Harding Lawson Associates

ENVIRONMENTAL PROTECTION

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HLA

November 11, 1997

11295.012

Ms. Pam Evans
Alameda County Health Care Services
Environmental Protection
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Response and Corrective Action Plan
STID 4148
1700 Jefferson Street
Oakland, California

Dear Ms. Evans:

Transmitted herewith is one copy of our *Response and Corrective Action Plan* (dated November 11, 1997) for the subject property.

We trust that this provides the information required at this time. If you have any questions, please call.

Yours very truly,

HARDING LAWSON ASSOCIATES

James McCarty

James G. McCarty
Project Engineer
JGM 11295\TRANS.DOC

Harding Lawson Associates

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1131 Harbor Bay Parkway, Suite 250
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Response and Corrective Action Plan
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1700 Jefferson Street
Oakland, California

Dear Ms. Evans

On behalf of Blue Print Services Company (BPS), Harding Lawson Associates (HLA) presents this letter is in response to the Alameda County Health Care Services (ACHCS) letter dated September 11, 1997, and provides a Corrective Action Plan (CAP) for the site at 1700 Jefferson, Oakland, California as required by the ACHCS. HLA currently operates a pump and treat system at the site to removes free phase and dissolved concentrations of gasoline present at the site. The system has nearly completed free product recovery operations and groundwater concentrations are anticipated to attenuate. As discussed below, the CAP evaluates actions suggested by ACHCS. Based on our evaluation, HLA recommends shutting down the system after completing free product recovery, conducting additional offsite groundwater and source investigations, and managing the site using risk-based corrective action (RBCA).

RESPONSE TO ACHCS LETTER DATED SEPTEMBER 11, 1997

HLA is providing several clarifications regarding ACHCS concerns and recommendations presented in your September 11th letter, referencing information from two HLA reports: *Semiannual Remediation and Monitoring Report* dated April 16, 1997 and *Preliminary Cost/Benefit Analysis* dated September 26, 1996. ACHCS itemized four concerns pertaining to the continued operation of the treatment system and requested an immediate halt to the current remediation effort. Based on the items listed by the ACHCS, it appears there are several misunderstandings about the system's effectiveness and the 3,800 pounds of free phase recovery to date. In addition, it appears that the letter did not consider information from the latest quarterly monitoring report dated July 14, 1997 (second quarter 1997). In an effort to clear up any misunderstanding and provide you with the current status of the site the four itemized concerns are addressed below.

1. **"Analytical data obtained from the historical quarterly groundwater data indicated the concentrations of contaminants around MW-1A (the extraction well) have not gone down."**

   The treatment system consists to two extraction wells: MW-1A and MW-4. This system has successfully completed free phase source removal operations. The free phase previously served as a continuing source of hydrocarbons dissolving into the shallow groundwater therefore no decrease in groundwater concentrations was expected pending source removal. Now that free product has been removed, dissolved total petroleum hydrocarbons as gasoline (TPHg) concentrations are anticipated to attenuate.

2. **"The groundwater pump and treat system does not appear to be controlling the hydrocarbon plume, as documented by the high concentration of petroleum hydrocarbons which have consistently been detected in the down gradient monitoring well (MW-5)."**

   The purpose of MW-5 is to provide a downgradient monitoring point and allow hydraulic gradient calculations. The recent variability of the groundwater gradient and potential offsite sources in the area make it difficult to assess overall groundwater conditions based on observations at any given monitoring point.

   Groundwater samples from both extraction wells have shown decreasing TPHg concentrations until the summer of 1996 when the dewatering activities for two upgradient construction projects reversed the local groundwater gradient direction. At that time free phase gasoline that had moved in the original gradient direction beyond the radius of influence of the two extraction wells migrated back onsite and was subsequently recovered by the treatment system. Between June 1996 and February 1997 approximately 200 gallons of free phase product were recovered by the system.

   The purpose of the treatment system is to remove free-phase product. When free phase product was no longer being recovered by the system in late 1995, HLA presented an *Offsite Groundwater Investigation Work Plan* to ACHCS, dated January 22, 1996, detailing a groundwater investigation to further define the dissolved TPHg plume and proposed to perform a RBCA evaluation as the next step in the site remediation. Details of the RBCA were discussed with ACHCS of March 6, 1996 during a telephone conference call between Dale Klatch and Madhulla Logan of the ACHCS and Rosemary Wood, Steve Book, and Dave Scrivner of HLA. It is our understanding that the Work Plan for the groundwater investigation and the details of the proposed risk assessment (RA) methodology were approved at that time. When the gradient change occurred and free phase product returned to the site in June of 1996 these plans were put on hold until the free phase product was recovered. Currently the system is no longer recovering free phase product and the latest data indicates an improvement in the water quality at MW-5 (see Charts 1, 2, 3, 4, and 5). The last groundwater monitoring report dated July 14, 1997 shows declining concentration in MW-1, MW-1A, MW-4, and MW-5 (see attached Table 1). Water level measurement taken during the last quarterly sampling event indicate the gradient has returned to its original direction, north to northwest.

3. **"Of the 3,800 pounds of contaminates removed since the remediation system began, only 300 pounds of hydrocarbons have been removed by the system (less than 8%)."**

   Actually, the system has removed 100% of the hydrocarbons referenced by ACHCS. As explained in the cost benefit analysis as well as the quarterly reports, the system consists of an oil water/separator and a bioreactor. The extracted groundwater first passes through the oil/water separator where any free phase product is removed, the groundwater is then drawn into the bioreactor where the dissolved TPHg and BTEX concentrations are reduce to low levels by hydrocarbon reducing microbes. The treated water from the bioreactor is pumped in approximately 500 gallon batches through three liquid-phase carbon drums arranged in-line to remove any remaining dissolved hydrocarbons before being discharged to the sanitary sewer as permitted by the East Bay Municipal District (EBMUD). As stated in the cost benefit analysis; of the 3,800 pounds of hydrocarbons removed, 3,500 pounds was free phase product removed by the system oil/water separator. We estimate that an additional 300 pounds of dissolved hydrocarbons have been removed by the bioreactor and carbon before the treated groundwater is discharged to the sanitary sewer. Since the cost benefit analysis report was issued to the ACHCS in September 1996, 175 gallons or 1,000 pounds of hydrocarbons have been remove in the same manner. Currently the system is only removing dissolved concentration as additional free phase product has not been observed in the oil/water separator since September 1997.

4. **"It is obvious, due to the high cost and lack of effectiveness, that the operation of the bioreactor pump and treat system should be discontinued at once. Notify this office as soon as this occurs."**

   We concur with ACHCS that system operations should be discontinued in the near future. However, we believe that discontinuation is appropriate because the system has successfully completed the free product recovery as designed. As a result, water quality in downgradient well MW-5 has shown significant improvement since the system began operation in 1992 and TPHg, benzene, and toluene have dropped by fifty percent or more, as shown by the attached Charts 1 through 5. Therefore, after two quarters of operation without observed free product, we agree that the decision to discontinue treatment system operation is in our client's and ACHCS's best interest.

CORRECTIVE ACTION PLAN

This Corrective Action Plan (CAP) evaluates several remediation approaches suggested by ACHCS. To assist with regulatory review and consistent with the National Contingency Plan (NCP), this CAP has been prepared in accordance with U.S. Environmental Protection Agency (EPA) guidance documentation[1].

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1 U.S. Environmental Protection Agency (EPA), 1988. *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA.*

Development of Corrective Action Alternatives

After considering a number of remediation approaches, HLA concurs with the four alternatives identified by ACHCS as being technologies worth considering for implementation at the site. These alternatives include:

- Alternative 1 - Free Product Removal
- Alternative 2 - Installation of Oxygen Releasing Compound (ORC)
- Alternative 3 - Bioslurping
- Alternative 4 - Vapor Extraction

Evaluation of Corrective Action Alternatives

This section provides an evaluation of the four corrective measure alternatives in accordance with the following nine criteria specified by EPA guidance documentation including:

- ***Short-term Effectiveness*** - Addresses the effectiveness and impacts that occur during construction and/or initial corrective action implementation.
- ***Long-term Effectiveness*** - Considers the effectiveness and impacts that occur through corrective action completion.
- ***Implementibility*** - Includes technical and administrative feasibility, availability of resources, and reliability of technology.
- ***Cost*** - Considers the relative cost to implement each corrective measure alternative.
- ***Overall Protection of Human Health and the Environment*** - Addresses the ability for each alternative to protect human health and the environment.
- ***Compliance with Applicable or Relevant and Appropriate Regulations (ARARs)*** - Addresses the regulatory requirements to be satisfied by each corrective action; such requirements have not been specifically developed for this site and is beyond the scope of this CAP.
- ***Reduction of Toxicity, Mobility, and Volume*** - Assesses the degree to which each corrective action reduces the toxicity, mobility, and volume of the contaminants.
- ***Regulatory Acceptance*** - Addresses the degree of regulatory acceptance for each alternative.
- ***Community Acceptance*** - Considers community concerns regarding each corrective action.

Alternative 1 - Free Product Removal

Free phase product removal is the most direct means of recovering released hydrocarbons. The current system actively extracts free phase product from the recovery wells and recovers the product using an oil/water separator. As demonstrated by the substantial amount of free product recovered by the system at this site (3,500 of 3,800 pounds).

Free product recovery has no short-term affects or impacts. Long-term effectiveness is very high because it directly removes a continuing source of groundwater contamination. This technology has already been implemented and is nearing completion; at an overall cost of $35 per pound of gasoline removed, this technology is far more cost effective than most other remediation technologies. Human health and the environment are protected by the removing a source of groundwater contamination. Free product removal reduces the mobility and volume of contaminants, is accepted by regulatory agencies as source removal, and the local community has not objected to the current system operations.

Alternative 2 - Installation of ORC

ORC is a recently developed technology that enhances natural biodegradation of TPHg by providing a continuous source of dissolved oxygen to support microbial populations that consume hydrocarbons. The ORC, a chemical substance with physical characteristics that are similar to dry concrete, is placed in direct contact with the groundwater via soil borings and/or monitoring wells. The ORC gradually releases oxygen into the groundwater over a period of 6 months to 2 years and this oxygen is readily used by micro organisms to degrade hydrocarbons. Dissolved oxygen radiates from the well via groundwater migration and natural dispersion; therefore, the effectiveness of ORC is highly dependent on permeability and other subsurface conditions. Because pure hydrocarbon product inhibits micro organisms, this technology may be excellent at remediating dissolved hydrocarbon plumes but is inappropriate for treating free product.

The installation of ORC has limited short-term disruptions during well and boring installation. Long-term effectiveness may be good to further reduce dissolved hydrocarbon concentrations now that free product has been removed from the site; however, insufficient information is currently available to reliably anticipate long-effectiveness and Implementibility in this area of Oakland for the following reasons:

- Possible nearby off-site sources contributing to free product and dissolved hydrocarbons
- Undefined extent of contamination
- Highly variable groundwater gradient direction
- Low permeability soils
- Shallow groundwater with numerous underground utilities acting as preferential pathways.

Assuming that ORC is feasible to implement, it would protect human health and the environment by reducing toxicity and volume of contaminants. This is a relatively inexpensive approach to reducing dissolved hydrocarbons concentrations but only has the potential of eliminating a fraction of the hydrocarbon mass the current free product recovery system has achieved. ORC has become commonly accepted by most regulatory agencies and was suggested by ACHCS. We do not anticipate objections from the local community except for minor disruptions during construction.

Alternative 3 - Bioslurping

Bioslurping involves groundwater and vapor extraction to remove hydrocarbons and introducing oxygen into the subsurface to enhance biodegradation. Soil vapors and groundwater with higher oxygen content are pulled through the soil pore space toward the well as contaminated fluids are extracted. This corrective measure involves the treatment and discharge of both treated groundwater and soil vapors.

The installation of bioslurping would involve significant construction to install vapor extraction capabilities. Implementation would be very difficult due to space constraints at the site. Long-term effectiveness and performance feasibility are difficult to reliably anticipate for the same reasons listed under Alternative 2. Bioslurping would protect human health and the environment by reducing toxicity, mobility, and volume of contaminants if it were feasible to implement. However, this approach would be cost prohibitive to implement, especially when compared to ORC as a more practical means of enhancing natural biodegradation processes. This system would be difficult to permit with multiple regulatory agencies overseeing operations. In addition, vapor extraction equipment is often noisy to a degree that is likely to be unacceptable to the local community.

Alternative 4 - Vapor Extraction

Vapor extraction removes hydrocarbons from the soil and introduces oxygen into the subsurface to enhance biodegradation. Soil vapors with higher oxygen content are pulled through the soil pore space toward the well as hydrocarbon-rich vapors are extracted. This corrective action involves discontinuing operation of the existing free-product recovery and groundwater treatment system and installation of a new system to treat and discharge contaminated soil vapors.

The installation of vapor extraction would involve local disruption during construction. Implementation would be very difficult due to space constraints at the site. Long-term effectiveness and performance feasibility are difficult to reliably anticipate for the same reasons listed under Alternative 2. Vapor extraction would protect human health and the environment by reducing toxicity, mobility, and volume of contaminants if it were feasible to implement. This approach would be cost prohibitive to implement. This system would be difficult to permit with multiple regulatory agencies overseeing operations. In addition, vapor extraction equipment is often noisy to a degree that is unacceptable to local community.

Selection of Preferred Alternative(s)

Alternative 1 (free product recovery) is clearly the most feasible corrective action that could be implemented at this site. With the removal of free product by the existing system nearing completion, we have eliminated much more hydrocarbon mass than will ever be achieved treating dissolved concentrations.

Alternative 2 (ORC installation) is much more practical to implement than either Alternative 3 (bioslurping) or Alternative 4 (vapor extraction). Because of minimal permitting requirements, ORC installation has a high degree of regulatory acceptance. In contrast, both bioslurping and vapor extraction are cost prohibitive when compared to ORC installation and they involve construction activities and noise that may be disruptive to the local community. However, as mentioned above, insufficient information is currently available to reasonably anticipate the feasibility of implementing ORC installation.

RECOMMENDATIONS

HLA recommends proceeding with the following CAP, which generally concurs with suggestions from ACHCS:

1. Discontinue operation of the existing free product recovery system. Since free product has not been observed since September 1997, we believe the system should be turned off in April 1998, assuming no product has been observed at the site for the entire 6 month period. This will allow time to monitor for improvement in groundwater quality, an indication of effective free phase removal. Although the system could continue extracting contaminated groundwater, continued operations will significantly increase the cost per pound of hydrocarbon recovered with a very minor contribution to the total mass removed.

2. Further delineate the plume and nearby contributing sources. We propose to proceed with our *Offsite Groundwater Investigation Work Plan* (dated January 22, 1996), as previously approved by ACHCS, to further delineate the hydrocarbon plume and identify possible offsite contributing sources. This plan proposed the construction of a upgradient monitoring well and the installation of seven temporary well points. The monitoring well construction was completed in April 1996 with the installation of MW-6. The remaining work involves advancing boring to approximately 5 feet below static groundwater level and inserting 1-inch slotted PVC casing as temporary well points. The temporary well point will be checked within 12 to 24 hours for free phase product and then sampled for TPHg and BTEX if free phase product is not present. The PVC casing would then be removed and the boring sealed with grout.

3. Proceed with RBCA and implement risk management approaches at the site. We propose to proceed with our human health risk assessment screening, as discussed with ACHCS during a meeting on August 8, 1996. The proposed RBCA consisted of collection of vapor flux measurements and the analysis of the data based on human health risk criteria. Six downgradient locations will be sampled by vapor flux; three in the basement area adjacent to the site, one near the foundation of the neighboring building, and two across 18th Street near the Homeless

Assistance Center. The data will be evaluated based on cancer risks and noncancer health hazards corresponding to Tier 3 of the RBCA method; target risk will be 10^{-6} for offsite residents receptors and 10^{-5} for offside commercial receptors. In the event that risk estimates for the chemicals of potential concern exceeds the target risk, risk-based site-specific groundwater cleanup goals will be developed corresponding to Tier 2 of the RBCA method.

We look forward to working with ACHCS in implementing these mutually agreeable activities. With source removal complete at this site, future activities can focus on risk management techniques rather than implementing costly and ineffective technologies.

Yours very truly,

HARDING LAWSON ASSOCIATES

James G. McCarty
Project Engineer

Michael A. Sides, P.E.
Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
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CIVIL
STATE OF CALIFORNIA

JGM/MAS/mlw 11295\036605L.DOC

1 copies submitted

Attachments: Table 1.
Groundwater Monitoring Analytical Results
Charts 1. through 5.
Chemical Results from groundwater Samples Collected at Monitoring Well 5

cc: Jeff Christoff
Blue Print Services Company
1057 Shary Circle
Concord, CA, 94518

Chart 1. Chemical Results from Groundwater Samples Collected at Monitoring Well 5
Blue Print Services, Oakland, California

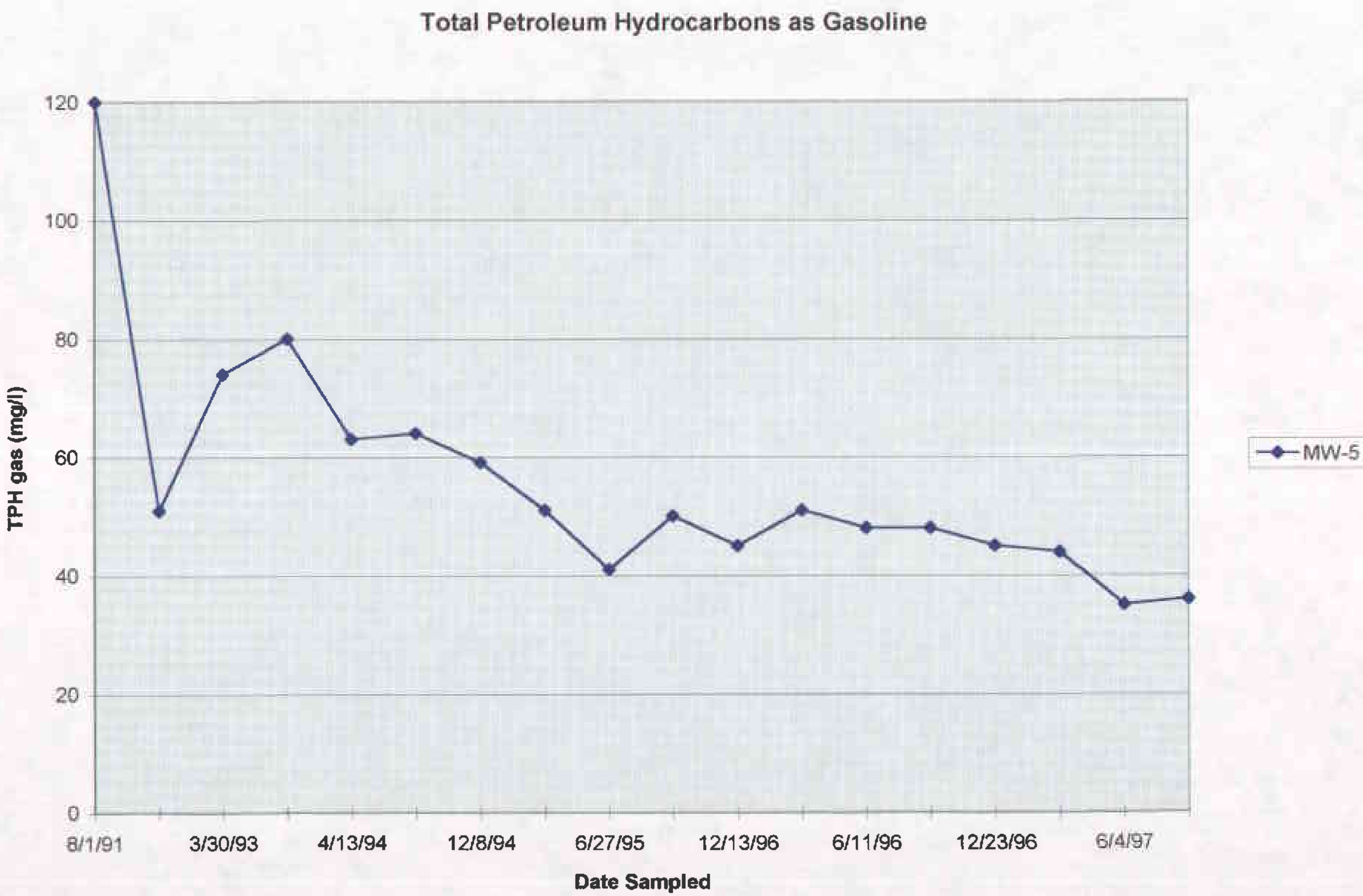

Chart 2. Chemical Results from Groundwater Samples Collected at Monitoring Well 5
Blue Print Services, Oakland, California

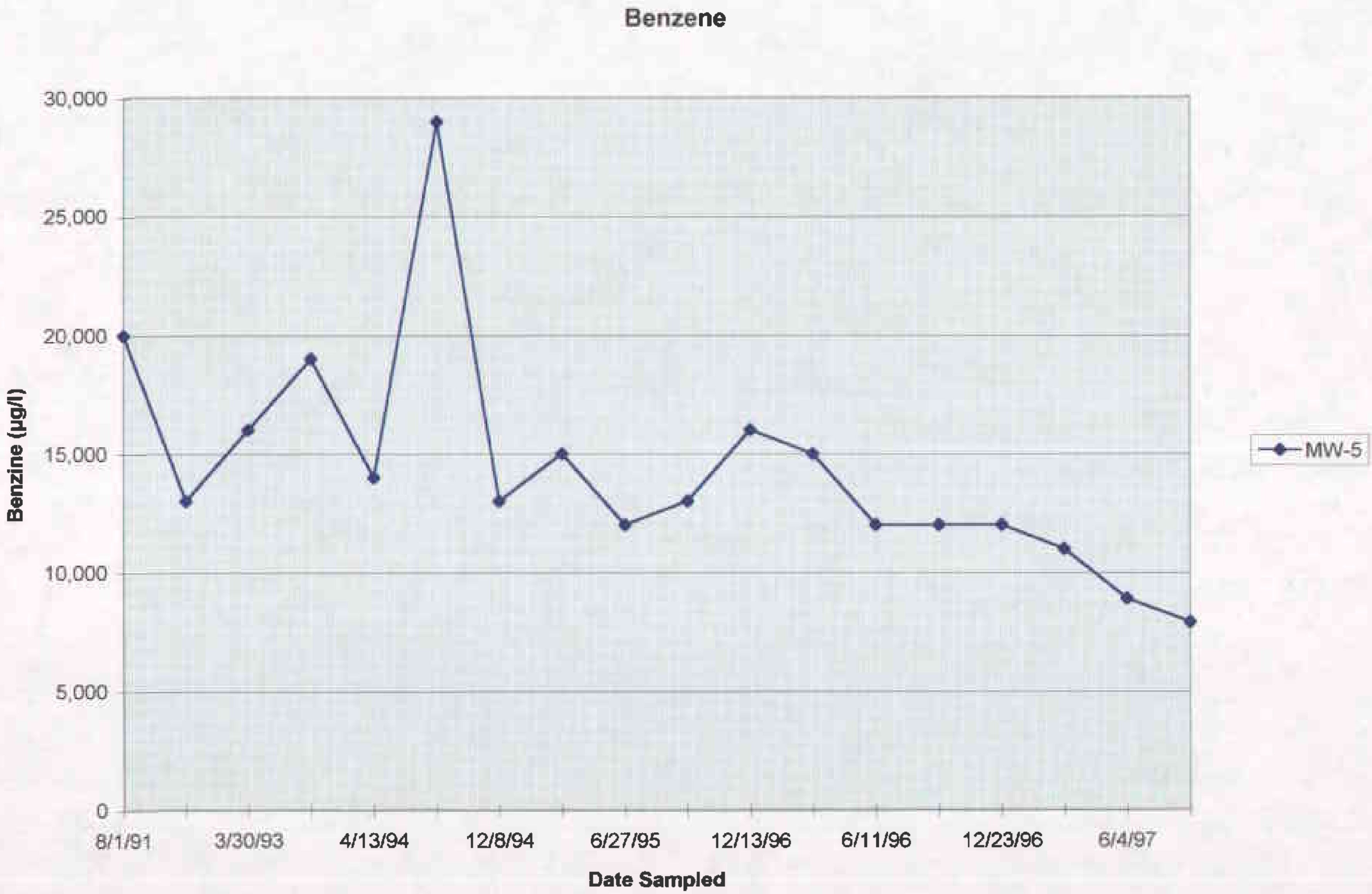

Chart 3. Chemical Results from Groundwater Samples Collected at Monitoring Well 5
Blue Print Services, Oakland, California

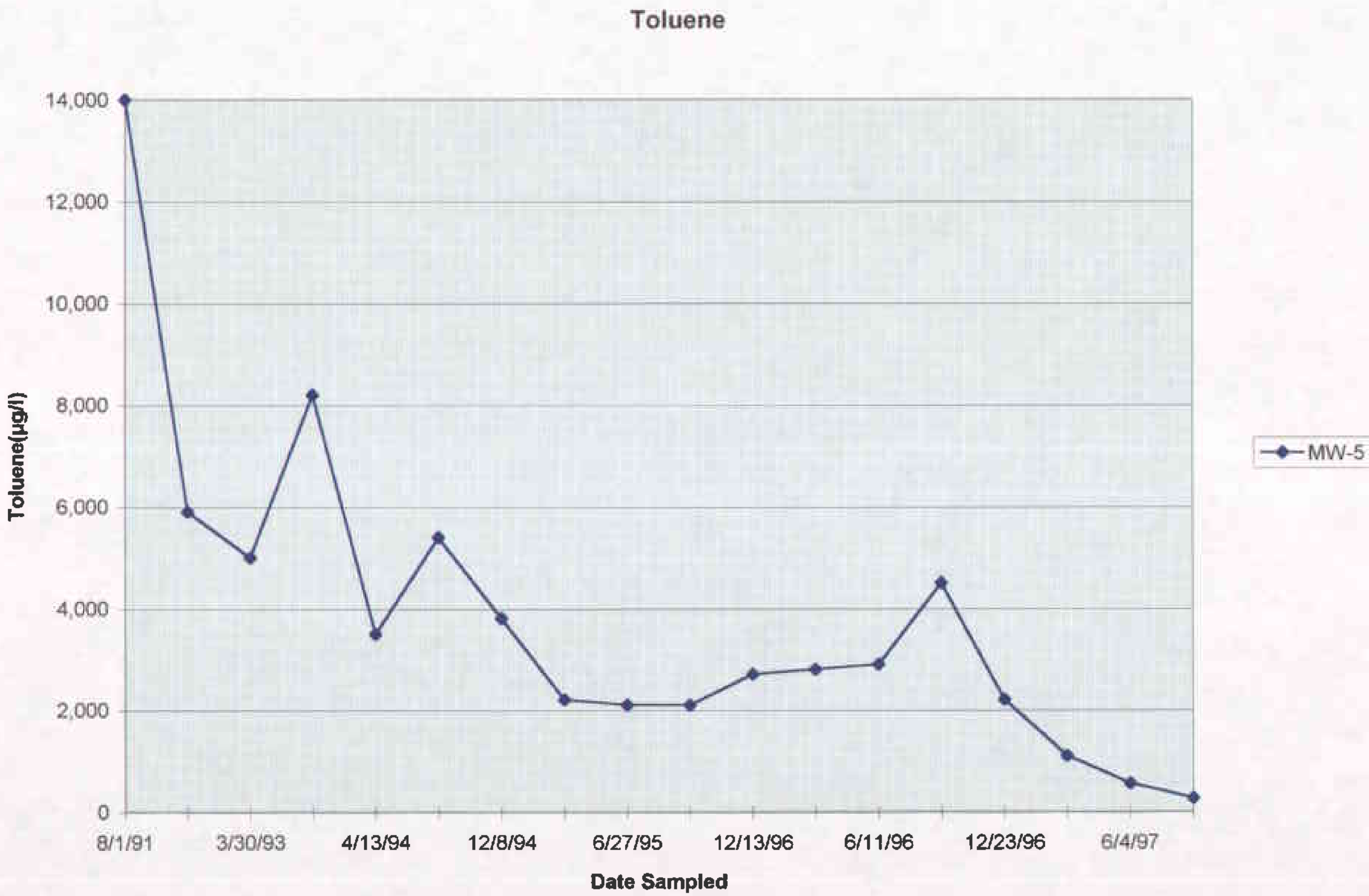

Chart 4. Chemical Results from Groundwater Samples Collected at Monitoring Well 5
Blue Print Services, Oakland, California

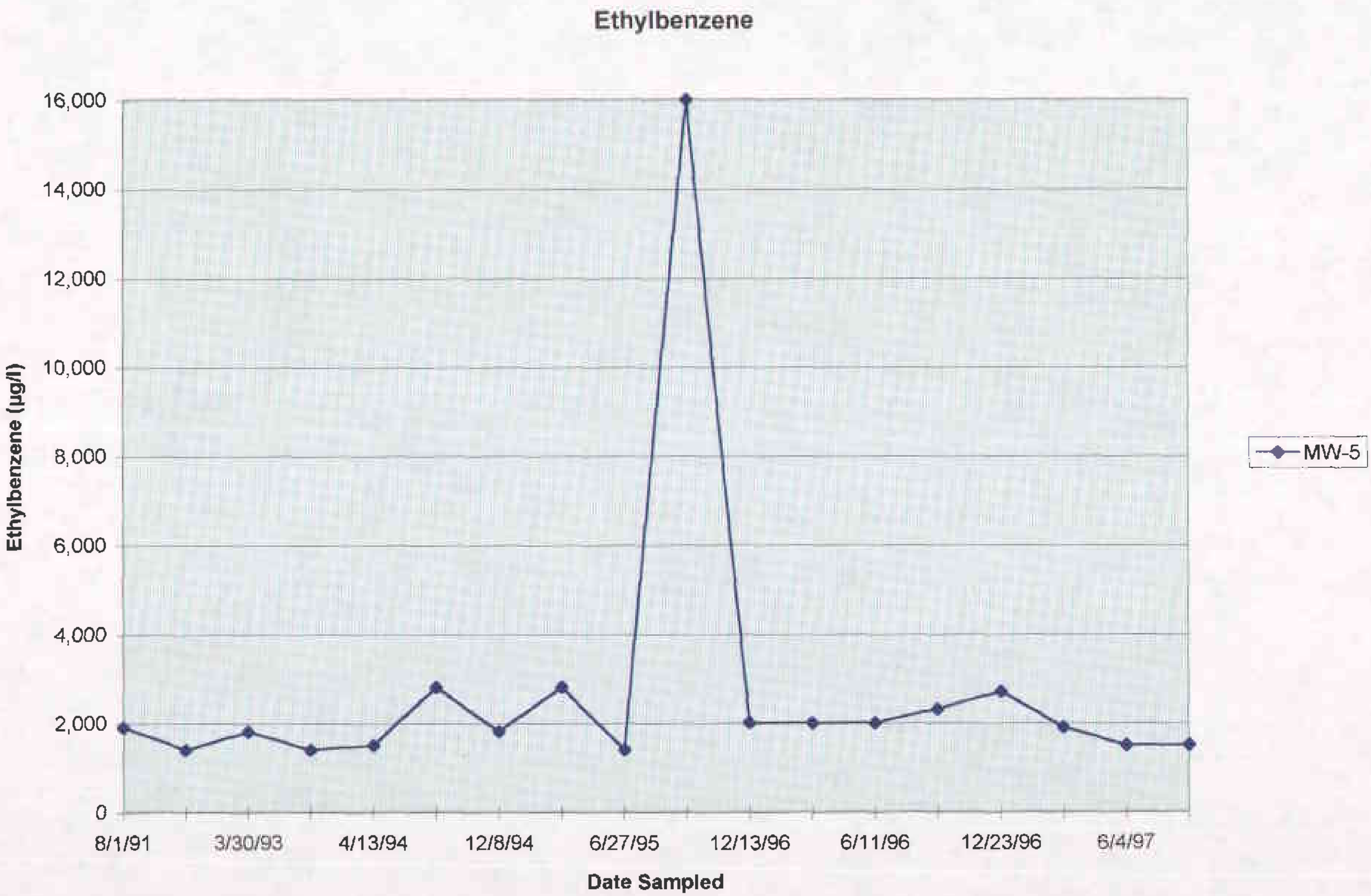

Chart 5. Chemical Results from Groundwater Samples Collected at Monitoring Well 5
Blue Print Services, Oakland, California