

## PROPOSED LEAKING UST (LUST) CASE CLOSURE

The Arizona Department of Environmental Quality (ADEQ) is considering closure of the following leaking underground storage tank (LUST) cases:

**LUST Case File #: 5125.01-.08**  
**Facility ID # 0-008789**  
**Mohave County**

**Ken & Mel's Exxon**  
**52 Lake Havasu Avenue S**  
**Lake Havasu City, Arizona 86043**

The Site previously operated as London Bridge Exxon. Five USTs were installed circa 1964. In December of 1995, fuel was observed seeping from beneath dispensers islands. As a result the piping between the dispensers and USTs were repaired in late December 1995. The USTs were permanently closed by removal in October 1999. Removal sampling results led to the assignment of eight (8) LUST release numbers.

In 2001, site characterization activities started and continued through 2008 and included the installation of soil borings and four monitoring wells. Free product was observed on 3 of 4 monitoring wells. Free product recovery began in 2001. The owner/operator estimates that 6,500 gallons of free product were recovered. No free product has been seen any of the monitoring wells since 2012.

The UST Owner/Operator entered into an agreement with the Arizona Department of Environmental Quality's (ADEQ) Corrective Action Section's State Lead Unit (SLU) in 2008 take over the characterization activities and remedial activities. SLU site operation's included the installation of a Soil Vapor Extraction/Air Sparge system in August 2010 which operated until summer 2014. Approximately 78,000 pounds (approximately 13,000 gallons of fuel) of gasoline range organics were removed during SVE/AS operations. In addition, two (2) PersulfOx® treatments were applied to MW-1 in December 2014 and January 2014. PersulfOx® is a chemical oxidation compound which reacts with organic contaminants to produce carbon dioxide and sodium bisulfate. A soil vapor survey, a site specific risk and detailed file/information search were also completed at the site. Benzene analytical groundwater results in MW-1 remain above AWQS.

Based upon the results of remedial activities and site specific information the above-referenced LUST site is eligible for alternative LUST closure under Arizona Revised Statutes (A.R.S.) §49-1005(E). Arizona Administrative Code (A.A.C.) R18-12-263.04 allows case closure of a LUST site with groundwater contamination above the Arizona Aquifer Water Quality Standards (AWQS) ADEQ has considered the results of a site specific assessment and the rule specific criteria below:

1. *Threatened or impacted drinking water wells:* According to ADWR records, there are no drinking water wells within ¼ mile of the site.
2. *Other exposure pathways:* To evaluate any possible other residual pathways residual subsurface soil volatile organic compound (VOC) contamination remaining after active remediation for vapor intrusion risk, a shallow soil vapor survey was conducted in November 2015. The soil samples collected between 5 and 15 feet had no VOC contamination present over an applicable regulatory standard, so dermal contact and ingestion are not complete

exposure pathways. The soil vapor survey demonstrates the inhalation exposure route shows an acceptable risk from any remaining VOC contamination left in subsurface soils. There are no surface water, agricultural or ecological receptors within ¼ mile of the site. Lake Havasu is to the west approximately 1/3 of a mile.

3. *Groundwater plume stability:* Groundwater plume stability is demonstrated by the remaining VOC contamination present over a regulatory standard in groundwater is limited to MW-1 and has not been detected in other monitoring wells above AWQS since October 2012. In addition, groundwater fluctuation are minimal with the average groundwater level is 55.71 feet below ground surface (bgs) while the mean is 55.79 feet bgs. These factors indicate that the groundwater plume is stable and not moving off site.
4. *Characterization of the groundwater plume:* Monitoring wells were installed and collection of volatile organic compounds (VOCs) samples took place over the course of 6 years. Groundwater monitoring wells and their respective sampling results at the property boundaries indicate that the plume is characterized and contained to the site.
5. *Natural Attenuation:* Natural attention can be demonstrated by decreasing VOC concentrations below AWQS in all of the monitoring wells except for MW-1. PersulfOx® destroys organic contaminants in the soil and groundwater through abiotic chemical oxidation reactions. MW-1 was sampled in January 2016, one month after the last PersulfOx® application, benzene concentration increased to 32.4 µg/L which exceeds the applicable AWQS due to the remnant PersulfOx® slower reaction with the contamination that is sorbed onto the soil, and releasing it into the groundwater. In April 2016, benzene concentrations continued to exceed the applicable AWQS. Concentration decreased to 30.6 µg/L as microbial degradation continued to occur. It is expected that decreasing benzene concentrations will continue to occur. In MW-1, field parameters indicate that prior to PersulfOx® application the dissolved oxygen concentrations were lower than after the injection. The Oxygen Reducing Potential also changed from positive values pre PersulfOx® to negative values post PersulfOx®.
6. *Removal or control of the source of contamination:* Source control and removal has been completed by the defueling and removal of the UST system in 1999, and by conducting remedial activities. Remedial activities removed approximate equivalent based upon of 19,000 gallons of fuel. In addition MW-1, source well and the primary release location area, had a benzene concentration of 16,000 µg/L prior to any remedial activities in July 2010 with up to 5-feet of free product present. Benzene levels and the concentrations have significantly decreased since that time. Currently benzene levels are 30.2 µg/L. The remaining monitoring wells have had no VOC contamination present over applicable regulatory standards since October 2012. Confirmation soil borings were completed at the release areas to depths of approximately 55-feet bgs, at the soil/groundwater transition vadose zone. Two detections of trimethyl benzenes were detected at a depth of 50-feet bgs in confirmation soil boring (CB-2) above soil remedial standards. Soil vapor survey results and risk assessment analysis indicated the detection to not be a factor.
7. *Requirements of A.R.S. §49-1005(D) and (E):* The results of the corrective action completed at the site assure protection of public health, welfare and the environment, to the extent

practicable, the clean-up activities completed at this site allow for the maximum beneficial use of the site, while being reasonable, necessary and cost effective.

8. *Other information that is pertinent to the LUST case closure approval:* The facility and LUST files were reviewed for information regarding prior clean up activities, prior site uses and operational history of the UST system prior to removal.

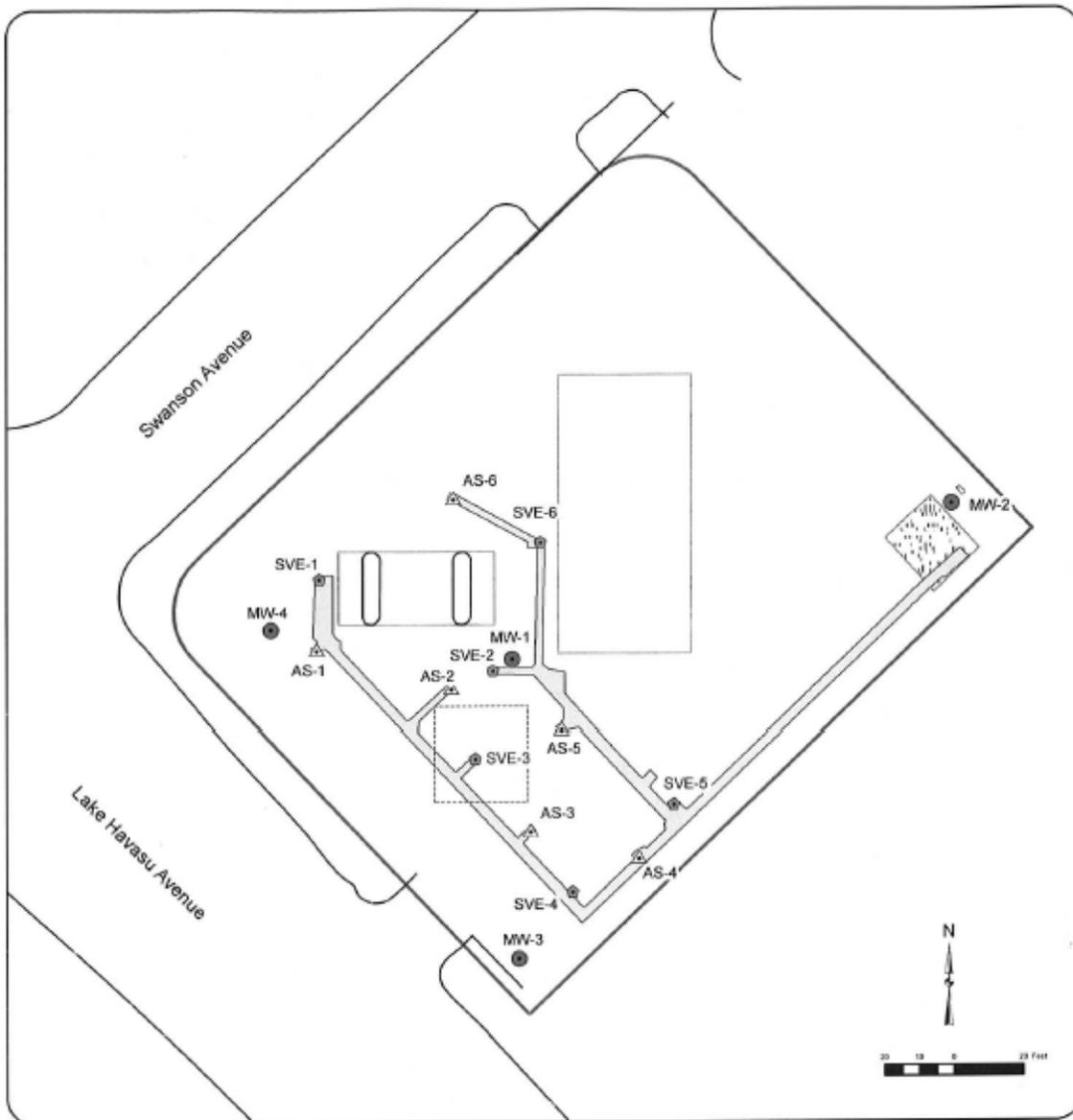
Historic groundwater information: MW-1

Date	Benzene AWQS is 5µg/L	Depth to water (Feet)
4/2016	30.6	55.79
1/2016	32.4	55.82
12/2015 ISCO application		
3/2015	2.5	Not Measured
1/2015 ISCO application		
9/2014	6.9	55.08
7/2014 SVE/AS System Off		
8/2013	13	55.25
10/2012	<100	55.23
4/2012	7,900	56.76
8/2010 SVE/AS System Start		
7/2010	16,000	56.03

Site specific information concerning this closure is available for review during normal business hours at the ADEQ Records Center <http://www.azdeq.gov/function/assistance/records.html> , 1110 W. Washington St., Suite 140, Phoenix, AZ 85007. ADEQ welcomes comments on the proposed LUST case closure. Please call the Records Center at 602-771-4380 to schedule an appointment. A 30-day public comment period is in effect commencing **July 8, 2016** and ending **August 8, 2016**. Comments should be submitted in writing to the Arizona Department of Environmental Quality, Waste Programs Division, Attention: Rick Brunton, 1110 W. Washington Street, Phoenix, AZ 85007.

If sufficient public interest is demonstrated during the public comment period, ADEQ will announce and hold a public meeting. ADEQ will respond to written comments following the public comment period. For more information on this notice, please contact Rick Brunton at 602-771-4745 or 800- 234-5677 ext. 771-4745 or at [rlb@azdeq.gov](mailto:rlb@azdeq.gov) .

Copies of the cited statutes and rules can be found at:  
<http://www.azleg.gov/ArizonaRevisedStatutes.asp?Title=49>, and  
[http://www.azsos.gov/public\\_services/Title\\_18/18-12.htm](http://www.azsos.gov/public_services/Title_18/18-12.htm)



**LEGEND**

- Monitoring Wells
- ▲ AS\_Wells
- ⊙ SVE\_Wells
- Lot Lines
- ▭ Trenches
- ▨ Remediation Compound

**eec** Engineering and Environmental Consultants, Inc.  
 7740 N. 10th St., Suite 135 Phoenix, AZ 85020  
 Tel: 602-248-7702 Fax: 602-248-7851

**FIGURE 1**

**SITE LAYOUT**  
 FORMER KEN & MEL'S EXXON  
 52 SOUTH LAKE HAVASU AVENUE  
 LAKE HAVASU CITY, ARIZONA

DES: KFC	DR: KFC	CK: JPB	DATE: 12-16-15
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FILE NAME: V510532.DS - FOR KEN & MEL'S STATE LEADERSHIP SITE LAYOUT.DWG

**ADEQ**  **Memorandum**  
Arizona Department  
of Environmental Quality

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**Date:** April 28, 2016

**To:** LUST File 

**From:** Debi Goodwin, UST Risk Assessor  
State Lead Unit  
WPD Corrective Action Section

**Subject:** Tier 3 Risk Assessment  
Former Ken & Mel's Exxon  
Facility No. 0-008789 LUST No. 5125.01-.08

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**Background**

The Site is currently vacant but has a building. The Site is located at 52 South Lake Havasu Avenue in Lake Havasu City. The Site previously operated as London Bridge Exxon. Five USTs were installed circa 1964. The USTs associated with the service station were removed in October 1999. In 2001, site characterization activities started and continued through 2008 and included the installation of soil borings and four monitor wells. Free product recovery began in 2001 and an automatic free product recovery system was installed in MW-1 in 2004. In 2001, an incomplete Site Characterization Report was submitted to ADEQ. In 2008, ADEQ requested a Site Characterization Report from the UST Owner/Operator (Ken & Mel's Exxon). A revised Site Characterization Report was submitted to ADEQ in 2008, but the report was not approved. The UST Owner/Operator entered into State Lead in 2008 so that State Lead would take over the characterization activities. Engineering and Environmental Consultants, Inc. (EEC), contractor to the State Lead Unit, installed an AS/SVE system in August 2010 and it began operation in February 2011 and operated until summer 2014.

Historic soil data shows that benzene and xylene concentrations exceed the rSRLs in the 2001 soil boring analytical results collected from B-1 between 15 and 60 feet bgs. Toluene concentrations exceed the rSRL between 50 and 60 feet bgs. 2008 soil data shows that several VOCs exceed applicable rSRLs in MW-4 at 50 to 60 feet, but this depth is below the water table. No PAHs were reported in any of the soil samples collected in 2008 with the exception of naphthalene was detected in MW-4 at 55 feet, but it was below rSRLs. Ken & Mel's is located on a terrace about 1/2 mile northeast of Lake Havasu and the Colorado River. The soil is silty sand.

Historic groundwater data goes back to 2008. The depth to water has ranged from approximately 50 to 60 feet bgs. The groundwater gradient is to the southwest. All four monitoring wells located on site had VOC contamination present over the respective AWQS until October 2012.

**Purpose**

Current groundwater, soil and soil vapor data provided by EEC and all other available site information has been used by ADEQ to determine whether remaining levels of contaminants at the site are adequately protective of human health and the environment.

### **Data Evaluation**

#### **Groundwater**

Groundwater samples have been collected since 2001. Free product was found in three of the four monitoring wells between 2001 and 2012. MW-2 and MW-3 have not had VOC contamination over applicable AWQS for several years. Benzene concentrations in MW-1, had the highest concentration in July 2010 at 16,000 µg/L. Samples collected in December 2014 and in March 2015 show benzene concentrations below the applicable AWQS. In January 2016 the benzene concentration rebounded to 32.4 µg/L. In April 2016 the benzene concentration is remaining stable at 30.6 µg/L. No other VOCs exceed applicable AWQS. The groundwater samples were analyzed for VOCs plus TICs by EPA Method 8260B by ESC. The other three monitoring wells showed no VOC contamination present over any applicable AWQS when last sampled in February 2015.

#### **Soil**

Four soil borings were installed in 2010. SB-2 (near the dispenser island- releases .01-.04) showed VOC concentrations that exceed applicable rSRLs between 20 and 60 feet bgs. SB-3 (UST #3 -release .06) showed VOC concentrations that exceed applicable rSRLs at 60 feet bgs. SB-1 located at the northwest side of the dispenser island showed no VOC contamination over applicable rSRLs. SB-4 (near waste oil UST- release .08) showed no VOC contamination present over applicable rSRLs. In November 2015, four confirmation borings were drilled and soil samples were collected between 5 and 50 feet bgs. The samples were analyzed for VOCs by EPA Method 8260B and for PAHs by EPA Method 8270C-SIM by ESC. CB-1 was located near a dispenser piping elbow (release .05). No VOCs or PAHs were reported over applicable rSRLs. CB-2 was located near the dispenser island (releases .01-.04) and VOCs were reported over applicable rSRLs or minimum GPLs between 35 and 50 feet bgs. No PAHs were reported over applicable rSRLs. CB-3 was located near MW-4 (UST #4- release .07). No VOCs or PAHs were reported over applicable rSRLs. CB-4 was located near SB-4 (UST #5 waste oil tank- release .08). There was no PAH data from SB-4, so PAH and VOC data was collected and no VOCs or PAHs were reported over laboratory reporting limits.

#### **Soil Vapor**

To evaluate any possible residual subsurface soil VOC contamination remaining after active remediation for vapor intrusion risk, a shallow soil vapor survey was conducted in November 2015. Temporary soil vapor probes installed at 5 feet. ESC analyzed the samples for VOCs by EPA Method TO-15 (did include the ADHS approved additional 31 compounds dated November 2011). Laboratory quality assurance (QA) measures are adequate for risk assessment data quality objectives. The field QA measures are acceptable for risk assessment data quality objectives. A *Soil Gas Detections with Qualification* table was provided by EEC.

### **Tier 3 Risk Assessment**

#### **Soil**

Soil data collected from four confirmation borings showed no VOCs or PAHs reported over applicable regulatory standards.

Soil vapor data was evaluated for vapor intrusion risk. The soil vapor data set was broken into smaller data sets based on which vapor points were associated with which release. All soil vapor data sets were evaluated regardless of soil data results from the confirmation borings.

The maximum concentrations of chemicals were modeled for both the cancer risk value (ELCR) and the hazard index (HI) or non-carcinogenic health hazard. ADEQ modeled the soil vapor data using the EPA on-line screening version of the Johnson and Ettinger (J&E) model. Chemicals are eliminated from inclusion in the risk assessment if they are not present at levels above 1/10th of the EPA Regional

Screening Level resident air levels dated November 2015, levels below the laboratory reporting limit, were a common laboratory contaminant and found at levels less than 5 times the concentration found in the field (equipment) blank, or if insufficient toxicity data is available or the chemical is not listed in the chemical pull down list. The risk assessment includes all compounds of concern (CoCs) associated with the fuel release and also non-petroleum related compounds (PCE) to determine cumulative risk.

Releases .01-.04 were evaluated with SG-1, SG-2. The soil data from CB-2 showed residual contamination remaining, so this soil vapor data set will evaluate any vapor intrusion issues. Since the contamination is subsurface, vapor intrusion is the only complete exposure pathway. The High Indoor Air Prediction for the J&E Simulation Results is used as the first comparison for a conservative approach, but the Best Estimate and Low Indoor Air Prediction values are also evaluated. Loamy Sand was used in the model for soil type, since the field notes states silty sand. The indoor air exchange rate used was  $0.5 \text{ hr}^{-1}$  to allow for typical heating/cooling systems present in homes. The Excess Lifetime Cancer Risk (ELCR) for the petroleum related compounds is  $5.76 \times 10^{-6}$ . The Hazard Index (HI represents non-cancer risk) value for the petroleum related compounds is less than 1. PCE, a non-petroleum related chemical, was evaluated, and the ELCR is  $6.72 \times 10^{-10}$  and the HI is less than 1. All of these values represent acceptable risk.

Release .05 was evaluated with SG-6. The High Indoor Air Prediction for the J&E Simulation Results is used as the first comparison for a conservative approach, but the Best Estimate and Low Indoor Air Prediction values are also evaluated. Loamy Sand was used in the model for soil type, since the field notes states silty sand. The indoor air exchange rate used was  $0.5 \text{ hr}^{-1}$  to allow for typical heating/cooling systems present in homes. The Excess Lifetime Cancer Risk (ELCR) for the petroleum related compounds is  $4.62 \times 10^{-6}$ . The Hazard Index (HI represents non-cancer risk) value for the petroleum related compounds is less than 1. Both of these values represent acceptable risk.

Release .06 was evaluated with SG-3, SG-4. The High Indoor Air Prediction for the J&E Simulation Results is used as the first comparison for a conservative approach, but the Best Estimate and Low Indoor Air Prediction values are also evaluated. Loamy Sand was used in the model for soil type, since the field notes states silty sand. The indoor air exchange rate used was  $0.5 \text{ hr}^{-1}$  to allow for typical heating/cooling systems present in homes. The Excess Lifetime Cancer Risk (ELCR) for the petroleum related compounds is  $9.7 \times 10^{-7}$ . The Hazard Index (HI represents non-cancer risk) value for the petroleum related compounds is less than 1. PCE and chloroform, non-petroleum related chemicals, were evaluated, and the ELCR is  $2.91 \times 10^{-7}$  and the HI is less than 1. All of these values represent acceptable risk.

Release .07 was evaluated with SG-5. The High Indoor Air Prediction for the J&E Simulation Results is used as the first comparison for a conservative approach, but the Best Estimate and Low Indoor Air Prediction values are also evaluated. Loamy Sand was used in the model for soil type, since the field notes states silty sand. The indoor air exchange rate used was  $0.5 \text{ hr}^{-1}$  to allow for typical heating/cooling systems present in homes. The Excess Lifetime Cancer Risk (ELCR) for the petroleum related compounds is  $1.06 \times 10^{-5}$ . The Hazard Index (HI represents non-cancer risk) value for the petroleum related compounds is less than 1. Both of these values represent acceptable risk.

#### Groundwater

Existing groundwater data shows that the groundwater contamination present at the Site only in MW-1 and benzene exceeds the applicable AWQS.

For alternative groundwater closure under A.A.C. R-18-12-263.04, several criteria must be met. Existing groundwater data shows that the groundwater plume is characterized, the source of contamination (former UST system) has been removed and was controlled by the active remediation

system that operated, and the groundwater plume is stable. The VOC contamination that is present in groundwater is limited on-site to MW-1. The other on-site monitoring wells have no VOC contamination over an applicable AWQS. Only monitoring and geotechnical wells were identified within ¼ mile of the Site. There is a residential area to the east of the Site within ¼ mile. The rest of the area is commercially developed. Lake Havasu is approximately 1/5 mile to the west.

**Conclusions and Recommendations**

A.A.C. R-18-7-206(D), A.A.C. R-18-12-263.01 and A.A.C. R-18-12-263.04 allow for a site specific risk assessment. Under risk assessment. Under A.A.C. R-18-7-206(D), multiple contaminants, multiple pathways of exposure, uncertainty of exposure and sensitive populations are evaluated as part of a site specific risk assessment. Any residual petroleum related VOC soil contamination may be present in the subsurface, so there isn't a risk posed by the dermal contact or ingestion exposure routes. The soil vapor survey demonstrates the inhalation exposure route shows an acceptable risk.

The groundwater data shows only benzene present over an applicable regulatory standard. The contamination is confined to on-site only. The contamination doesn't pose a risk to any drinking water wells. No threatened sensitive populations were identified.

Based on the data collected, it is recommended that LUST releases 5125.01-.08 be closed under A.A.C. R-18-12.263.03 for soil and A.A.C. R-18-12-263.04 for groundwater.

If you have any questions regarding this memo, please contact me at (602) 771-4453 or [dg1@azdeq.gov](mailto:dg1@azdeq.gov).