

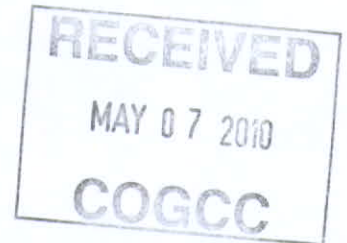


01577046



#3562

Kerr-McGee Oil & Gas Onshore LP
1099 18th Street, Suite 1800
Denver, Colorado 80202
720-929-6000 Fax 720-929-7000



May 6, 2010

Mr. Howard Urband
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, Colorado 80202-1129

RE: Remediation Injection Rule Authorization Application
HSR-Blank 15-5/HSR-Cabral 16-5
SWSE Sec. 5-T3N-R66W
Weld County, Colorado

Dear Mr. Urband:

Please find the enclosed Remediation Injection Rule Authorization Application for the above-referenced site for your review. If you have any questions or require additional information, feel free to contact me at 720-929-6726.

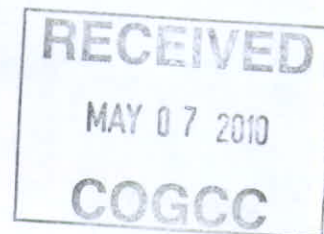
Sincerely,

Kerr-McGee Oil & Gas Onshore LP

Paul D. Schneider, P.G.
Senior Staff Environmental Analyst

Attachment

cc: Mr. Robert Chesson, Colorado Oil and Gas Conservation Commission ✓
Mr. Joe Wilkins, Green Valley Turf
Mr. Mike McKee, LT Environmental



**REMEDATION INJECTION RULE
AUTHORIZATION APPLICATION**

**KERR-MCGEE OIL & GAS ONSHORE LP
HSR BLANK 15-5 / HSR CABRAL 16-5 TANK BATTERY
SWSE 5-T3N-R66W
WELD COUNTY, COLORADO**

MAY 2010

Prepared for:

**U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 8
1595 Wynkoop Street
Denver, Colorado 80202-1129**

Prepared by:

**LT ENVIRONMENTAL, INC.
4600 West 60th Avenue
Arvada, Colorado 80003
(303) 433-9788**

UNDERGROUND INJECTION RULE AUTHORIZATION APPLICATION

KERR-MCGEE OIL & GAS ONSHORE LP
HSR BLANK 15-5 / HSR CABRAL 16-5 TANK BATTERY
SWSE 5-T3N-R66W
WELD COUNTY, COLORADO

May 2010

- 1. Property owner of facility including a physical and mailing address; phone and fax numbers.**

Mr. Joe Wilkins
Green Valley Turf
13159 North US HWY 85
Littleton, CO 80125
(303) 798-6764 phone

Kerr-McGee Oil and Gas Onshore LP (Kerr-McGee) owns and operates the facility. Mr. Wilkins owns the land where the facility is located.

- 2. Operator of facility including a physical and mailing address; phone and fax numbers.**

Kerr-McGee Oil & Gas Onshore LP
1099 18th Street, Suite 1800
Denver, Colorado 80202
(720) 929-6726 phone
(720) 929-7726 fax
Contact: Mr. Paul Schneider

- 3. Responsible party for the operation, maintenance, and closure of the injection system including a physical and mailing address and phone number.**

LT Environmental, Inc. (LTE)
4600 West 60th Avenue
Arvada, Colorado 80003
(303) 433-9788 phone
(303) 433-1432 fax
Contact: Mr. Mike McKee or Mr. John Cocroft

4. **Contact persons representing any other regulatory agencies that have an interest in the site; include a physical and mailing address and phone number.**

Mr. Bob Chesson
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, Colorado 80203
(303) 894-2100 phone
(303) 894-2109 fax

5. **Briefly outline the type of contamination and when it occurred.**

Petroleum-impacted groundwater and soil resulted from a subsurface release of produced water from the tank battery's subsurface water sump. The volume of produced water released is unknown. The release was discovered at the site in 2005.

6. **Map of the site location (1:24,000 topographic map or similar)**

See attached Figure 1.

7. **Analysis of groundwater from the receiving formation (up gradient from the contamination) and from the contaminated formation (near the source) include tabular data and a map of the contamination plume with the local groundwater flow direction shown.**

Groundwater analytical results are provided in Table 1. The monitoring well locations, aerial extent of the contaminant plume and groundwater flow direction are depicted in Figure 2.

8. **Analysis of contaminants. Include BTEX and MTBE if fuel spill related.**

BTEX concentrations in site groundwater are presented in Table 1. MTBE is not a potential contaminant because this was an unrefined product release.

9. **Type of proposed injection well. (example: water well, trench, injection gallery, etc.)**

Each injection point will be completed using 1.25-inch outside-diameter (OD) steel rods, driven to depth by a direct-push rig. A steel injection/drive point is used to install the injectate. Once breakthrough is achieved, the pressure of the injection will generally range between approximately 200 and 400 pounds per square inch (psi). After placing the injectate, the rods will be pulled and each 1.25-inch injection hole will be plugged with bentonite and hydrated. The

proposed injection area is shown on Figure 3. A summary of the injection plan is presented on Table 2.

10. Analysis of the proposed injectate.

The injectate is prepared by mixing BOS-200® and cultured bacteria with fresh water. BOS-200® is manufactured by Remediation Products Inc. and is designed for in-situ remediation of petroleum hydrocarbons under anaerobic conditions. The mechanism for degradation of the contaminants is sulfate reduction and the mixed slurry has the following approximate composition:

<u>Ingredient</u>	<u>Composition</u>
Activated carbon	7.1 weight percent (wt %)
Micro-nutrients	0.35 wt %
Gypsum	1.8 wt %
Water	90.75 wt %
*Bacteria	6.4×10^7 Colony-Forming Units per gram of carbon

*Bacteria - Commercial products vary over a considerable range and the amount added will depend on the source and whether it is a dry product or a liquid concentrate. Regardless of source, a sufficient amount of bacteria is added so that a targeted slurry concentration of 5 to 10 million colony-forming units per milliliter is attained.

A Material Data Safety Sheet for the above materials including bacteria and activated carbon is provided in Attachment 1.

11. Hydrogeologic description, location, depth, and current use (if any) of the receiving formations. Include hydrological studies if available.

The site is bounded to the west by land zoned for agricultural use. Wetlands are present to the north, east, and south of the site. The depth to the observed water table at various locations across the site is approximately 0.5 to 3 feet below ground surface (bgs). The general direction of groundwater flow at the site is to the northwest. Soils identified at the site are predominantly organic silt from ground surface to approximately 2 feet bgs and poorly-graded fine grain sand from 2 to 12 feet bgs.

12. Location of existing monitoring wells (if any) and the location of proposed monitoring wells.

See Figure 2 for existing monitoring well locations. The aerial extent of the dissolved phase petroleum hydrocarbon plume has been defined and point of compliance (POC) wells have been established. Additional monitoring wells will not be installed as part of the injection program.

- 13. Explain how the proposed monitoring system will be able to track contaminant migration and how the proposed remediation system will minimize further migration.**

Further plume migration will be minimized by initiating injections at the perimeter of the dissolved plume (impacts remain in only one monitoring well) and working inward toward the source area. It is estimated that less than 10% of the impacted groundwater pore space volume will receive the injectate. The proposed corrective action will be conducted in the area demonstrating the highest groundwater hydrocarbon concentration as a barrier for off site hydrocarbon migration. As a result, plume reduction should begin to occur within a short period of time, mitigating any potential for further plume migration. Existing monitoring wells will be sampled quarterly to track remediation progress.

- 14. If injection is into an alluvial aquifer, provide locations of surface water bodies, i.e. rivers, streams, and lakes, within one mile of injection site (may substitute topographic map).**

A topographic map of the area around the site is provided as Figure 1. The Evans Number 2 Ditch and Platte Valley Canal are located approximately $\frac{1}{4}$ mile to the south and approximately $\frac{1}{2}$ mile to the east of the site. A small unnamed irrigation ditch is present approximately $\frac{1}{4}$ mile to the north, and three unnamed small ponds are present approximately $\frac{3}{4}$ mile to the northeast.

- 15. Provide location and description of any drinking water wells within $\frac{1}{4}$ mile that may be impacted by the proposed injection.**

According to the Colorado Division of Water Resources' water well database, there are five drinking water wells located within $\frac{1}{4}$ mile of the site. The locations and details for these wells are summarized on Table 3. It is not anticipated that the proposed injection activities will impact these wells due to their distances from the injection area and because the wells are located hydraulically upgradient of the site.

- 16. Description of the remediation system including operational procedures.**

Remediation Design

The environment within hydrocarbon plumes is not normally found to contain much more than trace amounts of dissolved oxygen and anaerobic conditions are prevalent at most sites. Other in-situ technologies rely on aerobic microcosms for contaminant reductions and use chemical or mechanical methods to deliver oxygen into an affected formation. This creates an artificial state that is inconsistent with the natural conditions that support indigenous bacteria. An

alternative approach is to take advantage of the natural conditions and promote an anaerobic mechanism for cleanup.

The proposed corrective action plan for the site will take advantage of existing conditions. LTE's approach is designed to promote anaerobic oxidation of hydrocarbons through a sulfate-reduction mechanism. BOS-200® is a blend of selected nutrients, a cultured mix of bacteria (symbiotic facultative microbes) that are known hydrocarbon degraders, gypsum, activated carbon, and iron to eliminate the reduction byproduct sulfide. The above materials are mixed with fresh water for a short period of time to allow the bacteria to adsorb on to the carbon prior to injection. The "carbon microcosm" is then pre-inhabited by bacteria tailored for rapid assimilation and anaerobic oxidation of hydrocarbons.

The BOS-200® slurry is injected into the formation causing outward flow from the injection point along thin fractures or fissures that are typically oriented horizontally with respect to the ground surface. Once a fracture is initiated, fluid will always follow along the path of least resistance. As a result, it is difficult, if not impossible, to control how fissures propagate throughout the formation. However, experience has demonstrated that these seams tend to extend out horizontally (typically in a radial fashion) away from the injection point, then tend to migrate vertically toward the ground surface. So, if enough fluid is pumped into the ground, it may eventually break through to the ground surface. The seams can take on a variety of shapes, from irregular pancakes to thin fingers emanating from the injection point in every direction.

The objective of LTE's injection program is to create a three-dimensional network of material interlaced throughout the affected formation, such that it is unlikely that a significant volume of contaminants will move through the installation without contacting activated carbon. Injection points will be located on ten foot centers laid out in a triangular grid pattern. Targeted injection depths will be staggered to maximize the vertical distribution of the injectate. This will ensure aerial overlap and create vertical seams of injectate separated by no more than a few feet.

Once installed, BOS-200® rapidly reduces contaminant concentrations in soil and groundwater as hydrocarbon molecules are removed from these media via adsorption into the activated carbon. The adsorbed hydrocarbons are co-located with bacteria in the activated carbon pore network. As a result, the hydrocarbon contaminant concentration within the carbon matrix is substantially higher than that which existed in the soil or groundwater prior to treatment. Rates of degradation within the carbon matrix will be significantly faster than rates commonly observed using conventional in-situ bioremediation technology due to this concentration effect. As adsorbed contaminants are degraded, active sites within the carbon become available to adsorb fresh contaminant, and the cycle is repeated until the microcosm runs out of food (i.e., petroleum hydrocarbons). At

the same time, gypsum present in the formulation provides a continuous source of sulfate to support the degradation process.

Equipment

Injection trailer includes:

Gasoline driven motor, medium-pressure, injection pump (1,200 pounds per square inch [psi]);

Various centrifugal transfer pumps;

Mixers;

Polyethylene mixing tanks (300 to 750 gallon); and

High-pressure injection hose.

Hydraulically-powered, track-mounted, direct-push rig, including all the ancillary tooling, push rod, expendable points, and injection heads needed for normal operation.

The injection trailer is equipped with a positive-displacement pump capable of delivering up to 40 gallons per minute at a pressure in excess of 2000+ psi. Process tanks located on the trailer include two 330-gallon slurry-mixing tanks or one 750-gallon slurry-mixing tank. Pump suction is directly connected to the slurry-mixing tank, and fresh water is transferred to this tank from the frac-tank using a gas driven, high-volume centrifugal pump.

Operational Procedure

A volume of water is transferred into the slurry-mixing tank, a measured amount of BOS-200® is slowly added to the tank, and the mixer is started. A sufficient amount of cultured bacteria is added so that a targeted slurry concentration of 5 to 10 million colony-forming units per milliliter is obtained. It is recommended that mixing be continued for approximately 10 minutes when the slurry is first prepared. This allows the carbon to become impregnated with bacteria before injection, giving the cultured microbes an advantage over indigenous microbes.

A small diameter (1.25-inch OD) push rod is driven to the targeted depth, and an injection head is threaded securely onto the rod. The injection head is configured with a valve and quick-connect coupling to facilitate rapid connection to the injection pump discharge hose. Once the slurry is mixed, the pump is engaged, the injection head valve is opened, and the discharge line is pressured up. The injection rod is then pulled up slightly to shed the expendable point. Pressure is allowed to build until a fracture or fissure is created in the formation and slurry begins to flow out into the formation. The fracture or fissure propagates outward from the point of the injection as additional slurry is pumped into the injection rod.

After injection of the slurry batch, fresh water is transferred into the slurry tank, mixed and then injected to flush the system of residual product. The pump is subsequently disengaged, and the injection-head valve is closed. A fresh batch of slurry is then prepared, a new injection rod is installed, and the process is repeated.

After slurry is injected into the formation, back-pressure is present that dissipates over a period of time. Therefore, the injection rod is not immediately removed after the injection of slurry. Instead, the injection rods remain in the ground until the transient pressure dissipates. Residual pressure in the formation is checked by opening the injection head valve. Once residual pressure has dissipated, the rods are safely removed, and the borehole is sealed with hydrated bentonite.

17. If injectate is treated water, is it expected to meet current drinking water standards? If not, what exceedences are expected?

The injectate water will be obtained from a potable water source.

18. Describe effect of injectate on groundwater: reaction products or by-products that are anticipated.

The design radius of influence of the injectate is five feet per injection point. The injectate footprint will not extend more than five feet beyond the contaminant plume. Within this treated volume, total dissolved solids, conductivity, sulfate, ammonia, and nitrate will likely exceed background levels, at least initially. As the clean-up progresses, these parameters are expected to slowly return to background levels. A low, but persistent level of sulfate is expected for a period of approximately two or three years due to the injection of gypsum. The solubility of gypsum is low and the average groundwater sulfate concentration is not expected to exceed the Colorado groundwater standard of 250 parts per million (ppm). The gypsum product used in the formulation is principally marketed to the agricultural industry for use as a soil conditioner and plant-growth stimulant.

Byproducts of the anaerobic degradation process include water, carbon dioxide, a variety of light alkane fermentation products such as methane, and sulfide from the reduction of available sulfate. The product is designed to scavenge for sulfide, locking it up into insoluble, non-toxic precipitates. The principal precipitate is expected to be iron sulfide. Consequently, dissolved sulfide is expected to be maintained at a level orders of magnitude below the applicable standard.

19. Bench scale-testing results if available.

A bench scale-test will not be performed.

20. A specific closure plan for the removal, closure, or plugging of the injections system, including an estimate of closing costs.

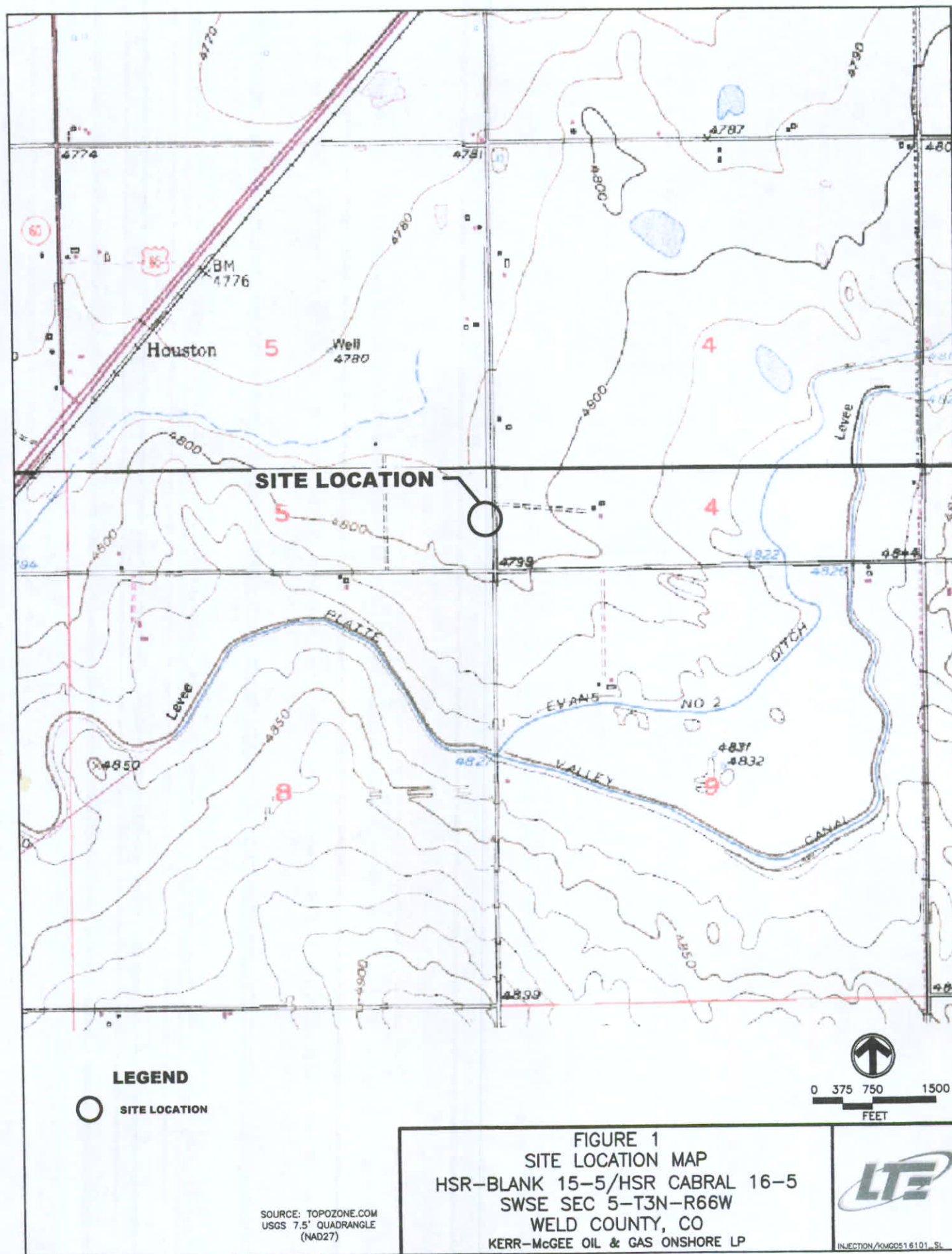
All monitoring and injection holes will be closed following state guidelines.

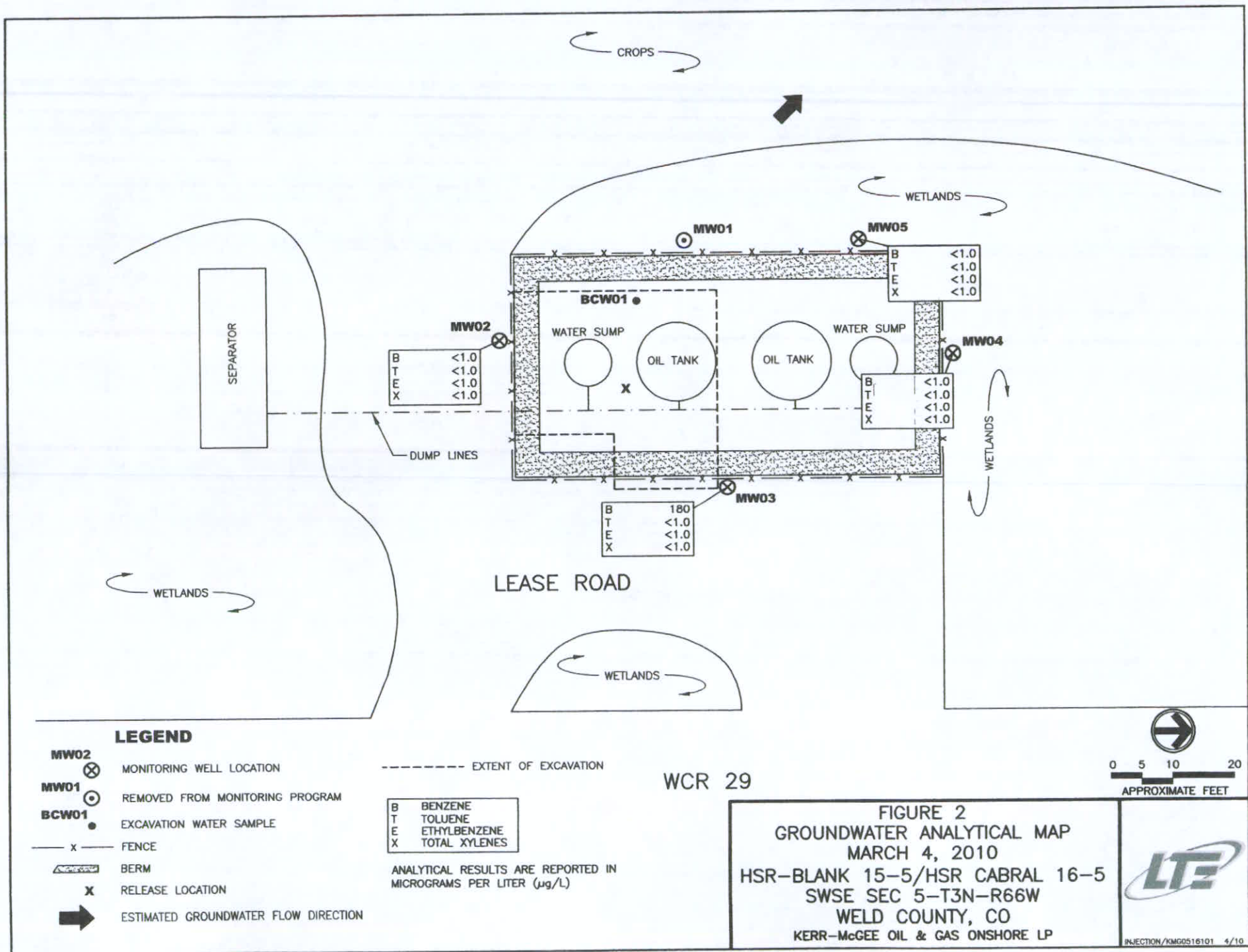
21. An executive summary of the approved Corrective Action Plan.

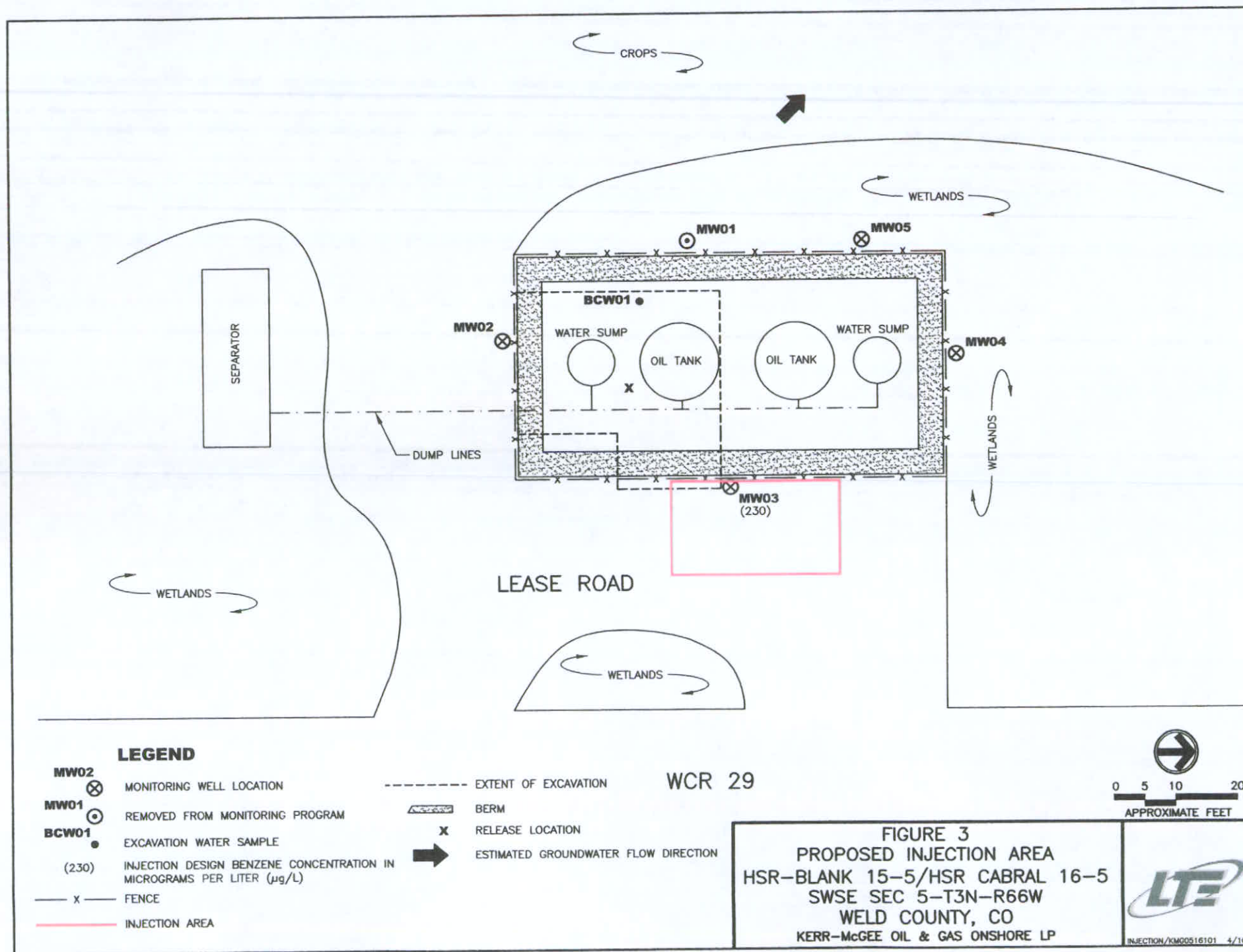
Following discovery of a subsurface petroleum hydrocarbon release in 2005, excavation of the source area was performed to Colorado Oil and Gas Conservation Commission (COGCC) standards. A network of five groundwater monitoring wells was installed to delineate the extent of the dissolved phase plume and perform monitored natural attenuation (MNA). Analytical reports indicate a persistent residual petroleum hydrocarbon impact to groundwater that exceeds the Colorado Groundwater Quality Standards (CGWQS). Concentrations of benzene at monitoring well MW03 range from 230 micrograms per liter (ug/L) (as sampled in September 2009) to 180 ug/L as of the most recent quarterly groundwater monitoring event conducted in March 2010. Please note that the remedial design is based upon the highest observed benzene concentration within the past year (230 ug/L). Per the COGCC rules, hydrocarbon impacts must be remediated to meet the CGWQS for benzene of 5.0 ug/L in groundwater. The remedial option selected for the site is injection of a sulfate-reducing slurry (BOS-200[®]) designed to remove petroleum hydrocarbons from impacted media.

22. Estimate the time period required to complete the task covered in this Rule authorization request.

It is estimated that all of the injection activities will be completed in approximately two days.







TABLES



**TABLE 1
GROUNDWATER ANALYTICAL AND FIELD RESULTS**

HSR-BLANK 15-5/ HSR-CABRAL 16-5

WELD COUNTY, COLORADO

KERR-McGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth to GW (ft bgs)	Relative GW Elev. (ft)
BCW01	08/04/2005	1700	4000	500	10800	NM	NA
MW01	09/29/2005	<1.0	<1.0	<1.0	<2.0	1.05	NA
	12/13/2005	<1.0	<1.0	<1.0	<2.0	1.05	NA
	03/28/2006	<1.0	<1.0	<1.0	<1.0	1.00	NA
	06/16/2006	<1.0	<1.0	<1.0	<1.0	2.36	NA
	09/21/2006	<1.0	<1.0	<1.0	<1.0	1.55	NA
	12/27/2006	<1.0	<1.0	<1.0	<1.0	.55	NA
	03/12/2007	<1.0	<1.0	<1.0	<1.0	.45	NA
	06/14/2007	<1.0	<1.0	<1.0	<1.0	1.50	NA
	09/11/2007	<1.0	<1.0	<1.0	<1.0	1.80	NA
	12/10/2007	<1.0	<1.0	<1.0	<1.0	.15	NA
	03/06/2008	<1.0	<1.0	<1.0	<1.0	1.08	NA
	06/10/2008	<1.0	<1.0	<1.0	<1.0	1.54	NA
	09/15/2008	<1.0	<1.0	<1.0	<1.0	.70	NA
	12/11/2008	<1.0	<1.0	<1.0	<1.0	.69	NA
	03/04/2009	<1.0	<1.0	<1.0	<1.0	1.30	NA
	06/01/2009	<1.0	<1.0	<1.0	<1.0	1.23	NA
	09/21/2009	Removed from monitoring				NM	NA
MW02	09/29/2005	40	<1.0	270	330	2.10	NA
	12/13/2005	<1.0	<1.0	<1.0	<2.0	1.60	NA
	03/28/2006	<1.0	<1.0	<1.0	<1.0	1.58	NA
	06/16/2006	2.3	<1.0	<1.0	<1.0	2.90	NA
	09/21/2006	<1.0	<1.0	<1.0	<1.0	2.06	NA
	12/27/2006	<1.0	<1.0	<1.0	<1.0	1.06	NA
	03/12/2007	<1.0	<1.0	<1.0	<1.0	.98	NA
	06/14/2007	1.1	<1.0	1.5	<1.0	2.20	NA
	09/11/2007	<1.0	<1.0	<1.0	<1.0	2.20	NA
	12/10/2007	<1.0	<1.0	<1.0	<1.0	.00	NA
	03/06/2008	<1.0	<1.0	<1.0	<1.0	1.70	NA
	06/10/2008	<1.0	<1.0	<1.0	<1.0	2.16	NA
	09/15/2008	<1.0	<1.0	<1.0	<1.0	1.21	NA
	12/11/2008	<1.0	<1.0	<1.0	<1.0	1.23	NA
	03/04/2009	<1.0	<1.0	<1.0	<1.0	1.75	NA
	06/01/2009	<1.0	<1.0	<1.0	<1.0	1.94	NA
	09/21/2009	<1.0	<1.0	<1.0	<1.0	1.90	NA



TABLE 1 (Continued)
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-BLANK 15-5/ HSR-CABRAL 16-5
WELD COUNTY, COLORADO
KERR-McGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth to GW (ft bgs)	Relative GW Elev. (ft)
MW02	12/04/2009	<1.0	<1.0	<1.0	<1.0	.94	NA
	03/04/2010	<1.0	<1.0	<1.0	<1.0	.96	NA
MW03	09/29/2005	260	<1.0	94	960	2.30	NA
	12/13/2005	64	<1.0	6.0	220	1.90	NA
	03/28/2006	70	<1.0	<1.0	59	1.90	NA
	06/16/2006	16	<1.0	<1.0	3.6	3.56	NA
	09/21/2006	2.4	<1.0	<1.0	<1.0	2.49	NA
	12/27/2006	30	<1.0	1.1	5.8	1.49	NA
	03/12/2007	610	<1.0	<1.0	22	1.60	NA
	04/10/2007	410	<1.0	<1.0	5.4	1.83	NA
	06/14/2007	120	<1.0	<1.0	<1.0	3.00	NA
	09/11/2007	190	<1.0	8.7	36	3.10	NA
	12/10/2007	5.1	<1.0	<1.0	<1.0	1.00	NA
	03/06/2008	<1.0	<1.0	3.8	160	2.49	NA
	06/10/2008	160	<1.0	<1.0	<1.0	2.85	NA
	09/15/2008	310	<1.0	<1.0	200	2.53	NA
	12/11/2008	16	<1.0	12	<1.0	2.39	NA
	03/04/2009	<1.0	<1.0	<1.0	<1.0	2.51	NA
	06/01/2009	230	<1.0	4.4	30	2.96	NA
	09/21/2009	<1.0	<1.0	<1.0	<1.0	2.95	NA
	12/04/2009	28	<1.0	<1.0	<1.0	2.48	NA
	03/04/2010	180	<1.0	<1.0	<1.0	2.08	NA
MW04	04/24/2006	<1.0	<1.0	<1.0	<1.0	2.50	NA
	06/16/2006	<1.0	<1.0	<1.0	<1.0	2.80	NA
	09/21/2006	<1.0	<1.0	<1.0	<1.0	2.00	NA
	12/27/2006	<1.0	<1.0	<1.0	<1.0	1.00	NA
	03/12/2007	<1.0	<1.0	<1.0	<1.0	1.05	NA
	06/14/2007	<1.0	<1.0	<1.0	<1.0	2.00	NA
	09/11/2007	<1.0	<1.0	<1.0	<1.0	2.18	NA
	12/10/2007	<1.0	<1.0	<1.0	<1.0	1.38	NA
	03/06/2008	<1.0	<1.0	<1.0	<1.0	1.35	NA
	06/10/2008	<1.0	<1.0	<1.0	<1.0	1.81	NA
	09/15/2008	<1.0	<1.0	<1.0	<1.0	1.08	NA
	12/11/2008	<1.0	<1.0	<1.0	<1.0	1.16	NA
	03/04/2009	<1.0	<1.0	<1.0	<1.0	1.54	NA



TABLE 1 (Continued)
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-BLANK 15-5/ HSR-CABRAL 16-5
WELD COUNTY, COLORADO
KERR-McGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth to GW (ft bgs)	Relative GW Elev. (ft)
MW04	06/01/2009	<1.0	<1.0	<1.0	<1.0	1.70	NA
	09/21/2009	<1.0	<1.0	<1.0	<1.0	1.86	NA
	12/04/2009	<1.0	<1.0	<1.0	<1.0	2.21	NA
	03/04/2010	<1.0	<1.0	<1.0	<1.0	1.02	NA
MW05	04/24/2006	<1.0	<1.0	<1.0	<1.0	.75	NA
	06/16/2006	<1.0	<1.0	<1.0	<1.0	1.90	NA
	09/21/2006	<1.0	<1.0	<1.0	<1.0	1.15	NA
	12/27/2006	<1.0	<1.0	<1.0	<1.0	.15	NA
	03/12/2007	<1.0	<1.0	<1.0	<1.0	.42	NA
	06/14/2007	<1.0	<1.0	<1.0	<1.0	1.93	NA
	09/11/2007	<1.0	<1.0	<1.0	<1.0	1.24	NA
	12/10/2007	<1.0	<1.0	<1.0	<1.0	.04	NA
	03/06/2008	<1.0	<1.0	<1.0	<1.0	.52	NA
	06/10/2008	<1.0	<1.0	<1.0	<1.0	.98	NA
	09/15/2008	<1.0	<1.0	<1.0	<1.0	.60	NA
	12/11/2008	<1.0	<1.0	<1.0	<1.0	.62	NA
	03/04/2009	<1.0	<1.0	<1.0	<1.0	.90	NA
	06/01/2009	<1.0	<1.0	<1.0	<1.0	1.04	NA
	09/21/2009	<1.0	2.2	<1.0	<1.0	1.03	NA
	12/04/2009	<1.0	<1.0	<1.0	<1.0	1.42	NA
	03/04/2010	<1.0	<1.0	<1.0	<1.0	.59	NA
Colo GW Quality Standards		5	1000	700	1400		

Notes: < - less than
ug/L - micrograms per Liter
NA - Not Analyzed/Not Available

GW - Groundwater Elev. - Elevation
Bold numbers indicate result equaled or exceeded standard.
NM - Not Measured ft bgs - feet below ground surface



TABLE 2
PROPOSED INJECTION PLAN
HSR BLANK 15-5 / HSR CABRAL 16-5
WELD COUNTY, COLORADO

INJECTION POINT ID	INJECTION DEPTH INTERVALS	POUNDS BOS-200® PER INTERVAL	TOTAL NUMBER OF INJECTION INTERVALS	BACTERIA ADDITIVE PER INTERVAL (mL)	TOTAL POUNDS BOS-200®	TOTAL SLURRY VOLUME (GALLONS)
HSR1	2' & 4'	10	2	200	20	80
HSR2	3' & 5'	10	2	200	20	80
HSR3	2' & 4'	10	2	200	20	80
HSR4	3' & 5'	10	2	200	20	80
HSR5	2' & 4'	10	2	200	20	80
HSR6	3' & 5'	10	2	200	20	80
TOTALS:			12	2,400	120	480

TABLE 3
WATER WELL DETAILS WITHIN 1/4 MILE OF SITE
HSR BLANK 15-5 / HSR CABRAL 16-5
WELD COUNTY, COLORADO

WELL PERMIT NUMBER	DISTANCE FROM INJECTION SITE (FEET)	DIRECTION FROM INJECTION SITE	DESIGNATED USE	WELL DEPTH	OWNER'S NAME	X-COORDINATE	Y-COORDINATE
183821_A	1205	NORTH-NORTHEAST	DOMESTIC	57'	KERN, WILLIAM	517741.0	4455706.9
94163_VE	1205	NORTH-NORTHEAST	DOMESTIC / STOCK	57'	KERN, WILLIAM	517741.0	4455706.9
18759	772	EAST	DOMESTIC	50'	GABEL, TODD	517908.9	4455339.0
31357	1265	SOUTHEAST	DOMESTIC	50'	BACKSTROM, THEODORE	517954.2	4455081.4
260984	1330	NORTHEAST	STOCK	60'	GABEL, TODD	518043.8	4455511.0

ATTACHMENT 1
MATERIAL SAFETY DATA SHEETS



Material Safety Data Sheet

Trap & Treat® BOS 200®



Section I

Manufacturer's Name <i>Remediation Products Inc.</i>	Emergency Telephone Number <i>303.487.1000</i>
Address (Number, Street, City, State, and ZIP Code) <i>6390 Joyce Drive, Suite 150 W, Golden, CO 80403</i>	Telephone Number for Information <i>303-487-1000</i>
Prepared by <i>T. Mecum</i>	Date Prepared <i>12/2/02</i>
	Signature of Preparer (optional)

Section II - Hazard Ingredients/Identity Information

Non-hazardous components are listed at 3 percent (%) or greater. This is not intended to be a complete compositional disclosure.

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	%(optional)
Carbon	5mg/M ³ (respirable)	10mg/M ³ (Total)	N/A	77
Calcium Sulfate (Gypsum)	"	"	N/A	19
N/A = Not Applicable PELs and TLVs are 8-hour TWAs unless otherwise noted.				

Section III - Physical/Chemical Characteristics

Boiling Point	N/A	Specific Gravity (H ₂ O = 1)	2.33 g/cc real density
Vapor Pressure (mm Hg.)	N/A	Melting Point	Decomposes at 1450°C
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A
Solubility in Water: Negligible			
Appearance and Odor: Black powder. No odor.			

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used) Not combustible	Flammable Limits	LEL N/A	UEL N/A
Extinguishing Media Flood with plenty of water			
Special Fire Fighting Procedures None			
Unusual Fire and Explosion Hazards Contact with strong oxidizer, such as ozone, liquid oxygen, chlorine, permanganate, etc., may result in fire.			
NFPA Rating: Health=0; Reactivity=0; Flammability=1			

Section V - Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility (<i>Materials to Avoid</i>)			
Strong oxidizers, such as ozone, liquid oxygen, chlorine, permanganate, etc., and acids.			
Hazardous Decomposition	May Occur	X	Conditions to Avoid Above 1450° - SO ₂ & CaO
	Will Not Occur		

Section VI - Health Hazard Data

Route(s) of Entry:	Inhalation? Yes	Skin? Yes	Ingestion? Yes
Health Hazards (<i>Acute and Chronic</i>)			
<p>The effects of long-term, low-level exposures to carbon have not been determined. Safe handling of this material on a long-term basis should emphasize the avoidance of all effects from repetitive acute exposures.</p> <p>Persons subjected to excessive dust will be forced to leave area because of nuisance; i.e., coughing, sneezing and nasal irritation.</p> <p>CAUTION!!! This material, when wet, removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state, and federal regulations.</p>			
Carcinogenicity:	NTP?	IARC Monographs?	OSHA Regulated?
	N/A	N/A	No
Signs and Symptoms of Exposure			
<p>Effects and Hazards of Eye Contact: The physical nature of this product may produce eye irritation, if exposed to dusting conditions without protective eye equipment.</p> <p>Effects and Hazards of Skin Contact: The product is not a primary skin irritant. The primary skin irritation (Rabbit) is 0.</p> <p>Effects and Hazards of Inhalation Breathing): This product is practically non-toxic through inhalation. The acute inhalation LD₅₀ (Rat) is >6.4 mg/l (nominal concentration). Could cause irritation to respiratory passages, if exposed to dusting conditions without protective respiratory equipment.</p> <p>Effects and Hazards of Ingestion (Swallowing): Material is non-toxic through ingestion. The acute oral LD₅₀ (Rat) is >10g/kg.</p>			
Medical Conditions Generally Aggravated by Exposure			
N/A			
Emergency and First Aid Procedures			
<p><u>Eyes:</u> Flush with plenty of water for at least 15 minutes. Call physician if irritation continues.</p> <p><u>Skin:</u> Wash with soap and water.</p> <p><u>Inhalation:</u> Move to fresh air.</p> <p><u>Ingestion:</u> N/A</p>			

Section VII - Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
Sweep or vacuum material from spillages into a waste container for disposal or repackage. Avoid dusting conditions.
Waste Disposal Method
Dispose of unused product in waste container. Dispose of in accordance with local, state, and federal or national regulations.
Precautions to Be Taken in Handling and Storing
CAUTION!!! This product, when wet, removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state, and federal or national regulations. Be sure proper ventilation and respiratory and eye protection are used under dusting conditions.
Other Precautions
Wash thoroughly after handling. Exercise caution in the storage and handling of all chemical substances.

Section VIII - Control Measures

Respiratory Protection (<i>Specify Type</i>)		
Carbon-A NIOSH-approved particulate filter respirator is recommended, if excessive dust is generated.		
Ventilation	Local Exhaust Recommended, when used indoors or in confined spaces	Special Not Required
	Mechanical (<i>General</i>) Recommended, when used indoors or in confined spaces	Other Not required
Protective Gloves Recommended	Eye Protection Safety glasses or goggles recommended	
Other Protective Clothing or Equipment Not required		
Work/Hygienic Practices Use of Tyvek® or Nomex® suits is suggested to protect skin from becoming excessively dirty and clothing from being ruined by contact with product.		

Material Safety Data Sheet

Trap & Treat® Bacteria Concentrate



REMEDIATION PRODUCTS, INC.

Manufacturer's Name: <i>Advanced Microbial Services, Inc.</i> (Distributed by Remediation Products Inc., 6390 Joyce Drive, Suite 150 West, Golden, CO 80403)	Emergency Telephone Number 1-800-984-9961
Address (Number, Street, City, State, and ZIP Code) 5738 S. 116 th West Avenue, Sand Springs, OK 74063	Telephone Number for Information 918-246-9733
Prepared by: <i>Advanced Microbial Services, Inc./Remediation Products Inc.</i>	Date Prepared 9/30/03

Section 1 – Product Identification

Trade Name	Description	NFPA 704M/HMIS Rating
AM-101	A blend of liquid naturally occurring bacteria and fungi.	Health=1; Flammability=0; Reactivity=0; Other=0

Section 2 – Hazardous Ingredients

Our hazard evaluation of the ingredient(s) under OSHA's Hazard Communication Rule, 29 CFR.1910.1200 has found none of the ingredient(s) hazardous.

Section 3 – Precautionary Label Information

CAUTION: May cause irritation to skin and eyes. Avoid contact with eyes. Avoid prolonged or repeated contact with skin. Do not take internally.

Empty containers may contain residual product. Do not reuse container unless properly reconditioned.

Section 4 – First Aid Information

Eyes:	Flush with water for 15 minutes. Call a physician.
Skin:	Wash thoroughly with soap and rinse with water. Call a physician.
Ingestion:	Do not induce vomiting. Give water. Call a physician.
Inhalation:	Remove to fresh air. Treat symptoms. Call a physician.
Note to Physician:	No specific antidote is known. Based on the individual reactions of the Patient, the physician's judgment should be used to control symptoms and clinical condition. Caution: If unconscious, having trouble breathing or in convulsions, do not induce vomiting or give water.

Section 5 – Health Effects Information

Primary Route(s) of Exposure:	Eye, skin
Eye Contact:	May cause irritation with prolonged contact.
Skin Contact:	May cause irritation with prolonged contact. Can cause allergic contact dermatitis in susceptible individuals.
Ingestion:	Can cause nausea and diarrhea.
Inhalation:	Can cause an allergic reaction in susceptible individuals.
Symptoms of Exposure:	A review of available data does not identify any worsening or existing conditions.

Section 6 – Toxicology Information

Acute Toxicity Studies: No toxicity studies have been conducted on this product.

Section 7 – Physical and Chemical Properties.

Color:	Tan to flesh colored.
Solubility:	Extremely soluble.
Form:	Liquid
Flash Point:	None
Odor:	Sour Milk

Section 8 – Fire and Explosion Information

Flash Point:	None
Extinguisher Media:	Not applicable

Section 9 – Reactivity Information

Incompatibility:	None known
Storage:	Storage temperature should be between 40 and 70 degrees F.
Thermal Decomposition Products:	In the event of combustion, CO and CO ₂ may be formed. Do not breathe smoke or fumes. Wear suitable protective equipment.

Section 10 – Personal Protective Equipment

Respiratory Protection	If it is possible to generate dust, wear a NIOSH approved or equivalent dust respirator, (see ANSI Z 88.2, 1980 for requirements and selection).
Protective Gloves:	Use of protective gloves, impermeable preferred (see ANSI Z87.1 for requirements.).
Protective Glasses:	Use chemical splash goggles (see ANSI Z 87.1 for requirements).
Protective Clothing:	Wear Tyvek® or Nomex® suits is recommended to protect skin and clothing from contamination. If clothing becomes contaminated, remove and thoroughly wash the affected area. Launder clothing before reuse.

Section 11 – Spill and Disposal Information

Solid Spills:	Sweep or vacuum up and reclaim into recovery container for disposal. Wear the protective equipment specified in Section 10. Refer to CERCLA in Section 14.
Disposal:	If this product becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recover Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, (i.e., D001 through D017) nor is it listed under Subpart D.

As a non-hazardous solid waste, the product can be disposed of in an industrial waste landfill in accordance with local, state and federal regulations.

Section 12 – Environmental Information

The following regulations apply to this product:

Federal Regulations:	<p>OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200: Based on hazard evaluation, this product is characterized as non-hazardous.</p> <p>CERCLA/SUPERFUND, 40 CFR 117.302: Notification of spills of this product is not required.</p> <p>SARA/SUPERFUND AMENDMENTS and REAUTHORIZATION ACT OF 1986 (Title III) – Sections 302, 311, 312 and 313:</p> <p>Section 302 – Extremely Hazardous Substances (40 CFR 355): This product does not contain ingredients listed in Appendix A and B as an Extremely Hazardous Substance.</p> <p>Sections 311 and 312 – Material Safety Data Sheet Requirements (40 CFR 370): Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.</p> <p>Section 313 – List of Toxic Chemicals (40 CFR 372): This product does not contain ingredients (at a level of 1% or greater) on the list of Toxic Chemicals.</p> <p>TOXIC SUBSTANCES CONTROL ACT (TSCA): The chemical ingredients in this product are on the 8(b) Inventory List (40 CFR 710).</p> <p>RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), 40 CFR 261 SUBPART C & D: If this product becomes a waste, it does not meet the criteria of a hazardous waste.</p> <p>FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT 40 CFR 401.15/formerly Sec. 307, 40 CFR 116/Former Sec. 311: None of the ingredients are specifically listed.</p> <p>CLEAN AIR ACT, 40 CFR 60, Section 111, 40 CFR 61, SECTION 112: This product does not contain ingredients covered by the Clean Air Act.</p>
State Regulations:	<p>CALIFORNIA PROPOSITION 65: None of the chemicals on the current Proposition 65 list are known to be present in this product.</p> <p>MICHIGAN CRITICAL MATERIALS: This product does not contain ingredients listed on the Michigan Critical Materials Register.</p> <p>STATE RIGHT TO KNOW LAWS: This product does not contain ingredients listed by State Right to Know Laws.</p> <p>INTERNATIONAL REGULATIONS: This is not a WHMIS controlled product under the House of Commons of Canada Bill C-70.</p>

Section 15 – Additional Information

None

Section 16 – User's Responsibility

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to ensure safe workplace operations. Please consult your sales representative for any further information.

Section 17 – Bibliography

ANNUAL REPORT ON CARCINOGENS, U.S. Department of Health and Human Service, Public Health Service, PB 33-135855, 1983.

CASARETT AND DOULL'S TOXICOLOGY, THE BASIC SCIENCE OF POISONS, Doull, J., Klaassen, D.D., and Admur, M.O., eds, Macmillan Publishing Company, Inc., N.Y., 2nd edition, 1980.

CHEMICAL HAZARDS OF THE WORKPLACE, Proctor, N.H., and Hughes, J.P., eds, J.P. Lipincott Company, N.Y., 1981.

DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS, Sax, N. Irving, ed., Van Nostrand Reinhold Company, N.Y., 6th edition, 1984.

IARC MONOGRAPHS ON THE EVALUATION OF THE CARCINOGENIC RISK OF CHEMICALS TO MAN, Geneva: World Health Organization, International Agency for Research on Cancer, 1972-1977.

PATY'S INDUSTRIAL HYGIENE AND TOXICOLOGY, Clayton, G.D., Clayton, F.E., eds., John Wiley and Sons, N.Y., 3rd edition, Vol. 2 A-C, 1981.

REGISTRY OF TOXIC EFFECT ON CHEMICAL SUBSTANCES, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, 1983 supplement of 1981-1982 edition, Vol. 1-3, OH, 1984.

Title 29 Code of Federal Regulations Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA).

THRESHOLD LIMIT VALUES FOR CHEMICAL SUBSTANCES AND PHYSICAL AGENTS IN THE WORKROOM ENVIRONMENT WITH INTNEDED CHANGES, American Conference of Governmental Industrial Hygienists, OH.