CONESTOGA-ROVERS & ASSOCIATES

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TRANSMITTAL

DATE: February 13, 2009

REFERENCE NO.: 241501

PROJECT NAME: 461 8th Street, Oakland

TO: Jerry Wickham
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

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Alameda County
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QUANTITY	DESCRIPTION
1	Work Plan for Groundwater Treatment by InSitu Chemical Oxidation

- ☐ As Requested
- ☐ For Your Use
- ☒ For Review and Comment
- ☐
- ☐

COMMENTS:
If you have any questions regarding the contents of this document, please call Thomas Sparrowe at (510) 420-3316.

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NA Trustee of Havens,
c/o John Ward
Leah Goldberg

Copy to: Grover Buhr (electronic only)

Completed by: Thomas Sparrowe [Please Print] Signed: Thomas Sparrowe

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WORK PLAN FOR GROUNDWATER TREATMENT BY INSITU CHEMICAL OXIDATION

FORMER SHELL SERVICE STATION
461 8th STREET
OAKLAND, CALIFORNIA

SAP CODE 129453
INCIDENT NO. 97093399
AGENCY NO. RO0000343

Prepared by:
Conestoga-Rovers & Associates

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FEBRUARY 13, 2009
REF. NO. 241501 (6)
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(Following Text)

1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) prepared this work plan on behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell), as requested in Alameda County Health Care Services Agency's (ACHCSA's) November 24, 2008 correspondence. This plan details groundwater treatment by insitu chemical oxidation (ISCO). ACHCSA's December 5, 2008 and January 15, 2009 electronic correspondence extended the original due date to February 13, 2009.

The site is a paved parking lot located at the southwest corner of the intersection of 8th Street and Broadway in a primary commercial area of Oakland, California (Figure 1). The former station layout included an underground storage tank complex and dispenser islands (Figure 2). While the subject site is currently used as a paid public parking lot, the current property owners have submitted development plans to construct a mixed-use site consisting of multi-storied commercial and residential units with a subsurface parking area.

2.0 SCOPE OF WORK

Soils and groundwater at the site are impacted by petroleum hydrocarbons. Total petroleum hydrocarbons as gasoline (TPHg) have been detected in site groundwater at concentrations of up to 120,000 micrograms per liter (µg/L). Benzene, toluene, ethylbenzene, and xylenes (BTEX) have also been detected. Benzene has been detected at concentrations of up to 43,000 µg/L. Significant impacts to groundwater have been observed at wells to the southwest of the excavation area including S-5, S-6, S-13, S-17, S-18, S-20, S-21A, and S-22A. Groundwater flow at the site is towards the southwest. Wells S-5 and S-6 are located more than 120 feet from the excavation area close to underground utilities, and it is hypothesized that impacted groundwater has flowed preferentially along the bedding of the utilities and caused these down-gradient impacts.

Between June 3 and June 10, 2008, Gettler-Ryan Inc. (GRI) of Dublin, California conducted excavation to remove hydrocarbon impacted soil to approximately 20 feet below grade (fbg) and installed an ISCO infiltration gallery. An area 20 feet by 50 feet was excavated to 20 fbg to remove residual source-impacted soil from beneath the former product piping and pump islands.

Between December 5, 2008 and January 9, 2009, two ISCO treatments of approximately 6,144 gallons of 20 percent sodium persulfate and 1,754 gallons of 10 percent hydrogen peroxide were applied to the excavation using the infiltration system. The ISCO treatment targeted contaminated soil that remained at the bottom of the excavation, but some treatment of groundwater adjacent to the excavation also occurred.

The results of the groundwater monitoring to date indicate that significant removal of TPHg and BTEX occurred immediately downgradient of the infiltration area and up to 10 feet away from the infiltration area. However, 15 feet downgradient of the infiltration area, this removal was not observed. Due to the elevated sorbed TPHg and BTEX concentrations in soils, the potential for disequilibrium exists. Therefore, it is recommended that additional groundwater treatment be performed to reduce groundwater hydrocarbon concentrations further from the excavation.

2.1 OBJECTIVES

The primary objectives of the proposed groundwater ISCO treatment are to reduce concentrations of TPHg and BTEX in groundwater.

2.2 INJECTION AND MONITORING WELL LOCATIONS

The excavation and down-gradient wells are shown on Figure 2. For the purposes of this work plan, it will be assumed that the wells that were impacted with TPHg and BTEX prior to the soil treatment will require treatment. The number and identity of wells requiring treatment may be revised based on pending groundwater data collected after the first two soil treatment injection events.

Injections will be performed at wells S-21A, S-22A and S-23, which are located adjacent to the excavation and at wells S-13, S-18, and S-20, which are downgradient of the excavation. Wells OW-1, S-9, S-14R, S-17, S-19, S-21B, and S-22B will be used as monitoring wells to evaluate the effectiveness of the ISCO treatment.

2.2.1 HEALTH AND SAFETY PLAN (HASP)

Pursuant to Occupational Safety and Health Administration (OSHA) and Shell requirements, CRA will prepare a HASP to protect site workers. The plan will be kept on site during field activities and will be reviewed and signed by each site worker. Air monitoring will be conducted using a photo-ionization detector (PID) during injection events. Appropriate personal protective equipment (PPE) will be used to ensure that the treatment chemicals do not come into contact with bare skin or the eyes during mixing or injection as it can produce irritation or burns. If frothing, bubbling, or steam production occurs as the oxidant solution is injected, injection will be slowed or halted until the reaction subsides and all risks are mitigated.

2.3 REAGENT INJECTION PROGRAM

The sodium persulfate dose to be used for groundwater ISCO treatment will be determined based on the evaluation of pending groundwater data collected after the two soil treatment injection events. However, for the purposes of this work plan the following program outline has been prepared.

Up to 600 gallons of 10 percent hydrogen peroxide (H_2O_2) mixed with 20 percent sodium persulfate will be injected into each well at each injection event. Mixing of the reagents will take place immediately prior to injection of the material. Injections will be performed by gravity feed or under slight pressure. The rate of injection is anticipated to be between 10 to 20 gallons per minute (gpm). If bubbling, frothing, or off-gassing is

observed, the rate will be slowed to reduce the reaction rate. If no frothing or bubbling is observed, the injection rate will be increased, if practical. Up to three injection events may be required; the number of injections will be based on the amount of oxidant required for treatment and field conditions. Based on CRA's experience at other sites and the usage rate of the chemicals, the optimum injection events would be spaced one month apart.

2.4 MONITORING

2.4.1 GROUNDWATER MONITORING

Groundwater monitoring will be conducted at injection wells S-13, S-18, S-20 S-21A, S-22A, and S-23 and at monitoring wells OW-1, S-9, S-14R, S-17, S-19, S-21B, and S-22B, prior to the oxidant injection, 1 week after the oxidant injection, and 1 month after the oxidant injection. Groundwater samples collected during these events will be analyzed for the following parameters/compounds:

- TPHg (EPA Method 8260B);
- BTEX (EPA Method 8260B);
- Sulfate (EPA Method 300 series);
- Total and Dissolved Metals;
    - Arsenic (As) (EPA Method 6000/7000 series);
    - Nickel (Ni) (EPA Method 6000/7000 series);
    - Chromium (Cr), Total (EPA Method 6000/7000 series);
    - Chromium VI (EPA Method 6000/7000 series);
- Dissolved Oxygen (DO) (field instrument);
- Oxygen Reduction Potential (ORP) (field instrument);
- Total Suspended Solids;
- Conductivity;
- Temperature; and
- Static water level.

2.4.1 SOIL VAPOR MONITORING

Three days after the completion of each injection event, all soil vapor probes will be sampled and analyzed for TPHg using EPA Method TO-2 Modified and for BTEX by EPA Method TO-14A Modified. The number of probes sampled and frequency of soil vapor sampling and analysis during the second injection event will be based upon the results of the first injection event.

2.5 HEALTH AND SAFETY MONITORING

Vapor and air monitoring will be conducted using a PID during injection events. Appropriate personal protective equipment (PPE) will be used to ensure that oxidant solutions do not come into contact with bare skin or the eyes, as they can produce burns. If frothing, bubbling, or steam production occurs as the oxidant is injected, the injection will be slowed or halted until the reaction subsides.

2.6 RESIDUALS MANAGEMENT

Any hydrogen peroxide or sodium persulfate not used during the activities described in this work plan will be disposed in accordance with applicable rules and regulations.

2.7 MONTHLY GROUNDWATER SAMPLING EVENTS

Groundwater sampling will be performed on a monthly basis beginning one month after the each injection event, and scheduled to occur just prior to each subsequent injection event. The monthly sampling events will continue for three months after the final injection. These sampling events will include purging and sampling of monitoring wells OW-1, S-8, S-9, S-12, S-13, S-14R, S-17, S-18, S-19, S-20, S-21A, S-21B, S-22A, S-22B, S-23 for the same parameters as the post-injection groundwater sampling event.

2.8 QUARTERLY GROUNDWATER MONITORING PLAN

Monitoring will take place at three, six, and nine months after the final injection event. DO, pH, ORP, sulfate, BTEX, and TPHg will be analyzed at each monitoring event. Since this corresponds with the existing quarterly monitoring program, all of the on-site wells will be analyzed for these parameters.

2.9 DATA EVALUATION AND REPORTING

Upon completion of the field injection, field and analytical data will be compiled and tabulated. The percent reduction of TPH as a result of the oxidation treatments will be calculated to assess the effectiveness of the tested oxidant. A report describing the tests conducted and the results obtained will be prepared and submitted to the ACHCSA following the final post-injection monitoring event and receipt of the analytical data. Periodic status updates will be provided in the ongoing quarterly groundwater monitoring reports for this site.

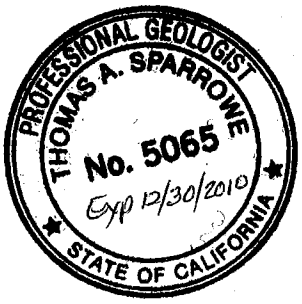
2.10 SCHEDULE OF ACTIVITIES

Pending work plan addendum approval, we are tentatively scheduling the initial application of the chemical oxidants to the injection wells from March 9 through 13, 2009, with a subsequent event the week of April 6 through 10, 2009. A report of findings for the ISCO activities will be prepared and submitted approximately 60 days following completion of the second post-remediation monitoring event.

All of Which is Respectfully Submitted,
CONESTOGA-ROVERS & ASSOCIATES

for: Aubrey K Cool
Sophia Dore

Thomas A. Sparrowe
Thomas A. Sparrowe, PG



FIGURES

11/10/08

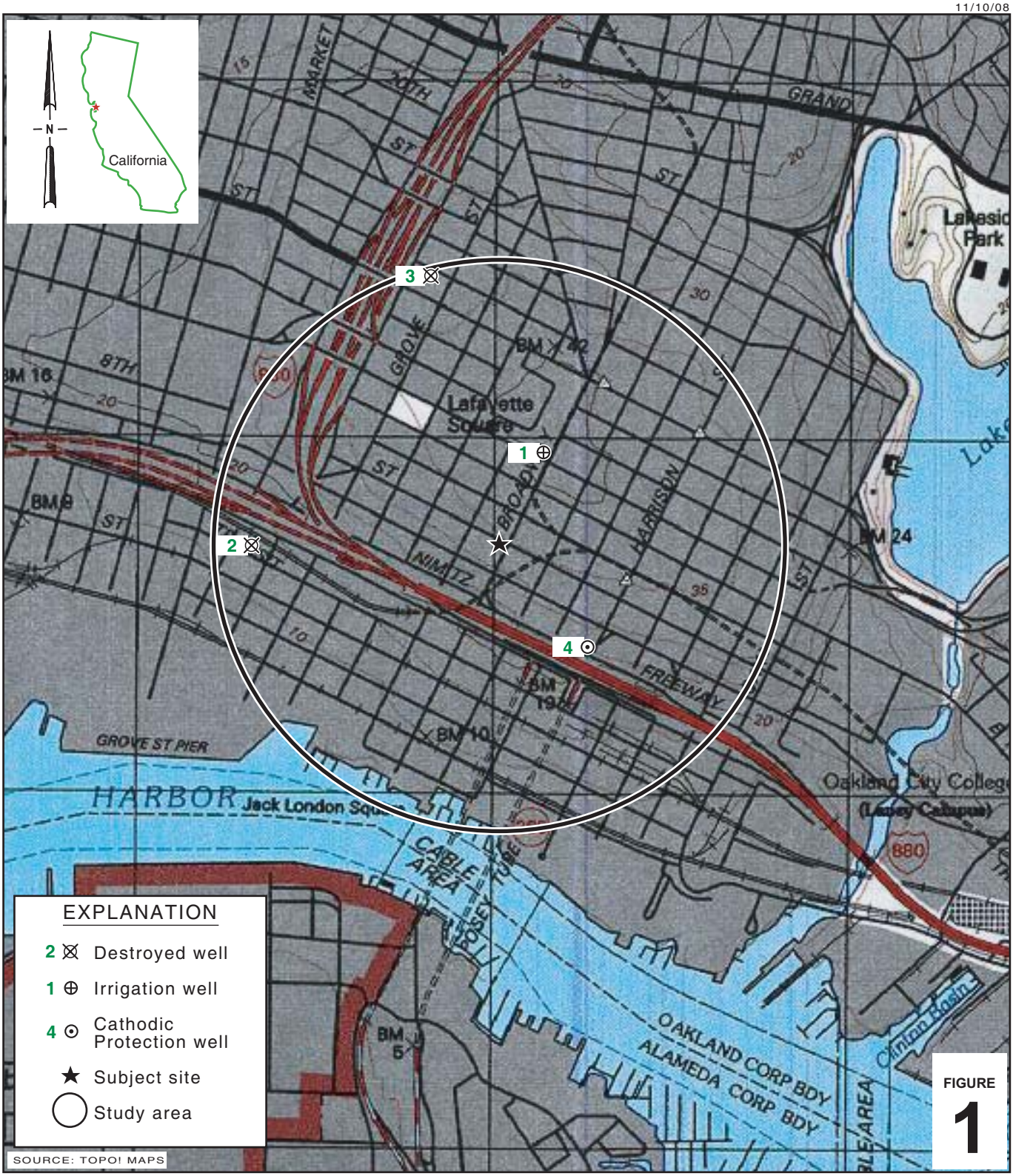


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FIGURE
1

0 1/8 1/4 1/2 1

SCALE (MILES)

Former Shell Service Station
461 8th Street
Oakland, California

CONESTOGA-ROVERS & ASSOCIATES

Vicinity Map

11/18/08

Site Plan

EXPLANATION

- B-28 — Soil boring location
- SVP-1 — Soil vapor probe location
- S-4 — Monitoring well location
- S-21B — Deeper monitoring well location
- OW-1 — Observation well location
- IP-1 — Injection point
- B-25/ VP-2 — Soil boring/vapor probe location
- S-1 — Destroyed well location
- STM — Storm drain line
- W — Water line
- SAN — Sanitary sewer line
- T — Telecommunications line
- G — Gas line
- E — Electrical line
- M.H. — Manhole
- C.B. — Catch basin
- FL = 16.50' — Flow line depth below ground surface

8TH STREET

7TH STREET

BROADWAY

Building

Building

Former Shell Station
461 8th St.

Former USTs

Former Fuel Lines

Former Dispenser Island (typ.)

Excavation Area

Driveway

Driveway

Driveway

Freight Elevator

S-1 S-10 S-8 S-23 S-16 IP-1 S-15 AS-1 S-21A IP-3 S-14 B-28 IP-2 S-12 OW-1 S-21B S-14R B-27/ VP-4 B-29 S-17 S-22B S-22A S-13 S-18 S-19 B-26/ VP-3 S-20 B-25/ VP-2 S-9 SVP-2 SVP-1 SVP-3 S-5 S-4 S-6

FL = 19.12'
FL = 17.59'
FL = 16.50'
FL = 13.12'
FL = 13.25'
FL = 13.80'
FL = 17.09'

0 20 40 80
Scale (ft)

N

FIGURE
2

Former Shell Service Station
461 8th Street
Oakland, California

CONESTOGA-ROVERS & ASSOCIATES

Base map modified from 6-25-08 Virgil Chavez Land Survey map.

I:\Shell\6-chars\2415--\241501-Oakland 461 8th\241501-FIGURES\241501 SITE PLAN.DWG