



ENVIRONMENTAL
PROTECTION
SECTION 6
PH 1-00

November 26, 1996

Mr. Scott Seery
Alameda County Health Services Agency
1131 Harbor Bay Parkway, Room 250
Alameda, California 94502

**RE: Corrective Action Plan and Risk-Based
Corrective Action Evaluation Addendum**

Shell Service Station
6039 College Avenue
Oakland, California
WIC #204-5508-3301
WA Job #81-0618-70

Dear Mr. Seery:

On behalf of the Shell Oil Products Company (Shell), Weiss Associates (WA) is submitting this corrective action plan to satisfy the requirements prescribed by California Administrative Code Title 23 Waters, Division 3, Chapter 16, Article 11, for the service station referenced above. This corrective action plan contains a re-evaluation of the Risk Based Corrective Action (RBCA) portion of the July 12, 1995, Comprehensive Site Evaluation and Proposed Future Action Plan prepared for the subject site. The re-evaluation is based on the standard California cancer slope factor for benzene and the changes resulting from issuance of the final American Society for Testing and Materials (ASTM) RBCA Standard Guidance document¹. In addition, continued ground water monitoring with respect to the presence of methyl-tertiary-butyl-ether (MTBE) detected in site ground water is proposed.

Impact Assessment (23 CAC Sec. 2725(e)):

Re-assessment of the extent of hydrocarbons in soil and ground water below the subject site and surrounding area is complete. The re-evaluation satisfies the site assessment requirements of Article 11 Section 2725(e). Responses addressing each impact as outlined in Section 2725(e) are presented in the order they appear. Each subsection of Section 2725(e) is paraphrased in italics and addressed with a corresponding response below:

¹ American Society for Testing and Materials, 1995. *Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites*. ASTM E 1739-95. The July 12, 1995, RBCA evaluation was performed using the 1994 ASTM RBCA interim guidance document, ASTM E 38-94.

- 1) *The physical and chemical characteristics of the hazardous substance or its constituents, including their toxicity, persistence, and potential for migration in water, soil and air.* Physical and chemical characteristics of the subsurface hydrocarbons and specifically the constituents, benzene, toluene, ethylbenzene and xylenes (BTEX) are summarized in the attached chemical hazard response information sheets (Attachment A). WA previously submitted a comprehensive Risk-Based Corrective Action (RBCA) evaluation of toxicity as it applies to gasoline migration in water, soil and air to potential receptors. At your request, WA has prepared tables of revised Tier 1 risk based screening levels (RBSLs) and Tier 2 site specific target levels (SSTLs) to address the more conservative California standard cancer slope factor for benzene and issuance of the final ASTM RBCA standard guidance document. The revised RBSLs and SSTLs are presented in Tables 1 and 2 (Attachment B). Review of Tables 1 and 2 indicate no change in the outcome of the previously submitted RBCA analysis. Maximum site concentrations remained below the revised RBSLs and SSTLs. Therefore, re-evaluation of RBCA criteria indicates the potential toxicological effect of released hydrocarbons to human health at the subject site remains insignificant.

BTEX

The toxicological effects related to MTBE were not addressed by the RBCA evaluation due to the lack of established toxicological data for that compound. WA notes that EPA has proposed, but not adopted, an advisory (not statutory) level for MTBE exposure via ingestion. A RBCA analysis will be conducted to evaluate the released MTBE when official toxicological data is adopted by California. The persistence of gasoline in soil and ground water is the subject of investigations focusing on degradation rates of BTEX compounds rather than gasoline due to the carcinogenic nature of benzene and the toxicological effects of toluene, ethylbenzene, and the xylene isomers. A table summarizing BTEX degradation rates in vadose zone soils is enclosed (Table 3, Attachment B). Benzene half lives in ground water have been predicted to range from 10 days for aerobic biodegradation to 24 months for highly anaerobic conditions². Little is known about the persistence of MTBE in ground water and soil. A program of continued monitoring and investigation is proposed in the future action plan presented below to address MTBE until definitive information becomes available.

MTBE

- 2) *The hydrogeologic characteristics of the site and the surrounding area where the unauthorized release has migrated or may migrate.* Hydrogeologic characteristics of the site and surrounding area were addressed in the previously submitted RBCA evaluation.
- 3) *The proximity and quality of nearby surface water or ground water, and the current and potential beneficial uses of these waters.* The proximity, quality and beneficial uses of nearby surface water and ground water was addressed in the previously submitted RBCA analysis.

² Howard, P.H. et. al., 1991. *Handbook of Environmental Degradation Rates*. Lewis, Chelsea, MI.

- 4) *The potential effects of residual contamination on nearby surface water and ground water.* Ground water monitoring data indicates nearby surface waters will not likely be impacted by the residual petroleum hydrocarbons associated with the subject site. With the exception of MTBE, petroleum hydrocarbon concentrations in ground water have been consistently below lowest laboratory detection limits in monitoring wells located between surface waters and plume area soil and ground water. Potential long term adverse effects caused by ingestion of MTBE is the only known potential effect the unauthorized release may have on nearby ground water.

However, ground water in this area is not currently being used, and there are no current plans for use, as a drinking water source according to the County of Alameda, Public Works Agency (WA, Personal Communication, 1995). The County of Alameda, Public Works Agency performed a well search of the nearest two square mile quadrants surrounding the Shell service station. The one domestic well and three irrigation wells found in the well inventory report are all outside a 1/2-mile radius of the Shell service station, and far outside the extent of the subsurface petroleum hydrocarbons associated with this site. The remainder of the wells identified in the search are for monitoring or various industrial uses, and are not within the extent of petroleum hydrocarbons associated with the Shell service station. There is no current onsite use of ground water at the site, nor is Shell or WA aware of any future plans for use

Corrective Action Alternatives (23 CAC Sec. 2725(f))

The results of the previous RBCA analysis and the re-evaluation contained herein indicate there is no actual adverse effect of the unauthorized petroleum hydrocarbon release and no nuisance conditions exist such as risk of fire or explosion. However, one potential adverse effect remains: potential ingestion of dissolved MTBE in ground water from a drinking water well located within the off-site plume area. To remedy the remaining potential adverse effect, three corrective action alternatives are presented below: (1) ground water extraction (GWE), (2) soil vapor extraction (SVE), and (3) implementing remediation by natural attenuation.

- 1) *Ground water extraction.* Petroleum hydrocarbon removal through GWE is limited by diffusion and desorption of petroleum hydrocarbons into the ground water from the lower permeability materials within a plume. Significant mass removal through GWE is not anticipated due to the low permeability sediments at this site. In addition, the statistical results of the California Leaking Underground Fuel Tank (LUFT) Rewrite Effort show that ground water extraction of dissolved hydrocarbons is not significantly more effective than natural attenuation mechanisms³. The LUFT researchers concluded from their statistical analysis that removal of separate phase hydrocarbons (SPH) is the

³ Rice D.W. *et al.* , March 12, 1996. California Leaking Underground Fuel Tank (LUFT) Historical Case Analysis, Presented at the Association for the Environmental Health of Soils Sixth West Coast Conference on Contaminated Soils and Groundwater, March 11 - 14, 1996, Newport Beach, California.

only engineered remedial action showing a substantial effect on dissolved hydrocarbon concentration and plume length. The residual SPH, which appear to have higher molecular weights than typical fuel hydrocarbons, are confined to the vicinity of MW-4 and are being removed continually by the dedicated SPH skimmer. Therefore, ground water pump and treat is not a cost effective corrective action.

- 2) *Soil Vapor Extraction.* SVE is an effective technique for removing volatile petroleum hydrocarbons from coarse-grained soils where little resistance to air flow results, and where ground water is deep. Soil boring logs and soil sampling results at this site indicate that the unsaturated zone consists of low permeability sediments that contain low or non detectable concentrations of petroleum hydrocarbons. The high vacuum required to draw air flow through these sediments will result in high energy costs with low petroleum hydrocarbon vapor removal rates due to the lack of petroleum hydrocarbon impacted soil in the unsaturated zone. Therefore, SVE is not cost effective corrective action at this site.
- 3) *Natural Attenuation.* As stated in the LUFT rewrite effort, natural attenuation mechanisms are capable of containing a dissolved hydrocarbon plume. Analytical results from ground water monitoring indicate that contaminant of concern (COC) concentrations are declining over time and remediation by natural attenuation is already occurring at the subject site. In addition, Shell will continue to remove SPH from MW-4 for as long as it is measurable. There is no need to initiate mass removal or plume containment by engineered processes. Petroleum hydrocarbon compounds will degrade through natural mechanisms such as sorption, dispersion, and/or chemical and biological activity. Therefore, natural attenuation is the most cost-effective corrective action for the subject site.

Recommendation. Natural attenuation is the preferred remedial alternative for the BTEX compounds and may also be the preferred alternative for MTBE. Since little attenuation data regarding MTBE is available, Shell is requesting that MTBE be monitored quarterly for a one year period to determine attenuation parameters before making a final decision on the preferred alternative for reducing MTBE levels to (future proposed) target levels. Soil vapor extraction and ground water extraction will not remove significant hydrocarbon mass and are not expected to provide significant plume containment.

Contaminant Target Levels (23 CAC Sec. 2725(g))

In accordance with Article 11 Section 2725(g), the ground water affected by the unauthorized release is designated for potential beneficial use and the required clean up levels are equal to the California maximum contaminant levels (MCLs). WA evaluated three alternatives to achieve the MCL values: (1) implementing remediation by natural attenuation, (2) ground water extraction and (3) soil vapor extraction. As discussed above, GWE and SVE are not cost-effective and remediation by natural attenuation is the most cost-effective corrective action alternative.

Natural attenuation is expected to reduce BTEX compound concentrations in ground water to levels below the California MCLs. Dissolved concentrations of ethylbenzene and xylenes are below the MCLs (680 ug/L and 1,750 ug/L respectively) in all ground water samples from monitoring wells. No California MCL is established for toluene. However, toluene concentrations are below RBCA Tier 1 RBSL values for all of the identified potential exposure pathways including ingestion. As of August 19, 1996, benzene concentrations were more than an order of magnitude higher than the established MCL (1 ug/L) in well MW-3. However, quarterly monitoring data indicate that dissolved benzene concentrations are declining over time as shown by the attached benzene concentration plots for well MW-3.

in what length of time?

WA proposes that Alameda County Health Services Agency consider remediation by natural attenuation to achieve concentrations below the California MCLs in ground water for all petroleum hydrocarbons except MTBE. Discussion of verification monitoring to achieve that objective is presented below.

MTBE ingestion

As of August 6, 1996, the USEPA Region IX Preliminary Remediation Goal for MTBE is 180 ug/L based on non-carcinogenic exposure. California has not yet adopted an MCL for MTBE. However, continued monitoring for MTBE at the subject site is presented in the future action plan below.

Verification Monitoring (23 CAC Sec. 2727)

Site data collected after submittal of the previous RBCA evaluation indicates the effectiveness of remediation by natural attenuation is verified with respect to all petroleum hydrocarbons except MTBE (Attachment D - Table of 3rd Quarter 1996 monitoring data). The attached first order attenuation curve fit of dissolved benzene concentration data from well MW-3 through February 1, 1995 (Attachment C) shows that the dissolved benzene concentration was declining by natural attenuation. The first order attenuation curve fit through August 19, 1996 verifies the declining dissolved benzene concentration trend. As stated above, dissolved benzene concentrations are anticipated to decline below the MCL due to natural attenuation. Therefore, verification monitoring at the above referenced site indicates remediation by natural attenuation is an effective corrective action for the remaining petroleum hydrocarbon compounds (except MTBE).

Proposed Future Action Plan

WA proposes continued ground water monitoring and investigation with respect to MTBE, continued manual bailing of SPH from MW-4 and remediation by natural attenuation for the remaining petroleum hydrocarbons as corrective actions to meet water quality objectives as outlined in Title 23 CAC Sec. 2725 (d). The proposed future actions to meet these objectives are:

- Discontinue ground water monitoring for all petroleum hydrocarbon compounds except MTBE;

- Discontinue ground water monitoring for all wells except MW-3, MW-5 and MW-6 (the wells which contain MTBE);
- Continue to remove SPH from MW-4 for as long as it is measurable;
- Conduct a detailed 750-foot radius well survey to locate potential receptors of MTBE in ground water;
- Collect one set of ground water samples from selected downgradient wells identified by the 750-foot radius well search; and,
- Perform a RBCA analysis for MTBE and propose appropriate corrective action when California establishes a decision process for addressing that compound.

Conclusions

Future actions have been proposed for management of water quality and protection of human health with respect to remaining hydrocarbons at the subject site. The RBCA analysis dated July 12, 1996 showed that petroleum hydrocarbons associated with the subject site do not pose significant risk to human health. Re-evaluation of the RBCA analysis based on the California standard cancer slope factor for benzene and the ASTM RBCA standard guidance document indicates no change in the outcome of the initial RBCA analysis. Remediation by natural attenuation was selected as the corrective action for all of the remaining petroleum hydrocarbons except MTBE based on evaluation of corrective action alternatives, contaminant target levels and verification monitoring. MTBE was not addressed in either the initial RBCA analysis or the re-evaluation contained herein. Interim corrective actions have been proposed until established toxicological data is adopted in California and a risk based corrective action approach can be taken. Therefore, on behalf of Shell, WA respectfully requests that Alameda County Health Services Agency approve the proposed future action plan.

Mr. Scott Seery
November 26, 1996

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Please feel free to call us at (510) 450-6000 if you have any questions or comments.

Sincerely,
Weiss Associates

A handwritten signature in black ink, appearing to read "Tim Utterback". The signature is fluid and cursive.

Tim Utterback
Senior Staff Engineer

A handwritten signature in black ink, appearing to read "Stephen P. Long". The signature is fluid and cursive.

Stephen P. Long, PE
Project Engineer


Enclosures: Attachment A - Chemical Hazard Response Information Sheets
Attachment B - Tables 1-3
Attachment C - Plots of Dissolved Benzene Concentration in Well MW-3
Attachment D - Table of Analytic Results for Ground Water

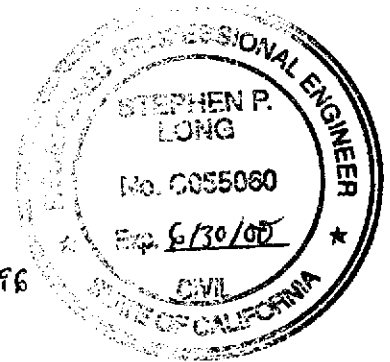
cc: Jeff Granberry, Shell Oil Products Company, PO Box 4023, Concord, California 94524
Brad Boschetto, Shell Oil Products Company, P.O. Box 25370, Santa Ana, CA 92704
Erik Hansen, Shell Development Company, Westhollow ET-108, 3333 Highway 6 South
Houston, Texas 77028-8101
John West, Regional Water Quality Control Board, San Francisco Bay Region,
2101 Webster Street, Suite 500, Oakland, California 94612

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CERTIFICATION

Weiss Associates' work for the former Shell Service Station at 1580 San Pablo Avenue, was conducted under my supervision. To the best of my knowledge, the data contained herein are true and accurate and satisfy the scope of work prescribed by the client for this project. The data, findings, recommendations, specifications or professional opinions were prepared solely for the use of Shell Oil Products Company in accordance with generally accepted professional engineering and geologic practice. We make no other warranty, either expressed or implied, and are not responsible for the interpretation by others of the contents herein.


Stephen P. Long, P.E.
CA. License No. C055060



ATTACHMENT A

CHEMICAL HAZARD RESPONSE INFORMATION SHEETS

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

<p>Common Synonyms Motor spirit Petrol</p>	<p>Watery liquid</p> <p>Colorless to pale brown or pink</p> <p>Gasoline odor</p> <p>Floats on water. Flammable, irritating vapor is produced.</p>																																								
<p>Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay windward and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>																																									
<p>Fire</p>	<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>																																								
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness, headache, difficult breathing or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. If swallowed, will cause nausea or vomiting. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>																																								
<p>Water Pollution</p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shorelines. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>																																								
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area Disperse and flush</p>		<p>2. LABEL</p> <p>2.1 Category: Flammable Liquid 2.2 Class: 3</p>																																							
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures 3.2 Formula: (Mixture of hydrocarbons) 3.3 IMO/IUM Designation: 3.1/1203 3.4 DOT ID No.: 1203 3.5 CAS Registry No.: Data not available</p>		<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless to brown 4.3 Odor: Gasoline</p>																																							
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Protective goggles, gloves. 5.2 Symptoms Following Exposure: Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination of, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonia. Swallowing may cause irregular heartbeat. 5.3 Treatment of Exposure: INHALATION: maintain respiration and administer oxygen; enforce bed rest if liquid is in lungs. INGESTION: do NOT induce vomiting; stomach should be lavaged (by doctor) if appreciable quantity is swallowed. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water. 5.4 Threshold Limit Value: 500 ppm 5.5 Short Term Inhalation Limit: 500 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg. 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight stinging of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause stinging and reddening of the skin. 5.10 Odor Threshold: 0.25 ppm 5.11 IDLH Value: Data not available</p>																																									
<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: -36°F C.C. 6.2 Flammable Limits in Air: 1.4%-7.4% 6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: None 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 853°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 4 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>																																									
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 33</p>																																									
<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 90 ppm/24 hr/juvenile American shad/TL₅₀/fresh water 81 mg/1/24 hr/juvenile American shad/TL₅₀/salt water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 8%, 5 days 8.4 Food Chain Concentration Potential: None</p>																																									
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Various octane ratings; military specifications 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (Name arteries) or pressure-vacuum</p>																																									
<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U-V-W</p>																																									
<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 HAS Hazard Rating for Bulk Water Transportation:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>2</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>0</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Salt Reaction</td> <td>0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>1</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>						Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	2	Aesthetic Effect	2	Reactivity		Other Chemicals	0	Water	0	Salt Reaction	0	Category	Classification	Health Hazard (Blue)	1	Flammability (Red)	3	Reactivity (Yellow)	0
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<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: Not pertinent 12.3 Boiling Point at 1 atm: 140-390°F = 60-199°C = 333-472°K 12.4 Freezing Point: Not pertinent 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 0.7321 at 20°C (liquid) 12.8 Liquid Surface Tension: 19-23 dynes/cm = 0.019-0.023 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 49-51 dynes/cm = 0.049-0.051 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 3.4 12.11 Ratio of Specific Heats of Vapor (Gas): (c_p/c_v) 1.054 12.12 Latent Heat of Vaporization: 130-150 Btu/lb = 71-81 cal/g = 3.0-3.4 X 10⁴ J/kg 12.13 Heat of Combustion: -18,720 Btu/lb = -10,400 cal/g = 435.1 X 10⁴ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 7.4 psia</p>																																									
<p style="text-align: center;">NOTES</p>																																									

BENZENE

BNZ

Common Synonyms Benzol Benzole		Watery liquid Colorless Gasoline-like odor	
Fluors on water, Flammable, irritating vapor is produced, Freezing point is 42°F.			
Avoid contact with liquid and vapor. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor isolate and remove discharged material. Notify local health and pollution control agencies.			
Fire		<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area.</p> <p>Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>	
Exposure		<p>CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. Harmful if swallowed.</p> <p>Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>	
Water Pollution		<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes.</p> <p>Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Restrict access		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3	
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C ₆ H ₆ 3.3 IMO/IUN Designation: 3.2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic rather pleasant aromatic odor; characteristic odor	
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene. 5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death. 5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician, if breathing is irregular or stopped, start resuscitation, administer oxygen. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhalation Limit: 75 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD ₅₀ = 50 to 500 mg/kg 5.7 Lethal Toxicity: Leukemia 5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard, if spilled on clothing and allowed to remain, may cause smearing and reddening of the skin. 5.10 Odor Threshold: 4.68 ppm 5.11 IDLH Value: 2,000 ppm			

6. FIRE HAZARDS 6.1 Flash Point: 12°F C.C. 6.2 Flammable Limits in Air: 1.3%-7.9% 6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back 6.7 Ignition Temperature: 1097°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 6.0 mm/min 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U-V-W																																					
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32		11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable liquid 11.2 MAS Hazard Rating for Bulk Water Transportation: <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire.....</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant.....</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant.....</td> <td>1</td> </tr> <tr> <td>Poisons.....</td> <td>3</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity.....</td> <td>3</td> </tr> <tr> <td>Aquatic Toxicity.....</td> <td>1</td> </tr> <tr> <td>Aesthetic Effect.....</td> <td>3</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals.....</td> <td>2</td> </tr> <tr> <td>Water.....</td> <td>1</td> </tr> <tr> <td>Self Reaction.....</td> <td>0</td> </tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue).....</td> <td>2</td> </tr> <tr> <td>Flammability (Red).....</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow).....</td> <td>0</td> </tr> </tbody> </table>		Category	Rating	Fire.....	3	Health		Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	3	Water Pollution		Human Toxicity.....	3	Aquatic Toxicity.....	1	Aesthetic Effect.....	3	Reactivity		Other Chemicals.....	2	Water.....	1	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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8. WATER POLLUTION 8.1 Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/distilled water 20 ppm/24 hr/sunfish/TL/lap water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days 8.4 Food Chain Concentration Potential: None		12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 78.11 12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 353.2°K 12.4 Freezing Point: 42.0°F = 5.5°C = 278.7°K 12.5 Critical Temperature: 552.0°F = 288.9°C = 562.1°K 12.6 Critical Pressure: 710 psia = 48.3 atm = 4.89 MN/m ² 12.7 Specific Gravity: 0.879 at 20°C (liquid) 12.8 Liquid Surface Tension: 28.9 dynes/cm = 0.0289 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 35.0 dynes/cm = 0.035 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 2.7 12.11 Ratio of Specific Heats of Vapor (Gas): 1.061 12.12 Latent Heat of Vaporization: 169 Btu/lb = 94.1 cal/g = 3.94 X 10 ⁴ J/kg 12.13 Heat of Combustion: -17,460 Btu/lb ; = -8696 cal/g = -406.0 X 10 ⁴ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 30.45 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 3.22 psia																																					
9. SHIPPING INFORMATION 9.1 Grades of Purity: Industrial pure 99+ % Thiophene-free 99+ % Nitration 99+ % Industrial 90% 85+ % Reagent 99+ % 9.2 Storage Temperature: Open 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum		NOTES																																					

ETHYLBENZENE

ETB

Common Synonyms Phenylethane EB	Liquid Colorless Sweet, gasoline-like odor	Floats on water. Flammable, irritating vapor is produced.	
Avoid contact with liquid and vapor. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.			
Fire	<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>		
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will burn skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>		
Water Pollution	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Mechanical containment Should be removed Chemical and physical treatment</p>		<p>2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3</p>	
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic hydrocarbon 3.2 Formula: C_8H_{10} 3.3 IMO/UM Designation: 3.3/1175 3.4 DOT ID No.: 1175 3.5 CAS Registry No.: 100-41-4</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic</p>	
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles. 5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters. 5.3 Treatment of Exposure: INHALATION: If ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limit: 200 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg (rat) 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Causes smearing of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure. 5.10 Odor Threshold: 140 ppm 5.11 OELM Value: 2,000 ppm</p>			

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 80°F O.C.; 59°F C.C. 6.2 Flammable Limits in Air: 1.0%-6.7% 6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical. 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Irritating vapors are generated when heated. 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back. 6.7 Ignition Temperature: 860°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 5.8 mm/min. 6.10 Adiabatic Flame Temperature: Data Not Available</p> <p style="text-align: right;">(Continued)</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U</p> <p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: Flammable liquid</p> <p>11.2 HAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>2</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>2</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Salt Reaction</td> <td>0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire	3	Health		Vapor Irritant	2	Liquid or Solid Irritant	2	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Salt Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 29 ppm/96 hr/bluegill/TL₅₀/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days 8.4 Food Chain Concentration Potential: None</p>	<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum</p>																																				
<p>6. FIRE HAZARDS (Continued)</p> <p>6.11 Stoichiometric Air to Fuel Ratio: Data Not Available 6.12 Flame Temperature: Data Not Available</p>																																					

TOLUENE

TOL

Common Synonyms Toluol Methylbenzene Methylbenzol		Watery liquid	Colorless	Pleasant odor
Floats on water. Flammable, irritating vapor is produced.				
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Slay upward and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>			
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>			
Water Pollution	<p>Dangerous to aquatic life in high concentrations. Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>			
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area</p>		<p>2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3</p>		
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C₆H₅CH₃ 3.3 IMO/UN Designation: 3.2/1294 3.4 DOT ID No.: 1294 3.5 CAS Registry No.: 108-88-3</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent, aromatic, benzene-like; distinct, pleasant</p>		
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves. 5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. 5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limit: 600 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg 5.7 Late Toxicity: Kidney and liver damage may follow ingestion. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm 5.11 IDLH Value: 2,000 ppm</p>				

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point 40°F C.C.; 55°F O.C. 6.2 Flammable Limits in Air: 1.27%-7% 6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires. 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 997°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.7 mm/min. 6.10 Adiabatic Flame Temperature: Data not available</p> <p style="text-align: right;">(Continued)</p>		<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U</p>																																					
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<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 1160 mg/l/96 hr/sunfish/TL₅₀/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 8 days 8.4 Food Chain Concentration Potential: None</p>		<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 92.14 12.3 Boiling Point at 1 atm: 201.1°F = 110.6°C = 383.8°K 12.4 Freezing Point: -109°F = -85.0°C = 178.2°K 12.5 Critical Temperature: 805.4°F = 318.5°C = 591.6°K 12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.106 MN/m² 12.7 Specific Gravity: 0.867 at 20°C (Liquid) 12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.089 12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 X 10⁴ J/kg 12.13 Heat of Combustion: -17,430 Btu/lb = -9686 cal/g = -405.5 X 10⁴ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 17.17 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 1.1 psia</p>																																					
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Research, reagent, nitration-99.8 + %; industrial; contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120; less pure than industrial. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum</p>		<p>6. FIRE HAZARDS (Continued)</p> <p>6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>																																					

m-XYLENE

XLM

<p>Common Synonyms 1, 3-Dimethylbenzene Xylol</p>	<p>Watery liquid Colorless Sweet odor</p> <p>Floats on water. Flammable, irritating vapor is produced.</p>																																				
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>																																					
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Water Pollution	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes.</p> <p>Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>																																				
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<p>3. CHEMICAL DESIGNATIONS 3.1 CG Competibility Class: Aromatic Hydrocarbon 3.2 Formula: m-C₆H₄(CH₃)₂ 3.3 IMO/IUN Designation: 3.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 106-36-3</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic</p>																																				
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.</p> <p>5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.</p> <p>5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe on; wash with soap and water.</p> <p>5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limit: 300 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD₅₀ = 50 to 500 g/kg 5.7 Late Toxicity: Kidney and liver damage. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.05 ppm 5.11 OELH Value: 10,000 ppm</p>																																					
<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 64°F C.C. 6.2 Flammable Limits in Air: 1.1%-6.4% 6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 986°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.8 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>																																					
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<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL₅₀/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days 8.4 Food Chain Concentration Potential: Data not available</p>																																					
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum</p>																																					
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<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 106.16 12.3 Boiling Point at 1 atm: 260.4°F = 131.9°C = 405.1°K 12.4 Freezing Point: -54.2°F = -47.9°C = 225.3°K 12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K 12.6 Critical Pressure: 513.8 atm = 34.95 psia = 3,540 MN/m² 12.7 Specific Gravity: 0.864 at 20°C (liquid) 12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.071 12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43 X 10⁶ J/kg 12.13 Heat of Combustion: -17,554 Btu/lb = -9752.4 cal/g = -406.31 X 10⁶ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 26.01 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 0.24 psia</p>																																					
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O-XYLENE

XLO

<p>Common Synonyms 1,2-Dimethylbenzene Xylol</p>	<p>Watery Liquid Colorless Sweet odor</p>	<p>Floats on water. Flammable, irritating vapor is produced.</p>
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
<p>Fire</p>	<p>FLAMMABLE Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>	
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>	
<p>Water Pollution</p>	<p>Dangerous to aquatic life in high concentrations. Fouling to shellfish. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment</p>	<p>2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3</p>	
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C_8H_{10} (CH₃)₂ 3.3 IMO/IUN Designation: 3.2/1307 3.4 DOT ID No: 1307 3.5 CAS Registry No.: 95-47-6</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Benzene-like; characteristic aromatic</p>	
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.</p> <p>5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.</p> <p>5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.</p> <p>5.4 Threshold Limit Value: 100 ppm</p> <p>5.5 Short Term Inhalation Limit: 300 ppm for 30 min.</p> <p>5.6 Toxicity by Ingestion: Grade 3; LD₅₀ = 50 to 500 mg/kg</p> <p>5.7 Late Toxicity: Kidney and liver damage.</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight stinging of the eyes or respiratory system if present in high concentrations. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause stinging and reddening of the skin.</p> <p>5.10 Odor Threshold: 0.05 ppm</p> <p>5.11 IDLH Value: 10,000 ppm</p>		

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 63°F C.C.; 75°F O.C. 6.2 Flammable Limits in Air: 1.1%-7.0% 6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 565°F 6.8 Electrical Hazard: Class I, Group 0 6.9 Burning Rate: 5.8 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U</p>																																				
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<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Research: 99.99%; Pure: 99.7%; Commercial: 95+ % 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No reaction 9.4 Venting: Open (flame arrester) or pressure-vacuum</p>																																					
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<p>Common Synonyms 1, 4-Dimethylbenzene Xylol</p>		<p>Watery liquid</p>	<p>Colorless</p>	<p>Sweet odor</p>
<p>Floats on water. Flammable, irritating vapor is produced. Freezing point is 56°F.</p>				
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies</p>				
<p>Fire</p>	<p>FLAMMABLE Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>			
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>			
<p>Water Pollution</p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>			
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment</p>		<p>2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3</p>		
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<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 81°F C.C. 6.2 Flammable Limits in Air: 1.1%-6.6% 6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 670°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.8 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>		<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U</p>																																					
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Flammability (Red).....	3																																						
Reactivity (Yellow).....	0																																						
<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL₅₀/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0 lb/lb in 5 days 8.4 Food Chain Concentration Potential: Data not available</p>		<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 106.16 12.3 Boiling Point at 1 atm: 280.9°F = 138.3°C = 411.5°K 12.4 Freezing Point: 55.9°F = 13.3°C = 265.5°K 12.5 Critical Temperature: 649.4°F = 343.0°C = 616.2°K 12.6 Critical Pressure: 509.4 atm = 34.65 psia = 3.510 MN/m² 12.7 Specific Gravity: 0.861 at 20°C (liquid) 12.8 Liquid Surface Tension: 28.2 dynes/cm = 0.0283 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 37.8 dynes/cm = 0.0378 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.071 12.12 Latent Heat of Vaporization: 150 Btu/lb = 81 cal/g = 3.4 X 10⁴ J/kg 12.13 Heat of Combustion: -17,559 Btu/lb = -9754.7 cal/g = -406.41 X 10⁴ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 37.83 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 0.34 psia</p>																																					
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Research: 99.99%; Pure: 99.8%; Technical: 99.0% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (Name arrester) or pressure-vacuum</p>		<p>NOTES</p>																																					

ATTACHMENT B

- Table 1. Comparison Of Site Characterization Data To RBSLS
- Table 2. Comparison Of Site Characterization Data To SSTLS
- Table 3. Compilation Of Degradation Rates In Soil

Table 1. Comparison of Site Characterization Data to ASTM Tier 1 Risk-Based Screening Levels (RBSL). Shell Service Station, 6039 College Avenue, Oakland, California. Revised to include California standard cancer slope factor for benzene and updated to March 5, 1996, RBCA Standard Guidance.

Media	Exposure Pathway	Benzene (ppm)		Ethylbenzene (ppm)		Toluene (ppm)		Xylenes (ppm)	
		RBSL ⁽¹⁾	Maximum Detected Onsite ⁽³⁾	RBSL ⁽²⁾	Maximum Detected Onsite	RBSL ⁽²⁾	Maximum Detected Onsite	RBSL ⁽²⁾	Maximum Detected Onsite
Soil	Volatilization to Outdoor Air (mg/kg)	1.33	1.1 at 15.5 ft in MW-3 on 2/7/90	RES ⁽⁴⁾	4.1 at 19 ft in B-3 on 1/5/90	RES	0.7 at 15.5 ft in MW-3 on 2/7/90	RES	10 at 19 ft in B-3 on 1/5/90
	Vapor Intrusion from Soil to Buildings (mg/kg)	0.032	1.1 at 15.5 ft in MW-3 on 2/7/90	1,100	4.1 at 19 ft in B-3 on 1/5/90	54.5	0.7 at 15.5 ft in MW-3 on 2/7/90	RES	10 at 19 ft in B-3 on 1/5/90
	Leachate to Protect Ground Water Ingestion Target Level (mg/kg)	0.17	1.1 at 15.5 ft in MW-3 on 2/7/90	1,610	4.1 at 19 ft in B-3 on 1/5/90	361	0.7 at 15.5 ft in MW-3 on 2/7/90	RES	10 at 19 ft in B-3 on 1/5/90
Ground Water	Volatilization to Outdoor Air (mg/L)	53.4	0.82 in MW-3 on 2/12/93	>S ⁽⁵⁾	0.27 in MW-3 on 3/8/91	>S	0.086 in BH-D on 9/10/93	>S	0.13 in MW-3 on 8/19/92
	Vapor Intrusion from Ground Water to Buildings (mg/L)	0.21	0.82 in MW-3 on 2/12/93	>S	0.27 in MW-3 on 3/8/91	85	0.086 in BH-D on 9/10/93	>S	0.13 in MW-3 on 8/19/92
	Ingestion	0.029	0.82 in MW-3 on 2/12/93	10.2	0.27 in MW-3 on 3/8/91	20.4	0.086 in BH-D on 9/10/93	>S	0.13 in MW-3 on 8/19/92

Notes:

- (1) The RBSLs used for benzene are based on a carcinogenic risk of 1 in 100,000 ($1E^{-5}$) and California's standard cancer slope factor of 0.1 mg/kg-day.
- (2) The target risk level used for non-carcinogenic constituents of concern is a chronic hazard quotient of 1.0 for commercial/industrial exposures.
- (3) Maximum concentration detected in soil borings reported by Harding Lawson Associates, 1990. Maximum ground water concentration detected in site wells from January 1990 through February 1995 (WA and Harding Lawson Associates quarterly ground water monitoring reports).
- (4) RES = Selected risk level is not exceeded for pure compound present at any concentration in soil.
- (5) >S = At pure component solubility (mg/l), selected risk level is not exceeded.

Table 2. Comparison of Site Characterization Data to ASTM Tier 2 Site-Specific Target Levels (SSTLs). Shell Service Station, 6039 College Avenue, Oakland, California. Revised to include California standard cancer slope factor for benzene and updated to March 5, 1996, RBCA Standard Guidance.

Media	Exposure Pathway	Benzene (ppm)		
		SSTL ⁽¹⁾	Maximum Detected Onsite ⁽²⁾	Maximum Detected at Alternative Points of Compliance ⁽³⁾
Soil	Volatilization to Outdoor Air (mg/kg)	1.33 (RBSL)	1.1 at 15.5 ft in MW-3	N/A
	Vapor Intrusion from Soil to Buildings (mg/kg)	91	1.1 at 15.5 ft in MW-3	N/A
	Leachate to Protect Groundwater Ingestion Target Level (mg/Kg)	0.17 (RBSL)	N/A	Not Detected in MW-5 or MW-6 ⁽⁴⁾
Ground Water	Volatilization to Outdoor Air (mg/L)	53.4 (RBSL)	0.82 in MW-3	N/A
	Vapor Intrusion from Ground Water to Buildings (mg/L)	5.2	0.82 in MW-3	N/A
	Ingestion (mg/L)	0.029 (RBSL)	N/A	0.0035 in MW-6

Notes:

⁽¹⁾ The SSTLs used for benzene are based on a carcinogenic risk of 1 in 100,000 (10^{-5}) and California's standard cancer slope factor of 0.1 mg/kg-day.

⁽²⁾ Maximum concentration detected in soil borings reported by Harding Lawson Associates, 1990. Max. ground water concentration detected in site wells from January 1990 through February 1995 (WA and Harding Lawson Associates quarterly ground water monitoring reports).

⁽³⁾ The selected alternative points of compliance are down gradient wells MW-5 and MW-6.

⁽⁴⁾ The benzene detection limit for soil from MW-5 was <0.005 mg/Kg and the benzene detection limit for soil from MW-6 was <0.0025 mg/Kg.

N/A = Not Applicable.

Table 3. A compilation of measured first order degradation rate constants for BTEX chemicals in unsaturated soils under aerobic conditions.

compound	half-life (hours)	rate constant (1/sec)	concentration	soil type	reference	notes	other notes
benzene toluene ethylbenzene xylenes	120 - 384 96 - 528 72 - 240 168 - 672	1.6e-6 - 5.0e-7 2.0e-6 - 5.0e-7 2.7e-6 - 3.6e-7 1.1e-6 - 8.0e-7			Howard (1991)	scientific judgment based on unacclimated aqueous aerobic biodegradation half-life.	p. 111 p. 410 p. 340 p. 643
total aromatic hydrocarbons (BTEX)	96 <	> 2.0e-6	6 - 31 ppm initial total aromatic hydrocarbons		Salanitro et al. (1989)	batch test-tube soil microcosms, >99% degradation.	aerobic, beach sand, Kalkaska sub-soil.
total aromatic hydrocarbons (BTEX)	48 - 96	4.0e-6 - 2.0e-6	0.1 - 31 ppm initial total aromatic hydrocarbons		Salanitro et al. (1988)	batch test-tube soil microcosms, >99% degradation.	aerobic, anaerobic also studied. Vero Beach, FA unsaturated soils.
benzene	60 - 108	3.2e-6 - 1.8e-6	0.5 - 50 ppm		Kemblowski et al. (1987)	microcosms.	aerobic, secondary reference, Baker (1993)
toluene benzene	24 < 24 <	> 8.0e-6 > 8.0e-6	to 500 ppm inlet concentrations		Salanitro et al. (1989)	convective soil columns, 97-99% removal at outlet.	3 in. dia., 6 ft. length, 5-6 L/dy flow, 5 hr retention time.
toluene			5-50 ppm inlet concentrations		Salanitro et al. (1989)	convective soil columns, <1-50 ppb, >99% degradation at outlet, beach sand, Kalkaska sub-soil.	3 in. dia., 6 ft. length, 4 ml/min flow, 5 hr retention time. 2-3 day acclimation period.
benzene toluene					Baker (1993)	column studies, CO ₂ , O ₂ stoichiometry.	
volatile organic compounds - gasoline					Fischer et al. (1996)	field measurements of soil gas under a building, sharp gradient in soil gas under building. (1000 x reduction, 0.1 m to 0.7 m depth).	slab-on-grade. VOC and SF ₆ tracer.
hydrocarbon vapor - aviation fuel	3.4	5.6e-5	100 - 10000 ppm vapor through vertical soil profile. fitted half-saturation constant = 260 ppm	uniform fine sand. OC not given, (conservatively) presumed zero. water/air partition, H _{equivalent} = 0.242. θ _r = 0.367, θ _s = 0.258. calculated H _{equiv} /K = 4.85	Ostendorf and Kampbell (1991); Ostendorf and Kampbell (1989); Kampbell et al. (1989)	field measurements of hydrocarbon vapor above a floating pool on the water table. Fitted Michaelis-Menton parameters, max. reaction rate V = 8.6e-9 kg/m ³ -s, half-sat. const K = 7.4e-4 kg/m ³ .	O ₂ and VOC profiles. stoichiometric transport modeling. Traverse City, MI
toluene	2	9.1e-5	11.1 - 140 (saturated) mg/L vapor at inlet	Pachappa loam (coarse-loamy), 0.49% OC, 2 mm sieve, well-mixed, 0.08 - 0.15 cm ³ /cm ³ water, cited H/K = 4.36	Jin, Y. et al. (1994)	diffusive soil columns. 4-6 day acclimation period. ND (>0.3 mg/L) to 30 x below what was expected with no degradation at the outlet.	multiple tests. 25 cm dia., 40 cm or 20 cm long soil columns.
benzene	4.5 - 8	4.3e-5 - 2.4e-5	0.11 ppm v/v initial vapor in chamber	Calico fine sandy loam with and without Bermuda grass and alfalfa	McFarlane, et al. (1981)	soil or soil-plant co-chambers, surface soils	degradation attributed to soil microorganisms. GC/FID benzene and ¹⁴ C-labeled, ¹⁴ CO ₂ analysis used.
volatile organic compounds - aviation fuel	1.8	1.1e-4	0.5 mg/L vapor	θ _w = 0.15 - 0.06	Moyer (1993)	intact unsaturated soil core, 0.6 m length, microcosm studies. Fitted Michaelis-Menton parameters, max. reaction rate V; half-sat. const K; V/K = 1.1e-4/s.	p. 109

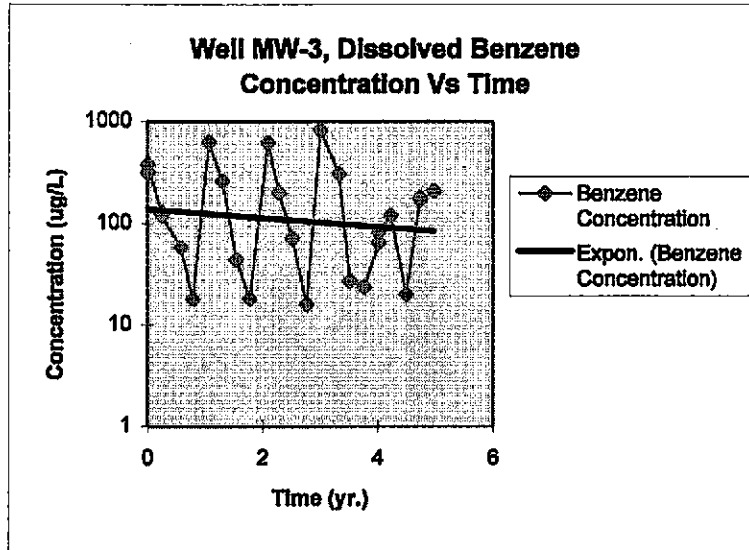
ATTACHMENT C

PLOTS OF DISSOLVED BENZENE CONCENTRATION IN WELL MW-3

Well MW-3, Benzene concentration in ground water with time as of February 1, 1995.

Shell Service Station WIC # 204-5508-3301, 6039 College Avenue, Oakland, California

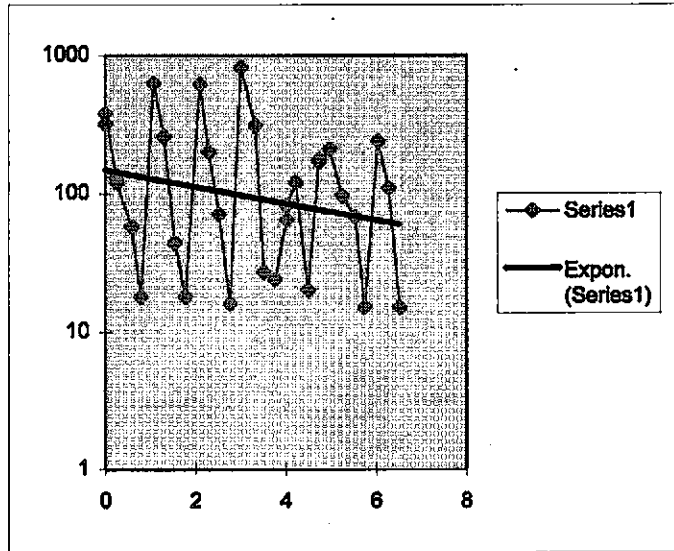
Date	Time (yr)	MW-3 benzene (ug/L)
2/13/90	0	320
2/13/90	0.00	380
5/14/90	0.25	130
5/14/90	0.25	120
9/12/90	0.58	58
11/27/90	0.79	18
3/8/91	1.06	630
6/3/91	1.30	260
8/30/91	1.54	44
11/22/91	1.77	18
3/18/92	2.09	620
5/28/92	2.29	200
8/19/92	2.52	71
11/17/92	2.76	16
2/12/93	3.00	820
6/10/93	3.32	310
8/18/93	3.51	27
11/19/93	3.77	24
2/18/94	4.02	65
2/18/94	4.02	82
5/4/94	4.22	120
5/4/94	4.22	120
8/10/94	4.49	20
11/8/94	4.74	180
11/8/94	4.74	170
2/1/95	4.97	210



Well MW-3, Benzene concentration in ground water with time as of August 19, 1996.

Shell Service Station WIC # 204-5508-3301, 6039 College Avenue, Oakland, California

Date	Time (yr)	MW-3 benzene
2/13/90	0	320
2/13/90	0.00	380
5/14/90	0.25	130
5/14/90	0.25	120
9/12/90	0.58	58
11/27/90	0.79	18
3/8/91	1.06	630
6/3/91	1.30	260
8/30/91	1.54	44
11/22/91	1.77	18
3/18/92	2.09	620
5/28/92	2.29	200
8/19/92	2.52	71
11/17/92	2.76	16
2/12/93	3.00	820
6/10/93	3.32	310
8/18/93	3.51	27
11/19/93	3.77	24
2/18/94	4.02	65
2/18/94	4.02	82
5/4/94	4.22	120
5/4/94	4.22	120
8/10/94	4.49	20
11/8/94	4.74	180
11/8/94	4.74	170
2/1/95	4.97	210
5/10/95	5.24	97
8/24/95	5.53	68
11/10/95	5.74	15
2/24/96	6.03	240
5/22/96	6.27	110
8/19/96	6.52	15



ATTACHMENT D

TABLE OF ANALYTIC RESULTS FOR GROUND WATER

Table 2. Analytic Results for Ground Water - Shell Service Station WIC #204-5508-3301, 6039 College Avenue, Oakland, California

Well/ Boring ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	TPH-MO	POG	MTBE	parts per billion (µg/L)					SVOCs
								B	E	T	X		
MW-1	02/13/90	17.73	95	650	770	---	---	ND	0.37	0.67	3.2	---	
	05/14/90	18.92	95	ND	770	---	---	0.70	0.71	0.57	3.5	---	
	09/12/90	19.81	ND	84	ND	---	---	ND	ND	ND	ND	---	
	11/27/90	20.39	---	---	---	---	---	---	---	---	---	---	
	03/08/91	16.85	ND	50	ND	---	---	ND	ND	ND	ND	---	
	06/03/91	17.82	ND	ND	ND	---	---	ND	ND	ND	ND	---	
	08/30/91	19.87	16.85	520	ND	---	---	ND	ND	ND	ND	---	
	11/22/91	20.58	<50	<50	<500	---	---	<0.5	<0.5	<0.5	<0.5	---	
	03/18/92	13.55	<30	<50	---	---	---	<0.3	<0.3	<0.3	<0.3	---	
	05/28/92	17.08	<50	<50	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/19/92	19.07	<50	<50	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/17/92	20.11	<50	<50	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/12/93	12.10	<50	<50	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	06/10/93	14.87	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	06/10/93 ^{dup}	14.87	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/18/93	16.90	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/19/93	19.72	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/18/94	15.08	<50	---	---	---	---	<0.5	<0.5	<0.5	1.7	---	
	05/04/94	17.20	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/10/94	18.76	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/10/94 ^{dup}	18.76	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/08/94	16.00	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/01/95	10.18	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	05/10/95	11.88	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/24/95	15.60	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/10/95	18.24	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/24/96	9.88	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	05/22/96	12.24	<50	---	---	---	---	<2.5	<0.5	<0.5	<0.5	---	
08/19/96	15.86	<50	---	---	---	---	<2.5	<0.5	<0.5	<0.5	---		
MW-2	02/13/90	16.90	ND	560	ND	---	---	ND	ND	ND	ND	---	
	05/14/90	18.01	ND	ND	ND	---	---	ND	ND	ND	ND	---	
	09/12/90	19.00	ND	ND	ND	---	---	ND	ND	ND	ND	---	

Table 2. Analytic Results for Ground Water - Shell Service Station WIC #204-5508-3301, 6039 College Avenue, Oakland, California (continued)

Well/ Boring ID	Date Sampled	Depth to Water (ft)	TPH-G	← parts per billion (µg/L) →								SVOCs
				TPH-D	TPH-MO	POG	MTBE	B	E	T	X	
	11/27/90	19.44	ND	ND	ND	---	---	ND	ND	ND	ND	---
	03/08/91	15.96	ND	ND	ND	---	---	ND	ND	ND	ND	---
	06/03/91	17.00	ND	ND	ND	---	---	ND	ND	ND	ND	---
	08/30/91	18.95	ND	ND	ND	---	---	ND	ND	ND	ND	---
	11/22/91	19.55	<50	<50	<500	---	---	<0.5	<0.5	<0.5	<0.5	---
	03/18/92	12.91	<30	---	---	---	---	<0.3	<0.3	<0.3	<0.3	---
	05/28/92	16.25	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	08/19/92	18.21	<50	---	---	---	---	<0.5	1.2	2	1.9	---
	11/17/92	19.15	<50	---	---	---	---	<0.5	1.2	2	1.9	---
	02/12/93 ^{dup}	11.60	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	02/12/93	11.60	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	06/10/93	14.14	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	08/18/93	16.10	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	08/18/93 ^{dup}	16.10	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	11/19/93	18.77	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	02/18/94	14.55	<50	---	---	---	---	<0.5	<0.5	<0.5	1.6	---
	05/04/94	16.34	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	08/10/94	15.79	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	11/08/94	15.04	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	02/01/95	10.08	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	05/10/95	11.68	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	08/24/95	14.94	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	11/10/95	13.36	<50	---	---	---	---	1.7	1.4	0.8	4.9	---
	02/24/96	9.90	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	02/24/96 ^{dup}	9.90	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	05/22/96	11.80	<50	---	---	---	<2.5	<0.5	<0.5	<0.5	<0.5	---
	08/19/96	15.08	<50	---	---	---	<2.5	<0.5	<0.5	<0.5	<0.5	---
	08/19/96 ^{dup}	15.08	<50	---	---	---	<2.5	<0.5	<0.5	<0.5	<0.5	---
MW-3	02/13/90	15.81	4,700	3,100	3,000	---	---	320	110	29	33	---
	02/13/90 ^{dup}	15.81	4,600	4,500	8,300	---	---	380	160	8.6	57	---
	05/14/90	16.97	1,400	620	40,000	---	---	130	40	8.6	17	---
	05/14/90 ^{dup}	16.97	8,200	660	10,000	---	---	120	38	31	13	---

Table 2. Analytic Results for Ground Water - Shell Service Station WIC #204-5508-3301, 6039 College Avenue, Oakland, California (continued)

Well/ Boring ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	TPH-MO	POG	MTBE	B	E	T	X	SVOCs
	09/12/90	18.78	2,000	1,500	19,000	---	---	58	16	5.8	15	---
	11/27/90	18.27	540	240	460	---	---	18	8.7	1.5	2.5	---
	03/08/91	14.86	3,400	2,100	ND	---	---	630	270	33	18	---
	06/03/91	15.84	1,700	690 ^a	ND	---	---	260	98	13	24	---
	08/30/91	17.79	870	370 ^b	500	---	---	44	10	6.1	2.9	---
	11/22/91	18.40	310	140	500	---	---	18	3.3	1.2	2.9	---
	03/18/92	12.03	67,100	1,900	20,000	---	---	620	220	28	38	---
	05/28/92	15.16	2,300	1,100 ^c	4,600	---	---	200	71	9	17	---
	08/19/92	17.03	5,700	1,000 ^c	1,800	---	---	71	52	77	130	---
	11/17/92	17.94	3,600	160 ^c	1,200	---	---	16	24	8.6	50	---
	02/12/93	9.16	4,700	560 ^c	<50	---	---	820	130	58	77	---
	06/10/93	13.20	2,200	---	940 ^d	---	---	310	89	23	23	---
	08/18/93	14.93	260	---	460 ^d	---	---	27	7.0	2.0	2.2	---
	11/19/93	17.58	1,500 ^e	---	960 ^d	<5,000	---	24	37	54	17	---
	02/18/94	13.30	2,700	---	1,600	<5,000	---	65	16	5.2	6.3	---
	02/18/94 ^{dup}		3,100	---	2,200	<5,000	---	82	19	6.7	7.9	---
	05/04/94	15.25	780	---	710	<5,000	---	120	21	7.5	6.9	f
	05/04/94 ^{dup}	15.25	920	---	1,600	<5,000	---	120	22	7.7	7.1	g
	08/10/94	16.63	920	---	<500	<5,000	---	20	3.0	2.3	2.2	r
	11/08/94	13.88	1,300	---	1,300	---	---	180	7.0	16	12	---
	11/08/94 ^{dup}	13.88	1,200	---	730	---	---	170	7.2	15	11	---
	02/01/95	9.25	1,400	---	900 ^e	---	---	210	11	8.5	8.7	t
	05/10/95	10.76	460	---	---	<5,000	---	97	1.0	10	19	r
	08/24/95	13.90	640	---	---	<5,000	---	68	14	21	19	u
	11/10/95	16.20	350	---	---	<5,000	---	15	1.2	2.3	2.5	---
	02/24/96	8.93	3,300	---	---	<5,000	---	240	38	53	55	---
	05/22/96	10.86	1,300	---	---	<5,000	3,500	110	<10	15	<10	v
	05/22/96 ^{dup}	10.86	1,300	---	---	<5,000	3,400	110	<10	17	<10	w
	08/19/96	13.97	350	---	---	9,200	340	15	3.4	3.3	3.3	x
MW-4	02/13/90	16.73	ND	1,200	3,000	---	---	ND	ND	ND	ND	---
	05/14/90	17.88	650	350	12,000	---	---	160	1.9	7	3.1	---
	09/12/90	17.85	440	260	2,600	---	---	91	0.75	1.1	0.79	---

Table 2. Analytic Results for Ground Water - Shell Service Station WIC #204-5508-3301, 6039 College Avenue, Oakland, California (continued)

Well/ Boring ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	TPH-MO	POG	parts per billion (µg/L)					SVOCs
	09/12/90 ^{dup}	17.85	520	1,100	16,000	---	---	85	0.71	0.71	0.81	---
	11/27/90	19.16	470	2,400	1,000	---	---	64	0.80	1.2	2.7	---
	03/08/91	15.77	1,100	2,600	15,000	---	---	330	88	3.5	5.8	---
	06/03/91	16.77	670 ^h	1,100 ⁱ	ND	---	---	240	1.6	2.3	2.3	---
	08/30/91	18.71	570	280 ⁱ	2,000	---	---	64	0.9	1.8	0.9	---
	11/22/91 ^{SPH}	---	---	---	---	---	---	---	---	---	---	---
	03/18/92 ^{SPH}	13.15	---	---	---	---	---	---	---	---	---	---
	05/28/92 ^{SPH}	16.22	---	---	---	---	---	---	---	---	---	---
	08/19/92 ^{SPH}	18.05	---	---	---	---	---	---	---	---	---	---
	11/17/92 ^{SPH}	18.89	---	---	---	---	---	---	---	---	---	---
	02/12/93 ^{SPH}	11.78	---	---	---	---	---	---	---	---	---	---
	06/10/93	14.20	---	---	---	---	---	---	---	---	---	---
	08/18/93 ^{SPH}	15.95	---	---	---	---	---	---	---	---	---	---
	11/19/93 ^{SPH}	18.48	---	---	---	---	---	---	---	---	---	---
	02/28/94 ^{SPH}	14.60	---	---	---	---	---	---	---	---	---	---
	05/04/94 ^{SPH}	16.15	---	---	---	---	---	---	---	---	---	---
	08/10/94 ^{SPH}	17.58	---	---	---	---	---	---	---	---	---	---
	11/08/94 ^{SPH}	15.05	---	---	---	---	---	---	---	---	---	---
	02/01/95 ^{SPH}	10.71	---	---	---	---	---	---	---	---	---	---
	05/10/95	11.90	---	---	---	---	---	---	---	---	---	---
	08/24/95	14.97	---	---	---	---	---	---	---	---	---	---
	11/10/95	17.27	4,700	---	---	29,000	---	100	23	22	38	---
	02/24/96	10.44	---	---	---	---	---	---	---	---	---	---
	08/19/96	15.23	---	---	---	---	---	---	---	---	---	---
MW-5	08/30/91	16.74	ND	80	ND	---	---	ND	ND	ND	ND	---
	11/22/91	17.27	<50	<50	<500	---	---	<0.5	<0.5	<0.5	<0.5	---
	03/18/92	11.28	<30	<50	---	---	---	<0.3	<0.3	<0.3	<0.3	---
	05/28/92 ^j	---	---	---	---	---	---	---	---	---	---	---
	08/19/92	15.99	<50	<50	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	11/17/92	16.84	<50	<50	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	02/12/93	10.30	<50	<50	---	---	---	<0.5	<0.5	<0.5	<0.5	---
	06/10/93	12.36	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---

Table 2. Analytic Results for Ground Water - Shell Service Station WIC #204-5508-3301, 6039 College Avenue, Oakland, California (continued)

Well/ Boring ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	TPH-MO	POG	MTBE	parts per billion (µg/L)					SVOCs
								B	E	T	X		
	08/18/93	14.02	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/19/93	16.50	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/19/93 ^{dup}	16.50	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/18/94	12.55	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	05/04/94	14.27	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/10/94	15.60	70 ^p	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/08/94	12.85	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/01/95	8.98	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	05/10/95	10.16	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	05/10/95 ^{dup}	10.16	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/24/95	12.98	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/10/95	15.12	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/24/96 ^j	---	---	---	---	---	---	---	---	---	---	---	
	05/22/96	10.10	<2,000	---	---	---	9,800	<20	<20	<20	<20	---	
	08/19/96	13.09	<2,500	---	---	---	13,000	<25	<25	<25	<25	---	
MW-6	09/21/93	14.64	<50	<50	---	<5,000	---	<0.5	<0.5	<0.5	<0.5	<10-50	
	11/19/93 ^k	---	---	---	---	---	---	---	---	---	---	---	
	02/28/94	12.18	98 ^l	---	---	<5,000	---	<0.5	<0.5	<0.5	<0.5	---	
	05/04/94	13.62	<50	---	---	<5,000	---	<0.5	<0.5	<0.5	<0.5	<2-10	
	08/10/94	14.98	80 ^o	---	---	<5,000	---	<0.5	<0.5	<0.5	<0.5	r	
	11/08/94 ^j	12.20	---	---	---	---	---	---	---	---	---	---	
	02/01/95	8.70	120	---	---	---	---	3.5	3.4	21	22	---	
	02/01/95 ^{dup}	8.70	110	---	---	---	---	0.6	0.5	0.6	0.9	---	
	05/10/95	9.86	---	---	---	---	---	---	---	---	---	---	
	08/24/95	12.46	80	---	---	---	---	<0.5	1.8	<0.5	2.4	---	
	08/24/95 ^{dup}	12.46	70	---	---	---	---	<0.5	1.2	<0.5	1.3	---	
	11/10/95	14.56	<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/10/95	14.56	60	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/24/96 ^j	---	---	---	---	---	---	---	---	---	---	---	
	05/22/96	10.23	<50	---	---	---	290	<0.5	<0.5	<0.5	<0.5	---	
	08/19/96	12.61	<1,250	---	---	---	1,100	<12	<12	<12	<12	---	

Table 2. Analytic Results for Ground Water - Shell Service Station WIC #204-5508-3301, 6039 College Avenue, Oakland, California (continued)

Well/ Boring ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	TPH-MO	POG	MTBE	parts per billion (µg/L)					SVOCs
								B	E	T	X		
BH-A	09/09/93	16.50	4,900	2,900 ^c	---	<5,000	---	18	54	<5	11	m	
BH-B	09/09/93	15.85	<50	150	---	<5,000	---	<0.5	<0.5	<0.5	<0.5	ND	
BH-C ⁿ	09/10/93	15.80	640 ^o	100	---	<5,000	---	3.5	0.6	<0.5	<0.5	ND	
BH-D ⁿ	09/10/93	14.2	24,000 ^o	25,000 ^c	---	20,000	---	720	44	86	11	p	
Bailer	08/19/92		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
Blank	11/17/92		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
Trip	02/13/90		ND	---	---	---	---	ND	ND	ND	ND	---	
Blank	05/14/90		ND	---	---	---	---	ND	ND	ND	ND	---	
	09/12/90		ND	---	---	---	---	ND	ND	ND	ND	---	
	03/08/91		ND	---	---	---	---	ND	ND	ND	ND	---	
	06/03/91		ND	---	---	---	---	ND	ND	ND	ND	---	
	08/30/91		ND	---	---	---	---	ND	ND	ND	ND	---	
	03/18/92		<30	<50	---	---	---	<0.3	<0.3	<0.3	<0.3	---	
	05/28/92		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/19/92		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/17/92		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/12/93		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	06/10/93		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/19/93		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/28/94		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	05/04/94		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/10/94		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/08/94		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	02/01/95		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	05/10/95		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	08/24/95		<50	---	---	---	---	<0.5	<0.5	<0.5	<0.5	---	
	11/10/95		<50	---	---	---	---	<0.5	<0.5	0.7	<0.5	---	

Table 2. Analytic Results for Ground Water - Shell Service Station WIC #204-5508-3301, 6039 College Avenue, Oakland, California (continued)

Well/ Boring ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	TPH-MO	POG	MTBE	B	E	T	X	SVOCs
DTSC MCLs			NE	NE	NE	---	---	1	680	100 ^q	1,750	---

Abbreviations:

TPH-G = Total petroleum hydrocarbons as gasoline by Modified EPA Method 8015
 TPH-D = Total petroleum hydrocarbons as diesel by Modified EPA Method 8015
 TPH-MO = Total petroleum hydrocarbons as motor oil by EPA Method 8015
 B = Benzene by EPA Method 8020
 E = Ethylbenzene by EPA Method 8020
 T = Toluene by EPA Method 8020
 X = Xylenes by EPA Method 8020
 POG = Petroleum Oil & Grease by EPA Method 5520B/F
 SVOCs = Semivolatile organic compounds by EPA Method 8270
 NE = Not established
 DTSC MCLs = California Department of Toxic Substances Control Maximum Contaminant Levels drinking water
 --- = Not analyzed or measured
 <n = Not detected at detection limits of n ppb
 ND = Not detected, detection limit not known
 SPH = Separate-phase hydrocarbons in well, not sampled
 dup = Duplicate sample

Notes:

a = Positive results for diesel appear to be less volatile constituents of gasoline
 b = Positive results for diesel has a typical diesel pattern
 c = Concentration reported as diesel is primarily due to the presence of a lighter petroleum product, possibly gasoline or kerosene
 d = Concentration reported as motor oil is due to the presence of a combination of motor oil and a lighter petroleum product of hydrocarbon range C6-C12, possibly gasoline

Notes (continued):

e = Concentration reported as gasoline is due to the presence of gasoline and a discrete peak not indicative of gasoline
 f = Compounds are within chromatographic range of gasoline but are not characteristic of the standard gasoline pattern
 g = Results include compounds apparently due to gasoline as well as those due to diesel
 h = 6.5 ppb Naphthalene detected
 i = 11.0 ppb Naphthalene detected
 j = Well inaccessible and not sampled
 k = Well inadvertently not sampled
 l = The concentration reported as gasoline is primarily due to the presence of a discrete peak not indicative of gasoline
 m = 13 ppb-methylnaphthalene and 23 ppb naphthalene detected
 n = Due to chain of custody mis-communication analyses run after holding time expiration
 o = The positive result has an atypical pattern for gasoline analysis
 p = 75 ppb 2-methylnaphthalene and 18 ppb naphthalene detected
 q = DTSC recommended action level; MCL not established
 r = Not detected at detection limits between 10 and 50 ppb
 s = Concentration reported as motor oil is due to the presence of heavier and lighter petroleum products.
 t = 27 ppb Naphthalene detected
 u = 12 ppb Naphthalene detected
 v = 37 ppb Naphthalene, 8.4 ppb 2methylnaphthalene detected.
 w = 37 ppb Naphthalene, 7.8 ppb 2methylnaphthalene detected.
 x = Reference not available

