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Richmond, BC V6V 2H3
North CA (415) 390-5483
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Canada (604) 562-7836

Oxygen

Many injectables can increase the dissolved oxygen in groundwater. The GPRO and iSOC units infuse dissolved oxygen directly into water. The oxygen is immediately available for the bacteria.

Well over 100 sites have used GPRO and iSOC units to infuse dissolved oxygen directly into groundwater.

Please call if you have any questions.

Regards,
John Sankey,
True Blue Technologies

Section 1. Chemical product and company identification

Product name	: Oxygen
Supplier	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	: Synthetic/Analytical chemistry.
Synonym	: Molecular oxygen; Oxygen molecule; Pure oxygen; O ₂ ; UN 1072; Dioxygen; Oxygen USP, Aviator's Breathing Oxygen (ABO)
MSDS #	: 001043
Date of Preparation/ Revision	: 9/24/2013.
In case of emergency	: 1-866-734-3438

Section 2. Hazards identification

Physical state	: Gas. [Compressed gas.]
Emergency overview	: DANGER! GAS: OXIDIZER. CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE. CONTENTS UNDER PRESURE. Do not puncture or incinerate container. May cause severe frostbite. LIQUID: OXIDIZER. CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE. Extremely cold liquid and gas under pressure. May cause severe frostbite. Do not puncture or incinerate container. Store in tightly-closed container. Avoid contact with combustible materials. Contact with rapidly expanding gases or liquids can cause frostbite.
Routes of entry	: Inhalation
Potential acute health effects	
Eyes	: May cause eye irritation. Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns.
Skin	: May cause skin irritation. Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns.
Inhalation	: Respiratory system irritation after overexposure to high oxygen concentrations.
Ingestion	: Ingestion is not a normal route of exposure for gases. Contact with cryogenic liquid can cause frostbite and cryogenic burns.
Medical conditions aggravated by over-exposure	: Acute or chronic respiratory conditions may be aggravated by overexposure to this gas.
See toxicological information (Section 11)	

Section 3. Composition, Information on Ingredients

<u>Name</u>	<u>CAS number</u>	<u>% Volume</u>	<u>Exposure limits</u>
Oxygen	7782-44-7	100	

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : None expected.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Non-flammable.
- Products of combustion** : No specific data.
- Fire hazards in the presence of various substances** : Extremely flammable in the presence of the following materials or conditions: reducing materials, combustible materials and organic materials.
- Fire-fighting media and instructions** : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Contact with combustible material may cause fire. This material increases the risk of fire and may aid combustion. In a fire or if heated, a pressure increase will occur and the container may burst or explode.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Eliminate all ignition sources if safe to do so. Do not touch or walk through spilled material. Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Store in tightly-closed container. Avoid contact with combustible materials. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures

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and will easily fracture.

- Storage** : Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalis, reducing agents and combustibles. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Personal protection

- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

When working with cryogenic liquids, wear a full face shield.

- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Insulated gloves suitable for low temperatures

- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

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Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

- Molecular weight** : 32 g/mole
Molecular formula : O₂
Boiling/condensation point : -183°C (-297.4°F)
Melting/freezing point : -218.4°C (-361.1°F)
Critical temperature : -118.15°C (-180.7°F)
Vapor density : 1.1 (Air = 1)
Specific Volume (ft³/lb) : 12.0482
Gas Density (lb/ft³) : 0.083

Section 10. Stability and reactivity

- Stability and reactivity** : The product is stable.
- Incompatibility with various substances** : Extremely reactive or incompatible with the following materials: oxidizing materials, reducing materials and combustible materials.
- Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.
- Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Environmental fate : Not available.

Environmental hazards : This product shows a low bioaccumulation potential.

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1072	OXYGEN, COMPRESSED	2.2	Not applicable (gas).	 	Limited quantity Yes.
	UN1073	Oxygen, refrigerated liquid				Packaging instruction Passenger aircraft Quantity limitation: 75 kg Cargo aircraft Quantity limitation: 150 kg Special provisions A52

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TDG Classification	UN1072	OXYGEN, COMPRESSED	2.2	Not applicable (gas).		<u>Explosive Limit and Limited Quantity Index</u> 0.125
	UN1073	Oxygen, refrigerated liquid				<u>ERAP Index</u> 3000 <u>Passenger Carrying Ship Index</u> 50 <u>Passenger Carrying Road or Rail Index</u> 75 <u>Special provisions</u> 42
Mexico Classification	UN1072	OXYGEN, COMPRESSED	2.2	Not applicable (gas).		-
	UN1073	Oxygen, refrigerated liquid				

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption:** This material is listed or exempted.
United States inventory (TSCA 8b): This material is listed or exempted.
SARA 302/304: No products were found.
SARA 311/312 Hazards identification: Fire hazard, Sudden release of pressure

State regulations

: **Connecticut Carcinogen Reporting:** This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is not listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.

Rhode Island Hazardous Substances: This material is not listed.

Canada

WHMIS (Canada)

- : Class A: Compressed gas.
Class C: Oxidizing material.

CEPA Toxic substances: This material is not listed.

Canadian ARET: This material is not listed.

Canadian NPRI: This material is not listed.

Alberta Designated Substances: This material is not listed.

Ontario Designated Substances: This material is not listed.

Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements

- : GAS:
OXIDIZER.
CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE.
CONTENTS UNDER PRESURE.
Do not puncture or incinerate container.
May cause severe frostbite.
LIQUID:
OXIDIZER.
CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE.
Extremely cold liquid and gas under pressure.
May cause severe frostbite.

Canada

Label requirements

- : Class A: Compressed gas.
Class C: Oxidizing material.

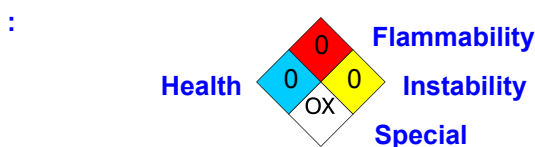
Hazardous Material Information System (U.S.A.)

Health	0
Flammability	0
Physical hazards	0

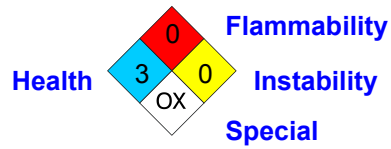
liquid:

Health	3
Fire hazard	0
Reactivity	0
Personal protection	

National Fire Protection Association (U.S.A.)



liquid:



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.



iSOC[®] YOUR ULTIMATE MANAGED ATTENUATION TOOL

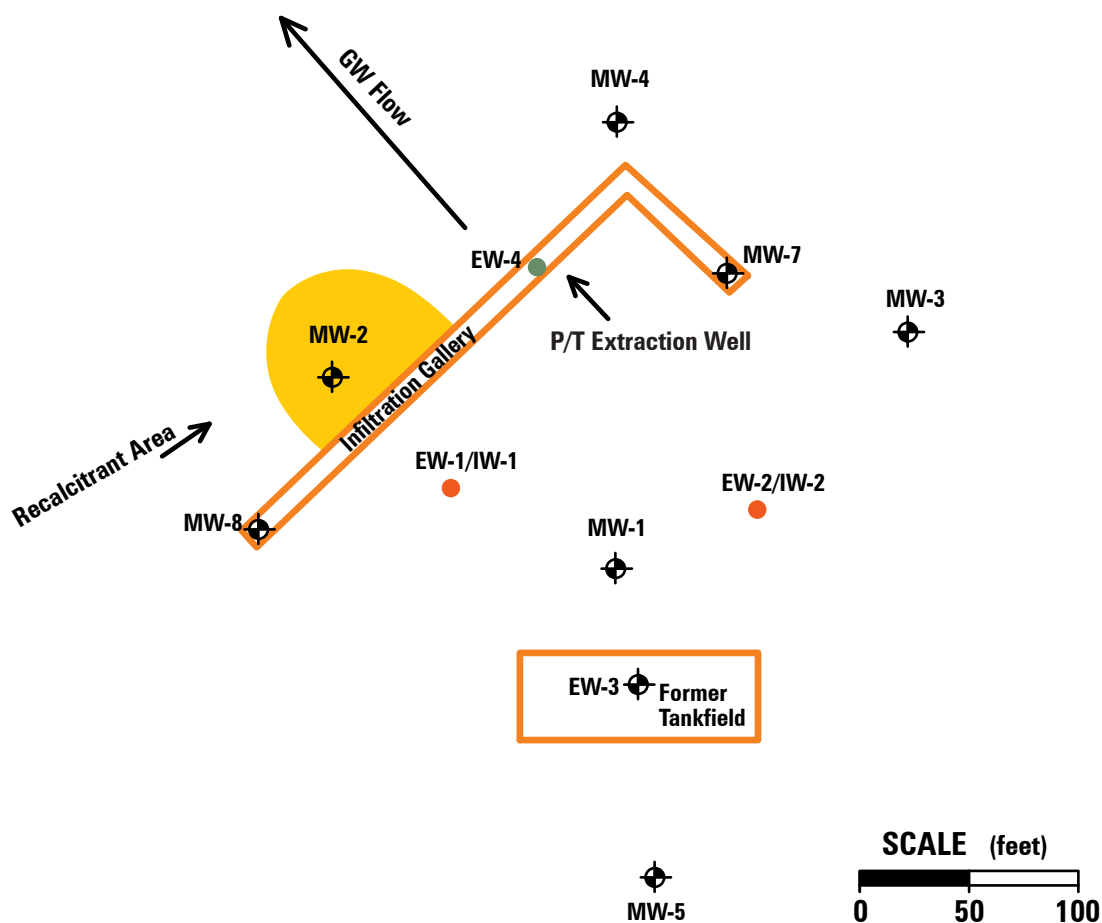


CASE STUDY: POLISHING OF A MTBE HOT ZONE IN LOW PERMIABILITY ARTIFICIAL TILL AFTER PUMP AND TREAT

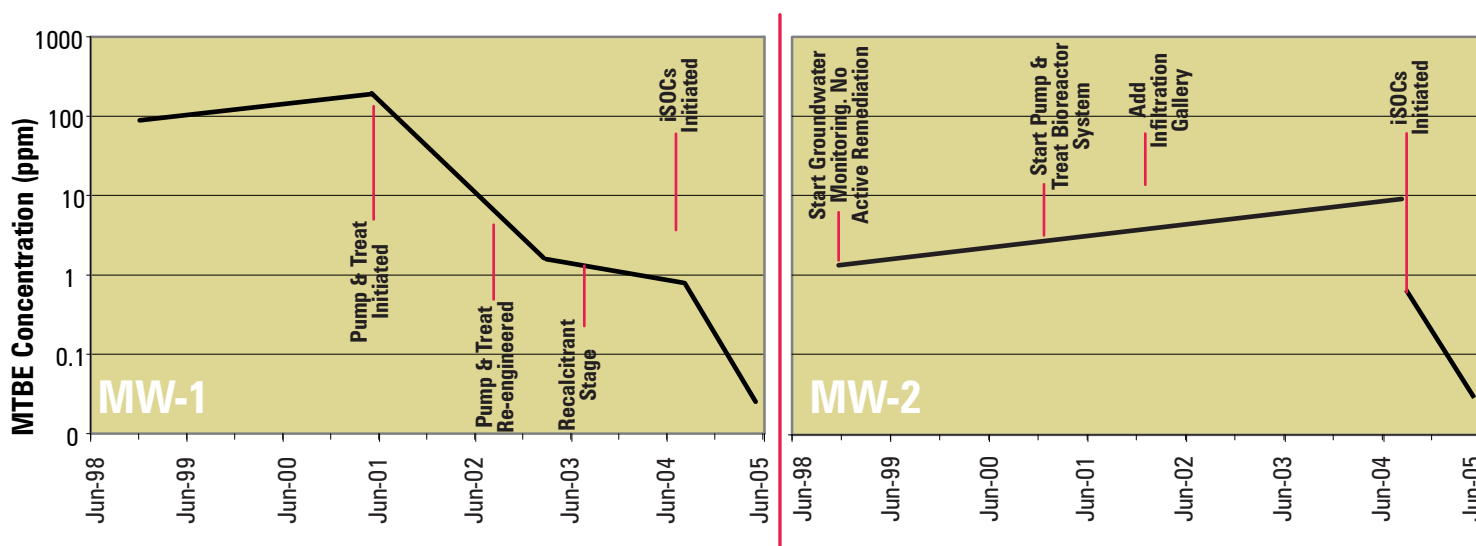
SITE SUMMARY

- Pump/treat system operated for 3 years.
- Groundwater in isolated portions of the site remained significantly above cleanup levels for MTBE.
- 2 iSOC[®]s used for 1 year upgradient of MW-2 and sidegradient and slightly downgradient of MW-1.
- MTBE levels were drastically reduced at MW-1 and MW-2: cleanup criteria were met.
- iSOC[®] system removed.
- Site is in post-remediation monitoring.

SITE PLAN



MTBE GROUNDWATER REMEDIATION RESULTS



OVERVIEW DETAILS

In June 2001, a pump and treat aboveground bioremediation system (bioreactor) was installed along with four extraction wells, EW-1 - EW-4. The primary contaminant of concern (COC) was identified as MTBE. At the time of starting the active remediation system, the highest MTBE concentration was recorded at MW-1, corresponding to 150,000 ppb. The State of Delaware (DNREC) established a risk based cleanup level of 1,000 ppb MTBE.

Other representative MTBE levels were 35,000 ppb, 22,000 ppb, and 7,000 ppb for monitoring points MW-4, EW-3 and MW-2. After three years of pump and treat, MTBE levels at MW-1, MW-4, EW-3 and MW-2 were 310 ppb, 49 ppb, Non Detect (ND), and 1,040 ppb respectively. These results illustrate limitations of a pump and treat system for treatment locations with extreme heterogeneous soil conditions. Areas with porous soils clean up readily but groundwater contamination in tight soil conditions often proves to be difficult to remediate.

This DE high school site demonstrates that implementation of strategically located iSOCs will effectively treat recalcitrant areas utilizing in situ, enhanced natural attenuation. After 1 year of enhanced bioremediation, the concentrations of MTBE in MW-1, MW-4, EW-3 and MW-2 were: ND, 229 ppb, 13.5 ppb and 21.5 ppb respectively.



iSOC[®] YOUR ULTIMATE MANAGED ATTENUATION TOOL

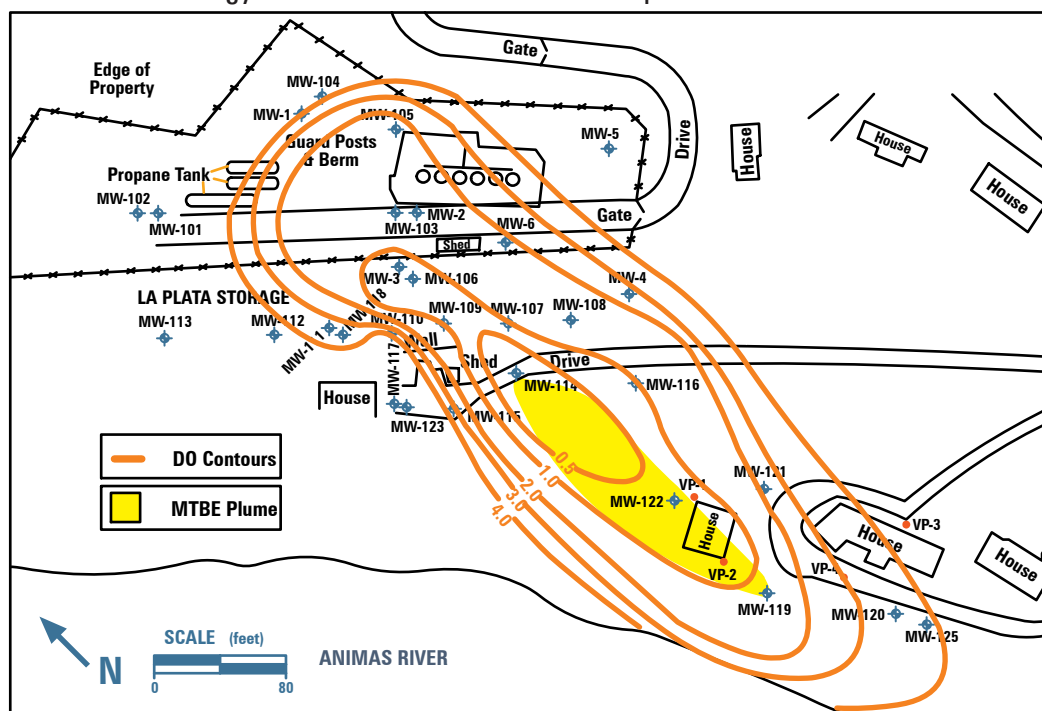
PILOT CASE STUDY: REMEDIATION OF RESIDUAL MTBE IN A FRACTURED BEDROCK AQUIFER IN SOUTHWESTERN COLORADO

SITE BACKGROUND

- Bulk petroleum storage facility with release of gasoline.
- Remedial investigation began Summer, 2002.
- BTEX and MTBE found in ground water on- and off-site.
- Direction of ground water flow is due south toward Animas River.
- Contamination found in fractured bedrock aquifer underlying site and outcropping along Animas River.
- Major concern: petroleum constituents reaching Animas River.

CLEAN-UP STRATEGY

- Soil vapor extraction system installed on-site and immediately off-site.
- SVE successful at removing majority of petroleum contamination.
- Major concern: Residual ground water contamination plume of mobile MTBE 320' long by 40' wide in fractured bedrock moving toward the Animas River.
- MTBE concentrations in plume: 59ppb to 6 ppb.
- iSOC[®] technology chosen to remediate the MTBE plume.

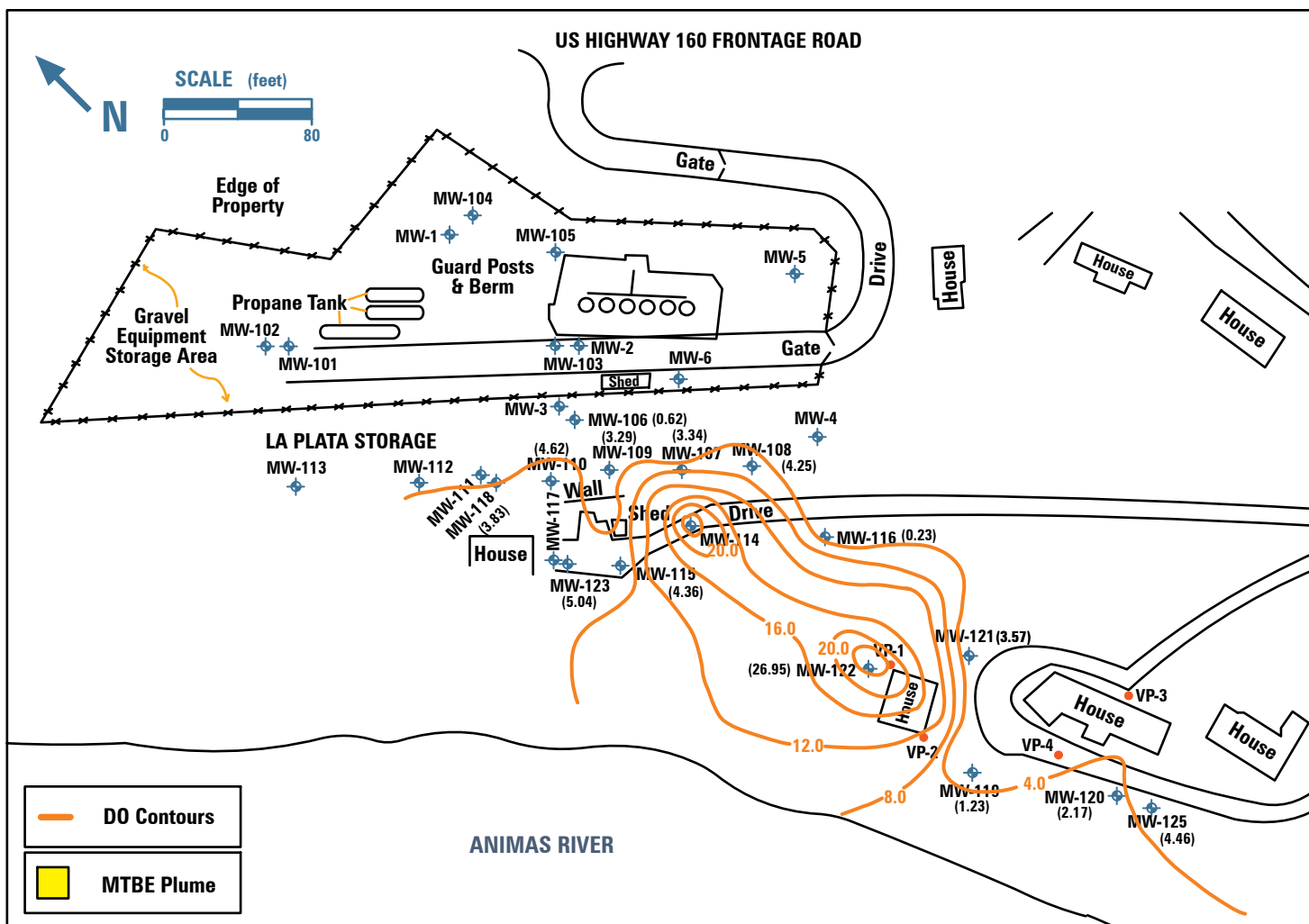


PRE - iSOC[®] DISSOLVED OXYGEN
CONTOURS (ppm)

iSOC® REMEDIATION PLAN

- June, 2004: 2 iSOC® units installed in 2 existing bedrock monitor wells (MW-122, MW-114) in the MTBE plume.
- Each well has water column of approximately 10'.
- Prior to iSOC® startup, dissolved oxygen (DO) levels in MTBE plume < 1ppm.
- June 2004-Feb 2005: iSOC® system running 8 months. DO increased throughout contamination area.
- DO in injection wells maintained at approximately 27 ppm.
- Feb 2005: DO up to 4 ppm in monitor wells at distances of 60-80' from MW-114.
- Feb 2005: DO up to 4 ppm in monitor wells at distances of 100 -160' from MW-122.

DISSOLVED OXYGEN CONTOURS AT 8 MONTHS (ppm)



SITE CLOSURE

- After two rounds of quarterly ground water sampling, MTBE concentrations in all off-site wells below detection limit.
- Feb 2005: iSOC® system removed from site and will be deployed at another site.
- This site currently in post-remediation monitoring.



iSOC[®] YOUR ULTIMATE MANAGED ATTENUATION TOOL

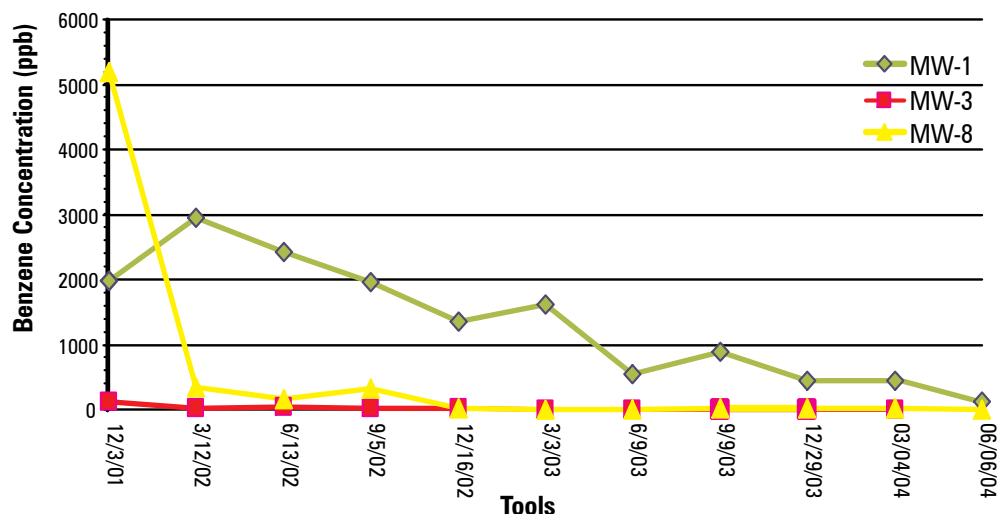
PILOT CASE STUDY: ENHANCED NATURAL ATTENUATION OF MTBE, BENZENE AT A LOW PERMEABILITY COLORADO SITE

iSOC[®] CASE STUDY: ENGLEWOOD, CO

- Low permeability silty clay sediments (permeability between 10^{-4} and 10^{-6} cm/sec).
- Gradient of 0.04 with groundwater flow to the NE.
- BTESite depth to water table approx. 20 ft.
- DO disperses around well into groundwater.
- Benzene primary concern at site from mid 90's to Dec. 01'. MTBE sampled at site Dec. 01', □ found concentrations as high as 195,000 ppb.

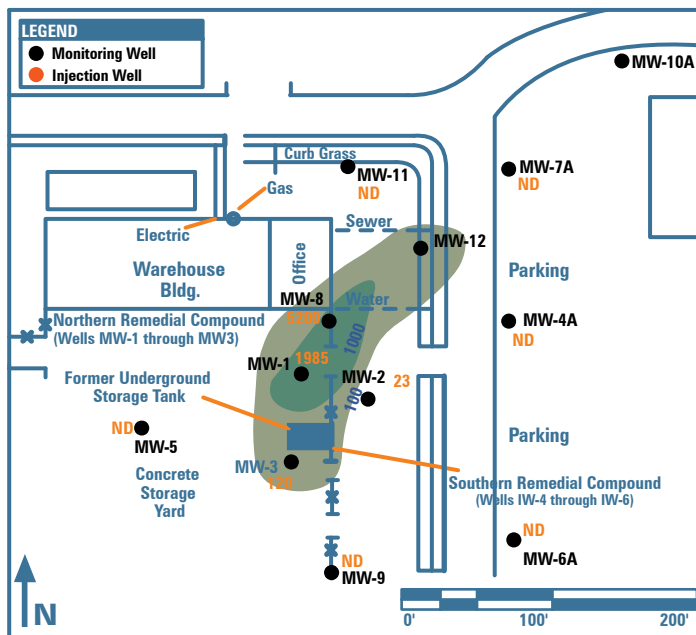
HISTORY OF SITE - REMEDIATION

- Tanks pulled in mid 90s.
 - Extensive amount of contaminated soil removed (no new tank installed).
- Sparge System Operated May 95 - Sept 96.
 - Very ineffective. Spread large amount of BTEX down gradient, cross gradient.
- Site Groundwater Monitoring.
 - Biannual 1996 – 2000.
 - Quarterly 2001 to present.
- iSOC[®] Technology
 - Pilot with one iSOC[®] near MW-8, Jan 02 – July 02. Additional 5 iSOC[®]s installed, □ Aug 02 - present.

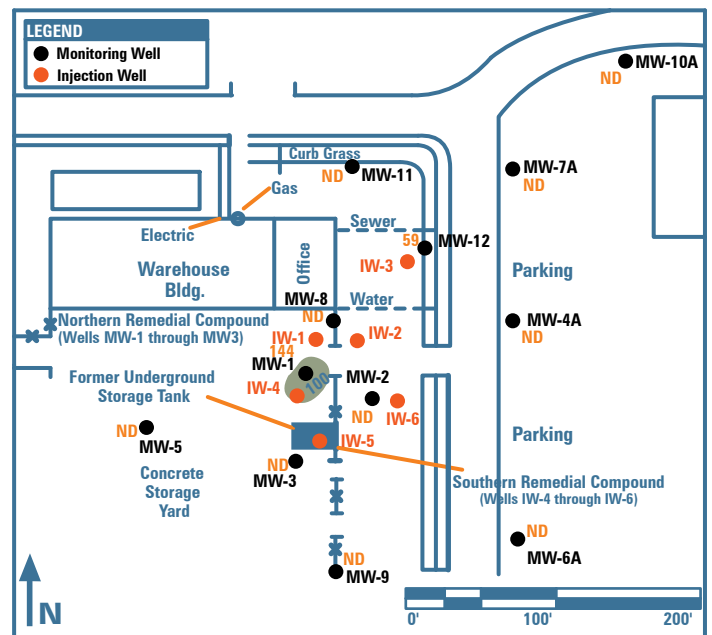


REMEDICATION RESULTS:
BENZENE RESULTS

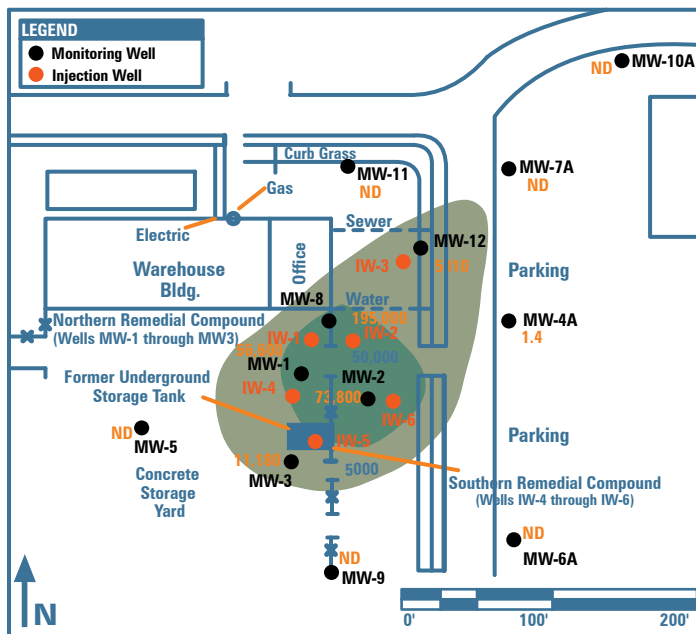
BENZENE CONCENTRATION: DEC 2001



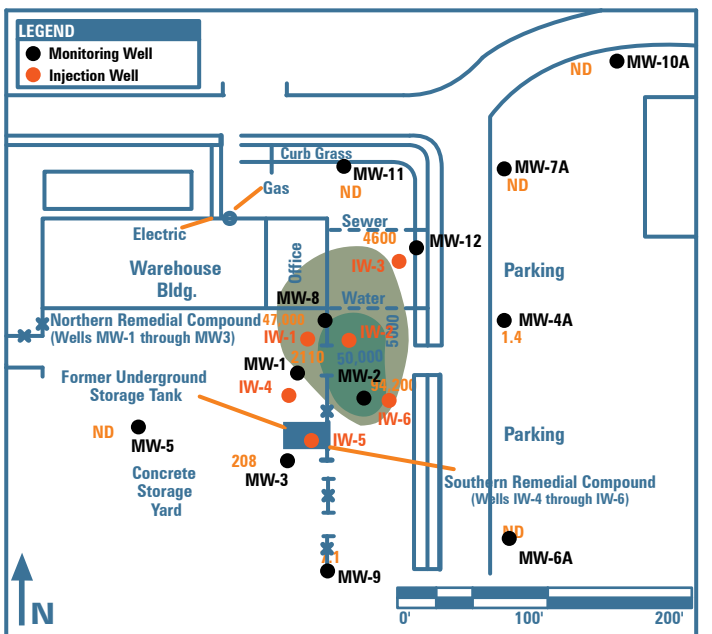
BENZENE CONCENTRATION: JUN 2004



MTBE CONCENTRATION: DEC 2001



MTBE CONCENTRATION: JUN 2004



CONCLUSION

- The iSOC® system was successful in stimulating attenuation of the MTBE and benzene hot spot.
- Contaminant migration was limited.
- Benzene concentrations reduced up to 99%.
- MTBE concentrations reduced significantly but still fluctuating.
- System continuing to operate to attenuate "rebound" increases in MTBE and benzene in the core of the hot spot.
- Use of iSOC® in low permeability sites provides cost benefit over site monitoring only option.