soil samples were collected from three areas of the site within the proposed treatment area for soil oxidant demand (SOD), total organic carbon (TOC) testing, fractional organic carbon (FOC) analysis, and VOC analysis.

The results of the baseline groundwater sampling in the PCE source area are contained in the status report submitted in June 2004 and included additional wells in the source area. The results are similar to those found in the source area in 2002 and 2003 and show the source area remains centered around wells MW-101S and MW-101D. The attached Figure 1 shows PCE groundwater concentration contours for the most recent sampling events. The results show that the eastern extent of the area requiring remediation is clearly bound by well pairs MW-207S&D and MW-208S&D.

Six soil samples and one groundwater sample were sent to Shaw's Technology Development Laboratory (TDL) in Knoxville, TN for SOD, TOC, and FOC analysis. The lab measured SOD is a total SOD for permanganate, but in actual application, the field observed SODs are usually about 25% lower due to incomplete soil exposure and mass

transfer limitations. The SOD used to develop the injection mass of sodium permanganate is 1.0 g/kg.

The results of the soil analytical sampling indicated elevated levels of PCE and trichloroethene (TCE) were detected in soil samples from the source area. These elevated levels coincide with elevated groundwater concentrations in the source area.

DESCRIPTION OF FOLLOW-ON TREATMENT PROGRAM

From April 2002 to April 2003, quarterly groundwater sampling results after the permanganate injections that occurred in March and April 2002 indicated PCE remedial goals have been met in several wells within the general vicinity of the treatment area. These wells include MW-112, MW-101S, and MW-201S&D, and the MW-116, MW-203, MW-204, MW-206, and MW-207 well couplets. However, the groundwater data indicate that continued treatment is necessary for the remedial goals to be achieved in wells MW-101D, MW-205, and MW-202S&D well couplet. Additional treatment is currently not necessary for the zone associated with MW-201D. At that time four successive quarters of groundwater PCE concentrations below the cleanup goal, for well MW-201D, had not yet been met. However, the most recent sampling round (March 2004) indicates that MW-201D is well below the treatment goal.

The proposed area for the follow-on injection is in the southeast portion of the 2002 treatment grid, and incorporates approximately 13,000 ft² encompassing wells MW-202S&D, MW-101S&D, MW-205, MW-209D, and MW-112 (Figure 2). The permanganate treatment will be conducted from the water table at approximately 25 feet below grade, to 50 to 70 feet below grade at 9 locations. The injection intervals will be approximately 20 feet in length. Further details of the injection wells and methods are discussed below.

Results of recent (March and April 2004) groundwater VOC analytical data were used to determine permanganate application locations and amounts. The dosage of permanganate was calculated from the estimated mass of PCE measured in groundwater (concentrations of other chlorinated hydrocarbons are insignificant for purposes of calculating the permanganate required), calculated mass of PCE absorbed to aquifer organic matter, and the estimated consumption by other reduced species in the subsurface soils and groundwater (matrix demand). The estimated mass of PCE absorbed to the aquifer organic matter was determined from the average dissolved groundwater concentrations and laboratory determined fractional organic carbon (FOC) values for the site. The matrix demand consists of naturally occurring metals and organic matter in the subsurface.

Based on the contaminant mass and estimated matrix demand, approximately 24,400 pounds of oxidant as sodium permanganate will be applied to the treatment zone. The liquid sodium permanganate solution (40%) will be mixed with water to produce a 10% solution for injection. The 10% concentration of injection solution was determined to provide a sufficient mass of permanganate to treat the contaminants in the groundwater, absorbed to the aquifer organic matter, overcome the matrix demand of the reduced species in the soil and groundwater, and also provide a volume of solution to provide an effective coverage of treatment. The 24,400 pounds of permanganate applied at a 10% concentration has a solution volume of approximately 21,000 gallons. The volume of solution to be added at each application location will be determined by pro-rating the volume based upon the local concentrations of VOCs detected during recent groundwater sampling and the depth of the vertical screen intervals. The estimated volume to be injected at each location will be between 1,500 gallons to 3,000 gallons.

Injection Well Installation

Permanganate solution will be injected into 9 locations across the treatment area (Figure 2). The injection points will be installed using either a direct push methodology or conventional drilling methods (depending on which is the most cost effective approach). The wells will be constructed of either 1.3-inch outside diameter push wells with stainless steel screens and carbon steel risers or 2-inch diameter PVC screens and risers. The wells screens will extend over the injection interval: approximately 25 to 70 feet below ground surface (bsg) in the area of treatment. Wells will be finished with road-boxes. The injection points will be furnished with connections for permanganate injection.

Permanganate Storage and Pumping System

Sodium permanganate will be delivered to the site as a 40% solution and stored in 20,000-gallon fractionation tanks, or similar aboveground tank. The permanganate will be mixed with clean water within the tank to the desired injection solution concentration. The sodium permanganate will be diluted to a concentration of 10% prior to injection. The solution will be delivered to each injection point through hoses and materials, selected for their resistance to permanganate, utilizing a portable positive displacement pump. A typical injection point assembly will consist of a pressure gauge, a flow indicator, a ball valve, and pressure relief port. The solution will be injected at a flow rate of up to 10 gallons per minute (gpm) at each injection point. This rate may be adjusted during the application of the solution based on conditions observed in the field. Permanganate solution may be injected at multiple locations at the same time.

The equipment will be stored in a locking storage trailer on-site when not in use. If any equipment cannot be stored in the locking trailer, or, if the permanganate storage tank

cannot be secured during non-working hours and on weekends, site security will be employed.

Spill Control Measures and Cleanup

Spill control devices (i.e., sorbent pads, sorbent boom and spill control handling equipment) will be kept on-site during the addition activities to mitigate potential spills during addition. Flushing with water and neutralization with a solution of water, vinegar (acetic acid) and hydrogen peroxide will clean up minor spills within the containment area. This solution rapidly oxidizes the permanganate and can be used on personnel, if accidentally splashed by the permanganate solution. An approximate volume of 250 gallons of neutralizer solution will be maintained on the site for spills and cleaning. The solution will be dispensed from a 3-gallon garden sprayer or hand held spray bottles.

Monitoring Activities

The monitoring proposed includes source area groundwater monitoring (during injection and post-injection). As with the first injection, the volume of oxidant being injected into the aquifer is small and it was demonstrated that permanganate did not leave the treatment area and hydraulic control was maintained. Nevertheless, groundwater elevation measurements will be made at each well during injection to confirm that significant groundwater mounding is not occurring.

Injection Groundwater Monitoring

During injection activities field parameters will be measured in selected treatment area monitoring wells daily and in all treatment area wells weekly. Field measurements will include oxidation/reduction potential (ORP), dissolved oxygen (DO), pH, temperature, and specific conductance (SC).

Post-Injection Groundwater Monitoring

Once the sodium permanganate injection has been completed, post-injection monitoring activities will commence. Field parameter measurements will be collected weekly for ORP, DO, temperature, pH, and SC for four (4) weeks following treatment and monthly (2 events) after that until three months post-injection. More frequent field parameter measurements would be conducted if conditions warrant. Groundwater samples will be collected for VOC analysis (EPA Method 8260) approximately 4 to 8 weeks post-injection from seven wells within the treatment area (MW-112, MW-209D, MW-205, MW 101-S&D, and MW-202S&D). Groundwater samples will be collected from all 21 source area monitoring wells for VOC analysis (EPA Method 8260) approximately 12 to

16 weeks post-injection. The samples collected 12 to 16 weeks post-injection would constitute the first round of quarterly sampling.

Following the 12 to 16 week post-injection groundwater sampling for VOCs, the quarterly monitoring program will begin, and an additional three (3) quarters of groundwater sampling will be conducted. Field parameter measurements would also be conducted during the quarterly groundwater sampling events.

Residual Permanganate Analysis and VOC Preservation

As was done during groundwater sampling following the 2002 permanganate additions, during the periodic groundwater sampling events groundwater samples will be obtained from wells indicating the presence of residual permanganate (i.e. observed purple color) for analysis of permanganate concentrations. The permanganate concentration analysis will be conducted utilizing a Hach spectrometer, which provides a colorimetric analysis of water samples based on a pre-programmed calibration.

Based on an evaluation of groundwater sampling following the 2002 permanganate additions, hydrochloric acid (HCL), the preservative typically used for VOC samples, will not be used on samples exhibiting a visual presence of permanganate or indicating the presence of permanganate using the colorimetric analysis. Instead, as conducted during the 2002 program, sodium thiosulfate will be added to the sample in order to 'quench' the oxidation reaction.

SCHEDULE

Shaw has included an attached schedule to complete the second injection in the month of August 2004.

REPORTING

As required in the RIDEM Order of Approval dated March 15, 2002, status reports will be provided to RIDEM on a monthly basis. A preliminary closure report with details of the remedial action and site status will be provided to the RIDEM Office of Waste Management and the Office of Water Resources/Underground Injection Control Program for review within 90 days of the conclusion of the groundwater remedy.

Shaw requests your review and approval of the proposed modifications to the Remedial Action Work Plan. The significant features of the groundwater remediation program remain the same as that previously approved by RIDEM.

Mr. Martella
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We are available to meet or discuss with you the proposed modifications.

If you have any questions, please contact Ed Van Doren at (978) 691-2130.

Sincerely,

SHAW ENVIRONMENTAL, INC.

A handwritten signature in black ink that reads "Edward P. Van Doren". The signature is written in a cursive style with a large, prominent "E" and "D".

Edward P. Van Doren, PE
Project Manager

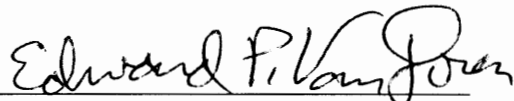
Attachments

cc: Craig Roy, RIDEM OWR
David McCabe, Textron
Jamieson Schiff, Textron
Thomas Dellar, City of Providence
Karriem Van Leesten, City of Providence

CERTIFICATIONS

The following certifications are provided pursuant to Rule 9.19 of the Remediation Regulations:

I, Edward P. Van Doren, as an authorized representative of Shaw Environmental, Inc. and the person responsible for the preparation of this Remedial Action Work Plan dated June 11, 2004, certify that the information contained in this report is complete and accurate to the best of my knowledge.




Edward P. Van Doren, P.E.
Project Manager

6/11/04

Date:

We, Textron, Inc., as the party responsible for submittal of this Monthly Status Report, certify that this report is a complete and accurate representation of the contaminated site and the release, and contains all known facts surrounding the release, to the best of our knowledge.

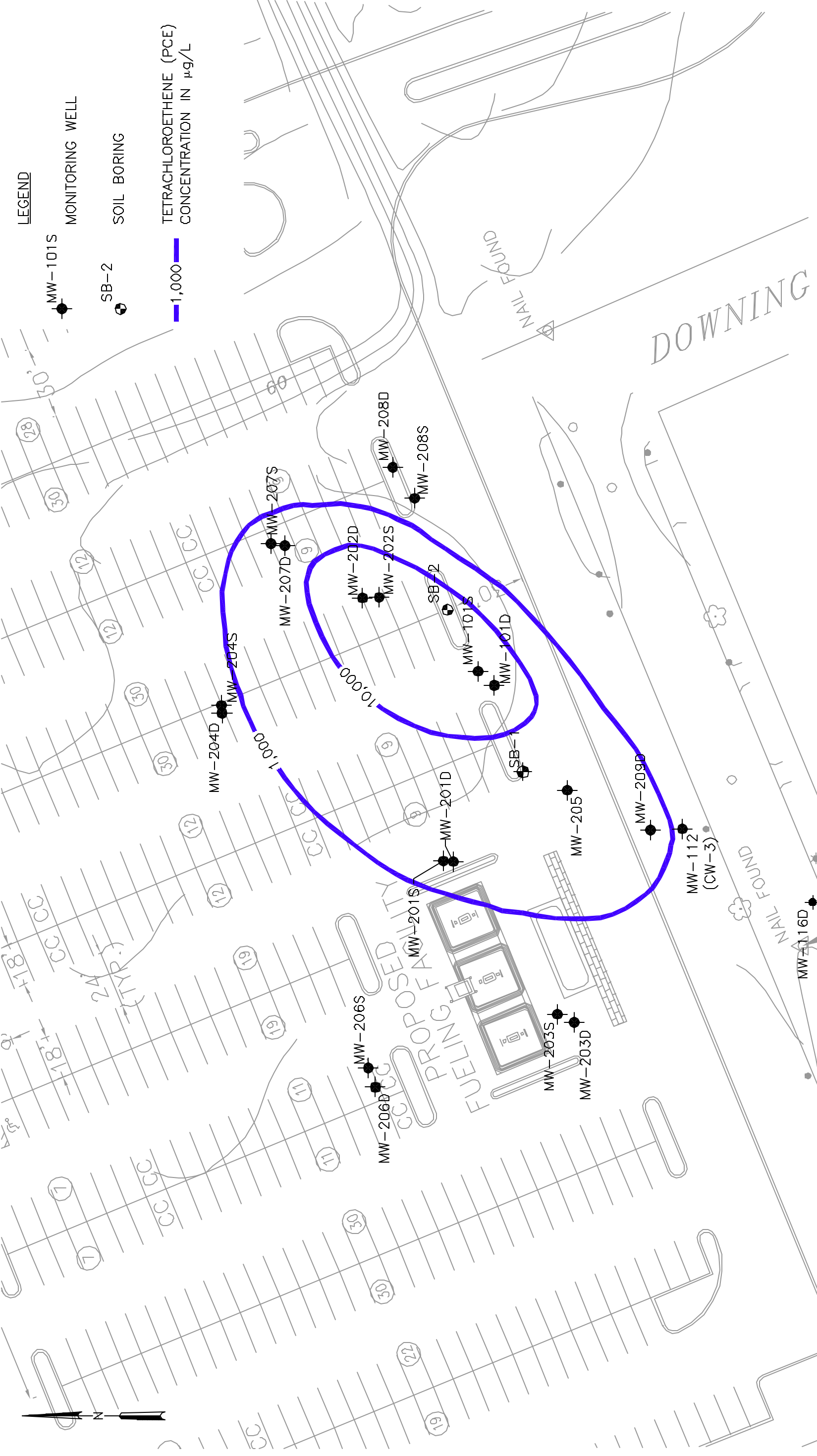
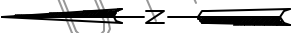
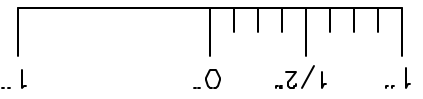
Certification on behalf of Textron Inc.



David M. McCabe, P.G.
Manager, Site Remediation

6/10/04

Date:



LEGEND

MONITORING WELL: MW-101S

SOIL BORING: SB-2

TETRACHLOROETHENE (PCE) CONCENTRATION IN µg/L: 1,000

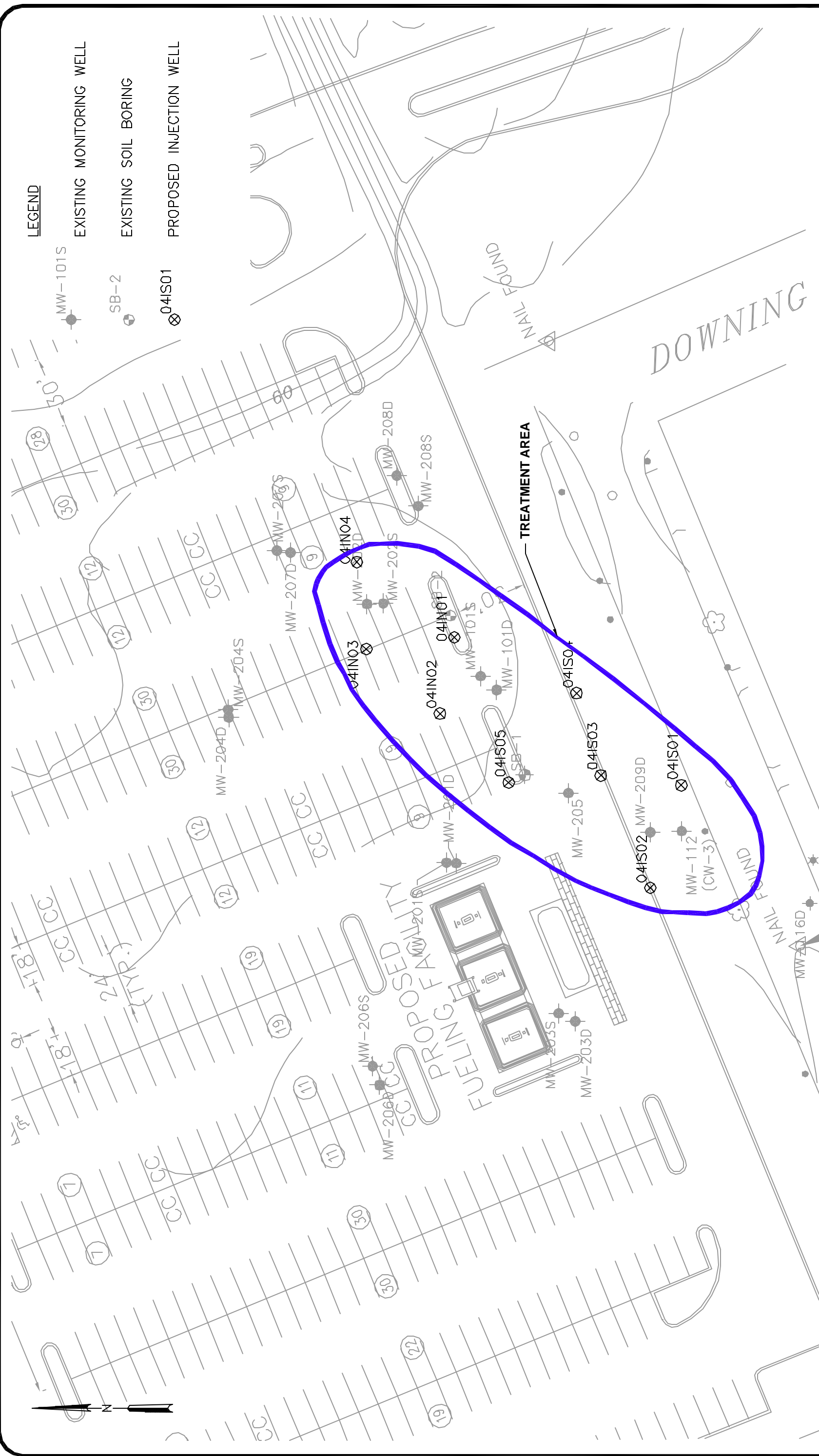
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FIGURE 1

TEXTRON PROVIDENCE
333 ADELAIDE AVENUE
PROVIDENCE, RHODE ISLAND

**TETRACHLOROETHENE CONCENTRATION
CONTOURS, MARCH/MAY 2004**











DATE	5/11/04
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FIGURE 2
 TEXTRON PROVIDENCE
 333 ADELAIDE AVENUE
 PROVIDENCE, RHODE ISLAND
PROPOSED INJECTION WELL LOCATIONS



ID	Task Name	Start	Finish	June				July				August				Se		
				5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8		8/15	8/22
1	RIDEM RAWP Review and Approval	Fri 7/2/04	Fri 7/2/04								◆ 7/2							
2	Subcontractor/Materials Procurement	Mon 7/5/04	Fri 7/30/04															
3	Injection Well Installations	Mon 8/2/04	Fri 8/13/04															
4	Sodium Permanganate Injection	Mon 8/16/04	Fri 8/27/04															

 Task
 Split
 Progress

 Milestone
 Summary
 Project Summary

 External Tasks
 External Milestone
 Deadline

Former Gorham Manufacturing Facility
 Revised Remedial Action Work Plan
 Fri 6/11/04