

**Appendix C**  
**Correspondence**

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**San Francisco Bay Regional Water Quality Control Board**

July 22, 2013

Mr. Nathan King  
SF Bay Regional Water Board  
1515 Clay St., Suite 1400  
Oakland, CA 94612-1482

*Sent via email only*

Subject: Comments on Tentative Order for Moonlite Associates, LLC, and United Artist Theater Circuit, Inc.

Dear Mr. King,

Please accept these comments from the Water Board's Advisory Team on the Tentative Order that would adopt Site Cleanup Requirements for Moonlite Associates, LLC, and United Artist Theater Circuit, Inc. The following comments recommend substantive changes. Attached is a redline version of the Tentative Order that includes these recommended changes as well as suggested minor typographical and formatting changes.

1. We recommend adding a reference to Water Code section 13267 in the "It is Hereby Ordered" paragraph to avoid any dispute regarding the Water Board's ability to require investigation as part of the Order.
2. On page 11 of the Order, under Cleanup Level Section B., Soil Cleanup, Soil Gas Cleanup, and Sub-Slab Soil Gas Cleanup, the Order as written appears to limit the requirements for the dischargers to meet the specified cleanup levels to the boundaries of the Site (the address), rather than all areas overlying the plume. However, from the findings and tasks in the Order, it appears that staff intends to have the dischargers clean up soil or soil gas offsite should that become necessary. The proposed edit, referring to areas overlying the plume rather than the Site, would ensure that the Order governs cleanup of any offsite portions of the plume.
3. For the same reasons given in comment 2, on page 12, we recommend requiring that the dischargers meet indoor air cleanup levels in all buildings overlying the plume, as opposed to only buildings overlying the Site.
4. The proposed deadline for Task 1 in Section C. is approximately two weeks after the September Board meeting. This may not be a concern for a discharger who is already investigating the Site, but if a previously-uninvolved discharger has concerns about meeting this deadline, we recommend moving the deadline.
5. Task 7 has a deadline that precedes the date when the Order is scheduled for adoption. As a matter of due process, the Water Board cannot enforce against

JOHN MULLER, CHAIR | BRUCE H. WOLFE, EXECUTIVE OFFICER

dischargers on a deadline that passes before they are actually ordered to do perform a particular task. Task 7 should be removed or the deadline pushed back until sometime after the adoption hearing.

6. Task 11 (recording a deed restriction) should be limited to the current property owner.

Thank you for your consideration of these comments.

Sincerely,

Bruce H. Wolfe  
Executive Officer

Attachment

cc: Tamarin Austin, Water Board Advisory Team

# GUALCO LAW

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Marc D. Roberts  
Of Counsel

July 29, 2013

## **Sent Via Email**

Dyan C. Whyte  
Assistant Executive Officer  
Cal. Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, 14<sup>th</sup> Floor  
Oakland, CA 94612

Nathan King, P.G.  
Cal. Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, 14<sup>th</sup> Floor  
Oakland, CA 94612

Re: Comments on Tentative Order – Site Cleanup Requirements for Moonlite Associates LLC and United Artists Theatre Circuit, Inc., 2640 El Camino Real, Santa Clara, California

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Dear Ms. Whyte and Mr. King:

Pursuant to the California Regional Water Quality Control Board-San Francisco Bay Region's ("Regional Water Board") letter dated June 25, 2013, please find below comments, prepared on behalf of Moonlite Associates LLC (Moonlite), on the *Tentative Order, Adoption of Site Cleanup Requirements, Moonlite Associates, LLC and United Artists Theatre Circuit, Inc.* ("TO/SCR") for the property located at 2640 El Camino Real, Santa Clara, California ("the Site"). The TO/SCR names Moonlite Associates LLC (Moonlite) and United Artists Theatre Circuit, Inc. (UATC) as dischargers and requires investigation and cleanup of tetrachloroethene (PCE) at the Site.

We appreciate the Regional Water Board's staff efforts and the TO/SCR reflects a comprehensive approach to addressing the releases at the Site. Our comments are presented in support of the TO/SCR with our primary requested modifications directed toward deferring selection of final cleanup goals and modifying certain task submittal dates.

## **Comments on TO/SCR**

### **Comment 1: Paragraph 3, pg. 2: Named Dischargers**

As indicated in the attached documents, we have identified additional past operators of the former Moonlite Cleaners, located at 2640 El Camino Real, Santa Clara, California:

1. On October 11, 1961, a Certificate of Limited Partnership was recorded with the Santa Clara County Recorder between Paul G. Schroeder, Hazel E. [sic] A.



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Schroeder and Herbert C. Bettencourt regarding the operation of a dry cleaning plant and business known as "Moonlite Cleaners." (Exhibit A-1). On March 21, 1962, an Amended Certificate of Limited Partnership was recorded with the Santa Clara County Recorder between Gustave P. Schroeder, Hazel A. Schroeder and Herbert C. Bettencourt regarding Moonlite Cleaners. (Exhibit A-2). October 18, 1962 and December 4, 1968, Certificates of Amount of Unsecured Property Tax and Penalties Due were recorded with the Santa Clara County Recorder naming Paul G. Schroder [sic], Hazel Schroder [sic] and Herbert C. Bettencourt, dba Moonlite Cleaners & Ye Olde Wash House. (Exhibits A-3 and A-4, respectively). On May 19, 1969 and July 28, 1969, Releases of Liens Imposed Under Certificates Nos. 5337 and 12088, respectively, for Gustave Schroder [sic] and Hazel Schroder [sic] and Herbert C. Bettencourt dba Moonlite Cleaners - Ye Olde Wash House, were recorded with the Santa Clara County Recorder. (Exhibits A-5 and A-6, respectively). See documents attached collectively as **Exhibit A** hereto.

2. On July 30, 1971, a "Notice by Transferee" was recorded with the Santa Clara County Recorder stating that Herbert C. Bettencourt, doing business as Moonlite Cleaners and Ye Olde Wash House, was transferring to John Reed and Blanche Reed, transferee in bulk, equipment, machinery and inventory and supplies of that dry cleaning business located at Moonlite Shopping Center. See **Exhibit B** attached hereto.
3. On July 11, 1975, a "Notice of Intent to Make Bulk Transfer (and Create a Security Interest)" was recorded with the Santa Clara County Recorder stating that John D. Reed and Helen B. Reed (Moonlite Cleaners and Laundromat) were intending to create a security interest in the dry cleaning equipment set forth in Exhibit A to such document, in favor of Bank of America. See **Exhibit C** attached hereto.
4. On May 14, 1979, a "Notice of Intended Transfer" was recorded with the Santa Clara County Recorder stating that Helen B. Reed and John D. Reed "intend to transfer" to Charles Martinez, Maria Martinez, Manuel G. Alvarado and Patricia J. Alvarado, "all the trade, fixtures, equipment and goodwill of that certain business know as Moonlite Cleaners located at 2640 El Camino Real, Santa Clara, California." See **Exhibit D** attached hereto.
5. On November 4, 1981, a "Notice of Intended Transfer" was recorded with the Santa Clara County Recorder stating that Charles Martinez and Maria Martinez "intend to transfer" to Manuel Alvarado and Patricia Alvarado, "[a]ll of their one-half interest in the stock-in-trade, merchandise, fixtures, equipment, goodwill, and trade" of Moonlite Cleaners. See **Exhibit E** attached hereto.

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6. On July 31, 1984, a "Notice of Bulk Transfer" was recorded with the Santa Clara County Recorder, stating that Moonlite Cleaners, Manuel G. and Patricia J. Alvarado were making a bulk transfer to Sung K. Kim and Johann Kim and the "property is described in general as ALL STOCK IN TRADE, FIXTURES, EQUIPMENT AND GOOD WILL of that cleaners business known as Moonlite Cleaners." See **Exhibit F** attached hereto.
7. On September 2, 1992, a "Notice to Creditors of Bulk Sale" was recorded with the Santa Clara County Recorder stating that Grace Jung Eun Kim was transferring to Jung Sup Kim and Soon Cheon Kim assets of a dry cleaner known as Moonlite Cleaners and described as "GOODWILL, FIXTURES & EQUIPMENT, LEASEHOLD IMPROVEMENTS, COVENANT NOT COMPETE." See **Exhibit G** attached hereto.

We have located the following last known addresses for individuals listed above:

1. Hazel A. Schroeder, address unknown
2. Charles L. Martinez, 308 Helena Way, Madera, CA 93637-5712
3. Manuel G. Alvarado and Patricia J. Alvarado, 3409 Caleb Court, West Bend, WI 53090-1067
4. Sung K. Kim, also known as Song K. Kim, 1609 Eagle Drive, Sunnyvale, CA 94087-4636
5. Johann Kim, 8086 N. Maroa Ave., Apt. 103, Fresno, CA 93711-6125
6. Grace Jung Eun Kim, 163 N. Main Street, Apt. 203, Milpitas, CA 95035-4361
7. Jung Sup Kim and Soon Cheon Kim, 2582 Parkcrest Way, Roseville, CA 95747-7140
8. We believe the following dry cleaner operators of the former Moonlite Cleaners are deceased: Gustave Paul Schroeder, Herbert C. Bettencourt, Helen B. Reed, John D. Reed and Maria Martinez.

We request that based on the attached Exhibits A through G, the Regional Water Board take appropriate action in reference to the above individuals. We are not requesting an extension and understand that the Regional Water Board will consider adding parties at a later date, as set forth in Paragraph 3 of the TO/SCR.

Comment 2: Paragraph 11(a), pg. 6: Basis for Cleanup Levels

The analysis presented in the TO/SCR indicates that Site data were compared to ESLs compiled by the Regional Water Board staff.<sup>1</sup> While we concur with use of the ESLs as an appropriate screening tool, it appears that the ESLs have also been used to establish the Site

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<sup>1</sup> California Regional Water Quality Control Board – San Francisco Bay Region, Screening for Environmental Concerns at Site with Contaminated Soil and Groundwater, Interim Final, Revised May 2013 (ESL Manual).

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cleanup levels included in the TO/SCR for sub-slab soil gas, soil gas and indoor air.

As identified in the TO/SCR, the ESLs for human health concerns (i.e., indoor-air) are based on a target excess cancer risk of one excess incremental lifetime cancer risk (ILCR) per million exposed ( $1 \times 10^{-6}$  or 1E-06) for carcinogens and a target Hazard Index of 1.0 for non-carcinogens. While we concur with the use of screening levels to identify where “additional investigation and evaluation of potential environmental concerns is warranted,” the “presence of chemicals at concentrations above ESLs does not necessarily indicate that a significant risk exists at the site” or that remediation to these levels is warranted.<sup>2</sup> As stated in the Regional Water Board’s ESL manual, the Tier 1 ESLs are “NOT regulatory cleanup standards”<sup>3</sup> [emphasis in original] and therefore, should not be prescriptively used as cleanup levels in the TO/SCR.

Further, as presented in the Regional Water Board’s ESL Manual, remediation is “generally warranted at sites where the estimated cancer risk exceeds  $10^{-4}$ . For sites where the estimated risk is between  $10^{-4}$  and  $10^{-6}$ , the need for active remediation is evaluated on a site-specific basis (i.e., risk within this range is potentially acceptable, depending on site-specific considerations).”<sup>4</sup> Therefore, the requirement in the TO/SCR to remediate to the ESLs based on 1E-06 ILCR is not necessarily appropriate, until further Site-specific evaluations have been conducted. In addition, the Regional Water Board has accepted cleanup levels for VOCs in soil gas above the 10-6 ILCR at other sites based on site-specific considerations, i.e., at concentrations greater than ESLs.<sup>5,6</sup>

The TO/SCR requires the Remedial Action Plan be prepared consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40CFR300). The NCP requires that “final remediation goals...be determined when the remedy is selected.”<sup>7</sup> As the required Remedial Action Plan (Task 8) will include a detailed evaluation of risks and development of Site-specific cleanup goals, we request that selection of final cleanup levels be deferred to this stage of the remedy selection process. To the extent that the Regional Water Board pursues including cleanup levels in the TO/SCR, we request consideration of Site-specific findings and use of current toxicity criteria for PCE, as discussed further below.

### Comment 3: Paragraph 11(g), pg. 8: Basis for Sub-Slab Soil Gas Cleanup Levels

The TO/SCR indicates an “attenuation factor of 0.05 was used from sub-slab soil gas to

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<sup>2</sup> ESL Manual, p.1-1.

<sup>3</sup> ESL Manual, p.ES-2.

<sup>4</sup> ESL Manual, p.4-4.

<sup>5</sup> California Regional Water Quality Control Board – San Francisco Bay Region, *No Further Action, Hexcel Site, 75 North Mines Road, Livermore, California*, June 5, 2008.

<sup>6</sup> California Regional Water Quality Control Board – San Francisco Bay Region, *Order No. R2-2008-0058, Adoption of Final Site Cleanup Requirements and Rescission of Order Nos. 89-027 and 91-024, Siliconix, Inc., 2201 Laurelwood Road, Santa Clara, Santa Clara County*, July 11, 2008.

<sup>7</sup> National Oil and Hazardous Substances Pollution Contingency Plan, 40CFR300.430(e)(2)(i).

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indoor air.” The TO/SCR proposed attenuation factor of 0.05 is too conservative and will require efforts that would not be cost-effective. Site-specific sampling has revealed that the actual attenuation is approximately 2.6E-05, i.e., the highest sub-slab soil gas concentration was reported at 5,700,000 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) with indoor air concentrations measured up to 150  $\mu\text{g}/\text{m}^3$ .<sup>8</sup> Therefore, development of sub-slab cleanup levels based on an attenuation factor of 0.05 is not justified by the Site data and would require a sub-slab soil gas concentration reduction of approximately 99.999 percent, a level that might not be technically achievable and is not justified based on Site data.

In addition, support for higher sub-slab attenuation factors is found in published studies by the USEPA. The 2012 USEPA’s study of subslab attenuation factors revealed an attenuation factor of 1.2E-05 for Mountain View, California, with a median sub-slab vapor attenuation factor of 0.002 for all sites evaluated in the database.<sup>9</sup> Based on the Site-specific findings and the USEPA studies, we request that to the extent that the Regional Water Board includes cleanup levels in the TO/SCR that the sub-slab soil gas cleanup levels be based on an attenuation factor of not greater than 0.002.

Comment 4: Paragraph 13, pg. 8: Risk Management

While we concur that risk management actions might be warranted, until such time as a Site-specific risk evaluation has been completed, it appears premature to reach conclusions regarding the necessity for ongoing operation of the current SVE system. We request that the necessity for a risk management plan be deferred until after the development of the RAP for the Site and an evaluation of the effectiveness of the remedial measures have been conducted.

**Section B. Remedial Action Plan and Cleanup Levels**

Comment 5: Paragraph 4, pg. 11: Soil Gas Cleanup Levels.

As noted above, we believe that it is premature to establish Site cleanup levels and that development of cleanup goals should be deferred to the remedy selection process where a site-specific analysis can be used to support appropriate remediation goals. To the extent that the Regional Water Board includes cleanup levels in the final SCR, we request that the cleanup levels for soil gas be revised based on current USEPA’s updated toxicity factors for PCE.

The February 10, 2012 IRIS assessment replaces the 1988 IRIS assessment for PCE and for the first time includes a hazard characterization for cancer effects.<sup>10</sup> The February 2012 PCE

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<sup>8</sup> Attenuation factor is based on the 150  $\mu\text{g}/\text{m}^3$  of PCE found in indoor air above sub-slab concentration of PCE of 5,700,000  $\mu\text{g}/\text{m}^3$ .

<sup>9</sup> USEPA, Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings, EPA 530-R-10-002, March 16, 2012. (USEPA, 2012).

<sup>10</sup> <http://yosemite.epa.gov/opa/admpress.nsf/0/E99FD55271CE029F852579A000624956>

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assessment has undergone several levels of rigorous, independent peer review including: agency review, interagency review, public comment, and external peer review by the National Research Council. Based on the studies, the USEPA has revised the inhalation unit reference concentration (IUR) for PCE from  $5.9\text{E-}06$  ( $\mu\text{g}/\text{m}^3$ )<sup>-1</sup> to  $2.6\text{E-}7$  ( $\mu\text{g}/\text{m}^3$ )<sup>-1</sup>, i.e., a change of approximately 20-fold reduction in estimated toxicity.

The soil gas, sub-slab soil gas and indoor air ESLs used by the Regional Water Board are based on the 1988 IUR of  $5.9\text{E-}06$  ( $\mu\text{g}/\text{m}^3$ )<sup>-1</sup> for PCE rather than the February 2012 updated IUR of  $2.6\text{E-}07$  ( $\mu\text{g}/\text{m}^3$ )<sup>-1</sup>.<sup>11</sup> Using the updated toxicity criteria, the USEPA has revised its Regional Screening Levels (RSLs) for PCE based on an ILCR of  $1\text{E-}06$  for indoor air to  $9.4$   $\mu\text{g}/\text{m}^3$  for residential exposure and  $47$   $\mu\text{g}/\text{m}^3$  for commercial/industrial exposure. Based on the updated toxicity factors and a default attenuation factor of 0.001, we request that at a minimum the PCE soil gas cleanup levels be revised to  $9,400$   $\mu\text{g}/\text{m}^3$  for residential and  $47,000$   $\mu\text{g}/\text{m}^3$  for commercial/industrial.

The requested revisions are consistent with current recommendations and cleanup levels used by the California Environmental Protection Agency's Department of Toxic Substances Control (DTSC). Based on revisions in toxicity factors, DTSC's Human and Ecological Risk Office (HERO) "recommends using EPA RSLs as a starting point for development of PRGs for VOCs."<sup>12</sup> The use of USEPA RSLs with attenuation factors to develop cleanup goals has been accepted by DTSC for other nearby sites with VOCs in soil gas.<sup>13</sup>

#### Comment 6: Paragraph 5, pg. 11: Sub-slab Cleanup Levels

In accordance with the comments presented above regarding the use of an attenuation factor of 0.002 and updated toxicity criteria, we request that the sub-slab cleanup levels be revised. Using the PCE target indoor air cleanup levels  $9.4$   $\mu\text{g}/\text{m}^3$  and  $47$   $\mu\text{g}/\text{m}^3$  for residential and commercial/industrial exposures, we request that to the extent cleanup levels are included in the final SCR, that the PCE sub-slab cleanup levels be revised to  $4,700$   $\mu\text{g}/\text{m}^3$  and  $23,500$   $\mu\text{g}/\text{m}^3$ , respectively. Similarly, based on the sub-slab attenuation factor of 0.002, we request that the TCE sub-slab cleanup levels be revised to  $215$   $\mu\text{g}/\text{m}^3$  and  $1,500$   $\mu\text{g}/\text{m}^3$ , respectively, for residential and commercial/industrial exposures.

#### Comment 7: Paragraph 6, pg. 12: Indoor Air Cleanup Levels

Consistent with the comments above regarding the updated toxicity factors, we request that the indoor air cleanup levels in the TO/SCR reflect the current USEPA RSLs. The indoor air RSLs for PCE for residential exposure is  $9.4$   $\mu\text{g}/\text{m}^3$  and commercial/industrial exposure is  $47$   $\mu\text{g}/\text{m}^3$ .

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<sup>11</sup> Regional Water Board, ESLs, Table E-3, May 2013.

<sup>12</sup> DTSC, Memorandum from Brian Endlich, Ph.D., June 26, 2013.

<sup>13</sup> EKI, Response Plan, 470 Persian Drive, Sunnyvale, California, May 8, 2013.

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### **Section C. Tasks**

We are providing comments on the proposed schedule for the submittals as outlined in Section C of the TO/SCR. The comments are provided with reference to the specific paragraphs identified for the tasks in the TO/SCR.

#### **Comment 8: Task 1. Work Plan for Additional Soil Gas Investigations**

Due to the proposed scheduled adoption of the TO/SCR on September 11, 2013, we request that the submittal of the work plan for additional soil gas investigations be due on October 31, 2013. The additional time is being requested to facilitate coordination between the named dischargers pending the adoption of the TO.

#### **Comment 9: Task 2. Completion of Soil Gas Investigation**

Pursuant to the comment on the required submittal date for the soil gas investigation work plan, we request that the submittal date for the report of the soil gas investigation be revised to January 31, 2014.

#### **Comment 10: Task 3. Work Plan for Additional Indoor Air Sampling**

Pending results of the soil gas sampling, we request that the submittal date for the report of the work plan for additional indoor air sampling be revised to February 28, 2014.

#### **Comment 11: Task 4. Completion of Indoor Air Sampling**

Pursuant to the comment on the required submittal date for the indoor air investigation work plan, we request that the submittal date for the completion of the additional indoor air sampling be revised to May 31, 2014.

#### **Comment 12: Task 5. Work Plan for Groundwater Monitoring Wells Installation**

Due to the proposed scheduled adoption of the TO/SCR on September 11, 2013, we request that the submittal of the Work Plan for Groundwater Monitoring Wells Installation be due on November 30, 2013. The additional time is being requested to facilitate coordination between the named dischargers pending the adoption of the TO/SCR.

#### **Comment 13: Task 6. Completion of Groundwater Monitoring Wells Installation**

Pursuant to the comment on the required submittal date for the groundwater monitoring wells work plan, we request that the submittal date for the completion of the groundwater monitoring wells installation be revised to March 31, 2014.

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Comment 14: Task 7. Completion of Zero-Valent Iron Pilot Study

The pilot study has been completed and the groundwater monitoring results have been incorporated into the quarterly groundwater monitoring reports. The results and technology evaluation will be presented in the Remedial Action Plan. Therefore, inclusion of this task does not appear necessary.

Comment 15: Task 8. Remedial Action Plan

Due to the proposed scheduled adoption of the TO on September 11, 2013, and subsequent revisions to dates for completion of additional investigations in the previous comments, we request that the submittal of the Remedial Action Plan (RAP) be revised to June 30, 2014.

Comment 16: Task 9. Implementation of Remedial Actions

Pursuant to the above comment on the required submittal date for the RAP, we request that the submittal date for the implementation of remedial actions be revised to May 31, 2015. The additional time is requested to allow adequate time to coordinate with third parties and other named dischargers.

Comment 17: Task 10. Proposed Deed Restriction

While we concur that the deed restriction will most likely include land use activity restrictions for use of shallow groundwater, it seems premature to require including restrictions for sensitive uses such as residential. We suggest that the need for deed restrictions be determined based on the scope of the proposed cleanup plan presented in the RAP. If this task is retained, we request that the wording for the Task 10, Proposed Deed Restriction be revised to reflect the option to remediate to residential standards.

Comment 18: Task 12. Risk Management Plan Implementation

As noted in Comment 4 above, we request that the necessity for a risk management plan be deferred until after the development of the RAP for the Site and an evaluation of the effectiveness of the remedial measures have been conducted.

Comment 19: Task 13. Five Year-Status Report

Due to the proposed scheduled adoption of the TO on September 11, 2013, and subsequent revisions to dates for implementation of remedial actions, we request that the submittal of the Five Year Status report be revised to January 31, 2020, and every five years thereafter, as needed.

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## **Self-Monitoring Program**

### Comment 20: Paragraph 2: Monitoring

We request the sampling frequency be revised to quarterly for the groundwater monitoring wells for the first three-years following adoption of the TO/SCR then semi-annually thereafter if concentrations of chemicals of concern (COCs) in groundwater indicate stable or decreasing trends. In addition, all new groundwater monitoring wells installed at the Site would be sampled quarterly for the first three years then semi-annually thereafter under the same criteria as the existing monitoring wells. Existing and new monitoring wells that have achieved MCLs, e.g., MW-1, would be sampled annually until the Regional Water Board approves cessation of monitoring. We also request that there be provision for cessation of groundwater monitoring if it can be demonstrated that water quality objectives will be reached within a reasonable time, e.g., plume stability, decreasing trends. Cessation of groundwater monitoring prior to reaching water quality objectives is consistent with the protocols outlined by the Regional Water Board's in its July 2009 *Assessment Tool for Closure of Low-Threat Chlorinated Solvent Sites*.<sup>14</sup>

Since surface monitoring has not revealed concentrations above water quality objectives, we request that surface water sampling be removed from the monitoring requirements, or if the Regional Water Board believes surface water sampling is necessary, we request that the frequency be revised from quarterly to annually.

### **June 24, 2013 Cleanup Staff Report**

We have prepared comments to the Regional Water Board's June 24, 2013 Cleanup Staff Report regarding the bases for naming Moonlite and UATC as dischargers in the TO/SCR.

### Comment 21: Paragraph IV. Site History

As noted in Comment 1 above, a detailed list of dry cleaning equipment used and additional parties (operators/owners) have been identified for Moonlite Cleaners.

### Comment 22: Paragraph VII. Response to March 12, 2013 EKI Report

We suggest adding to the 1<sup>st</sup> paragraph that PCE is also present upgradient and southwest of the dry cleaner in MW-1.

In the 2<sup>nd</sup> paragraph we note that EKI fails to take into account localized pumping from nearby water supply wells that have locally influenced groundwater flow directions. As noted in

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<sup>14</sup> Regional Water Board, *Draft Final Assessment Tool for Closure of Low-Threat of Solvent Sites*, July 31, 2009.



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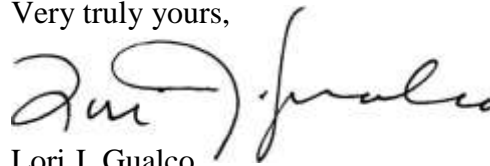
reports for the former Chevron USA Station<sup>15</sup> (2798 El Camino Real), groundwater flow directions were to the west-southwest in 1990 and 1991.

In the 3<sup>rd</sup> paragraph, we note that EKI did not consider the groundwater flow directions from the former Chevron USA Station which was located on the Moonlite Shopping Center property and closer to the former Moonlite Cleaners than the Shell Station example used by EKI.

In the 4<sup>th</sup> paragraph, as noted above, groundwater flow directions measured at the former Chevron USA Station were to the west-southwest in the early 1990s. Regional groundwater elevation contours were locally affected from nearby water supply well extraction with groundwater flow directions to the west-southwest during the early 1990s.<sup>16</sup> Regional groundwater flow was also described as to the north during this period.<sup>17</sup>

Please contact me at (916) 930-0700, if you have any questions or wish to discuss these comments further.

Very truly yours,



Lori J. Gualco

LJG/jbh

cc: Stephen A. Hill (via email)  
John Wolfenden (via email)  
Bill Mehrens (via email)  
Scott H. Reisch (via email)  
Peter M. Krasnoff (via email)  
George Cook (via email)  
Julia A. Hill (via email)  
David Parker (via email)  
Carey Peabody (via email)

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<sup>15</sup> [http://geotracker.waterboards.ca.gov/profile\\_report.asp?global\\_id=T0608500370](http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0608500370).

<sup>16</sup> Pacific Environmental Group (PEG), *Supplement to January 1991 Groundwater Investigation Report, Chevron USA Service Station #9-9631, 2798 El Camino Real, Santa Clara, California*, March 11, 1992.

<sup>17</sup> PEG, March 11, 1992.

# EXHIBIT A

2.80

2074504

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CERTIFICATE OF LIMITED PARTNERSHIP

The undersigned, desiring to form a limited partnership under the Uniform Limited Partnership Act, as set forth in Title 2, Chapter 2, of the California Corporations Code, hereby make the following certificate:

- 1. The name of the partnership shall be "MOONLIGHT CLEANERS".
- 2. The character of the business shall be the operation of a dry cleaning plant and any other business necessary, and related thereto.
- 3. The location of the principal place of business shall be at Moonlight Shopping Center, Santa Clara, California.
- 4. The names and places of residence of the general partners, are:

PAUL G. SCHROEDER of 1489 English Drive, San Jose, California, and  
 HAZEL E. SCHROEDER of 1489 English Drive, San Jose, California.

- 5. The partnership shall continue for an indefinite term.
- 6. The amount of cash contributed by each limited partner is as follows:  
 HERBERT C. BETTENCOURT - \$ 6,000.00
- 7. Each partner may make additional contributions to the capital of the partnership as may from time to time be agreed upon by the general partners.
- 8. Each partner may make such withdrawals from his capital account as may from time to time be agreed upon by the general partners, and may withdraw from the partnership upon giving THIRTY (30) day's notice in writing to all other partners.

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9. By reason of their contributions, the partners shall receive the following percentages of the net profits of the partnership:

HERBERT C. BETTENCOURT	FIFTY (50) per cent
PAUL G. SCHROEDER and HAZEL E. SCHROEDER	FIFTY (50) per cent

10. In addition to a FIFTY (50) per cent share in the net profits, HERBERT C. BETTENCOURT will receive ONE HUNDRED DOLLARS (\$100.00) per week from the gross receipts of the partnership.

11. In the event of the retirement, expulsion, bankruptcy, death or insanity of a general partner, the remaining partners have the right to continue the business of the partnership under the same name by themselves, or in conjunction with any other person or persons they select.

IN WITNESS WHEREOF, we have hereunto set our hands this 15<sup>th</sup> day of September, One thousand nine hundred and sixty one.

2074504  
BOOK 5325 PAGE 746  
FILED FOR RECORD AT REQUEST OF  
*Myrtle & Paul Schmidt*

OCT 11 2 58 PM 1961  
OFFICIAL RECORDS  
SANTA CLARA COUNTY  
PAUL R. TEILH  
RECORDER

*280*

GENERAL PARTNERS

*Paul G. Schroeder*  
PAUL G. SCHROEDER

*Hazel E. Schroeder*  
HAZEL E. SCHROEDER

LIMITED PARTNER

*Herbert C. Bettencourt*  
HERBERT C. BETTENCOURT

*Handwritten notes and signatures at the bottom of the page.*

STATE OF CALIFORNIA, } ss.  
County of Santa Clara

BOOK 5325 PAGE 748

On this 15th day of September in the year one thousand nine hundred and sixty one  
before me, Robert P. Aguilar a Notary Public in and for the County of Santa Clara, State of  
California, personally appeared Paul G. Schroeder, Hazel A.  
Schroeder and Herbert C. Bettencourt



known to me to be the person whose name subscribed to the  
within instrument and acknowledged to me that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Official  
Seal, at my office in the County of Santa Clara, the day and year in this certificate  
first above written.

*Robert P. Aguilar*  
(General) ROBERT P. AGUILAR  
Notary Public in and for the County of Santa Clara, State of California  
My Commission expires September 8, 1965

CURTIS LINDSAY, INC., STATIONERS - SAN JOSE



2161488 BODY 5509 PAGE 26

AMENDED CERTIFICATE OF LIMITED PARTNERSHIP

The parties hereto, having already filed a Certificate of Limited Partnership, amend the same as follows:

PARAGRAPH 10 of said Certificate of Limited Partnership shall be amended as follows:

Each partner may make such withdrawals from his capital account as may from time to time be agreed upon by the general partners, and may withdraw from the partnership upon giving THIRTY (30) day's notice in writing to all other partners.

The partners hereto agree that all net profits shall be computed semi-annually and shall be distributed 50% to Herbert C. Bettencourt and 50% to Gustave P. Schroeder and Hazel A. Schroeder jointly. In addition to the share of the net profits, Herbert C. Bettencourt shall receive \$100.00 per week. Said \$100.00 per week shall act as a draw against Herbert C. Bettencourt's share of 50% of the net profits. Gustave P. Schroeder shall receive \$150.00 per week and Hazel A. Schroeder shall receive \$125.00 per week. All weekly payments to the partners shall be taken from the gross receipts of the partnership.

The Certificate is amended to include the following paragraph:

- GENERAL PARTNERS: GUSTAVE P. SCHROEDER HAZEL A. SCHROEDER LIMITED PARTNER: HERBERT C. BETTENCOURT

IN WITNESS WHEREOF we have hereunto set our hands this 29th day of December One thousand nine hundred and sixty one.

Signatures of Gustave P. Schroeder, Hazel A. Schroeder, and Herbert C. Bettencourt.

O.R. BOOK  
5509

PAGE

27

STATE OF CALIFORNIA, } ss. BOOK 5509 PAGE 27  
County of Santa Clara  
On this 29<sup>th</sup> day of December In the year one thousand nine hundred and sixty one  
before me, Robert P. Aguilar a Notary Public in and for the County of Santa Clara, State of  
California, personally appeared Gustave E. Schroeder, Hazel A. Schroeder and Herbert G. Battencourt



known to me to be the person(s) whose name(s) subscribed to the within instrument and acknowledged to me that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Official Seal, at my office in the County of Santa Clara, the day and year in this certificate first above written.

*Robert P. Aguilar*

(General) Notary Public in and for the County of Santa Clara, State of California  
My Commission Expires September 8, 1965  
CURTIS LINDSAY, INC., STATIONERS - SAN JOSE

[Faint, mostly illegible text from the reverse side of the document, including a large number '2161488' and a date 'MAR 21 11 29 AM 1962']

*Mezzette and McQuinn*  
2800 1st St.  
San Jose, California

2161488  
BOOK 5509 PAGE 26  
FILED FOR RECORD  
AT REQUEST OF  
MAR 21 11 29 AM 1962  
OFFICIAL RECORDS  
SANTA CLARA COUNTY  
PAUL R. YEHL  
RECORDER

**C.R. BOOK**

**5759**

**99**

BOOK 5759 PG 99

2279241

FOR RECORDER'S USE

Recording Requested By:  
**COUNTY OF SANTA CLARA  
DEPARTMENT OF TAX COLLECTOR  
STATE OF CALIFORNIA**

When Recorded Mail to:

**County of Santa Clara  
Department of Tax Collector**

D.H.

**ROY P. EMERSON**  
OFFICIAL RECORDS  
SANTA CLARA COUNTY  
PAUL R. TEILH  
RECORDER  
OCT 10 2 01 PM 1962  
FILE BOOK FOR 5759 PG 99  
AT REQUEST OF  
2279241

**CERTIFICATE OF AMOUNT OF UNSECURED PROPERTY TAX AND PENALTIES DUE.**

STATE OF CALIFORNIA }  
COUNTY OF SANTA CLARA } ss: Certificate No. 1457

I, Roy P. Emerson, County Tax Collector of the County of Santa Clara, hereby certify that:

NAME Paul G. Schroder - Hazel Schroder - Herbert G. Bettencourt  
ADDRESS 2630 El Camino Real Santa Clara, Calif.  
DBA: Moonlite Cleaners & Ye Olde Wash House

HAS TAXES WHICH ARE NOT SECURED BY REAL PROPERTY, DUE, in the amount of \$ 2,059.90 including penalties. The taxes became a LIEN as of Noon on the First Monday in March for property assessed for the Year 1962 in Code Area No. 7-060 Assessment No. 12,391 of the UNSECURED ASSESSMENT ROLL of Santa Clara County.

That this tax has the effect of a judgment against the person as provided by Section 2186 of the Revenue and Taxation Code.

Dated OCT 11 1962

IN WITNESS WHEREOF, Said first party has hereunto set his hand the day and year first above written.

*Roy P. Emerson*  
Roy P. Emerson

STATE OF CALIFORNIA }  
COUNTY OF SANTA CLARA } ss. Tax Collector of the County of Santa Clara

On OCT 11, 1962, before me, Paul R. Teilh, County Clerk and ex officio Clerk of the Superior Court of the State of California in and for the County of Santa Clara, personally appeared Roy P. Emerson known to me to be the Tax Collector of said Santa Clara County and the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same as such Tax Collector.

000

PAUL R. TEILH (SEAL)

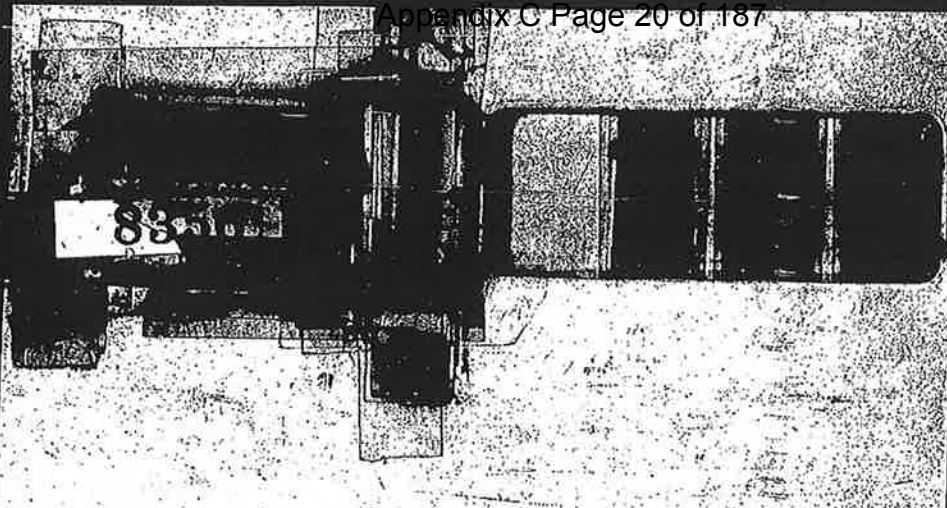
County Clerk and ex officio Clerk of the Superior Court

OCT 1 1962

By *DR [Signature]* Deputy.

51C1





3531118

BOOK 8356 PG 726

Recording Requested By:

COUNTY OF SANTA CLARA  
DEPARTMENT OF FINANCE -  
TAX COLLECTOR

State of California

When Recorded Mail to:

County of Santa Clara  
Department of Finance - Tax Collector  
70 W. Hedding Street, San Jose, California 95114

FOR RECORDER'S USE

FILED FOR RECORD  
AT REQUEST OF:  
DEPARTMENT OF FINANCE  
TAX COLLECTOR COUNTY OF SANTA CLARA  
Dec 4 11 49 AM '68  
OFFICIAL RECORDER  
SANTA CLARA COUNTY  
GEORGE E. MARTIN  
RECORDER

BOOK 8356 PG 726  
3531118

NO FEE

**CERTIFICATE OF AMOUNT OF UNSECURED PROPERTY TAX AND PENALTIES DUE.**

STATE OF CALIFORNIA }  
COUNTY OF SANTA CLARA } ss: Certificate No. 12088

I, Edward N. Glaeser, Director of Finance - Tax Collector of the County of Santa Clara, hereby certify that:

NAME OF ASSESSEE: Gustave Schroeder & Hazel Schroeder & Herbert C. Bettencourt  
LAST KNOWN ADDRESS: 2640 El Camino Real, Santa Clara, California 95051  
DBA: Moonlite Cleaners & Ye Olde Wash House

IS LIABLE FOR TAXES DUE, in the amount of \$ 1,651.42 including penalties. The taxes became a LIEN as of 12:01 on the First day of March for property assessed for the Year 1968 in Code Area No. 7.059 Assessment No. 13,250 of the UNSECURED ASSESSMENT ROLL of Santa Clara County and that the provisions of Division I of the Revenue and Taxation Code have been compiled within the computation and levy of the said tax; and that this tax has the effect of a judgment against the person as provided by Section 2186 of the Revenue and Taxation Code and further is hereby a lien upon all the personal and real property owned by or acquired by said assessee prior to expiration of this lien as provided for by Section 2191.4 of the Revenue and Taxation Code.

Dated: November 27, 1968

EDWARD N. GLAESER,  
Director of Finance - Tax Collector

IN WITNESS WHEREOF, Said first party has hereunto set his hand the day and year first above written.

By:

*G. Carl Martin*  
Deputy

OR. BOOK

8539

A

200

3620246

BOOK 8539 P. 297

Recording Requested By:

County of Santa Clara  
Dept. of Finance/Tax Collector  
70 W. Hedding Street  
San Jose, California

FOR RECORDER'S USE

3620246

BOOK 8539 P. 297

When Recorded Mail to:

Moonlite Cleaners  
2640 El Camino Real  
Santa Clara, California

Recorded at the request of  
DEPARTMENT OF FINANCE  
TAX COLLECTOR COUNTY OF SANTA CLARA  
MAY 19 1969  
GEORGE E. FOWLES, Recorder  
Santa Clara County, California

2.00

County of Santa Clara  
Tax Collector

RELEASE OF LIEN IMPOSED UNDER CERTIFICATE NO. 5337  
Pursuant to Section 2194 of the Revenue and Taxation Code.

The Tax Collector of Santa Clara County hereby releases and certifies that there has been released all property from any lien imposed thereon by the filing and recording of that certain Certificate of Amount of Unsecured Property Tax and Penalties Due from:

Gustave Schroder & Hazel Schroder & Herbert C. Bettencourt  
2640 El Camino Real, Santa Clara, California

DBA: Moonlite Cleaners-Ye Olde Wash House in the

amount of \$ 1,852.21 which was recorded on October 20, 1967  
in Volume 7900 at page 226 of Official Records of the County of Santa Clara.

Account No. 1967, 7-059, 22843

EDWARD N. GLAESER  
Ex-Officio Tax Collector

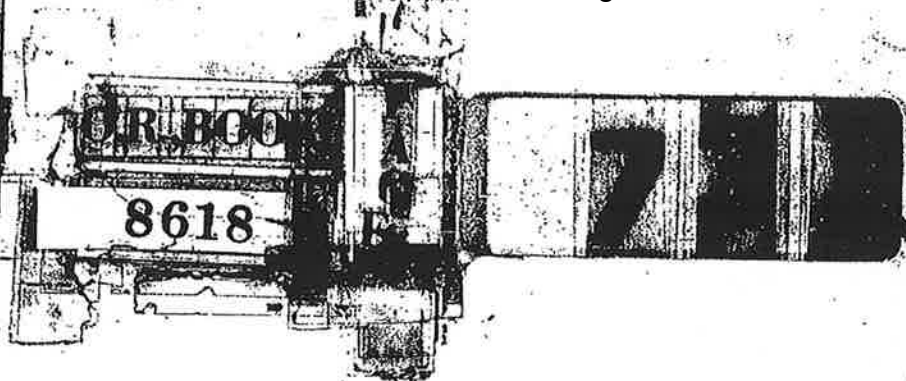
Dated May 19, 1969

IN WITNESS WHEREOF, Said first party has hereunto set his hand the day and year first above written.

By W. Marsh  
Deputy County Tax Collector

CS 233 (Rev. 3-67)

Recording Fees Prior Collected by Tax Collector



3659190

BOOK 8618 pg 731

Recording Requested By:

County of Santa Clara  
Dept. of Finance/Tax Collector  
70 W. Hedding Street  
San Jose, California

FOR RECORDER'S USE

FILED FOR RECORD  
AT REQUEST OF  
DEPARTMENT OF FINANCE  
TAX COLLECTOR COUNTY OF SANTA CLARA  
JUL 28 12 52 PM '69  
CLERK  
SANTA CLARA COUNTY  
GEORGE C. LOWLER  
RECORDER

3659190

When Recorded Mail to:

Gustave Schroeder  
2640 El Camino Real  
Santa Clara, California 95051

2.00

BOOK 8618 pg 731

County of Santa Clara  
Tax Collector

RELEASE OF LIEN IMPOSED UNDER CERTIFICATE NO. 12088  
Pursuant to Section 2194 of the Revenue and Taxation Code.

The Tax Collector of Santa Clara County hereby releases and certifies that there has been released all property from any lien imposed thereon by the filing and recording of that certain Certificate of Amount of Unsecured Property Tax and Penalties Due from:

Gustave Schroeder & Hazel Schroeder & Herbert C. Bettencourt  
2640 El Camino Real, Santa Clara, California 95051

DBA: Moonlite Cleaners & Ye Olde Wash House in the  
amount of \$ 1,651.42 which was recorded on December 4, 1968  
in Volume 8356 at page 726 of Official Records of the County of Santa Clara.

Account No. 1968, 7-059, 13250

EDWARD N. GLAESER  
Ex-Officio Tax Collector

Dated July 25, 1969

IN WITNESS WHEREOF, said first party has hereunto set his hand the day and year first above written.

By W.G. Marsh  
Deputy County Tax Collector

5039 (Rev. 3-67)

Recording Fees Prior Collected by Tax Collector

# EXHIBIT B

C.R. BOOK  
9443

194

4061588

BOOK 9443 PAGE 194

*280*  
NOTICE BY TRANSFEREE

TO THE CREDITORS OF HERBERT C. BETTENCOURT, DOING BUSINESS AS MOONLITE CLEANERS AND YE OLD WASH HOUSE, TRANSFEROR:

PLEASE TAKE NOTICE that you and each of you are, pursuant to Section 6105 and 6107 of the Uniform Commercial Code of the State of California, and all applicable laws, HEREBY NOTIFIED as follows:

1. The transferor, HERBERT C. BETTENCOURT, doing business as MOONLITE CLEANERS and YE OLD WASH HOUSE, is about to transfer to the undersigned, JOHN REED and BLANCHE REED, transferees, in bulk, all or a substantial part of materials, supplies, merchandise, equipment, fixtures and other inventory of said transferor now located at MOONLITE CLEANERS and YE OLD WASH HOUSE in the Moonlite Shopping Center, Santa Clara, California, and consisting mainly of equipment, machinery and inventory and supplies commonly used in the dry cleaning and washette business, all as more particularly described in a schedule which is on file and open for inspection and copying by any creditors at all reasonable hours at the Moonlite Shopping Center, Santa Clara, California.

2. The names and business addresses at this time of the transferor and the transferee are as follows:

TRANSFEROR: Moonlite Shopping Center, Santa Clara, California.

TRANSFEE: Moonlite Shopping Center, Santa Clara, California.

All business names and addresses used by the transferor within three (3) years last past as far as is known to transferee, are as above set forth.

3. The above transfer is to be consummated at 711 First National Bank Building, San Jose, California, on or before August 10, 1971.

Dated: July 30, 1971

*John Reed*  
\_\_\_\_\_  
JOHN REED

*Blanche Reed*  
\_\_\_\_\_  
BLANCHE REED

TRANSFEE

BOOK 9443 PAGE 194

4061588

OFFICE OF THE CLERK OF SUPERIOR COURT  
SAN JOSE, CALIFORNIA  
JUL 30 4 40 PM '71  
AT REQUEST OF  
*Jerry Pannini*

*Jerry Pannini*  
711 First Natl. Bank Bldg.  
San Jose, Calif 95113

BOOK  
9443

195

STATE OF CALIFORNIA,  
County of Santa Clara } BOOK 9443 PAGE 195  
On this 30th day of July in the year one thousand nine  
hundred and ~~seventy-one~~ before me, Gary V. Giannini  
a Notary Public, State of California, duly commissioned and sworn, personally appeared  
JOHN REED and BLANCHE REED

GARY V. GIANNINI  
Notary Public  
Santa Clara County, Calif.  
My Commission Expires March 4, 1972

known to me to be the person(s) whose names are subscribed to the within instrument  
and acknowledged to me that they executed the same.  
IN WITNESS WHEREOF I have hereunto set my hand and affixed my official seal  
in the County of Santa Clara the day and year in this  
certificate first above written.

*Gary V. Giannini*  
Notary Public, State of California.

Notary's Form No. 32—Acknowledgment—General  
(C. C. Sec. 1190.5)

My Commission Expires March 4, 1972

# EXHIBIT C

5048441

5048441

Submitted for Recordation  
By and Return to

**BANK OF AMERICA**  
NATIONAL TRUST AND SAVINGS ASSOCIATION

Office El Camino Riely Office  
Address 2670 El Camino Real (P.O. Box 60)  
City Santa Clara, California  
State CA  
Zip 95051

B 502 PAGE 515

FILED FOR RECORD  
AT REQUEST OF  
*Bank of America*  
MAY 11 12 27 PM '75

OFFICIAL RECORDS  
SANTA CLARA COUNTY  
GEORGE A. MARR  
DEPT. OF COUNTY RECORDER

SPACE ABOVE THIS LINE FOR RECORDER'S USE

**NOTICE OF INTENT TO MAKE BULK TRANSFER  
(AND CREATE A SECURITY INTEREST)**  
(Secs. 6101-6107 U.C.C.)

B 502 PAGE 515

Notice is hereby given, pursuant to division of the Uniform Commercial Code of the State of California, that the undersigned, whose business name is Moonlite Cleaners and Laundromat and whose business address is 2676 S. 2540 El Camino Real, Santa Clara, California and whose business is that of a Retail Cleaner & Laundromat, intends, as transferor, to transfer to Bank of America National Trust and Savings Association, whose business address is given herein below, as transferee, a security interest in certain property, of which a general description is as follows:

All equipment and fixtures, dry cleaning and laundromat equipment and fixtures, including but not limited to that equipment described on Exhibit "A" consisting of two pages, attached hereto,

*PK*

*JK*

9 X



MOONLITE CLEANERS AND LAUNDRYMAT  
John D. Reed and Helen B. Reed

B 502 PAGE 516

Exhibit "A"  
Page one of  
Two pages

No.	Kind of Equipment
1	Ajax DFB-RB Double Cabinet Bosom Press
1	Ajax CBS Cabinet Sleeve
1	Ajax FFT Automatic Folder
1	DBF Damp Box
1	Ajax 51" Utility Press Model T354
1	Ajax Mushroom Press model 218
1	50# Glover Autotrol Washer
1	25# Wascomat Automatic Washer Extractor
1	Galaco 24" Extractor
1	White Conveyor Model 350
1	White Conveyor Model 700L
1	White Conveyor Model 1000
3	U Diala for above conveyors, one foot switch shirt conveyor
4	Berkatono Commercial Washers Model BC 522
6	Norge Commercial Washers Model AKM5010C
15	Wascomat Commercial Washers Model Jr.
1	Wascomat Washer Model Giant
1	Wascomat 25# Washer Extractor
1	Western Softmassur Water Softener
1	Norge Automatic Washer Extractor 20#
5	Hoyt Ven-clene Dry Cleaning Machines
2	Keatinghouse Dry Cleaning Machines Model DC20B
1	Bishop 20 shirt Transport
1	2K Drapery Folder
2	TZ Counters
1	Marking Machine
1	37-16 Machine with Stand
1	475-T Machine with stand
1	Blindstitch Machine
1	Model 521 Chungmaster
1	Cissell pre-spotting unit
1	Cissell FG-2 Form Finisher
1	Cissell Guff Brusher
1	Parker Hot Water Boiler - heater and tank
2	Palatic Rug Dispensers
1	Cissell Vacuum Spotting Board

*BR*  
*JK*

*2*

30  
35  
Secret

Page Two of Two Pages

B 502 PAGE 517

<u>No.</u>	<u>Kind of Equipment</u>
1	Room 3 Vacuum
1	Hoffman PT Adjustaform
1	Hoffman Model 200 AS Puff
1	Hoffman Model 200 NF Puff
1	Hoffman Model 200 A Press
1	Hoffman Narco-5 Utility Press
1	Hoffman-Ajax DCV 365 Logger
1	Hoffman Q 240 5 HP Compressor
1	Hoffman H800 Va-per-mat
1	Hoffman SF130 Solvo-mixer
1	Hoffman Jet 445 Dry Cleaning machine
1	Washer Extractor
2	Hoyt S.F. 130 Park Reclaimers
1	Parker 25HP Steam Boiler
1	Ctsacell Topomatic Model 1B-1
1	Forenza Fastback Utility Press
12	Habsch 37 x 30 Laundry Dryers
1	Auto-flox Combination Cooker and Still
	Model AF 2000
1	Soft Drink Dispenser Model H77A
1	Clary Cash Register Model 302

Household Cleaners and Laundromat

BY John D. Reed  
John D. Reed

B: Helen B. Reed  
Helen B. Reed

34

which property is located at 2636 & 2640 El Camino Real, B. 502 page 518  
Santa Clara (CITY), California, and that said transfer will be consummated at the El Camino Realty  
 office of transferee at 2670 El Camino Real  
Santa Clara (CITY), California, on or after the 30th day of July  
1975.

So far as is known to the transferee, the transferor has not used any business name or address other than the above, during the three years last past, except:

\_\_\_\_\_  
 (NAME) (ADDRESS)

\_\_\_\_\_  
 (NAME) (ADDRESS)

*John D. Reed*  
 John D. Reed (TRANSFEROR)  
 N-186 3-73 (REV. 4)

**BANK OF AMERICA**  
 NATIONAL TRUST AND SAVINGS ASSOCIATION  
 By *John Tamburino*  
 John Tamburino (AGENT)  
 CLK

# EXHIBIT D

When recorded please mail to **E 491 PAGE 732**

**YETTICK & CHANDLER LAW CORPORATION**  
121 Park Center Plaza, Fifth Floor  
San Jose, CA 95113

**6373268**  
**E 491 PAGE 732**

FILED FOR RECORD  
AT REQUEST OF

*Yettick & Chandler*  
MAY 14 12 33 PM '79

NOTICE OF INTENDED TRANSFER

OFFICIAL RECORDS  
SANTA CLARA COUNTY  
GEORGE A. MANN  
RECORDER

NOTICE IS HEREBY GIVEN that Helen B. Reed and John D. Reed, whose business address is 2640 El Camino, Santa Clara, California, intend to transfer to Charles Martinez, Maria Martinez, Manuel G. Alvarado and Patricia J. Alvarado, whose business address is 462 San Mateo Avenue, San Bruno, California, the following property now located at 2640 El Camino, Santa Clara, California: all the trade fixtures, equipment and goodwill of that certain business known as Moonlite Cleaners located at 2640 El Camino, Santa Clara, California.

*500*

So far as known to the undersigned, during the three (3) years immediately last past said Helen B. Reed and John D. Reed have used only the following additional business names and addresses:

<u>Business Name</u>	<u>Business Address</u>
Helen B. Reed and John D. Reed dba Moonlite Leather Cleaners	2562 Seaboard Avenue San Jose, California
Helen B. Reed and John D. Reed dba Kings Court Cleaners	728 Blossom Hill Road Los Gatos, California

The said intended transfer will be handled through an escrow. The escrow agent for the intended transfer is: Yettick & Chandler Law Corporation, 121 Park Center Plaza, Fifth Floor, San Jose, California 95113. Creditors of

E 491 733

Helen B. Reed and John D. Reed may file their claims with the escrow agent on or before May 31, 1979, at 5:00 p.m.

The said intended transfer will be consummated on or after June 1, 1979, at 11:00 a.m. at the office of Yettick & Chandler Law Corporation, 121 Park Center Plaza, Fifth Floor, San Jose, California.

Dated: MAY 10, 1979

Charles Martinez  
Charles Martinez

Maria Martinez  
Maria Martinez

Manuel G. Alvarado  
Manuel G. Alvarado

Patricia J. Alvarado  
Patricia J. Alvarado

STATE OF CALIFORNIA  
COUNTY OF SANTA CLARA

)  
SS.  
)

E 491 PAGE 734

On this 10th day of May, 1979, before me, a Notary Public in and for the County of Santa Clara, State of California, duly commissioned and sworn, personally appeared CHARLES MARTINEZ, MARIA MARTINEZ, MANUEL G. ALVARADO and PATRICIA J. ALVARADO, known to me to be the persons whose names are subscribed to the foregoing Notice of Intended Transfer, and acknowledged to me that they executed the same.

WITNESS my hand and official seal.

*Fred Sommer*  
Notary Public in and for said  
County and State



# EXHIBIT E



7206517

Recording Requested By And  
When Recorded Mail To

John V. Willoughby  
Yettick, Chandler & Schneider  
Fifth Floor, Wells Fargo Bldg.  
121 Park Center Plaza  
San Jose, CA 95113

REC. FEE	✓
MICRO	✓
LIEN NO.	
SMPP	

FILED FOR RECORD  
AT THE OFFICE OF  
Yettick et al  
81 NOV 4 P 3:18

G432 PAGE 130

NOTICE OF INTENDED TRANSFER

NOTICE IS HEREBY GIVEN that Charles Martinez and Maria Martinez, whose business address is 2640 El Camino, Santa Clara, California 95051, intend to transfer to Manuel Alvarado and Patricia Alvarado, whose business address is 2640 El Camino, Santa Clara, California 95051, the following property located at 2640 El Camino, Santa Clara, California 95051:

All of their one-half interest in the stock-in-trade, merchandise, fixtures, equipment, goodwill, and trade of that certain business known as "Moonlite Cleaners" located at 2640 El Camino, Santa Clara, California 95051.

The transfer of the property is subject to Commercial Code Section 6106.

Within the last three years, as far as known to the undersigned transferee, Charles Martinez and Maria Martinez have used the following additional business names and addresses:

- 1) My Cleaners  
462 San Mateo Avenue  
San Bruno, California 94066

The intended transfer will be consummated on or after November 27, 1981, at the office of, and claims for debts of the transferor may be filed with, Yettick, Chandler & Schneider Law Corporation, Fifth Floor, Wells Fargo Building,

121 Park Center Plaza, San Jose, California 95113. The last date for filing for debts of the transferor is November 25, 1981.

Dated: October 30, 1981

G432 PAGE 131

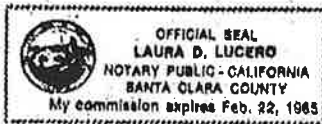
*Manuel Alvarado*  
MANUEL ALVARADO

*Patricia Alvarado*  
PATRICIA ALVARADO

STATE OF CALIFORNIA )  
COUNTY OF *Santa Clara* ) ss.

On the 30 day of October, 1981, before me, LAURA D. LUCERO, Notary Public in and for said County and State, personally appeared Manuel Alvarado known to me to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same.

WITNESS my hand and official seal.



*Laura D. Lucero*  
NOTARY PUBLIC

STATE OF CALIFORNIA )  
COUNTY OF *Santa Clara* ) ss.

On the 30 day of October, 1981, before me, LAURA D. LUCERO, Notary Public in and for said County and State, personally appeared Patricia Alvarado known to me to be the person whose name is subscribed to the within instrument and acknowledged to me that she executed the same.

WITNESS my hand and official seal.



*Laura D. Lucero*  
NOTARY PUBLIC

# EXHIBIT F

RECORDING REQUESTED BY

REC. FEE	3-
MICRO	✓
LIEN NOT	
SMFF	

1765 PAGE 442  
8143593

FILED FOR RECORD  
AT REQUEST OF  
*Minuttillo*  
JUL 31 11 16 AM '84

AND WHEN RECORDED MAIL TO

*W* Daniel C. Minuttillo  
375 West Santa Clara St. #104  
San Jose, Ca. 95113

OFFICIAL RECORDS  
SANTA CLARA COUNTY  
GEORGE A. MANN  
REGISTRAR RECORDER

SPACE ABOVE THIS LINE FOR RECORDER'S USE

### NOTICE OF BULK TRANSFER

(Secs. 6101 - 6107 U.C.C.)

Notice is hereby given to the Creditors of Moonlite Cleaners, Manuel G. and Patricia J. Alvarado, Transferor(s), whose business address is

2640 El Camino Real Santa Clara, Calif., County of Santa Clara  
Street Address City

State of California, that a bulk transfer is about to be made to Sung K. Kim and Johann Kim

Transferee(s), whose business address is 1609 Eagle Dr. Sunnyvale, Ca. 94087, County of Santa Clara  
Street Address City

The property to be transferred is located at 2640 El Camino Real Santa Clara Ca. 95051  
Street Address City

County of Santa Clara, State of California

Said property is described in general as: ALL STOCK IN TRADE, FIXTURES, EQUIPMENT AND GOOD WILL OF THAT cleaners business known as Moonlite Cleaners and located at

Type of Business Name of Business  
2640 El Camino Real, Santa Clara Ca. 95051, County of Santa Clara  
Street Address City

State of California.  
The bulk transfer will be consummated on or after the 20 day of August, 19 84.

at Daniel C. Minuttillo Attorney at Law 375 W. Santa Clara St. #104  
Street Address City  
San Jose, County of Santa Clara, State of California.

So far as known to the Transferee(s), all business names and addresses used by Transferor(s) for the three years last past, if different from the above are:

Business Name	Street Address	City	County	State
Business Name	Street Address	City	County	State

Dated July 28, 1984

Signed by: Sung K. Kim Transferee  
Johann Kim Transferee

INSTRUCTIONS: Unless signatures above are clearly legible, please type or print names on duplicate copy. Mail original and one copy to us and we will record the original and publish the duplicate as required by law.

# EXHIBIT G

11525667

FILED FOR RECORD  
AT REQUEST OF

GRANTEE

SEP 2 2 14 PM '92

OFFICE OF RECORDS  
SANTA CLARA COUNTY  
LAURIE KANE  
RECORDER

RECORDING REQUESTED BY:

ESCROW CONTROL COMPANY

WHEN RECORDED MAIL TO:

ESCROW CONTROL COMPANY  
830 KIELY BOULEVARD, SUITE 103  
SANTA CLARA, CA 95051

REC FEE	3
RMF	1
MICRO	1
RTCF	
LIEN	
SMPP	
5	CON

SPACE ABOVE THIS LINE FOR RECORDER 'S USE

ESCROW NO: 01-30384-CG

DATE: SEPTEMBER 2, 1992

NOTICE TO CREDITORS OF BULK SALE  
[SECS. 6104, 6105 U.C.C.]

Notice is hereby given to creditors of the within named seller that a sale that may constitute a bulk sale has been or will be made.

The individual, partnership, or corporate names and the business addresses of the seller are:

GRACE JUNG EUN KIM  
2640 EL CAMINO REAL, SANTA CLARA, CA 95051

The individual, partnership, or corporate names and the business addresses of the buyer are:

JUNG SUP KIM AND SOON CHEON KIM  
7318 RAINBOW DRIVE #A, CUPERTINO, CA 95014

As listed by the seller, all other business names and addresses used by the seller within three years before the date such list was sent or delivered to the buyer are: NONE

The assets sold or to be sold are described in general as:

BUSINESS TYPE: DRY CLEANER  
and are located at: 2640 EL CAMINO REAL, SANTA CLARA, CA 95051 of a certain DRY CLEANER business known as MOONLITE CLEANERS.  
DESCRIPTION: GOODWILL, FIXTURES & EQUIPMENT, LEASEHOLD IMPROVEMENTS, COVENANT NOT TO COMPETE

This bulk sale is subject to California Uniform Commercial Code Section 6106.2.

The place, and date on or after which the bulk sale is to be consummated are:  
at ESCROW CONTROL COMPANY, 830 KIELY BOULEVARD, SUITE 103, SANTA CLARA, CA 95051.  
DATE: ON OR AFTER SEPTEMBER 2<sup>4</sup>, 1992

Claims may be filed with:  
ESCROW CONTROL COMPANY  
830 KIELY BOULEVARD, SUITE 103, SANTA CLARA, CA 95051

All claims must be received at this address by SEPTEMBER 2<sup>4</sup>, 1992 which is the business day before the sale date specified above unless the bulk sale also includes the transfer of liquor license, in which case, all claims must be received prior to the date on which the liquor license is transferred by the Department of Alcoholic Beverage Control.

ESCROW CONTROL COMPANY

BY   
CHARLES F GILL, ESCROW AGENT  
FOR JUNG SUP KIM AND SOON CHEON KIM

Hogan Lovells US LLP  
One Tabor Center, Suite 1500  
1200 Seventeenth Street  
Denver, CO 80202  
T +1 303 899 7300  
F +1 303 899 7333  
www.hoganlovells.com

July 28, 2013

**BY ELECTRONIC MAIL AND FEDERAL EXPRESS**

Dyan C. Whyte  
Assistant Executive Officer  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, California 94612

**Re: United Artists Theatre Circuit Inc.'s Comments on the Tentative Order – Site Cleanup Requirements for Moonlite Associates, LLC, and United Artist[s] Theat[re] Circuit, Inc., for the Property Located at 2640 El Camino Real, Santa Clara, Santa Clara County – File No. 43S1090 (NMK)**

Dear Ms. Whyte:

Enclosed please find United Artists Theatre Circuit, Inc.'s comments on the Tentative Order – Site Cleanup Requirements for Moonlite Associates, LLC, and United Artist[s] Theat[re] Circuit, Inc., for the Property Located at 2640 El Camino Real, Santa Clara, Santa Clara County issued by the staff of the San Francisco Bay Regional Water Quality Control Board on June 25, 2013.

Please do not hesitate to contact me with any questions.

Very truly yours,



Scott H. Reich

Partner  
scott.reisch@hoganlovells.com  
D 303.899.7355

Enclosures

cc: Nathan King, California Regional Water Quality Control Board  
Lori Gualco, The Law Offices of David E. Frank (via Federal Express)  
Julia Hill, Assistant City Attorney (via Federal Express)

**COMMENTS OF UNITED ARTISTS THEATRE CIRCUIT, INC, ON THE  
TENTATIVE ORDER AND CLEANUP STAFF REPORT  
PREPARED BY STAFF OF THE SAN FRANCISCO BAY REGIONAL WATER  
QUALITY CONTROL BOARD, DATED JUNE 25, 2013**

United Artists Theatre Circuit, Inc. (“UATC”) hereby submits these comments on the Tentative Order and associated Cleanup Staff Report (“Staff Report”) prepared by the Staff of the San Francisco Bay Regional Water Quality Control Board (“Regional Board” or “Board”) regarding the property located at 2640 El Camino Real in Santa Clara, California (the “Site”).<sup>1</sup> In these documents, the Staff propose to name UATC as a “discharger” under Section 13304(a) of the California Water Code and to require UATC to perform various Site cleanup activities to address releases of perchloroethylene (“PCE”) at the Site by a dry cleaner that apparently operated at the Site from 1962 until the mid-1990s. For the reasons set forth below, the Staff’s proposal is unjustified by the facts and unsupported by the law, and should be rejected by the Regional Board.

**I. EXECUTIVE SUMMARY**

The Tentative Order naming UATC, a former owner of the Site, as a liable “discharger” is unique and unprecedented. It hangs on a thin, one-sided record supplied to the Regional Board Staff by the current Site owner, Moonlite Associates LLC (“Moonlite Associates” or “Moonlite”), with little corroboration or independent investigation by the Staff. It relies on misstatements of both fact and law and mischaracterizations of the technical analysis of scientific experts. It rejects sound scientific analysis by the United States Environmental Protection Agency (“EPA”), the Santa Clara Valley Water District, the United States Geological Survey and other recognized experts in favor of “anything-is-possible” conjecture and speculation. And it asks the Regional Board to adopt a new precedent under which innocent former landowners will be subject to draconian cleanup liability based solely on the mere existence of a former commercial use of their property and the detection decades later of contamination not previously associated with that commercial use.

Without facts and technical analysis to support the Tentative Order, the Regional Board lacks substantial evidence on which to name UATC as a discharger. Moreover, even if UATC would otherwise be liable under Section 13304(a), any such liability was discharged when UATC went through bankruptcy in 2001. Indeed, because of UATC’s bankruptcy, to hold UATC liable, the Regional Board must find that UATC reasonably should have known by 1978 (when UATC’s affiliation with the Site ended) that its tenant had contaminated the Site with PCE, while simultaneously concluding that the Regional Board should not reasonably have known by 2001 that UATC’s tenant had contaminated the Site with PCE. The Regional Board should decline to make these utterly inequitable and incompatible findings.

For these reasons, which are set out in detail in the ensuing comments, the Regional Board should decline to name UATC as a discharger responsible for cleaning up the Site.

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<sup>1</sup> By email from Nathan King to Scott Reisch (and others) dated July 18, 2013, the deadline for submitting these comments was extended to 8 AM PDT, July 29, 2013.



## II. FACTUAL BACKGROUND

### A. Site History

UATC (and entities affiliated with UATC) owned the Site from the mid-1940s until November 1975, when UATC sold the Site to Hanson Holdings, Inc. (“Hanson”).<sup>2</sup> After the sale, UATC leased the Site back from Hanson.<sup>3</sup> In September 1977, after several other Site ownership changes, Sherman, Clay of Delaware, Inc. (“Sherman, Clay”)—an entity related to Moonlite Associates—bought the Site.<sup>4</sup> About a year later, in November 1978, UATC and Sherman, Clay terminated the 1975 lease, effective September 1, 1978.<sup>5</sup> In 1983, Sherman, Clay transferred the Site to Moonlite, which continues to own the Site today.<sup>6</sup>

Evidence in the record suggests that a dry cleaner began operating at the Site in mid-1962, when the City of Santa Clara (the “City”) issued a Certificate of Occupancy dated July 10, 1962, certifying that the City had inspected a “44’ wide section – Cleaners & Laundry” at the Site and approving occupancy of the property.<sup>7</sup> It is undisputed that dry cleaning occurred at the Site (though perhaps not continuously) until at least October 1996, approximately 18 years after UATC vacated the Site.

Little is known about dry-cleaning practices at the Site. In anticipation of a dry cleaner operating at the Site, in May 1961, the California State Fire Marshal issued a permit to “Moonlight Cleaners” authorizing it to run a “clothes cleaning establishment” at the Site.<sup>8</sup> The permit allowed Moonlite Cleaners to install a Hoffman Master-Jet Cleaning Unit, Hoyt SF-130 Reclaimer, Per Combo Filter-Still-Cooker, and a Vaper-Mat Model 800. It also placed a handful of conditions on Moonlite Cleaners’ operations. For example, it required “[a]ll processes consisting of washing, extracting, and deodorizing solvent-cleaned garments [to] take place in equipment approved for that purpose by the State Fire Marshal.” Moonlite Cleaners had to ensure that exhaust fans on the cleaning and reclaiming equipment operated automatically when the equipment doors were open so that vapors would be exhausted to the outside of the building through ventilation ducts. The permit also required Moonlite Cleaners to use an enclosed piping

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<sup>2</sup> UATC, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, UATC’s Technical Report on Site History” 2 (Apr. 12, 2012), enclosed with letter from S. Reisch to B. Wolfe (Apr. 12, 2012). In the interests of efficiency, UATC has not attached to these comments any document that is posted on the State Water Resources Control Board GeoTracker database ([http://geotracker.waterboards.ca.gov/profile\\_report.asp?global\\_id=T10000000901](http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000000901)), as of today’s date. We understand that all such documents are part of the administrative record in this matter.

<sup>3</sup> *Id.* at 3 and Exhibit 3-A.

<sup>4</sup> *Id.* at 3–4 and Exhibit 3-E.

<sup>5</sup> *Id.* at 4 and Exhibit 3-F.

<sup>6</sup> *Id.* at 4 and Exhibit 3-G.

<sup>7</sup> City of Santa Clara, Building Department, “Certificate of Occupancy No. 1032,” enclosure to L. Gualco letter to N. King (Dec. 18, 2012).

<sup>8</sup> State Fire Marshal letter to Moonlight [sic] Cleaners (May 11, 1961), enclosure to L. Gualco letter to N. King (Dec. 18, 2012). For simplicity, we use the name “Moonlite Cleaners” to refer collectively to all of the dry-cleaning businesses that operated at the Site. According to Moonlite, at least nine different individuals operated that business. *See* Letter from L. Gualco to N. King, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California” Tab 11 (Mar. 30, 2011).

system to transfer reclaimed solvent from the “muck-reclaimer” to the “cleaning system.” Although the permit refers to “solvent,” it does not mention the type of solvent.

In June 1961, the City of Santa Clara approved a one-page application for a building permit at the Site, which requested permission to install partitions in the Moonlite Cleaners’ space, a minor improvement with an estimated value of \$1,000.<sup>9</sup> The application identifies “United Calif Theater” as the Site owner but is signed by a construction contractor.<sup>10</sup>

Scarcely any other documentation about Moonlite Cleaners or its operations has been identified or relied upon in the Tentative Order and Staff Report. The Staff has not set forth evidence of a single lease between any landlord and Moonlite Cleaners’ owners or operators. In fact, the Staff Report points to no records whatsoever to shed light on how Moonlite Cleaners actually conducted its operations either before or after UATC vacated the Site in September 1978—records about the volume of business the dry cleaner conducted, how it received and disposed of the “solvent” it used, or how much solvent the dry cleaner used or the frequency of solvent deliveries, or any documentation of landlord, City, or fire marshal inspections or spill responses at the Site. Moreover, the Staff Report has not identified or offered evidence from any witnesses with direct knowledge of Moonlite Cleaners’ operations.

The absence of pre-1978 records (such as a lease) regarding the Site is attributable in part to the fact that many of UATC’s historic records were destroyed in 2006, several years after UATC was sold to a new owner, as part of an established document-retention program.<sup>11</sup> There is nothing in the record, however, that explains the absence of information from the (more recent) post-1978 period. There is also little information in the record about how the City of Santa Clara operated and maintained the sewer system that serviced the Site, despite evidence that the sewer system is a source of the PCE contamination. The City submitted a Site History Technical Report to the Staff on April 13, 2012, which responded to the Staff’s request for certain information and records.<sup>12</sup> Although the City enclosed nearly two hundred pages of inspection and maintenance records for the sewer system in the vicinity of the Site, the earliest dated inspection documented by those records occurred in March 1995.<sup>13</sup>

## **B. UATC’s Bankruptcy**

On September 5, 2000—twenty-two years after UATC’s involvement with the Site ended—UATC and other affiliated entities commenced chapter 11 bankruptcy cases in the

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<sup>9</sup> “Application for Building Permit” (June 27, 1961), enclosure to L. Gualco letter to N. King (Dec. 18, 2012).

<sup>10</sup> *Id.*

<sup>11</sup> UATC, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, UATC’s Technical Report on Site History” 1 (Apr. 12, 2012), enclosed with letter from S. Reisch to B. Wolfe (Apr. 12, 2012).

<sup>12</sup> Letter from J. Hill to B. Wolfe, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, Site History Technical Report – City of Santa Clara” (Apr. 13, 2012); Letter from B. Wolfe to J. Hill, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, Requirement for Technical Report on Site History” (Mar. 13, 2012).

<sup>13</sup> Letter from J. Hill to B. Wolfe, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, Site History Technical Report – City of Santa Clara” Ex. 1 (Apr. 13, 2012).

United States District Court for the District of Delaware (the “Bankruptcy Court”).<sup>14</sup> On January 25, 2001, the Bankruptcy Court confirmed the debtors’ joint plan of reorganization (“Bankruptcy Plan”).<sup>15</sup>

The Bankruptcy Court order confirming the Bankruptcy Plan (“Bankruptcy Court Order”) broadly discharged legal claims against the debtors, which included UATC. In particular the order provided that:

The Plan shall bind all Holders of Claims and all Equity Interests, and all Claims against, and Equity Interests in, the Debtors and Debtors in Possession shall be satisfied, discharged and released in full, and the Debtors’ liability with respect thereto shall be extinguished completely . . . and (iii) all Persons and Entities shall be precluded from asserting against the Debtors, the Debtors in Possession, the Estates, and the Reorganized Debtors, their successors and assigns, their assets and properties, any other Claims or Equity Interests based upon any documents, instruments, or any act or omission, transaction or other activity of any kind or nature that occurred prior to the Effective Date [of the Bankruptcy Plan].<sup>16</sup>

As a limited exception to the discharge provision, the order also provided:

Notwithstanding any language to the contrary in the Plan or in this Order, nothing in the Plan or this Order shall be construed as releasing or relieving any entity of any liability to a governmental entity under any police or regulatory statute as the owner or operator of property that the entity owns or operates after the date of this Order.<sup>17</sup>

Thus, the Bankruptcy Court Order expressly carved out of its discharge provisions governmental entity claims relating to property that is still owned or operated by UATC “after the date of [the Bankruptcy Court Order].” There is no such carve-out for governmental entity claims relating to property that was not owned or operated by UATC after the date of the Bankruptcy Court Order (*i.e.*, January 25, 2001).

### **C. The Claims Against UATC**

According to Moonlite, in September 2004, Moonlite discovered PCE contamination in groundwater at the Site in excess of state standards.<sup>18</sup> The record does not reflect whether Moonlite sampled groundwater at the Site because it had reason to know of a PCE release at the

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<sup>14</sup> See Docket for Case No. 00-03514 (PJW) (Jointly Administered) (Bankr. D. Del.) (“Chapter 11 Case”); Chapter 11 Case Docket No. 1 (Voluntary Petition under Chapter 11 filed on September 5, 2000).

<sup>15</sup> See Chapter 11 Case Docket No. 867 (Confirmation Order entered on January 25, 2001).

<sup>16</sup> Bankruptcy Court Order 43 (emphasis added), attached as Ex. A to letter from S. Reisch to N. King, “Moonlite Associates LLC’s Claims Re: United Artists at 2640 El Camino Real, Santa Clara, California” (Dec. 29, 2011).

<sup>17</sup> Bankruptcy Court Order 23 (emphasis added).

<sup>18</sup> See [http://geotracker.waterboards.ca.gov/profile\\_report.asp?global\\_id=T10000000901](http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000000901) (Regulatory Activities).

Site during its ownership or for some other reason. What is evident is that Moonlite conducted no further investigation or remediation of the Site in 2004, and did not report the contamination to the Regional Board or further investigate the contamination until March 2009, **four and one-half years** later.<sup>19</sup> The reason for this delay in reporting the Site contamination, as required by California law,<sup>20</sup> has never been explained.

On October 24, 2011, Moonlite sent a letter to the Staff, asking the Regional Board to name UATC as a “discharger” responsible for cleanup of the Site and also asking the Regional Board to obtain information to support naming the City as a discharger as a result of PCE releases from its sewer system.<sup>21</sup> In response, UATC submitted a letter to the Regional Board asserting that UATC should not be named as a discharger, both because of the absence of any evidence of any PCE spills during UATC’s ownership and tenancy and because UATC’s liability, if any, was discharged in the 2001 bankruptcy.<sup>22</sup>

After additional correspondence with the Staff about whether UATC should be named as a discharger, the Regional Board required UATC and the City to submit reports concerning the Site history.<sup>23</sup> UATC submitted its report on April 12, 2012, and the City followed suit the next day.<sup>24</sup> The Regional Board accepted and approved the City’s report on July 25, 2012, and did the same with respect to UATC’s report on August 31, 2012.<sup>25</sup> To UATC’s knowledge, no site history report has ever been requested from, or submitted by, Moonlite Associates, despite its lengthy ownership of the Site, including 19 years while dry-cleaning operations occurred at the Site.

In August 2012, the Staff also shared a draft letter with Moonlite partially approving and partially rejecting a feasibility study and pilot study work plan Moonlite had prepared concerning

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<sup>19</sup> Moonlite, “Request for Agency Oversight of a Brownfield Site” (Jan. 22, 2009).

<sup>20</sup> See Cal. Health & Saf. Code § 25359.4 (requiring that an unauthorized release of a reportable quantity of a hazardous substance be reported to the California Department of Toxic Substances Control within 30 days after the release is discovered).

<sup>21</sup> Letter from L. Gualco to N. King, “Former Moonlite Cleaners, 2640 El Camino, Santa Clara, California” (Oct. 24, 2011) attached hereto as Ex. A.

<sup>22</sup> Letter from S. Reisch to N. King, “Moonlite Associates LLC’s Claims Re: United Artists at 2640 El Camino Real, Santa Clara, California” (Dec. 29, 2011).

<sup>23</sup> Letter from B. Wolfe to S. Reisch, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara County, Requirement for Technical Report on Site History” (Mar. 13, 2012); Letter from B. Wolfe to J. Hill, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara County, Requirement for Technical Report on Site History” (Mar. 13, 2012).

<sup>24</sup> Letter from S. Reisch to B. Wolfe, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, Technical Report on Site History” (Apr. 12, 2012); Letter from J. Hill to B. Wolfe, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, Site History Technical Report – City of Santa Clara” (Apr. 13, 2012).

<sup>25</sup> Letter from B. Wolfe to J. Hill, “Approval of Technical Report on Site History – Former Moonlite Cleaners 2640 El Camino Real, Santa Clara, Santa Clara County” (July 25, 2012); Letter from B. Wolfe to S. Reisch, “Approval of United Artist[s] Theat[re] Circuit, Inc. Technical Report on Site History, Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County” (Aug. 31, 2012).

remediation of the Site.<sup>26</sup> The Staff's draft letter contested the conceptual site model described in Moonlite's work plan, which took the position that a significant release of PCE occurred near the Site from the City's sewer system.<sup>27</sup> Shortly after the Staff shared the draft letter with Moonlite, Moonlite formally withdrew its request that the City be named as a discharger and the Staff and City agreed to withdraw and, according to Moonlite, "delete" the draft letter objecting to Moonlite's work plan.<sup>28</sup> Moonlite simultaneously promised to provide the Staff with "additional information relevant to the naming of United Artists as a former owner of the [Site]" and reiterated its request that the Staff name UATC as a discharger at the Site.<sup>29</sup>

The Staff acceded to Moonlite's request. In an e-mail dated October 9, 2012, the Staff notified Moonlite and UATC that the Regional Board was "planning on moving forward with issuing an order that names Moonlite and [UATC] as dischargers."<sup>30</sup> The Staff also informed UATC that it was declining to pursue a claim against the City of Santa Clara because the City purportedly had been conscientious in maintaining its sewer lines in the area and the PCE discharges violated a 1975 City ordinance.<sup>31</sup> In addition, the Staff took the position that the contamination at the Site is primarily attributable to a release in the vicinity of Moonlite Cleaners' dry-cleaning equipment and not from a leaking sewer line.<sup>32</sup>

On November 20, 2012, the Staff met with representatives of UATC and Moonlite to discuss UATC's objections to being named as a discharger. At the meeting, UATC presented a technical analysis prepared by groundwater hydrology experts from Erler & Kalinowski, Inc. ("EKI"), in which EKI concluded that it is unlikely that a PCE release occurred at the Site while UATC owned or leased the property (*i.e.*, before September 1978). UATC also argued that it should not be named as a discharger because the Regional Board lacked substantial evidence that (a) a PCE release occurred before September 1978; (b) UATC knew or reasonably should have known by 1978 that groundwater contamination was a danger common to dry-cleaning operations; and, (c) UATC had the legal ability to prevent the discharge. In addition UATC explained that any claim the Regional Board might have against UATC was discharged in UATC's 2001 bankruptcy.

In the following months, Moonlite and UATC exchanged additional correspondence with the Staff about whether the Regional Board had an adequate basis for naming UATC as a discharger. In March 2013, UATC submitted a report by EKI to the Staff setting forth EKI's

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<sup>26</sup> Draft letter from N. King to B. Mehrens, "Partial Approval of Feasibility Study/Pilot Study Work Plan and Request for Reports, Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County" (Aug. 2012), attached hereto as Ex. B.

<sup>27</sup> *Id.*

<sup>28</sup> Letter from L. Gualco to N. King, "Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California" (Aug. 28, 2012).

<sup>29</sup> *Id.*

<sup>30</sup> E-mail from N. King to S. Reisch and L. Gualco, "Moonlite Cleaners" (Oct. 9, 2012), attached hereto as Ex. C.

<sup>31</sup> The Staff did not explain how an ordinance issued in 1975 could provide a basis for declining to name the City as a discharger for releases that Staff contends occurred between 1962 and 1975.

<sup>32</sup> Draft letter from N. King to B. Mehrens, "Partial Approval of Feasibility Study/Pilot Study Work Plan and Request for Reports, Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County" (Aug. 2012) attached hereto as Ex. B.

conclusion that the distribution of PCE in the subsurface at the Site is consistent with a post-1978 release and that there is no evidence of a pre-1978 release at the Site.<sup>33</sup> Nonetheless, the Staff has recommended to the Regional Board in the Tentative Order and Staff Report that both Moonlite and UATC be named as dischargers liable for cleaning up PCE contamination at the Site.

**III. THERE IS NO BASIS FOR NAMING UATC AS A “DISCHARGER” UNDER THE WATER CODE.**

Under the Porter-Cologne Water Quality Control Act, the Regional Board may issue a cleanup and abatement order to “[a]ny person ... who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance....” Cal. Water Code § 13304(a) (emphasis added). The Regional Board must have “substantial evidence” supporting any decision to name an entity as a “discharger.” See *In re Exxon Co.*, Cal. State Water Res. Control Bd. Order No. WQ 85-7 at 10–11 (Aug. 22, 1985); William R. Attwater, Memorandum to Regional Board Executive Officers Regarding Responsible Party Orders, (Dec. 2, 1992). Substantial evidence means “credible and reasonable evidence which indicates the named party has responsibility.” *In re Exxon Co.*, WQ 85-7 at 12.

The Regional Board may conclude that UATC “caused or permitted” a discharge under Water Code Section 13304(a) as a former owner and landlord at the Site only if the Regional Board finds, based on substantial evidence, that UATC:

- (1) owned or was in possession of the Site at the time PCE was discharged;
- (2) either knew of the PCE release or knew or reasonably should have known while it owned or leased the Site that groundwater contamination was a danger common to dry-cleaning businesses; and
- (3) had the legal ability to prevent the discharge of PCE from the Site.

See *In re Logsdon*, Cal. State Water Res. Control Bd. Order No. WQ 84-6 at 10 (July 19, 1984) (former landowners caused or permitted a tenant’s discharge where they had “(1) actual knowledge of the dangerous condition and (2) an opportunity to obviate it”); *In re Stuart*, Cal. State Water Res. Control Bd. WQ 86-15 at 6 n.3 (Sept. 18, 1986) (actual knowledge of contamination is not required where a lessor “should have known” of the contamination based upon common knowledge at the time). As explained below, the Regional Board has failed to identify substantial evidence on not just one, but all three of these critical elements.

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<sup>33</sup> EKI, “Review of Environmental Data: Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California” (Mar. 12, 2013) (“EKI Report”), enclosed with letter from S. Reisch to N. King (Mar. 12, 2013) and attached hereto as Ex. D.

**A. The Tentative Order’s Assertion that a Discharge Occurred While UATC Owned or Leased the Site Is Based on Conjecture Rather than Substantial Evidence, Conflicts with the Only Viable Technical Analysis Presented, and Represents a Major Departure from Board Precedent.**

The Tentative Order flatly asserts that discharges of PCE occurred while UATC owned or leased the Site in the 1960s and mid-1970s. Tentative Order at 2. However, a review of the Staff Report on which the Tentative Order is based demonstrates that, having failed to conduct a complete and independent investigation, the Staff really does not know when the release of PCE occurred at the Site, it is literally guessing as to what “could have” or “would have” happened at the Site, and as a result, it seeks without precedent and without any contemporaneous documents, Site-specific technical analysis or eyewitness testimony to hold UATC liable as a prior landowner merely because it long ago owned commercial property that is now contaminated.

**1. The Tentative Order and Staff Report Rely on an Incomplete and Inadequate Investigation of the Site.**

Despite the fact that Moonlite admitted it was liable for cleaning up the Site, it appears from the record that the Staff completely ignored Moonlite as a source of information about whether PCE was released at the Site while Moonlite owned it. Although the Regional Board required UATC and the City of Santa Clara to submit site-history reports, according to the record, the Regional Board did not require Moonlite to do the same. Instead, Moonlight Associates voluntarily provided a timeline to the Regional Board that set out some information as to the identity of various owners and operators of Moonlite Cleaners, but Moonlite included no supporting documentation, and, to UATC’s knowledge, no such supporting documentation was ever requested by the Staff.<sup>34</sup> For example, it appears that Staff never asked Moonlite Associates how it knows that (1) Sung Ki Kim and Chinhea Kim became dry cleaner tenants on assignment of rents on March 24, 1986; (2) Jung Sup Kim and Soon Cheon Kim entered a new lease for the dry cleaner at the Site on October 1, 1992; or (3) the Site became vacant on October 9, 1996.<sup>35</sup> This is but one example of the inadequacy of the Staff’s investigation, and there are many others. Indeed, it appears from the record that the Staff—

- Never required Moonlite to provide written responses to basic questions about dry-cleaning operations conducted at the Site during the 19 years that Moonlite and affiliated companies owned it;
- Did not ask whether Moonlite possessed evidence of a release of PCE during its ownership of the Site;
- Did not ask how PCE was handled by Moonlite’s tenants;
- Did not ask whether Moonlite ever inspected the Site;

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<sup>34</sup> Letter from L. Gualco to N. King, “Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California” Tab 11 (Mar. 30, 2011).

<sup>35</sup> *Id.*

- Did not ask Moonlite to provide leases with its former dry cleaner tenants;
- Did not ask Moonlite for records of how PCE was transported to or from the Site or used at the Site, for records of the dry-cleaning equipment Moonlite's tenants used at the Site, or for records of Site renovations or modifications; and,
- Did not ask Moonlite why dry-cleaning operations at the Site ceased and the dry-cleaning tenant moved to a different location.

Rather than conduct this basic inquiry into Site operations during Moonlite's ownership, the Staff indicate that Moonlite told the Staff that all of the former owners and operators of the dry cleaner were deceased, and the Staff simply accepted that assertion wholesale and then repeated it as an unqualified "fact" in both the Staff Report and the Tentative Order. But the Staff now acknowledge that the assertion is wrong and admit that they never conducted any independent investigation into this alleged "fact."

The Staff's investigation of the City as a potential discharger is plagued with similar shortcomings. For example, it appears that the Staff have decided not to pursue the City as a discharger, in part, because the Staff concluded that the City properly maintained the sanitary sewer system near the Site. But the maintenance records submitted by the City predominantly concerned inspections and repairs of the sewer system performed in 2007 and thereafter.<sup>36</sup> There are only a few entries in those records that are dated before Moonlite Cleaners vacated the Site in 1996, and those entries relate to work orders for what appear to be minor operational incidents, not rigorous, routine inspections and maintenance. In fact, the earliest documented inspection occurred in March 1995, after the dry cleaner had allegedly operated for over thirty years. There are a half dozen work orders dated between July 1995 and May 1996 for nondescript customer complaints and lateral blockages at 2780 El Camino Real, and a single entry in July 1996 for routine maintenance. These records provide no information whatsoever about whether and how well the City maintained the sewer system when dry cleaning occurred at the Site between 1962 and 1996, and in particular, do not address what steps the City took to maintain the sewer system following the Loma Prieta earthquake in October 1989.

Indeed, it appears from the record that the Staff simply stopped investigating the City as a potential discharger after Moonlite Associates formally withdrew its request that the City be named as a party responsible for remediating the Site.<sup>37</sup> The Staff did not require the City to take samples from around the sewer system, even though, according to Moonlite, the Staff had previously indicated that such samples would aid in determining whether a release from the sewer system had occurred.<sup>38</sup> Furthermore, it is evident from the record that the Staff made no additional inquiries about the City's maintenance practices even though the records supplied by the City did not address most of the relevant timeframe.

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<sup>36</sup> Letter from J. Hill to B. Wolfe, "Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County, Site History Technical Report – City of Santa Clara" Ex. 1 (Apr. 13, 2012).

<sup>37</sup> Letter from L. Gualco to N. King, "Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California" 1 (Aug. 28, 2012).

<sup>38</sup> Letter from L. Gualco to N. King, "Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California" 3 (Oct. 24, 2011), attached hereto as Ex. A.



The Staff's failure to scrutinize these issues impacts not only whether all relevant parties are before the Regional Board, but also the validity of the Staff's conclusions that PCE was discharged at the Site before 1978 and that leaks from aging sewers are not a primary cause of contamination at the Site.

## **2. The Staff's Reliance on Generalities about Contamination from Dry-Cleaning Businesses Is Misplaced.**

In the absence of a diligent investigation into dry-cleaning operations at the Site, the Staff Report instead relies on generalities, unsupported assumptions, and flawed logic to conclude that PCE was released at the Site while UATC owned or leased it. In particular, the Staff Report concludes that PCE was released at the Site between 1962 and 1978 based on: (a) physical evidence of PCE at the Site and down-gradient from the Site; (b) the history of solvent usage at the Site beginning in the early 1960s and historic common industry-wide practices that led to PCE discharges in the 1960s and 1970s; and (c) inefficiencies of older dry-cleaning equipment from the 1960s. Tentative Order at 2; Staff Report at 3. As explained below, none of the information relied upon by the Staff supports their conclusion.

### a) Presence, Concentration and Distribution of PCE in Groundwater

The mere presence of PCE at the Site and down-gradient from the Site provides no basis for pinpointing when PCE was released at the Site. If Moonlite Associates' tenants spilled PCE at the Site and UATC's tenant did not, there would still be physical evidence of PCE at and down-gradient from the Site, even though no release occurred between 1962 and 1978.

To the extent the Staff Report intends to claim that the concentration and distribution of PCE at the Site supports an inference that PCE was released to the surface of the Site before 1978, that claim has already been debunked by the analysis submitted to the Regional Board by EKI, which demonstrates that the concentrations and distribution of PCE at the Site show exactly the opposite. In particular, groundwater monitoring and elevation data from the Site and the surrounding area indicate that the direction of groundwater flow beneath and around the Site changed in approximately the mid-1990s.<sup>39</sup> Those data reveal that groundwater elevations around the Site were relatively deep until the mid-1990s, and Saratoga Creek was a losing stream, causing a northwest-trending groundwater gradient.<sup>40</sup> If a PCE release had occurred before 1978, according to EKI's travel-time calculations, PCE would have migrated through the unsaturated zone and reached the groundwater table in approximately six years, resulting in a *northwest-trending* PCE plume.<sup>41</sup> But that is not what groundwater monitoring data from the Site show. Rather, a PCE plume about 600-feet long trends from the Site to the *northeast*.<sup>42</sup> That northeastern trend is consistent with a release that occurred in the late 1980s or thereafter, shortly before the groundwater gradient at the Site changed.

<sup>39</sup> EKI Report 6–7, attached hereto as Ex. D.

<sup>40</sup> *Id.*

<sup>41</sup> *Id.*

<sup>42</sup> *Id.* at 10–11. EKI also concluded that a northwest-trending plume would still be detectable today if a release had occurred before 1978, despite the mid-1990s shift in gradient to the northeast. *Id.*

EKI also explained in its technical report that PCE groundwater contamination at the Site is relatively shallow, which is consistent with a post-1978 release when the water table was far shallower than in the pre-1978 timeframe. In particular, if a pre-1978 release occurred, PCE would have migrated vertically downward through the vadose zone, at least as far as a thick layer of clay underneath the Site and at an elevation approximately 40–45 feet above mean sea level (msl).<sup>43</sup> But the core of the current PCE plume is substantially shallower, at about 55 feet msl.<sup>44</sup> Moreover, PCE concentrations are extremely low in the deepest groundwater samples, at about 30 feet msl. Thus, the vertical distribution of PCE is consistent with a post-1978 release.

Finally, both EKI and Moonlite Associates' consultant, West Environmental Services and Technologies ("West"), have concluded that the concentrations of PCE in groundwater indicate that contamination at the Site was not caused by a surface release of PCE, but rather by wastewater containing PCE that leaked from sewer lines beneath and near the Site.<sup>45</sup> If PCE had been spilled on the surface at the Site, it would have been released as a dense non-aqueous phase liquid ("DNAPL").<sup>46</sup> According to EPA guidance, groundwater that has been impacted by a DNAPL release would exhibit PCE concentrations above one percent effective solubility.<sup>47</sup> But PCE groundwater concentrations at the Site are below that threshold, with a maximum of about 0.51 percent effective solubility.<sup>48</sup> The concentrations of PCE at the Site are therefore indicative of a release of PCE in the *dissolved* phase in wastewater from the sewer system, rather than a surface release. This is significant because a pre-1978 *sewer* release undoubtedly would have resulted in a northwest trending PCE plume given the groundwater flow direction during that period. Because no such plume is evident at the Site, such a release could not have occurred.

Although the Staff Report responds to EKI's analysis, the response is full of unsubstantiated assertions, mischaracterizations, and omissions, many of which are catalogued in EKI's "Comments on Cleanup Staff Report Accompanying Moonlite Tentative Order," dated July 29, 2013 ("EKI Comments"), which is attached hereto as Attachment A. With respect to EKI's specific conclusions about the PCE release timing based on shifting groundwater flow, the Staff Report theorizes that PCE could have leaked onto and slowly seeped through the concrete floor, for as long as decades, before migrating through soil to groundwater. Staff Report at 6. Yet, the 2007 Santa Clara Valley Water District study ("2007 Study") on which the Staff Report heavily relies, explains that releases of PCE to concrete (so-called above-slab releases) are prone to volatilize into air rather than penetrate a slab.<sup>49</sup> And EKI concludes that, if PCE had migrated

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<sup>43</sup> *Id.* at 12.

<sup>44</sup> *Id.*

<sup>45</sup> EKI Report at 10, attached hereto as Ex. D; West, "Feasibility Study/Pilot Study Work Plan, 2640 El Camino Real, Santa Clara, California" 8, 25 (Sep. 20, 2012); West, "Site Investigation Report, 2640 El Camino Real, Santa Clara, California" 28–29 (Oct. 5, 2011).

<sup>46</sup> EKI Report at 10, attached hereto as Ex. D.

<sup>47</sup> *Id.*

<sup>48</sup> EKI Report at 10 n.3, attached hereto as Ex. D.

<sup>49</sup> See Santa Clara Valley Water District, "Study of Potential for Groundwater Contamination from Past Dry Cleaner Operations in Santa Clara County" 21 (2007). See also Environmental Protection Agency, National Risk Management Research Laboratory, "Groundwater Issue: Assessment & Delineation of DNAPL Source Zones at Hazardous Waste Sites" 11 (Sep. 2009) (fine grained materials like concrete present a barrier to non-aqueous phase liquid entry), attached hereto as Ex. E.

through the concrete floor, several feet of PCE would have had to accumulate before it would pass through the clay beneath the building. If that had happened, the PCE would have migrated quickly downward to groundwater, as opposed to sitting above the groundwater for decades.<sup>50</sup> Thus, the Staff Report's assertion that it took decades for a PCE surface release to reach groundwater is not scientifically possible. Either (1) PCE released at the surface never reached groundwater because not enough DNAPL was released to push it through the building slab and underlying clay, or (2) sufficient DNAPL was released such that its weight, due to the force of gravity, was able to push the DNAPL to groundwater much faster than several decades. If DNAPL had migrated to groundwater as a result of a pre-1978 release, remnants of a northwest trending plume still would be evident. Again, the absence of such a plume demonstrates that a pre-1978 release did not occur.

Similarly, the Staff Report's response to EKI's analysis of the potential for sewer releases is unconvincing. Importantly, the 2007 Study upon which Staff otherwise rely found that leaking sewer lines are the most frequent cause of PCE releases from dry-cleaning businesses.<sup>51</sup> In fact, three key pieces of evidence support the conclusion that PCE contamination at the Site is attributable to a release through the sewer:

1. PCE has been detected at elevated concentrations in groundwater samples taken cross-gradient from the former dry-cleaning premises and along the sewer lines (boreholes B6, B43, B44, B12, and MW2).
2. As explained above, the low effective solubility of sampled PCE concentrations indicates that the PCE was released in the dissolved phase, which would occur in a release of wastewater from sewers, rather than as a DNAPL, which would occur in a surface spill.
3. Video logging of the 8-inch diameter sewer line south of the Site, which was constructed by the City in 1960 or 1961, reportedly revealed compromised pipe integrity.<sup>52</sup>

In short, the concentration and distribution of PCE at the Site support the conclusion that PCE was released only after 1978, and from the sewer system, a conclusion that is exactly contrary to that reached in the Staff Report.

#### b) Use of PCE and "Common Industry-Wide Practices"

The Staff Report's second argument—that use of PCE at the Site and “common industry-wide practices” in the 1960s and 1970s indicate that a PCE release occurred prior to 1978—is equally unavailing. At the outset, it is important to recognize that what the Staff refer to as “common industry-wide practices” is actually a list of all the possible ways that PCE could enter groundwater from dry-cleaning operations and includes everything from dumping PCE onto soil

<sup>50</sup> See EKI Comments at 6–7, attached hereto as Attachment A.

<sup>51</sup> See 2007 Study at 20, Figure 5.

<sup>52</sup> See Letter from L. Gualco to N. King, “Former Moonlite Cleaners, 2640 El Camino, Santa Clara, California” 3 (Oct. 24, 2011), attached hereto as Ex. A.

to PCE seeping through concrete. Rather than providing an explanation for how and when PCE was discharged at this particular Site, the listing of these disparate, general mechanisms and pathways demonstrates that the Staff really have no idea how and when PCE entered the environment at the Site.

The danger in relying on generalities instead of site-specific data is that generalities can point in opposite directions. For example, the Staff Report's list of common industry-wide practices includes "leakage from sewer laterals," which EKI has demonstrated must have occurred after 1978. In addition, if the Regional Board is willing to make judgments about liability at the Site based on general trends and practices, the Regional Board could just as easily reach the conclusion that contamination at the Site was more likely to occur after 1978, as equipment and sewers aged.

It is inequitable and indefensible for the Staff Report to rely on the parts of the 2007 Study that are superficially consistent with the Staff Report's conjecture about a pre-1978 release and ignore the rest of the study, but that is precisely what the Staff Report has done. Not only does the Staff Report ignore the 2007 Study's conclusion that sewer releases are the principal source of PCE groundwater contamination, but it also disregards data in the 2007 Study that indicate that at least one quarter of historic dry-cleaning operations have never caused PCE contamination.<sup>53</sup> Similarly, the Staff ignore portions of the 2007 Study that acknowledge that changes in ownership and handling practices may have affected the amount of solvent used and released during a dry cleaner's operating life.<sup>54</sup> Thus, while the 2007 Study provides some useful background information about the dry-cleaning industry generally, it does not provide substantial evidence that a PCE release occurred at this Site before 1978.

#### c) Inefficiencies of Older Equipment

Finally, supposed "inefficiencies of older dry-cleaning equipment from the 1960s" also prove nothing about when PCE was released at the Site. Again, there is nothing in the record to connect this generality about dry-cleaning equipment to the actual equipment UATC's tenant used at the Site. The Staff Report offers no evidence, for example, of how UATC's tenant operated and maintained the equipment in use at the Site before 1978, or whether it was more or less reliable than other dry-cleaning equipment.

The Staff Report also claims, in reliance on the 2007 Study, that "the earlier a dry cleaner operated[,] the more likely it is that larger quantities of PCE were released to soil and groundwater due to older equipment and common PCE handling and disposal practice[s] for that time period." *Id.* However, as EKI points out, the higher PCE loss rate in the 1960s was caused by greater air emissions, not greater discharges to the subsurface.<sup>55</sup>

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<sup>53</sup> See 2007 Study at 6.

<sup>54</sup> *Id.* at 45.

<sup>55</sup> EKI Comments at 5, attached hereto as Attachment A.

### 3. There Is No Precedent for Reaching Conclusions as to the Timing of a Discharge Without Eyewitness Testimony or Technical Evidence.

After an extensive review, UATC has found no cleanup and abatement orders where the timing of a discharge was in dispute and a regional board made a finding on that issue based solely on the grounds that discharges of a detected chemical were common in the industry at issue. Instead, in the few cleanup and abatement orders where the timing of a discharge was directly in dispute, regional boards have relied on at least some direct evidence that the relevant contaminant was in fact spilled at the site in the relevant time period or on some technical evidence—such as a fate-and-transport analysis—to estimate the timing and location of the discharge.

For example, in *In re Stinnes-Western Chem. Corp.*, Cal. State Water Res. Control Bd. Order No. WQ 86-16, 5–10 (Sept. 18, 1986), the State Board affirmed a cleanup and abatement order issued by the Regional Board to the current owner of a contaminated site and the successor-in-interest of the former owner of the site based on eyewitness declarations about the timing of a PCE spill and a technical calculation of solvent-plume velocity to determine the timeframe in which a discharge occurred. In *In re Wenwest*, Cal. State Water Res. Control Bd. Order No. WQ 92-13, 1992 WL 12622783 at \*2 (Oct. 22, 1992), the State Board affirmed a regional board’s finding that discharges occurred while the site was owned by a former owner based on technical reports that, “considering the soil in the area and the distance the gasoline has travelled to reach the neighbor’s well, discharges took place at least 12 years before it was detected by the neighbor,” placing the discharge well within the period in which the site was owned by the former owner. Similarly, in *In re Sanmina Corp.*, Cal. State Water Res. Control Bd. Order No. WQ 93-14, 1993 WL 456494 at \*4 (Oct. 19, 1993), the State Board found evidence sufficient to find the petitioner—a former tenant at the site—caused or permitted a discharge where the petitioner operated a manufacturing business in which volatile organic compounds (“VOCs”) were typically used, documentary and testimonial evidence established that the petitioner stored or used VOCs, such compounds were detected beneath the petitioner’s concrete “wet floor” at the facility, the petitioner had a history of repeated spills, and the contamination could not be attributed to an upgradient source. *See also In re Spencer Rental Serv.*, Cal. State Water Res. Control Bd. Order No. WQ 87-1 (Jan. 22, 1987) (lessee of contaminated site properly named as discharger despite claims that the contamination pre-dated his tenancy where contamination was detected directly beneath gasoline tank used by lessee, evidence showed that no such contamination was present when the tank was installed, and monitoring data was consistent with a more recent spill).

A finding in this case that UATC is a discharger requires the Regional Board to jettison these precedents and establish a new one. If the Regional Board concludes in this case that there is substantial evidence that a PCE release occurred while UATC owned the property, then it follows that everyone who owned commercial or industrial property in the 1960s and 1970s would be liable under Water Code Section 13304(a) so long as they or their tenants used the same chemicals that are later found at the Site, and the Staff can allege, as they always will, that historical handling practices were generally worse than they are today. Such a broad threat of liability contradicts the express terms of the statute, which requires evidence that prior owners “caused or permitted” a discharge, and makes no sense because former property owners have no

ability to control whether someone else later releases the same chemicals on their former property. The Regional Board should not use this case to expand the reach of Section 13304(a) beyond what the California State Legislature intended and what relevant State Board precedents have established.

**B. The Staff Report Fails to Provide Substantial Evidence that UATC “Knew or Should Have Known” That PCE Was Discharged While UATC Owned or Leased the Site.**

**1. Legal Precedents Require Actual or Constructive Knowledge of a Discharge.**

In addition to linking the timing of a discharge to UATC’s ownership or tenancy at the Site, in order to conclude that UATC “caused or permitted” waste to be discharged under Water Code Section 13304(a), the Regional Board must have substantial evidence that UATC knew or should have known of the discharge and failed to prevent it. *See In re Logsdon*, WQ 84-6 at 10 (former landowners caused or permitted a tenant’s discharge where they had “(1) actual knowledge of the dangerous condition and (2) an opportunity to obviate it”); *In re U.S. Dept. of Ag., Cal. State Water Res. Control Bd. Order No. WQ 87-5* at 3 n.1 (Apr. 16, 1987) (actual knowledge of a discharge is required “when a reasonable person would not have suspected that a problem could arise from the land use involved”; landowners are also liable without actual knowledge of a discharge “where the activity permitted on the property might be expected, by a reasonable and prudent landlord, to result in a discharge.”); *In re Stuart*, WQ 86-15 at 6 n.3 (liability may attach under Section 13304 without proof of actual knowledge of contamination because the risk of leaking underground storage tanks was common knowledge in the oil industry in 1986); *see also Resolution Trust Corp. v. Rossmoor Corp.*, 34 Cal. App. 4th 93, 102 (Cal. App. 1995) (to be liable for a nuisance, “[t]he defendant must be aware of the specific dangerous condition and be able to do something about it before liability will attach.”); *Redevelopment Agency of the City of Stockton v. BNSF Railway Co.*, 643 F.3d 668, 675 (9th Cir. 2011) (liability for nuisance may attach if the possessor of land knows or should know of the artificial condition and the nuisance). As a result, the Water Code requires some evidence of UATC’s culpability for the discharge before UATC can be ordered to conduct remediation. The theory behind these cases is that a landlord in effect “permits” a nuisance, as the statute requires, if he knows or should know it exists or is threatened, has the authority to prevent it, and chooses not to. *See In Re Stuart*, WQ 84-6 at 6.

In evaluating when a landowner “should have known” about contamination caused by others, prior court decisions have focused on whether the landowner had a reasonable basis for undertaking an inspection for contamination, and if so, whether the contamination was discoverable by a reasonable inspection. *See Resolution Trust*, 34 Cal. App. 4th at 103 (evaluating liability under Section 13304(a) in accordance with the law of nuisance); *cf. City of Stockton*, 643 F.3d at 675–77 (evaluating common law nuisance claim). Importantly, the case law recognizes that a reasonable inspection does not oblige landowners to take extraordinary measures, such as extensive and expensive soil testing, to discover contamination on property they own or possess. *See City of Stockton*, 643 F.3d at 675–77; *Resolution Trust*, 34 Cal. App. 4th at 103–104.

The *Resolution Trust* case is particularly instructive. In that case, a landowner leased its property (through a subtenant) to a gas station. 34 Cal. App. 4th at 98. During the time that the gas station operator rented the property, substantial gasoline and diesel fuel leaks occurred, contaminating the plaintiff's neighboring property. *Id.* at 98–99. The plaintiff brought a nuisance claim against the landowner who had leased the property to the gas station operator. *Id.* at 98. The California Court of Appeals held that the landowner was not liable for a nuisance. *Id.* at 98. In so holding, the court specifically evaluated the circumstances under which a landlord has a duty to inspect for nuisances created by its tenant or subtenant. *Id.* at 102–104. The court stressed that “[t]he landlord need not take extraordinary measures or make unreasonable expenditures of time and money in trying to discover hazards unless the circumstances so warrant.” *Id.* at 103. On this basis, the court went on to conclude that there was no reason to find that the landlord should have known that its tenant's gas station operations had caused subsurface contamination of adjoining property. *Id.* at 103–04.

Here, neither the Tentative Order nor the Staff Report even alleges that a reasonable inspection of the Site would have identified a PCE discharge into groundwater (or soil). And, in fact, none of the “common release” mechanisms identified by the Regional Board as possibly occurring at the Site—*e.g.*, colorless PCE seeping through concrete or leaking from sewer laterals buried beneath the building floor—would have been detected through a reasonable inspection.

## **2. The Tentative Order and Staff Report Advance Theories of Liability Predicated on Mischaracterizations of the Law and Unsupported Factual Assumptions.**

Instead of following established legal precedents, the Tentative Order and the Staff Report advance two alternative grounds for finding that UATC caused or permitted the dry cleaner discharge: (a) UATC “was actively involved in the establishment of the dry cleaner site” and knew of the “hazardous nature of solvent handling” because of information contained in the State Fire Marshal Permit; and (b) based upon the “historical record,” UATC “should have known of the use of chemicals at the Site and its dangers, including the potential for unauthorized discharges.” Staff Report at 8. As set forth below, neither of these arguments is at all persuasive.

### **a. There is No Evidence that UATC Had Actual Knowledge of a Discharge of PCE at the Site while UATC Owned or Leased the Site.**

The Staff's claim that UATC is liable because it somehow actually knew of the “activities that resulted in the discharge” is deficient on a number of grounds. If the Staff is arguing that the Regional Board can impose liability on UATC because UATC merely knew that dry cleaning occurred at the Site, that position is plainly inconsistent with State Board precedents and the court cases cited above. Those precedents require proof that the landowner knew or reasonably should have known of the contamination at issue. *See, e.g., In Re Stuart*, WQ 86-15 at 6 n.3; *In re U.S. Dept. of Ag.*, WQ 87-5 at 3 n.1. For example, in *In re Stuart*, the State Board did not impose liability on Stuart Petroleum merely because it leased a site to a gas station operator but, rather because it was “common knowledge” when the discharge occurred,

especially in the oil industry, that underground storage tanks leaked, and Stuart Petroleum therefore should have known of the contamination caused by its tenant's leaking underground storage tank. *In Re Stuart*, WQ 86-15 at 6 n.3.

If the Staff is instead arguing that UATC actually knew of specific conduct by its tenant that resulted in releases of PCE to the surface around the Site, that assertion has no factual support whatsoever. Remarkably, the Staff Report infers that UATC was “actively involved” in the establishment of the dry cleaner site based solely on the (alleged) fact that UATC obtained a building permit for Moonlite Cleaners and subsequently received a certificate of occupancy “on behalf of Moonlite Cleaners.” In truth, it appears that UATC had little or no involvement in obtaining the building permit, which merely lists “United Calif Theater” as the owner of the premises at 2640 El Camino Real and was signed by a construction contractor, not UATC. Moreover, the building permit only authorizes installation of interior “partitions,” a minor improvement unlikely to require much, if any, attention from UATC. Similarly, the fact that UATC received a certificate of occupancy for a tenant says nothing about the level of UATC's involvement with the dry cleaner's operations. At most, the only conclusion that can be drawn from these documents is that UATC leased space to a dry cleaner.

The Staff's reliance on the Fire Marshal permit is similarly unpersuasive. There is no indication in the record that UATC ever received or reviewed the document, which is addressed only to “Moonlight Cleaners” and copied only to the Santa Clara Fire Department. Even if there were evidence that someone affiliated with UATC actually reviewed the Fire Marshal permit, there is no basis for inferring that the Fire Marshal permit actually notified UATC in 1961 (or at any other time before 1978) of the danger that California Water Code Section 13304 is concerned with: *groundwater contamination*. The Fire Marshal permit expressly authorizes Moonlite Cleaners to install equipment that uses solvents, but nothing in the permit precludes Moonlite from discharging “solvent” to the sewer system. In fact, the Fire Marshal permit does not impose any restrictions on solvent-disposal practices or mention the risk of groundwater contamination. To the contrary, the Fire Marshal permit's provisions are aimed at hazards associated with inhalation of vapors during the dry-cleaning process and—not surprisingly since the permit was issued by the Fire Marshal—the risk that solvent vapors could be flammable. The permit specifies how exhaust fans should be operated, requires use of breathing masks or floor-level ventilation under certain conditions, ensures that reclaimed solvent is transferred in enclosed rather than open piping, and requires fans to be in use during equipment operation. The State Fire Marshal most likely had jurisdiction to issue the permit to Moonlite Cleaners in the early 1960s because of the fire risk associated with dry cleaners at that time. Highly flammable petroleum-based cleaning solutions, such as Stoddard solvent, were used widely in the dry-cleaning industry until they were generally phased out in favor of chlorinated solvents.<sup>56</sup> Indeed, PCE replaced petroleum-based solvents in part due to the fire risk associated with petroleum-

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<sup>56</sup> See State Coalition for Remediation of Drycleaners, “Chemicals Used in Drycleaning Operations” (Jan. 2002), attached hereto as Ex. F. See also “A Chronology of Historical Developments in Drycleaning” (Nov. 2007), enclosed as Ex. B to letter from S. Reisch to N. King, “Moonlite Associates LLC's Contentions as to United Artists Theatre Circuit, Inc.'s Liability for Contamination at 2640 El Camino Real, Santa Clara, California” (Dec. 17, 2012); State Compensation Ins. Fund, “Dry Cleaner Safety” 1, attached hereto as Ex. G.



based solvents.<sup>57</sup> It is plainly the risk of fire and the potential for occupational exposure to vapors, and not the risk of discharges to groundwater, that the Fire Marshal permit conditions are designed to guard against.

For all of the reasons set out in Section III.A above, the conclusion in the Staff Report that PCE was in fact discharged at the Site while UATC owned or leased it is not supported by the evidence. The further assertion in the Staff Report that UATC actually knew of the activities that caused that (alleged) discharge is even more far-fetched. There is simply no support in the documents cited by the Staff Report or anywhere else that suggests that UATC had actual knowledge that its tenant's operations released PCE into soil or groundwater at the Site.

b. The Staff's Conclusion that UATC Should Have Known that Chemicals Used by Dry Cleaners at the Site Presented a Risk of Groundwater Contamination Is Unfounded.

Perhaps because the Staff recognize that their "actual knowledge" theory of liability stretches the facts, the Staff Report advances the alternative argument that, "[e]ven if one accepts that UATC did not have actual knowledge, the historical record shows that UATC should have known of the use of chemicals at the Site and its dangers, including the potential for unauthorized discharges." Staff Report at 8. In making this assertion, the Staff charge UATC, on a cryptic and ill-defined basis, with knowing that dry-cleaning operations posed a risk of groundwater contamination long before that was common knowledge or anyone else appears to have been aware of that risk. Indeed, the Staff Report goes on to assert on the very next page—when analyzing the effect of UATC's bankruptcy—that the Regional Board did not have reason to know of a PCE release at the Site as late as 2001. Nowhere does the Staff even attempt to justify its absurd conclusion that a movie theater company was supposed to know in the 1960s and early 1970s that groundwater contamination was a hazard common to dry-cleaning operations when the Regional Board, which is charged with protecting water quality, apparently had no reason to know of contamination at the Site during the 1990s and early 2000s. The Staff's inequitable and illogical treatment of the Regional Board and UATC in this regard is indefensible.

While it is unclear what the Staff Report means when it refers to the "historical record," it is indisputable that groundwater contamination was not identified as a hazard common to the dry-cleaning industry until the 1980s, several years after UATC's affiliation with the Site ended. For example, the 2007 Study on which the Staff Report repeatedly relies suggests that PCE contamination from dry cleaners was first detected in the Central Valley in California in approximately 1984 as a result of state-mandated groundwater testing.<sup>58</sup> Similarly, a 1992 publication by the Central Valley Regional Water Quality Control Board indicates that groundwater contamination from dry-cleaning operations in California was first identified in the late 1980s.<sup>59</sup> A publication of the State Coalition for Remediation of Drycleaners suggests the

<sup>57</sup> See State Coalition for Remediation of Drycleaners, "Chemicals Used in Drycleaning Operations" (Jan. 2002), attached hereto as Ex. F.

<sup>58</sup> See 2007 Study at 142.

<sup>59</sup> See Central Valley Regional Water Quality Control Board, "Dry Cleaners—A Major Source of PCE in Ground Water" 10 (Mar. 27, 1992), enclosed as Ex. A to letter from S. Reisch to N. King, "Moonlite

same.<sup>60</sup> And it appears that the State Board did not issue or uphold a cleanup and abatement order in connection with groundwater contamination caused by a dry cleaner until 1988. *See In re Spitzer*, 1989 WL 97148 at \*1 (May 16, 1989). Based on these sources, the earliest that a landowner “should have known” about the risk of groundwater contamination from a dry-cleaning tenant is the mid-1980s, several years after UATC ceased owning or leasing the Site.

Comparing the State Board’s decision in the *Stuart* case to the Staff’s approach in the present dispute is instructive. In that case, in imposing liability on Stuart Petroleum, a sublessor of a gas station, the State Board did not rely on Stuart Petroleum’s knowledge that the subtenant operated a gas station at the site, or on its knowledge that the subtenant handled gasoline at the site, or on its likely knowledge that ingesting gasoline was hazardous to human health. Instead, the State Board found Stuart Petroleum liable based on the fact that by 1986, “problems of leaking underground tanks have become common knowledge, particularly in the oil industry.” *In Re Stuart*, WQ 86-15 at 6 n.3. Similarly, in the present case, it is not appropriate to impose liability on UATC merely because it leased the Site to a dry cleaner or because the Fire Marshal permit mentions solvent usage at the Site and the dangers associated with solvent inhalation or flammability. Instead, the Regional Board would have to find substantial evidence that, during UATC’s ownership of and tenancy at the Site, it was “common knowledge” that dry cleaners contaminated groundwater with PCE. In reality, the possibility that PCE from dry cleaners could leach through concrete and soil into groundwater, or that sewers connected to dry cleaners could leak, was not understood by regulators in the 1960s and early 1970s, let alone by movie theater operators.

**C. There is Not Substantial Evidence that UATC Had the Legal Ability to Prevent a PCE Discharge.**

In determining whether a landlord has legal authority to prevent a tenant’s discharge of waste, the State Board has focused on whether the terms of the relevant lease authorized the landlord to terminate the tenancy, enter the premises, or otherwise remediate the contamination. *See, e.g., In re Logsdon*, WQ 84-6 at 12 (lease authorized landlord to re-enter the premises if tenants violated lease provisions prohibiting tenant from creating a nuisance on the premises and requiring tenant to abide by all laws); *In re Spitzer*, WQ 89-8, 1989 WL 97148 at \*4 (owners had right to regain possession of the site if the lessee failed to maintain the premises in good order and condition or failed to comply with all applicable laws).

The Staff Report postulates without any substantiation that “UATC would have had a lease with Moonlite Cleaners for operation of the dry cleaning business,” and “[t]his lease would have given UATC legal control over Moonlite Cleaners’ activities and would have given UATC the legal ability to prevent the discharge.” Staff Report at 8 (emphasis added). But the Staff

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Associates LLC’s Contentions as to United Artists Theatre Circuit, Inc.’s Liability for Contamination at 2640 El Camino Real, Santa Clara, California” (Dec. 17, 2012).

<sup>60</sup> *See* “A Chronology of Historical Developments in Drycleaning” 4 (Nov. 2007), enclosed as Ex. B to letter from S. Reisch to N. King, “Moonlite Associates LLC’s Contentions as to United Artists Theatre Circuit, Inc.’s Liability for Contamination at 2640 El Camino Real, Santa Clara, California” (Dec. 17, 2012) (indicating that dry cleaners were not identified as a source of groundwater contamination until the City of Lodi detected PCE in groundwater samples in the late 1980s).

have no evidence whatsoever that a single lease, whether written or verbal, existed between UATC and its tenant, and there is nothing in the record that indicates whether or not movie theater owners typically entered into written leases with their tenants in the 1960s. Even if it were reasonable to assume that UATC entered into written leases with its tenant at the Site in the 1960s, nothing about the content of any such lease is known. The Staff Report engages in pure speculation when it claims that UATC's lease or leases "would have given UATC legal control over Moonlite Cleaners' activities." Staff Report at 8. There is absolutely no evidence from which to infer that any applicable leases would have included provisions allowing UATC to enter the premises, terminate the lease, or remediate contamination if, for example, a tenant operated in accordance with its permit but PCE somehow leaked from sewers serving the Site. Thus, the Regional Board simply lacks substantial evidence from which to conclude that UATC had the legal authority to prevent a discharge of PCE by its tenant, and the Regional Board accordingly cannot conclude that UATC "caused or permitted" a discharge under Water Code Section 13304(a).

**IV. IF UATC HAD ANY LIABILITY FOR CONTAMINATION AT THE SITE, THAT LIABILITY WAS DISCHARGED IN UATC'S 2001 BANKRUPTCY.**

Even if the Regional Board were to conclude that UATC is a discharger under Section 13304(a) of the Water Code, any and all claims against UATC by the Regional Board are barred as a matter of law because such claims were discharged by the Bankruptcy Court order confirming the Bankruptcy Plan.

As a general matter of bankruptcy law, any and all pre-bankruptcy claims against a debtor are discharged in bankruptcy. As courts universally recognize, "the purpose of bankruptcy law and the provisions for reorganization could not be realized if the discharge of debtors were not complete and absolute." *See, e.g., In re Penn Central Transp. Co.*, 771 F.2d 762, 767 (3d Cir. 1985). Here, the Bankruptcy Court order granted UATC a broad discharge from all claims against UATC. The order provides that:

all Persons and Entities shall be precluded from asserting against the Debtors, the Debtors in Possession, the Estates, and the Reorganized Debtors, their successors and assigns, their assets and properties, any other Claims or Equity Interests based upon any documents, instruments, or any act or omission, transaction or other activity of any kind or nature that occurred prior to the Effective Date [of the Bankruptcy Plan].

Bankruptcy Court Order at 43.

The Effective Date of the UATC Bankruptcy Plan was March 2, 2001. Because UATC has not owned or leased the Site since 1978, any claims that may be asserted against UATC relating to the Site would necessarily be based on an "act or omission, transaction or other activity of any kind or nature that occurred prior to the Effective Date [of the Bankruptcy Plan]." Accordingly, any such claims have been discharged by the Bankruptcy Court Order and cannot now be asserted against UATC.

Indeed, further support that any claims against UATC relating to the Site were discharged can be found in the fact that the Bankruptcy Court Order provides for the following limited exception to its discharge provisions:

Notwithstanding any language to the contrary in the [Bankruptcy] Plan or in this Order, nothing in the [Bankruptcy] Plan or this Order shall be construed as releasing or relieving any entity of any liability to a governmental entity under any police or regulatory statute as the owner or operator of property that the entity owns or operates after the date of this Order.

Bankruptcy Court Order at 23 (emphasis added).

Thus, the Bankruptcy Court Order expressly carves out of its discharge provisions governmental entity claims relating to property that is owned or operated by UATC “after the date of [the Bankruptcy Plan].” However, there is no such carve-out for claims (governmental or otherwise) relating to property that was not owned or operated by UATC after the date of the Bankruptcy Court Order (*i.e.*, January 25, 2001). The Bankruptcy Court’s approach provides UATC with the “fresh start” promised by the Bankruptcy Code, while preserving the ability of regulators to protect the environment by holding those in possession of contaminated property responsible for ongoing compliance with environmental laws. *See Ohio v. Kovacs*, 469 U.S. 274, 283-285 (1985) (holding that claims against the debtor for cleanup costs were discharged, but noting that the Court did not “question that anyone in possession of the site . . . must comply with the environmental laws of the State . . . . Plainly, that person or firm may not maintain a nuisance, pollute the waters of the State or refuse to remove the source of such conditions.”). In accordance with the Bankruptcy Court Order’s terms, because UATC did not own or operate the Site at any time after January 25, 2001, any claims against UATC relating to the Site were discharged in UATC’s bankruptcy.

Despite the plain language and clear intent of the Bankruptcy Order, the Staff Report takes the position that the Regional Board’s claim against UATC is not discharged because, according to the Staff Report, (1) orders requiring cleanup of ongoing contamination are not “claims” within the meaning of the Bankruptcy Code; and (2) even so, the Regional Board’s claim against UATC did not arise pre-petition and thus could not have been discharged by the Bankruptcy Court. Neither of these arguments is persuasive.

#### **A. Cleanup Orders Are Claims Under the Bankruptcy Code.**

As to the first argument, the Staff Report relies on *In re Chateaugay Corp.*, 944 F.2d 997 (2d Cir. 1991), a decision by the Second Circuit Court of Appeals, which lacks jurisdiction over California courts. According to the Staff Report, *In re Chateaugay* stands for the proposition that “an obligation to cleanup and ameliorate ongoing pollution is not a claim that is dischargeable through bankruptcy.” Staff Report at 9. Importantly, the Staff Report wholly ignores the fact that the Bankruptcy Code expressly provides that the term “claim” includes “the right to an equitable remedy for breach of performance” if such breach “gives rise to a right to payment . . . .” 11 U.S.C. § 101(4)(B). And *Chateaugay* itself recognizes that equitable remedies, such as certain injunctions requiring environmental remediation, are, in fact, treated as

“claims” under the Bankruptcy Code where monetary damages may be paid as an alternative to the equitable remedy. *Id.* at 1007–08. Here, the Regional Board is plainly authorized under the Porter-Cologne Water Quality Control Act to perform any required cleanup itself and recover costs incurred from any “liable party.” Cal. Water Code §13304(b)(1) & (2), (c). Thus, an order requiring UATC to remediate the Site can be a “claim” that is dischargeable in bankruptcy, even under *Chateaugay*.

It appears that the Staff may be relying on language in *Chateaugay* that states that “a cleanup order that accomplishes the dual objectives of removing accumulated wastes and stopping or ameliorating ongoing pollution emanating from such wastes is not a dischargeable claim” because EPA “has no authority to accept a payment from a responsible party as an alternative to continued pollution.” *Id.* at 1008. Here, UATC has not owned or leased the Site for several decades and is not currently causing or allowing continuing pollution. In that regard, the Seventh Circuit’s decision in *In re CMC Heartland Partners*, 966 F.2d 1143, 1147 (7th Cir. 1992), is instructive. In that case, which was decided after *Chateaugay*, the court expressly considered the different positions under the Bankruptcy Code of former and current property owners that are liable under sections 107(a)(2) and 107(a)(1), respectively, of the federal Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. § 9607 et seq. (“CERCLA”) with respect to ongoing pollution that EPA claimed presented a current threat to human health and the environment. The court concluded that, because EPA cleanup orders issued under section 106 of CERCLA against prior owners and operators that are liable under section 107(a)(2) “require a person to pay money today because of acts before or during the reorganization proceedings,” they are “claims” dischargeable under the Bankruptcy Code, whereas Section 106 orders issued to current owners and operators liable under CERCLA sections 107(a)(1) “depend not at all on the debtor’s actions before or during the reorganization” and are therefore not dischargeable. *CMC Heartland Partners*, 966 F.2d at 1146–47. Here, the Regional Board seeks to require UATC, a former owner of the Site, to perform a cleanup based on occurrences before its bankruptcy, and those claims are therefore discharged.

Finally, while the Staff Report assumes that the exception carved out in *Chateaugay* for remedial orders relating to “ongoing” pollution applies in this case, *Chateaugay* is not controlling precedent in this case, has not been universally followed, and, in fact, has been expressly rejected by a district court within the Ninth Circuit, which includes California. In *In re Goodwin*, 163 B.R. 825, 829–833 (Bankr. D. Idaho 1993), the court undertook a thorough and careful review of the Bankruptcy Code and prior Supreme Court decisions and declined to follow *Chateaugay*. Instead, the court held that the only relevant question is whether the enforcing agency has an alternative right to perform the cleanup itself and seek damages from the debtor, a prior owner of the contaminated property. The Regional Board clearly has that option here. Cal. Water Code §13304(b)(1) & (2), (c). Thus, under the *Goodwin* court’s analysis, the Regional Board’s assertion that UATC is liable under Section 13304 would be a claim subject to discharge by UATC’s bankruptcy.

If the Regional Board names UATC as a discharger at the Site in addition to Moonlite, it is effectively prosecuting a collection action on behalf of Moonlite and for Moonlite’s benefit. Moonlite is already responsible for cleaning up the Site, so the only result of issuing a cleanup and abatement order to UATC would be to require UATC to share in Moonlite’s costs. But

Courts plainly disfavor such efforts to repackage an injunction as a claim for damages in order to evade the effect of a bankruptcy proceeding. *See In re CMC Heartland Partners*, 966 F.2d at 1147 (EPA may not repackage a forfeited cleanup claim for damages as an injunction). Moreover, Moonlite does not deserve any special assistance from the Regional Board given that it leased the Site to dry cleaners until 1996, failed to investigate potential impacts from the former dry cleaners until 2004 (even after evidence of environmental impacts from dry cleaners was well known), and then failed to report the results of its discovery of PCE impacts at the Site to the state for almost five more years.

**B. The Regional Board’s Claim against UATC Arose before UATC Filed for Bankruptcy.**

The Staff Report argues that, even if the Tentative Order is a claim under the Bankruptcy Code, under the “fair contemplation” test that the Staff contend applies to this case,<sup>61</sup> the Regional Board’s claim was discharged in UATC’s bankruptcy only if it is “based on pre-petition conduct that [could] be fairly contemplated by the parties at the time of [UATC’s] bankruptcy.” *In re Jensen*, 995 F.2d 925, 930 (9th Cir. 1993); Staff Report at 9. That is, the Staff Report asserts that a pre-petition claim is dischargeable only if the creditor reasonably should have anticipated that it had the claim because it knew or should have known of the facts underlying the claim by the time the bankruptcy plan was confirmed.

The Staff Report contends that the Regional Board did not fairly contemplate its claim against UATC by the time of UATC’s bankruptcy because the Regional Board did not learn of contamination at the Site until 2009, years after UATC’s bankruptcy was confirmed. Staff Report at 9. Even assuming that is true,<sup>62</sup> as the Staff acknowledge, the inquiry under the fair contemplation test does not end if the Regional Board lacked actual knowledge of contamination at the Site. If the Regional Board should have known of contamination at the Site by the time UATC’s bankruptcy was confirmed—that is, had constructive knowledge of the contamination—its claim against UATC arose before the bankruptcy was confirmed and has been discharged. *See In re Jensen*, 995 F.2d at 930–931; *In re Chicago, Milwaukee, St. Paul & Pac. R.R. Co.*, 3 F.3d 200, 207 (7th Cir. 1993). In determining whether the Regional Board should have fairly contemplated its claim against UATC, knowledge of other state agencies may be imputed to the Regional Board. *See In re Jensen*, 995 at 931.

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<sup>61</sup> Not all courts apply the “fair contemplation” test, and UATC does not concede that it applies in this case. For example, under the “conduct” test applied by some courts, an environmental cleanup claim arises when the conduct occurred, even though the injury resulting from the conduct was not manifest at the commencement of the case. *See, e.g., In re Parks*, 281 B.R. 899, 902 (E.D. Mich.2002); *In re Jensen*, 995 F.2d at 930. In the environmental context, the test permits the discharge in bankruptcy where the release of hazardous substances occurred prepetition, regardless of when the release was discovered. *See, e.g., In re Chateaugay*, 944 F.2d at 1005.

<sup>62</sup> UATC is unable to independently determine when the Regional Board first learned that a dry cleaner operated at the Site. If, as the Regional Board appears to contend, actual knowledge of the existence of a dry cleaner at the Site is a basis for imposing liability under the Water Code, then such information is relevant to when the Regional Board “fairly contemplated” its claim against UATC. Accordingly, we respectfully request that the Regional Board make this information available in the public record.

It is plain that the Regional Board by 2001 had extensive knowledge of the risks of dry cleaner contamination. Certainly, if the Regional Board is prepared to conclude that UATC should have known before 1978 that its dry cleaner tenant had released PCE into the environment on the grounds that such releases were common knowledge, it must also inevitably be true that the Regional Board should have known by 2001 that such a release had occurred at the Site.

In particular, the Regional Board undeniably knew by January 2001 that dry cleaners had released PCE into the environment throughout the Central Valley and in Santa Clara. In 1992, the neighboring Regional Board issued a study entitled “*Dry Cleaners – A Major Source of PCE In Ground Water*,” and concluded that “[t] data strongly indicate that leakage through the sewer lines is the major avenue through which PCE is introduced to the subsurface.”<sup>63</sup> According to the 2007 Santa Clara Valley Water District study, the Regional Board had initiated 38 dry cleaner release cases in Santa Clara County by 2002. *Id.* at 115. The Regional Board also had by January 2001 the data necessary to identify historical dry-cleaning operations. By surveying records such as telephone, business, and shopping mall directories, the 2007 Study identified approximately 1,250 dry cleaner sites that operated in Santa Clara County between 1946 and 2001. *Id.* at 31–35. In fact, the survey specifically included the dry-cleaning businesses that operated in the Moonlite Shopping Center and identified them as a historical, medium-threat facility. *Id.* at 192. Lastly, data indicating that releases were common in the dry-cleaning industry was available to the Regional Board by 2001. The 2007 Study explains that a 2001 EPA survey estimated that 75 percent of active dry-cleaning facilities in the United States have caused soil and groundwater contamination. *Id.* at 13–14.

Moreover, it is undisputed that the California State Fire Marshal knew since the early 1960s that dry cleaning with solvents occurred at the Site. If as the Staff Report asserts, UATC “should have known of the use of chemicals at the Site and its dangers, including the potential for unauthorized discharges” because of the Fire Marshal Permit, Staff Report at 8, then the State Fire Marshal should have had the same knowledge in the 1960s and 1970s. And, just as the knowledge of a California regional water quality control board was imputed to the California Department of Health Services in *Jensen*, 995 F.2d at 931, then in this case the State Fire Marshal’s knowledge should be imputed to the Regional Board.

Thus, if the Regional Board takes the position that UATC—a movie theater company that was operating well before the dawn of modern environmental law—should have known that a release of PCE occurred at the Site before 1978, the Regional Board indisputably should have drawn the same conclusion itself by 2001. Accordingly, to the extent the Regional Board has a viable claim against UATC under Section 13304, that claim must have arisen before UATC’s bankruptcy was confirmed, and it was therefore discharged.

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<sup>63</sup> Victor J. Izzo, *Dry Cleaners – A Major Source of PCE In Ground Water*, Sacramento: California Regional Water Quality Board, Central Valley Region (1992).

## **V. THE TENTATIVE ORDER SEEKS TO IMPOSE IMPRACTICABLE DEADLINES AND OTHER UNREASONABLE REQUIREMENTS.**

UATC strongly believes that it is not a proper party in this matter. However, because the Regional Board's rules require that UATC raise any objections to the Tentative Order now, before a determination of liability is made, UATC offers the following additional comments on the Tentative Order without waiving any of the foregoing arguments or any of its rights.<sup>64</sup>

### **A. Deadlines**

The Tentative Order is not scheduled to take effect until September 11, 2013, at the earliest, yet some of the tasks required by the Tentative Order must be completed by the end of September and October 2013, and other compliance dates flow from those initial deadlines. Compliance dates for all tasks should be extended by at least 90 calendar days to allow the dischargers to coordinate efforts and prepare the Additional Soil Gas Investigation Workplan, which is the first joint submittal under the Tentative Order.

### **B. Clean-Up Levels**

Designation of specific cleanup levels is premature and should be omitted from any order in this matter. Pursuant to Section 13307 of the Water Code, the Regional Board is required to follow policies and procedures consistent with Section 25355.7 of the Health and Safety Code in supervising remedial actions at a hazardous substance release site. Section 25355.7(c) of the Health and Safety Code specifies that those procedures shall include identifying and utilizing the most cost-effective methods for carrying out remedial actions. A site-specific risk assessment may establish alternate cleanup levels that allow for a more cost-effective remedy than the cleanup levels identified in the Tentative Order, while still achieving the overall remedial action objectives stated in the Tentative Order. *See* Tentative Order at 8. Instead of setting cleanup levels now, the Tentative Order could establish a schedule and procedure for establishing them at a more appropriate time.

### **C. Individual Tasks**

UATC also offers the following comments on specific tasks required by the Tentative Order.

#### **Task 4. Completion of Soil Gas Investigation, p. 12.**

The objective of this investigation should be limited to further delineating the extent of soil gas contamination without requiring characterization of VOC concentrations to Regional Board Environmental Screening Levels ("ESLs"). Characterizing VOC soil gas concentrations to ESLs may not be needed to develop and implement remedial actions that are protective of human health based upon the results of a site-specific risk assessment performed as part of Task 8, which entails preparation of a Remedial Action Plan.

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<sup>64</sup> UATC reserves the right to present additional information to the Regional Board if new information relevant to this matter comes to light following submission of these comments.



**Task 3. Workplan for Additional Indoor Air Sampling, p. 12.**

The objectives of this work should be limited to further delineating indoor air contamination without requiring characterization of VOCs to ESLs. Indoor air typically contains VOCs from consumer products, building materials, and outdoor (ambient) air.<sup>65</sup> Contributions from these “background” sources may prevent characterization of VOC indoor air concentrations to ESLs.

**Task 5. Workplan for Groundwater Monitoring Wells Installation, p. 13.**

The objective of this investigation should be limited to further delineating the extent of groundwater contamination without requiring characterization of VOC concentrations to Maximum Contaminant Levels (MCLs). Characterizing VOC groundwater concentrations to MCLs may not be needed to develop and implement remedial actions that meet Applicable or Relevant and Appropriate Requirements and protect human health and the environment.

**Task 7. Completion of Zero-Valent Iron Pilot Study, p. 13.**

This task should be omitted from the Tentative Order. The compliance date for the technical report describing the pilot study is July 31, 2013, which is before the Tentative Order is scheduled to be adopted on September 11, 2013. Moonlite Associates has conducted the pilot study independently. Thus, Moonlite Associates should be solely responsible for preparing and submitting the technical report to the Regional Board.

**Task 9. Implementation of Remedial Actions, p. 14.**

This task requires, among other things, proof of system start-up for ongoing actions. As UATC has not been involved in any ongoing actions, it would not be in a position to document their initiation, and should be exempt from this requirement.

**Tasks 10 and 11. Proposed Deed Restriction and Recordation of Deed Restriction, pp. 14-15**

As UATC is not the owner of the Site, it will have no ability to record a deed restriction on the property, and should be exempted from these requirements.

**Task 16. Evaluation of New Health Criteria, p. 17.**

This task is routinely performed as part of a five-year review. Toxicity and other contaminant characteristics are examined for changes and the effects these changes have on

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<sup>65</sup> EPA, Office of Solid Waste & Emergency Response, “Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990-2005): A Compilation of Statistics for Assessing Vapor Intrusion,” 1 (June 2011).

site-specific, risk-based cleanup levels are evaluated during the five-year review.<sup>66</sup> Task 16 should be deleted to avoid duplication of effort in preparing Five-year Status Reports under Task 13 of the Tentative Order.

#### **D. Provisions**

##### **Provision 3, Cost Recovery**

Even if UATC is found to be liable under the Water Code, UATC objects to any allocation of liability that does not reflect the fact that (a) Moonlite owned the Site and leased it to a drycleaner for years after drycleaner contamination became common knowledge, and failed to investigate the Site until 2004; and (b) Moonlite failed to report contamination discovered in 2004 until 2009 despite a legal duty to do so.

##### **Provision 4, Access to Site and Records**

Because UATC does not own the Site, it cannot be responsible for providing access to the Site to the Regional Board or its authorized representatives, and should be excluded from this responsibility.

##### **Provision 5, Self-Monitoring Program**

The Self-Monitoring Program requires sampling and analysis of Saratoga Creek, and all existing and new monitoring wells on a quarterly basis. Quarterly sampling of Saratoga Creek and site wells has been conducted for five years. Review of available data shows VOC concentrations in surface water and groundwater are stable.<sup>67</sup> Quarterly sampling and reporting is not warranted to assess changes in site conditions. UATC recommends amending the sampling and reporting frequency in the Self-Monitoring Program to semi-annually rather than quarterly.

## **VI. CONCLUSION**

The Regional Board should reject the Tentative Order and decline to name UATC as a discharger liable for cleaning up the Site under Water Code Section 13304(a). The case made against UATC in the Staff Report is predicated on a series of untenable inferences drawn from an inadequate record and unsound arguments based on mischaracterizations of the law. The Regional Board has not identified substantial evidence that a discharge of PCE occurred while UATC owned or leased the Site. It has not identified substantial evidence that UATC should have known by 1978 that groundwater contamination was a danger common to the dry-cleaning industry. And it has not identified substantial evidence that UATC had the authority to prevent a

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<sup>66</sup> EPA, Office of Emergency and Remedial Response, “Comprehensive Five-Year Review Guidance,” 4–7 (June 2001).

<sup>67</sup> P&D Environmental, Inc., “Quarterly Monitoring and Report: First Quarter 2013, File No. 43S1130 (NMK) Former Moonlite Cleaners, 2640 El Camino Real Santa Clara, California” Table 3A (Apr. 26, 2013).

tenant from discharging PCE into the environment. And, in any event, UATC's bankruptcy extinguished any liability that UATC could have in regard to the Site.

Finally, based on the reasoning set forth in the Staff Report, if the Regional Board names UATC as a discharger at the Site, it also must name the City of Santa Clara as a discharger. It is clear from EKI's analysis, and from the 2007 Study upon which the Staff puts so much weight, that discharges from the sewer system have significantly impacted the Site. It is equally clear that Staff's prior decision not to pursue the City was based on an inadequate review of the information provided by the City. Thus, if the Regional Board does not reject the Tentative Order and decline to name UATC as a discharger, UATC requests that the Regional Board also name the City of Santa Clara as a liable party.<sup>68</sup>

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<sup>68</sup> William R. Attwater, Office of the Chief Counsel, State Water Resources Control Board, "Responsibility of Operators of Publicly Owned and Operated Sewer Systems for Discharges from Their Systems which Pollute Ground Water," (Apr. 27, 1992) ("Public agencies which own or operate sanitary sewer systems are responsible for discharges of waste from their collection and treatment systems. If the waste creates or threatens to create a condition of pollution or nuisance, the public agencies may be ordered to clean up the wastes or abate the effects thereof.").

# ATTACHMENT A

29 July 2013

Scott H. Reisch  
Hogan Lovells US LLP  
One Tabor Center, Suite 1500  
1200 Seventeenth Street  
Denver, CO 80202

**Subject: Review of Cleanup Staff Report attached to Tentative Order - Site Cleanup Requirements  
2640 El Camino Real, Santa Clara, California**

Dear Mr. Reisch:

The Staff of the Regional Water Quality Control Board, San Francisco Bay Region (Staff) transmitted the Tentative Order – Site Cleanup Requirements and accompanying Cleanup Staff Report for 2640 El Camino Real, Santa Clara, California to Moonlite Associates, LLP and United Artists Theatre Circuit, Inc. (UATC) on 25 June 2013. At the request of Hogan Lovells US LLP, Erler & Kalinowski, Inc. (EKL) has reviewed the documents. Upon review, we do not find technical support for Staff's contention that PCE was released before 1978 when UATC owned or leased the site.

In its 12 March 2013 report, EKL explained that existing data indicate that the distribution of PCE in the subsurface at the Site is consistent with a post-1978 release and that there is no evidence of a pre-1978 release at the Site. Staff nevertheless contend that PCE was discharged during UATC's ownership based on "the physical evidence of PCE at the Site and downgradient from it, the history of solvent usage beginning in 1961, common industry-wide operational practices, and the inefficiencies of older dry cleaning equipment from the 1960s." However, nothing in the Staff Report alters EKL's previous conclusions. In fact, the Staff Report contains numerous mis-statements and conflicts with scientific analysis by U.S. EPA, U.S. Geological Survey, and other recognized experts.

EKL's detailed technical comments on the Staff Report are attached.

Very truly yours,

ERLER & KALINOWSKI, INC.



Andrew N. Safford, P.E.  
Vice President

## ERLER & KALINOWSKI, INC. COMMENTS ON CLEANUP STAFF REPORT ACCOMPANYING MOONLITE TENTATIVE ORDER

Erler and Kalinowski, Inc. (EKI) has prepared comments on technical statements made in the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) Cleanup Staff Report, dated 24 June 2013, which accompanies the Tentative Order – Site Cleanup Requirements for 2640 El Camino Real, Santa Clara, California (site). For ease of reference, we have numbered our Comment Nos. 1 through 17 and presented our comments in the order in which the relevant statements are made in the Staff Report. Excerpts or EKI's synopses of statements made in the Staff Report are shown in blue lettering.

### 1. Section IV. Site History C, p. 3

“(the highest PCE concentrations in soil and groundwater are beneath the Site and downgradient from the Site)”

**Comment:** This statement is made in the context of the Staff Report's assertion that contamination at the site is due to perchloroethylene (PCE) that seeped through the building's concrete floor in the form of a dense non-aqueous phase liquid (DNAPL).<sup>1</sup> Available data do not support Staff's assertion.

Contrary to the statement made on page 3 of the Staff Report, no soil data exist for the site. In addition, the highest PCE groundwater concentrations are northeast and southeast of the former Moonlite Cleaners building, not directly beneath the building. Specifically, the highest PCE groundwater concentrations were measured at the site in 2011. Groundwater samples collected from monitoring wells MW4 and MW5A contained 1,280 µg/L and 1,130 µg/L of PCE, respectively.<sup>2</sup> The highest PCE groundwater concentration underneath the building was 160 µg/L in a grab groundwater sample collected from direct push boring B8 in 2009.<sup>3</sup> PCE groundwater concentrations at the site are consistent with releases of PCE dissolved in wastewater, not releases of PCE DNAPL, as asserted by Staff.

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<sup>1</sup> DNAPLs are liquids that form a separate, immiscible phase when in contact with water. Differences in the properties of DNAPL and water result in the formation of a physical interface between the liquids that prevents the two fluids from mixing. DNAPLs have densities greater than that of water.

<sup>2</sup> West Environmental Services and Technologies (West). October 2011. *Site Investigation Report, 2640 El Camino Real, Santa Clara, California*. Table 3-6.

<sup>3</sup> *Ibid.*, Table 3-4.

## ERLER & KALINOWSKI, INC. COMMENTS ON CLEANUP STAFF REPORT ACCOMPANYING MOONLITE TENTATIVE ORDER

U.S. EPA (2009, 1994, 1992) considers DNAPL to be present in groundwater at a site if the concentrations of DNAPL compounds in groundwater samples are greater than 1 percent of their pure phase or effective solubility.<sup>4,5,6</sup> One percent of the pure phase solubility of PCE is approximately 2,000 µg/L.<sup>7</sup> PCE concentrations in groundwater at the site are less than this threshold value.

### 2. Section V. Hydrogeology, p. 4

“The sediment beneath the Site is ancestral Saratoga Creek stream channel sediment overlying older Late Pleistocene alluvial plain sediment. The ancestral Saratoga Creek sediment is fine to coarse grained channel deposits, with fine grained flood deposits outside the channels. The pattern of fine and coarse grained lenses of sediment observed at the Site represent the deposits of the meandering ancestral Saratoga Creek flowing northward over the alluvial plain sediments.”

**Comment:** Staff contend that channelized deposits cause contaminated groundwater to flow to the northeast irrespective of the direction of the groundwater gradient. This contention is unsupported. Review of available geologic data in three dimensions shows no pattern of northeast-trending coarse grained channelized deposits flanked by fine grained channelized deposits. The unconsolidated sediments in the saturated zone consist of a complex distribution of permeable sands, gravels, and silts, with lesser clays, consistent with a meandering distributory channel within an alluvial fan complex. A northeasterly preferential pathway is not evident. Consequently, groundwater at the site flows in the direction of the gradient.

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<sup>4</sup> U.S. EPA. September 2009. *Ground Water Issue: Assessment and Delineation of DNAPL Source Zones at Hazardous Waste Sites*. National Risk Management Research Laboratory. EPA/600/R-09/119. p. 6.

<sup>5</sup> U.S. EPA. September 1994. *DNAPL Site Characterization*. Office of Solid Waste and Emergency Response. EPA/540/F-94/049. p. 10.

<sup>6</sup> U.S. EPA. January 1992. *Estimating Potential for Occurrence of DNAPL at Superfund Sites*. Office of Solid Waste and Emergency Response. Publication: 9355.4-07FS. p. 5.

<sup>7</sup> Based upon PCE solubility limit in water of 206,000 µg/L reported by U.S. EPA in its *Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table*, dated May 2013.

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**3. Section V. Hydrogeology, p. 4**

“The flow direction of groundwater at the Site is most likely controlled by north-trending Saratoga Creek, the north-trending ancestral Saratoga Creek stream deposits, the gently north sloping topography, and deep production wells located in the vicinity.”

**Comment:** As discussed in Comment No. 2, groundwater flow direction is controlled by the groundwater gradient imposed by the Creek. Saratoga Creek can be a sink for water (gaining stream) or a source of water (losing stream) depending upon the surrounding groundwater levels. The Creek is currently a gaining stream and the predominant groundwater flow direction is northeast towards the Creek. The present landowner’s consultant, West agrees with this finding and states: “Similarly, with the fluctuations in groundwater elevations, Saratoga Creek has fluctuated between a losing stream and a gaining stream...As groundwater elevations rose above the base of Saratoga Creek, groundwater flow shifted to the northeast toward the Saratoga Creek.”<sup>8</sup>

Staff do not identify nor provide construction details of the deeper production wells that Staff surmise are influencing groundwater conditions at the site. Production wells screened in the deeper aquifer below the regional clay layer are unlikely to affect horizontal groundwater flow in the shallow zone above the clay layer. The top of the regional clay layer is encountered at an elevation of approximately 45 feet above mean sea level at the site.

**4. Section V. Hydrogeology, p. 4**

“Concentrations of PCE have been detected in groundwater down gradient of the Site to the north, from the northeast to the northwest.”

**Comment:** It is true that PCE concentrations have been detected north-northwest of the site (i.e., locations B-2, B17, B-3, B32, B18, and B23), but the detections are 1 to 2 orders of magnitude less than concentrations detected in samples from within the PCE plume that is migrating northeast towards Saratoga Creek. The lower PCE concentrations at locations B-2, B17, B-3, B32, and B18 are not inconsistent with a post-1978 release and are likely due to PCE soil vapor migration or PCE dispersion in groundwater. West (2011) attributes PCE at location B23 to former Perfect Cleaners/Jim’s Cleaners, which operated a dry cleaning establishment at 1520 Kiely Boulevard from the 1980s until at

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<sup>8</sup> West, 2011, *op cit.*, p. 28.



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least 2006.<sup>9</sup> Perfect Cleaners/Jim's Cleaners was permitted as a RCRA hazardous waste small quantity generator and PCE air emission source.<sup>10,11</sup>

### 5. Section VI. Investigation and Cleanup, pp. 4-5

"The highest historical detections of PCE in groundwater, soil gas, and indoor air are in the immediate vicinity of or directly beneath the Site, indicating a discharge directly beneath the dry cleaner . . . . The Site data clearly indicate that the highest concentrations of PCE are immediately beneath, down gradient, and downstream of the former dry cleaner, and decrease with distance away from the former dry cleaner. This pattern indicates that significant releases of PCE occurred directly beneath the former dry cleaner and are likely from common release mechanisms discussed in Section IV.C."

**Comment:** As discussed in Comment No. 1, the highest PCE groundwater concentrations are northeast and southeast of the former Moonlite Cleaners building, not directly beneath the building. Moreover, PCE groundwater concentrations are below 1% pure phase or effective solubility and do not indicate DNAPL (which is what a surface spill would consist of) was released beneath the former Moonlite Cleaners building. EKI and West agree that contamination at the Site was caused by PCE-containing wastewater that leaked from sewer lines beneath the former Moonlite Cleaners building and adjacent to the site.<sup>12</sup>

The Staff do not mention that SCVWD found leaking sewer lines to be the most frequent type of releases at dry cleaning establishments. SCVWD (2007) states: "PCE exfiltration from sewer lines connected to dry cleaners in the 1980s and earlier was a primary route of subsurface contamination from dry cleaners (Figure 5)."<sup>13</sup> This finding is

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<sup>9</sup> West, 2011, *op cit.*, pp. 31-32.

<sup>10</sup> Department of Toxic Substances Control (DTSC). EPA ID Profile: Jim's Dry Cleaners, 1520 Kiely Boulevard, Santa Clara, California. [http://hwts.dtsc.ca.gov/report\\_search.cfm?id=2](http://hwts.dtsc.ca.gov/report_search.cfm?id=2). Accessed 22 July 2013.

<sup>11</sup> Bay Area Air Quality Management District. Toxic Inventory 2004. <http://www.baaqmd.gov>. Accessed 22 July 2013.

<sup>12</sup> EKI. 12 March 2013. *Review of Environmental Data, Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California*. p. 9; West. September 2012. *Feasibility Study/Pilot Study Work Plan, 2640 El Camino Real, Santa Clara, California*. pp. 8 and 25; West, 2011, *op cit.*, pp. 28-29.

<sup>13</sup> Figure 5 in the SCVWD report is a chart that depicts leaks from sewer lines as the most common release mechanism based upon a survey of 40 dry cleaner sites.

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corroborated by other studies of dry cleaners. RWQCB (1992) finds: “Where a source investigation has been done in connection with PCE contamination, the evidence has shown that dry cleaners have degraded the ground water. The data strongly indicate that leakage through the sewer lines is the major avenue through which PCE is introduced to the subsurface.”<sup>14</sup> Lohman (2002) states: “The presence and distribution of perchloroethylene in the vicinity of dry cleaners are frequently associated with sewer laterals serving the facility.”<sup>15</sup> SCVWD (2007) concludes: “Releases above slab versus releases above unpaved surfaces versus release below ground may have different characteristics...PCE releases from sewer lines may migrate to groundwater more readily due to leaching from the leaking line and vapors sinking to and dissolving into the water table.”

SCVWD indicates releases above a slab are prone to volatilize into air inside the building rather than penetrate the slab. SCVWD (2007) states: “Releases above slab will volatilize more readily than subsurface releases.” U.S. EPA reached the same conclusion. In a study of the dry cleaning industry, U.S. EPA (1995) found solvent spills, equipment leaks, and drips from transferring wet clothing from the washer to the dryer affect air inside the building.<sup>16</sup> In 1993, U.S. EPA began regulating air emissions from such release mechanisms under the National Emission Standard for Hazardous Air Pollutants (NESHAP) for Perchloroethylene Dry Cleaning Facilities.<sup>17</sup> The NESHAP restricted PCE air emissions, which resulted in the substantial decline in the PCE loss rate at dry cleaning facilities in the 1990s compared to that of the 1960s. Accordingly, the higher PCE loss rate in the 1960s was caused by greater air emissions, not greater discharges to the subsurface.

Review of available data supports the finding that a release of PCE-containing wastewater, as opposed to a DNAPL release, is the source of PCE in soil gas and groundwater at the site. Immediately beneath the building is approximately 4 to 7 feet of clay, organic clay, clayey sand, and silt. The sewer lines and gravel fill surrounding the lines are likely 5 feet deep or more and situated at the base of this clay layer. Thus,

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<sup>14</sup> RWQCB. 27 March 1992. *Dry Cleaners – A Major Source of PCE in Ground Water*. Central Valley Region. p. 2.

<sup>15</sup> Lohman (2002). *A History of Dry Cleaners and Sources of Solvent Releases from Dry Cleaning Equipment*. Environmental Forensics. Vol. 3. pp. 35-58.

<sup>16</sup> U.S. EPA. September 1995. *EPA Office of Compliance Sector Notebook Project: Profile of the Dry Cleaning Industry*. Office of Enforcement and Compliance Assurance. EPA/310-R-95-001. pp. 26-27.

<sup>17</sup> See Title 40 of Code of Federal Regulations (CFR), section 63.320 *et seq.*

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PCE-containing wastewater may have directly entered the sands and gravels beneath the clay and traveled almost immediately to groundwater. Wastewater also would have passed through the clay if it were present beneath the sewer lines. As explained more fully in Comment No. 7, soil moisture in the clay will attract PCE-containing wastewater but repel DNAPL. EKI estimates approximately 6 years were required for PCE dissolved in wastewater to migrate through the clay and reach groundwater.<sup>18</sup>

**6. Section VII. Response to March 12, 2013, EKI Report A, p. 6**

Staff contend that PCE seeped through the concrete floor of the building.

**Comment:** As described by EPA (2009), the fine grained nature of materials like concrete presents a barrier to NAPL entry.<sup>19</sup> NAPL would have spread across the floor rather than seep through the concrete.

**7. Section VII. Response to March 12, 2013, EKI Report A, p. 6**

Staff contend that decades were probably required for PCE to migrate through clay and PCE only reached the saturated zone after groundwater began to flow northeast towards Saratoga Creek.

**Comment:** If DNAPL had migrated through the floor (e.g., through pipe penetrations or cracks), the DNAPL still would have had to force its way through the clay underlying the building because DNAPL does not mix readily with water. The lack of miscibility causes soil moisture to repel DNAPL and to attract water.<sup>20,21</sup> This tendency is represented by the soil capillary pressure. DNAPL would need to accumulate on the order of several feet to overcome the capillary pressure and enter the clay. If DNAPL had entered the clay, downward movement of DNAPL to groundwater would have occurred rapidly. High density and low viscosity DNAPL, such as PCE, are driven downward through soil pores

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<sup>18</sup> EKI, 2013, *op. cit.*, p. 10.

<sup>19</sup> EPA, 2009, *op. cit.*, p. 11.

<sup>20</sup> U.S. EPA. March 1991. *Ground Water Issue: Dense Nonaqueous Phase Liquids*. Office of Solid Waste and Emergency Response. EPA/540/4-91-002. p. 8.

<sup>21</sup> Mercer, J.W. and R.M. Cohen. 1990. *Review Paper. A Review of Immiscible Fluids in the Subsurface: Properties, Models, Characterization and Remediation*. Journal of Contaminant Hydrology. Vol. 6. pp. 112-113.

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by gravity (ESTCP, 2008).<sup>22</sup> Further, as discussed in Comment No. 6, impacts to groundwater are explained by PCE-containing wastewater that leaked from the sewer lines beneath and south of the former Moonlite Cleaners establishment. Such a release would have taken 6 years or less to reach groundwater.<sup>23</sup>

### 8. Section VII. Response to March 12, 2013, EKI Report A, p. 6

“The EKI report assumes a continual leak of wastewater from a leaking sanitary sewer line as the driver for carrying PCE through soil to groundwater. Cleanup Staff disagree and assert that the extremely high PCE indoor air concentrations more likely indicate a direct release to the floor of the dry cleaner.”

**Comment:** PCE soil gas and indoor air concentrations measured at the site are entirely explained by a release of PCE-containing wastewater from sewer lines beneath the building.<sup>24</sup> Moreover, PCE is not limited to indoor air within the building once occupied by Moonlite Cleaners, but also is found in indoor air within buildings to the east and west of the former dry cleaning establishment. The presence of PCE in the other buildings (where no dry cleaning equipment was present) suggests vapor intrusion of PCE from underlying soil and groundwater contamination, not volatilization of PCE DNAPL released during sloppy dry cleaning operations that somehow impregnated the concrete slab, as suggested by Staff.

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<sup>22</sup> Environmental Security Technology Certification Program (ESTCP). July 2008. *Frequently Asked Questions Regarding Management of Chlorinated Solvents in Soils and Groundwater*. p. 3.

<sup>23</sup> EKI, 2013, *op. cit.*, p. 10.

<sup>24</sup> The maximum PCE soil gas and indoor air concentrations of 5,700,000  $\mu\text{g}/\text{m}^3$  and 150  $\mu\text{g}/\text{m}^3$ , respectively, measured at the Moonlite site can be replicated with DTSC's screening level vapor intrusion model, GW-SCREEN, Version 3.0, assuming the source of contamination is sandy clay loam at a depth of 5 feet impacted by wastewater that has leaked from sewers beneath the building (see Comment No. 5 for discussion of this release mechanism). Inserting a PCE wastewater concentration of 8,000  $\mu\text{g}/\text{L}$  (8 ppm) in GW-SCREEN yields a PCE soil gas concentration of 5,710,000  $\mu\text{g}/\text{m}^3$  and a PCE indoor air concentration of 163  $\mu\text{g}/\text{m}^3$ . A PCE wastewater concentration of 8 ppm is a reasonable value, but may be conservatively low. SCVWD (2007) at p. 31 states: “Prior to the adoption of cradle-to-grave regulation of hazardous wastes in the mid-1980s, it was permissible and common for dry cleaning plants to discharge condensate wastewater laden with up to 150 ppm PCE to sanitary sewers.”

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**9. Section VII. Response to March 12, 2013, EKI Report A, p. 6**

RWQCB Staff do not discuss data and other information that contradict its contention that PCE released inside the building is the source of PCE in groundwater at the site.

**Comment:** The following data and other information support the finding that PCE-containing wastewater was released from sewer lines at the site:

1. PCE concentrations detected in groundwater samples throughout the area are below 1% pure phase or effective solubility, which indicates sampled groundwater has not come in contact with PCE in DNAPL form (which is what a surface spill would consist of), but rather PCE that was released in the dissolved phase (such as in wastewater from sewers).
2. PCE in groundwater samples collected from boreholes B6, B43, B44, B12, and well MW2. These boreholes and well are located approximately 160 and 350 feet in a direction that is east-southeast of the site (i.e., cross-gradient direction) along the orientation of the sewer lines.
3. Video inspection of the 8-inch diameter sewer line south of the site, which was constructed by the City of Santa Clara in 1960 or 1961, revealed offset joints, broken pipe, and sags.<sup>25</sup>

**10. Section VII. Response to March 12, 2013, EKI Report B, p. 6**

“Staff disagrees with EKI’s analysis and concludes that PCE does exist to the north and northwest, as well as to the northeast.”

**Comment:** Staff misrepresent EKI’s report. EKI did not state that PCE does not exist to the north and northwest. Instead, EKI’s report states that PCE groundwater concentrations north and northwest of the site are much lower than those observed to the northeast, indicating that the PCE plume in groundwater is moving to the northeast towards Saratoga Creek.<sup>26</sup>

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<sup>25</sup> West, 2011, *op. cit.*, p. 23.

<sup>26</sup> EKI, 2013, *op. cit.*, pp. 10-11.

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**11. Section VII. Response to March 12, 2013, EKI Report B, p. 6**

“The index well that EKI used to compare the Site with is a deep well located approximately six miles to the southeast and screened in a different aquifer. The index well is located in the recharge zone, while the Site is located in the confined zone. This is too great a distance away to be able to draw conclusions for shallow groundwater at the Site.”

**Comment:** EKI used the San Jose index well as a proxy for regional groundwater conditions. The index well simply demonstrates that regional groundwater levels were substantially lower in the past than they are today, a point with which Moonlite’s consultant agrees.<sup>27</sup> Rising groundwater levels measured in wells at the Shell station on the east side of Saratoga Creek (which is 1,000 feet from the site) correspond to rising groundwater levels in the San Jose index well (see Figure 9 of EKI report). This correspondence ceases when Saratoga Creek becomes a gaining stream, at which point the shallow groundwater levels at the Shell station no longer rise. This pattern of gradual groundwater recharge throughout the Santa Clara Valley Basin also is seen in data compiled for the Chevron and Shell stations that were situated 800 feet west of the site, which further confirms groundwater levels rose throughout the area from the late 1980s through the 1990s, and significantly altered the regional groundwater gradient. The significant rise in Santa Clara Valley Basin groundwater levels in response to reduction in groundwater withdrawals beginning in the late 1960s has been studied extensively and is well known.<sup>28</sup>

**12. Section VII. Response to March 12, 2013, EKI Report B, p. 6**

“EKI used 1990 to 2000 groundwater data from a Shell gas station 1000 feet away from the Moonlite Cleaners Site, and on the opposite side of Saratoga Creek, to estimate the groundwater

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<sup>27</sup> West, 2011, *op cit.*, pp. 27-28.

<sup>28</sup> Publicly available studies on this topic include:

Fio, J.L. and D.A. Leighton. 1995. *Geohydrologic Framework, Historical Development of the Ground-Water System, and General Hydrologic and Water-Quality Conditions in 1990, South San Francisco Bay and Peninsula Area, California*. U.S. Geological Survey Water-Resources Investigations Report 94-357.

Poland, J.F. and R.L. Ireland. 1988. *Land Subsidence in the Santa Clara Valley, California as of 1982*. U.S. Geological Survey Professional Paper 497-F.

RWQCB. 2003. *A Comprehensive Groundwater Protection Evaluation for the South San Francisco Bay Basins*. Groundwater Committee of the California Regional Water Quality Control Board, San Francisco Bay Region.

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flow direction at the Moonlite Cleaners Site in the 1960s and 70s. The time and distance involved in this comparison is too large and could lead to variations in the correlations of groundwater flow directions between the two sites.”

**Comment:** EKI chose to analyze water levels from the Shell station on the east side of Saratoga Creek for two reasons:

1. The Shell station is approximately the same distance from the Saratoga Creek as the Moonlite Cleaners site, and, thus, would be expected to experience a similar magnitude of effect from Saratoga Creek, but in an opposite direction due to symmetry across the Creek.
2. Groundwater level data were available from the Shell station for the period when Saratoga Creek was transitioning from a losing stream to a gaining stream. EKI did not rely on the Shell data to estimate groundwater flow direction specifically for the 1960s and 1970s as stated in the Staff Report; rather, EKI used the Shell data to show that when Saratoga Creek was a losing stream, groundwater gradients were generally in a direction away from the stream (i.e., northeast to east at the Shell station). This groundwater flow pattern, supported by the Shell data, is consistent with expectations for the behavior of an unconfined aquifer near a hydraulically connected stream. As explained by the U.S. Geological Survey (USGS): “For ground water to discharge into a stream channel, the altitude of the water table in the vicinity of the stream must be higher than the altitude of the stream-water surface. Conversely, for surface water to seep to ground water, the altitude of the water table in the vicinity of the stream must be lower than the altitude of the stream water surface.”<sup>29</sup>

**13. Section VII. Response to March 12, 2013, EKI Report B, p. 6**

“EKI’s depiction of a northwest trending groundwater plume in Figure 10 of the EKI report is not supported by the groundwater flow variations seen at the Shell gas station. Staff reviewed the groundwater flow directions from the Shell gas station contained in Attachment A of the EKI report and observed a roughly 45 degree variation in the groundwater flow direction from the time when Saratoga Creek was purportedly losing or gaining.”

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<sup>29</sup> USGS. 1998. *Groundwater and Surface Water: A Single Resource*. U.S. Geological Survey Circular 1130. p. 9.

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**Comment:** Staff contend that the data in Attachment A does not demonstrate a sufficiently large shift in the groundwater gradient direction to cause the PCE plume in groundwater to migrate to the northwest when Saratoga Creek was a losing stream. Staff's rationale for this assertion appears to be based on a qualitative categorization of gradient directions presented by EKI in Table A-1 of our 12 March 2013 report into generalized compass points. It is unclear whether RWQCB staff performed any quantitative assessment of the hydraulic gradient data to support its assertion. EKI performed a Mann-Kendall test of the gradient direction time series presented in our 12 March 2013 report. The Mann-Kendall test demonstrates a statistically significant counter-clockwise shift (i.e., northeast to northwest) at the 95% confidence level in groundwater gradient direction over the period of record of the Shell station data.

EKI also calculated a moving average time series for the Shell gradient direction data. Between August 1991 and December 1993, the moving average gradient direction remained consistently in the northeastern quadrant, varying from a high of N 51° E in August 1991 to a low of N 19° E in May 1992. Beginning in February 1994, the moving average gradient shifted to the northwest for the first time. From this point through the remainder of the period of record, the gradient direction remained generally in the northwestern quadrant, varying between N 05° E in May 1994 and N 32° W in May 1996.

The moving average data show the gradient "crossed over" (i.e., when the hydraulic gradient shifted counter-clockwise from northeast to northwest at the Shell station) in February 1994. The average 1990-1993 gradient was N 36° E, and the average 1994-2001 gradient was N 05° W, thereby documenting a clear and dramatic shift in the gradient direction. Since the Shell station is on the opposite side of Saratoga Creek from the Moonlite Cleaners site, the groundwater gradient at the Shell station mirrors the gradient at the Moonlite Cleaners site (i.e., groundwater gradients on the Moonlite site have shifted from northwest to northeast).

Figure 10 of the EKI report depicts a PCE plume that is shifted approximately 60 degrees counter-clockwise from its present configuration. If PCE-containing wastewater had been released at the site before 1978, PCE in groundwater would have migrated to the northwest. Calculations performed by EKI with the REMChlor model indicates total chlorinated organic compound concentrations on the order of 100 µg/L to 200 µg/L still should persist in groundwater northwest of the site as evidence of this migration. Given no such chemical concentrations have been detected in groundwater northwest of the site, a pre-1978 PCE release did not occur.



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**14. Section VII. Response to March 12, 2013, EKI Report B, p. 7**

“Using a 45 degree amount of variation in the groundwater flow direction from a losing to a gaining creek, the groundwater flow direction at the Moonlite Cleaners Site could have varied from its present northeast direction under gaining-creek conditions to a northerly direction under losing-creek conditions. This is consistent with the areal spread of groundwater contamination seen in the current groundwater plume with groundwater concentrations in northerly borings, B2, B17, B18, and B32 at 27 µg/L PCE, 4.6 µg/L PCE, 18 µg/L PCE, and 96 µg/L PCE, respectively (see figure 3).”

**Comment:** Direct push borings B2 and B32 are located close to the building that Moonlite Cleaners formerly occupied. These borings are not useful in determining plume direction because they are within the PCE plume that most likely resulted from a sewer line release after 1978. Borings B17 and B18 are located northwest and north of the building, respectively. As explained in Comment No. 4, the low PCE concentrations in groundwater samples from borings B17 and B18 are not inconsistent with a post-1978 release and are likely due to PCE soil vapor migration or PCE dispersion in groundwater.

**15. Section VII. Response to March 12, 2013, EKI Report B, p. 7**

“EKI concludes that there is no evidence of groundwater contamination in the northwest direction.”

**Comment:** RWQCB Staff misrepresent the EKI report. The report does not say that there is no evidence of groundwater contamination to the northwest. Rather, the report concludes that low PCE concentrations in groundwater samples collected north-northwest of the building are not inconsistent with a PCE plume that resulted from a post-1978 release and is oriented in the northeast direction.

**16. Section VII. Response to March 12, 2013, EKI Report C, p. 7**

Staff reiterate their contention that PCE DNAPL may not have reached groundwater until the 1990s. Thus, Staff contend that a PCE release before 1978 would not necessarily have resulted in a PCE plume in groundwater that migrated to the northwest before the gradient shifted.

**Comment:** As discussed in prior comments, review of available data supports the finding that a release of PCE-containing wastewater, as opposed to a DNAPL release, is the source of PCE in soil gas and groundwater at the site. EKI estimates approximately 6 years were

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required for PCE dissolved in wastewater to reach groundwater.<sup>30</sup> If a pre-1978 release had occurred, sufficient time existed for a PCE plume to develop in groundwater and migrate to the northwest.

### 17. Section VII. Response to March 12, 2013, EKI Report D, p. 7

“EKI infers from a review of groundwater data that groundwater levels at the Site were deeper during the pre-1978 period, therefore if a PCE release occurred pre-1978, it would have resulted in a deeper groundwater plume, which according to EKI does not exist. This is incorrect. Groundwater in boring B32 located 50 feet north of the Site contained 96 µg/L PCE at approximately 40 feet below ground surface. Groundwater monitoring well MW5A located 50 feet northeast of the Site contained 1,130 µg/L PCE at approximately the same depth.”

**Comment:** PCE concentrations in direct push boring B32 and well MW5A are attributable to downward vertical groundwater gradients in this portion of the site. As groundwater moves northeast to Saratoga Creek, a component of flow moves downward in the vicinity of boring B32 and well pair MW5/MW5A. The flow subsequently rises to enter the bottom of the Creek. The well pair MW5/MW5A has consistently shown a downward vertical groundwater gradient while the well pair MW4/MW4A next to Saratoga Creek has consistently shown an upward vertical groundwater gradient. PCE dissolved in groundwater moves both laterally and vertically in response to the gradients.

A PCE concentration of 1,130 µg/L was detected in the initial groundwater sample collected from well MW5A in September 2011. According to U.S. EPA: “Initial well measurements are sometimes highly variable during a ‘break in’ sampling and analysis period and potentially less trustworthy.”<sup>31</sup> Subsequent testing demonstrates lower PCE groundwater concentrations in well MW5A. Eleven additional groundwater samples have been collected from this well and analyzed for chlorinated organic compounds between December 2011 and March 2013. The PCE concentrations of these samples ranged from 350 µg/L to 578 µg/L. As shown on Figure 6 of EKI’s report, the PCE concentrations detected in the eleven subsequent sampling events at well MW5A and deeper groundwater samples (i.e., direct push borings B26 and B32, and well MW4A)

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<sup>30</sup> EKI, 2013, *op. cit.*, p. 10.

<sup>31</sup> U.S. EPA. March 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Resource Conservation and Recovery. EPA 530/R-09-007. p. 4-8.



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are consistent with the bottom of a plume formed by a release of PCE-containing wastewater after 1978.<sup>32</sup>

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<sup>32</sup> P&D Environmental, Inc. 26 April 2013. *Quarterly Monitoring and Report: First Quarter 2013*. File No. 43S1130 (NMK) Former Moonlite Cleaners, 2640 El Camino Real Santa Clara, California. Table 3A.

# EXHIBIT A

FRANK LAW GROUP, P.C.

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October 24, 2011

**VIA EMAIL**

Nathan King, P.G.  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, 14<sup>th</sup> Floor  
Oakland, CA 94612

Re: Former Moonlite Cleaners, 2640 El Camino, Santa Clara, California

Dear Mr. King,

Pursuant to our meeting on September 27, 2011, I am writing on behalf of my client, Moonlite Associates, LLC, to request that the California Regional Water Quality Control Board – San Francisco Bay Region (Regional Board) include United Artists as a discharger and require it to conduct investigation and remediation of the releases of tetrachloroethene (PCE) at and near the Moonlite Shopping Center located at 2610 to 2798 El Camino Real in Santa Clara, California (“the Site”). In addition, I request that the Regional Board pursue obtaining the additional information and data it believes is necessary to support including the City of Santa Clara as a discharger for releases from its sewer system that have impacted my client’s property.

United Artists

In March 2011, my office, on behalf of Moonlite Associates, the current property owner, forwarded extensive documentation regarding United Artists’ development and ownership of the subject property. As presented in the documents provided to the Regional Board, United Artists (formerly United California Theaters) developed the Moonlite Shopping Center in 1961. United Artists (as United Artists Theatre Circuit, Inc.) continued to own and operate the Moonlite Shopping Center until 1975. In 1975, United Artists sold the Moonlite Shopping Center, but continued as the Master Lessor until 1978, including subleasing tenant space to Moonlite Cleaners until 1978.

Nathan King, P.G.  
October 24, 2011  
Page 2 of 3

The former Moonlite Cleaners operated at the Site between 1961 and 1996. United Artists owned, controlled and/or operated the Moonlite Shopping Center with the dry cleaner as a tenant for 17 of those years, half the time of operation and when less sophisticated equipment and practices were used by operators. United Artists leased the tenant space to Moonlite Cleaners and had control over the tenants' operations from 1961 to 1978. In addition, United Artists through its lease agreement had knowledge of the activities that resulted in releases of PCE and had the authority to prevent such activities by the dry cleaners during this period.

Recent environmental investigations conducted at the Site have shown that the dry cleaner solvent PCE was released to soil, soil gas and groundwater beneath the Site during the period United Artists owned and managed the property, e.g., contamination at depth when groundwater elevations were lower. In addition, the distribution of PCE in the subsurface has been correlated to releases when flow directions were controlled by the lower groundwater elevations during the 1960s and 1970s.

In accordance with the State Water Resources Control Board (SWRCB) Policy on Naming Dischargers (Attwater, 1992), "prior landowners and lessees should be named if they owned or were in possession of the site at the time of discharge, had knowledge of the activities which resulted in the discharge, and had the legal authority to prevent the discharge (numerous orders, including WQ 85-7, 86-15, 91-7 and 92-13)." Based on the foregoing, we are requesting that United Artists be included as a named discharger for releases of PCE at the Moonlite Shopping Center and be required to investigate and remediate the contamination.

#### City of Santa Clara

Based on our discussions at the September 27, 2011 meeting, we understand that the Regional Board requires additional information before concluding the City of Santa Clara is a discharger of PCE. While we believe that the recent investigations provide definitive data showing releases have and are occurring from the City of Santa Clara wastewater collection system, the Regional Board has indicated that additional soil and/or groundwater data would support inclusion of the City of Santa Clara as a discharger of PCE that has impacted the Site.

Recent investigations have revealed higher concentrations of PCE in groundwater up to 1,280 micrograms per liter ( $\mu\text{g}/\text{l}$ ) in samples collected near the City of Santa Clara sewers with lower concentrations found at and near the area of the former Moonlite Cleaners. As explained during our meeting, the presence of higher concentrations of PCE at distances farther from the dry cleaner than found near the dry cleaner can only reasonably be explained as having originated from releases from the sewer system. In addition, the recent investigations identified the co-presence of Methylene Blue Active Substances (MBAS) and PCE in groundwater. MBAS measures components of synthetic detergents, which are not naturally-occurring and can only reasonably be present in groundwater due to leakage of wastewater containing detergents. Further, during the July 2011 closed circuit television inspection (CCTV) of the sewer pipeline, the City of Santa Clara's sewer system was

observed to be currently discharging wastewater where it "probably will be discharged into waters of the state (Attwater, 1992)."

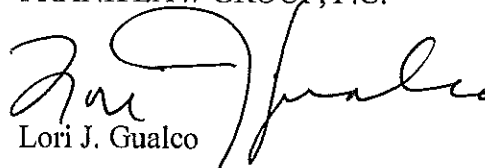
Moonlite Associates believes the information is conclusive and adequate to support naming the City of Santa Clara as a discharger pursuant to the SWRCB memorandum on the "Responsibility of Operators of Publicly Owned and Operated Sewer Systems for Discharges from their Systems which Pollute Ground Water" (Attwater, 1992). As summarized by the SWRCB, "it must be concluded that the owner or operator of a [publicly owned treatment works] is responsible for discharges from the sewer collection system." Based on this analysis, the SWRCB concluded to the extent the release of wastes creates or threatens to create pollution or nuisance, "the public agencies may be ordered to cleanup the wastes or abate the effects thereof." In addition, as the operator of the sewer system the City of Santa Clara has been in possession of the land where the discharges occurred, had knowledge of the operation of its sewer system and had the legal authority (and responsibility) to prevent such discharges. For these foregoing reasons, the City of Santa Clara should be required as a discharger to address the release of PCE from its sewers.

During our meeting, the Regional Board indicated that soil and/or groundwater data from samples collected from beneath or immediately adjacent to the sewer pipes would aid in its evaluations of the contributions from the City of Santa Clara. Therefore, to the extent that the Regional Board believes such data are necessary, we are requesting it take appropriate action to request the City of Santa Clara to obtain the requisite additional information regarding discharges of PCE near its sewer lines in the vicinity of the Moonlite Shopping Center.

If you have any questions, please contact me.

Very truly yours,

FRANK LAW GROUP, P.C.

  
Lori J. Gualco

LJG/slh

cc: Client

John Wolfenden, Regional Board  
Scott H. Reish, Hogan Lovells US LLP, Attorneys for United Artists,  
Julia Hill, Assistant City Attorney  
Michael C. Severian, Esq., Rankin, Landsness

## EXHIBIT B



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**San Francisco Bay Regional Water Quality Control Board**

Date: August XX, 2012  
File No. 43S1090 (NMK)

Moonlite Associates, LLC  
c/o SC Management  
Attn: Mr. Bill Mehrens  
1111 Bayhill Drive, Suite 450  
San Bruno, California 94066  
Bill\_Mehrens@sclay.com

**SUBJECT:** Partial Approval of Feasibility Study/Pilot Study Work Plan and Request for Reports, Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, Santa Clara County

Dear Mr. Mehrens:

This letter responds to your March 16, 2012, Feasibility Study/Pilot Study Work Plan (Workplan) for the subject Site. As explained below, I partially approve the Workplan and request five reports.

The Workplan was voluntarily submitted to the Regional Water Board. The Workplan proposes to conduct a feasibility study and an in-situ enhanced biodegradation/chemical reduction pilot study.

**Partial Approval**

I approve Section 7 of the Workplan containing the Pilot Study Workplan. I am not able to approve the other sections of the report due to deficiencies as described below and in the attached comments.

**Conceptual Site Model**

We do not agree with the proposed Conceptual Site Model (CSM) that a significant release of the dry cleaning chemical tetrachloroethene (PCE) occurred from the City of Santa Clara sewer. The more likely scenario is that all or most of the release of PCE can be attributed to the former Moonlite Cleaners and not to the City of Santa Clara sewer. A CSM showing a significant release of PCE beneath the former Moonlite Cleaners is supported by the following Site data:

- The highest historical detections of PCE in groundwater, soil gas, and indoor air are in the immediate vicinity of or directly below the former Moonlite Cleaners and not in the immediate vicinity of the City of Santa Clara sanitary sewer.

- The high concentration of PCE in groundwater monitoring well MW-4 is most likely attributed to a release from the former Moonlite Cleaners and not from the City of Santa Clara sewer, since MW-4 is located down gradient of the former Moonlite Cleaners.
- Groundwater monitoring well MW-2 and surface water sampling location C2 are more accurately described as down gradient from the former Moonlite Cleaners. The assumption of these two locations being cross gradient from the former Moonlite Cleaners is used to support the statement that a separate release has occurred from the City of Santa Clara sewer. These two locations are better described as down gradient from the former Moonlite Cleaners if a typical model of a gaining stream is used with Site groundwater and surface water elevation data to explain groundwater flow. Concentrations of PCE collected in groundwater and surface water from these locations most likely originates from a release from the former Moonlite Cleaners.
- Our records indicate the City of Santa Clara has good maintenance practices for its sanitary sewer system, as indicated by its low rate and volume of sanitary sewer overflows and its high capital improvement budget per 100 miles of sewer (both relative to other sanitary sewer systems in the region).
- There is substantial disagreement between Moonlite Associates and the City of Santa Clara over the condition of the sanitary sewer in the immediate vicinity of the site, with the City arguing that its condition is generally good. (We will state our own position on this point when we respond to Moonlite Associates' request to name the City.)

### **Request for Reports**

Please submit the following reports; the reports should address this letter's comments:

- Workplan for contaminated soil gas delineation, contaminated indoor air delineation, and groundwater monitoring well installation
- Pilot Study Completion report
- Revised Workplan

If you have any questions, please contact Nathan King of my staff at (510) 622-3966 [nking@waterboards.ca.gov].

Sincerely,

Bruce H. Wolfe  
Executive Officer

Attachment: Feasibility Study/Pilot Study Workplan Comments  
cc w/attachment: Mail List

**Mail List**

Mr. George Cook  
Santa Clara Valley Water District  
gcook@valleywater.org

Mr. David Parker  
Santa Clara City Fire Department  
Hazardous Materials Division  
dparker@ci.santa-clara.ca.us

Ms. Lori Gualco  
Gualco Law  
ljgualco@gualcolaw.com

Ms. Julia Hill  
City of Santa Clara  
City Attorney's Office  
jhill@santaclaraca.gov

Mr. Scott Reisch  
United Artists Theatre Circuit, Inc.  
c/o Hogan Lovells US LLP  
Scott.reisch@hoganlovells.com

Mr. Peter Krasnoff  
West Environmental  
peterk@westenvironmental.com

## Feasibility Study/Pilot Study Workplan Comments

Pg. 2, Section 1.1, Background, fourth paragraph: The preliminary remediation goal (PRG) of 14 ug/m<sup>3</sup> PCE in indoor air for this Site is not sufficiently protective of human health. We recommend using the Regional Water Board Environmental Screening Level for PCE in indoor air of 0.69 ug/m<sup>3</sup>, which corresponds to a 10<sup>-6</sup> excess cancer risk (the point of departure value for acceptable risk under Cal/EPA and USEPA guidance).

Pg.8, Section 2.4, Historical Site Use: The discussion regarding the ownership history of the Site is not complete. Update this section with a full ownership history of the Site.

Pg. 8, Section 2.4.1, Dry Cleaning: It is unclear how the use of PCE and disposal of the PCE waste to the sanitary sewer can be inferred from building department records and telephone directories. Clarify this section.

Pg. 9, Section 2.4.3, Subsurface Utilities: There is no mention of any other utilities and utility trenches that may also be acting as preferential pathways for soil gas. Address this possibility since it is important to consider when developing the Conceptual Site Model (CSM).

Pg. 11, 3.1 Indoor Air Sampling: Indoor air samples have not been collected from within the next tenant space to the east (Rite Aid); soil gas samples collected beneath Rite Aid on March 20, 2009, contained concentrations of PCE at 240,000 ug/m<sup>3</sup>, more than 570 times higher than the associated ESL. Soil gas has not been delineated beneath the Palo Alto Medical Group tenant space to the west and indoor air samples have not been collected from this tenant space. Soil gas could similarly be contaminated with PCE at the same concentrations as beneath Rite Aid due to the similar distance from the former dry cleaner facility. Submit an indoor air sampling workplan to further delineate the extent of PCE in the breathing space by collecting samples from these tenant spaces.

Pg. 14, Section 3.2, Soil Gas Sampling and corresponding figures: Soil gas contamination is not delineated to the adjacent tenant spaces within the Moonlite Shopping Center, and is not delineated off-Site to the east before the residences, to the south before the residences, or downgradient across El Camino Real. Submit a soil gas sampling workplan to delineate the soil gas plume down to or below the corresponding ESL for PCE in soil gas (410 ug/m<sup>3</sup> residential, 1,400 ug/m<sup>3</sup> commercial).

The western extent of soil gas contamination is sampling locations SG5 (580 ug/m<sup>3</sup> PCE), SG6 (45,000 ug/m<sup>3</sup> PCE), and SG13 (190,000 ug/m<sup>3</sup> PCE) located beneath the adjacent western tenant space. The extent of the soil gas contamination to the west of these sampling locations beneath 2652 El Camino Real has not been delineated (Palo Alto Medical Group).

The eastern extent of soil gas contamination is sampling locations SG11 (530 ug/m<sup>3</sup> PCE) and SG12 (2,800 ug/m<sup>3</sup> PCE), located two tenant spaces to the east. The extent of soil gas contamination to the east of these sampling locations beneath Savemart has not been delineated. Additionally, the soil gas contamination has not been delineated east of Savemart to Bowe Avenue.

The southern extent of soil gas contamination is sampling location SG25 (1,500 ug/m<sup>3</sup> PCE, 10-foot sample) located in the alley before the residences behind the strip mall. The extent of soil gas contamination before the residences to the south of this sampling location has not been delineated.

Off-site soil gas has not been delineated before the residences in the parking lot to the north across El Camino Real. Concentrations of PCE in soil gas at 3,400 ug/m<sup>3</sup> at 10' at the downgradient (southern) side of the residences indicates that further investigation is required. Please submit an off-Site soil gas investigation workplan to further delineate the extent of contaminated soil gas.

The soil gas data is not discussed in the context of characterization, but discussed chronologically by investigations. Provide the following:

- Soil gas isoconcentration figure for each depth (5' and 10')
- Discussion of the lateral and vertical extent and source of soil gas contamination and use this in developing the CSM

Pg. 15, Section 3.2.2, Soil Gas Sampling – December 2009: Please use the common name of vinyl chloride in the text and in the corresponding figures. The term chloroethene is not widely used and can lead to confusion.

Pg. 21, Section 3.8, Soil Vapor Extraction System: There are no vertical soil vapor extraction wells beneath the facility, only horizontal extraction wells, which potentially will not be able to remove PCE in soil and soil gas down to groundwater. Please discuss how the design of the soil vapor extraction system immediately beneath the facility can be expected to remediate the vadose zone, which will continue to release PCE to groundwater unless addressed.

Pg. 25, section 4.0, Data Evaluation, and figure 4-1, Conceptual Site Model (CSM): The most significant source of PCE at the site, the dry cleaner, is not shown on the CSM. Soil gas concentrations beneath the dry cleaner are up to 5,700,000 ug/m<sup>3</sup>, while soil gas concentrations near the sewer line are up to 110,000 ug/m<sup>3</sup>. Indoor air concentrations in the dry cleaner were up to 150 ug/m<sup>3</sup> PCE. These concentrations indicate that the dry cleaner is by far the most significant source at the site. Revise figure 4-1 to reflect this. Show the dry cleaner on figure 4-1 and depict the much greater concentrations discharged directly from the dry cleaner to soil and groundwater.

Pg. 25, section 4.1, Historic Groundwater Elevations, first sentence: Should it be 75 feet “below” mean sea level?

Pg. 26, Section 4.2, Hydrogeology of the Site: The discussion of MW-2 and Saratoga Creek sample location C2 as being located cross-gradient from the former dry cleaning facility is not entirely accurate. Groundwater monitoring well MW-2 and surface water sampling location C2 are more accurately described as down gradient from the former Moonlite Cleaners. The assumption of these two locations being cross gradient from the former Moonlite Cleaners is used to support the statement that a separate release has occurred from the City of Santa Clara sewer. These two locations are better described as down gradient from the former Moonlite Cleaners if a typical model of a gaining stream is used with Site groundwater and surface water

elevation data to explain groundwater flow. Concentrations of PCE collected in groundwater and surface water from these locations most likely originates from a release from the former Moonlite Cleaners. Provide a groundwater elevation figure with contours with an interpretation of the flow of groundwater into the gaining stream.

Pg. 27, Section 4.3.1, Former Moonlite Cleaners: The possibility of a PCE release directly beneath the facility from the dry cleaning machines and equipment is not discussed. This is the most likely scenario given the extremely high soil gas and indoor air concentrations beneath the former dry cleaning facility. Include this scenario in the discussion and update the CSM to reflect this.

It is stated that PCE wastewater was discharged to the sanitary sewer lateral beneath Moonlite Cleaners prior to discharging into the City of Santa Clara's sewer system main in the alley south of the shopping center. Please discuss how the Moonlite lateral sewer has been investigated and the likelihood of the sewer lateral causing a release of PCE to the environment.

Pg. 27, Section 4.3.2, City of Santa Clara Sewers: It is again stated that MW-2 and surface water sampling point C2 are located cross gradient from the former dry cleaning facility. This is not entirely accurate and requires further discussion – see comment above.

Pg. 28, section 4.3.2, City of Santa Clara Sewers, second and third full paragraphs: The most significant source of PCE to groundwater at the site is the dry cleaner as demonstrated by the soil gas concentrations referenced above. The current direction of groundwater flow is from the dry cleaner to the northeast towards the intersection of El Camino Real and Bowe Avenue. PCE detected in groundwater beneath the parking lot north of the SaveMart is most likely from a release directly from the dry cleaner. PCE in Saratoga Creek at locations C4 and C5 is most likely from the groundwater plume from the dry cleaner discharging to the creek since the creek is a gaining creek and the groundwater gradient is from the dry cleaners towards the creek. Revise these sections to reflect this.

Our records indicate the City of Santa Clara has good maintenance practices for its sanitary sewer system. We think it is less likely that the release of PCE was from the sanitary sewer.

The assumption that the presence of PCE and methylene blue active substances (MBAS), an indicator for anionic surfactants such as detergents, can only be reasonably explained as emanating from sewer releases is not accurate. Another possibility of two separate releases is not discussed: (1) a PCE release from the dry cleaning facility and (2) MBAS release from a broken sewer pipe beneath the facility or the sewer main. The lateral is not maintained by the City and a leaking lateral could be the cause of the release. Revise these sections to reflect this.

Pg. 29, section 4.3.2, City of Santa Clara Sewers, second paragraph: The most significant source of PCE to groundwater at the site is the dry cleaner as demonstrated by the very high soil gas concentrations referenced above. Boring B33 at 1,059 ug/L PCE does not have the highest concentrations of PCE, monitoring well MW-5A at 1,130 ug/L PCE does near the dry cleaner. Revise this paragraph to state that the PCE in groundwater in the northern portion of the site is most likely from a release from the dry cleaner. We note that MW-5A is no longer the highest concentration well, which we attribute to the soil vapor extraction in the area of MW-5A.

Pg. 30, section 4.4, Lateral Extent of PCE: Include the lateral extent of PCE in soil gas and indoor air. See comments above.

Currently, the existing monitoring wells do not adequately define the extent of contaminated groundwater for monitoring purposes through time. Additional shallow zone monitoring wells should be installed down gradient of the existing wells. MW-4 contained 1,020 ug/L PCE in the most recent monitoring event, yet this is the furthest down gradient monitoring well.

Additionally, a deeper well should be installed to monitor this deeper zone – two wells are insufficient to monitor a water bearing zone. MW-5A had up to 1,130 ug/L PCE and MW-4A had up to 21.5 ug/L PCE. The deeper water bearing zone may flow in a more northerly direction and be less affected hydraulically by Saratoga Creek.

Submit a monitoring well installation workplan to address these deficiencies.

Pg. 32, section 5.0, Feasibility Study Objective, second sentence: Include indoor air in the list of media with VOCs.

Pg. 32, section 5.1, Development of Remedial Action Objectives, second sentence: Include indoor air in the list of media with VOCs.

Pg. 33, section 5.1, Development of Remedial Action Objectives, first bullet: Also include monitoring of indoor air.

Pg. 33, section 5.1, Development of Remedial Action Objectives, third paragraph, third sentence: Also include indoor air results when developing PRGs.

Pg. 35, section 5.4, Screening Level Assessment, third paragraph: Also include PRGs for soil and indoor air.

Pg. 35, section 5.4, Screening Level Assessment, third paragraph: Also include maximum contaminant levels and Regional Water Board environmental screening levels as screening levels.

Pg. 35, section 5.4.1, Exposure Pathways Evaluation, second sentence: Also include human exposure to indoor air.

Pg. 35, section 5.4.1, Exposure Pathways Evaluation, third sentence: Also include screening for soil.

Pg. 36, section 5.4.2, Identification of PRGs: Also include PRGs for indoor air.

Pg. 36, section 5.4.2, Identification of PRGs: PRGs are narratively mentioned but not numerically stated. Include numerically what the specific PRGs are for each chemical of concern and for each media. A table would be helpful.

Pg. 36, section 5.4.2.1, Environmental Screening Levels, first sentence: ESLs are also available for soil.

Pg. 37, section 5.5, Evaluation of Findings: Also include a section on indoor air conditions.

Pg. 38, section 5.5.2, Soil Gas Conditions: Include a summary of soil gas data and a comparison to ESLs.

Pg. 38, section 5.5.3, Groundwater Conditions: Also include a comparison of PCE groundwater concentrations to MCLs.

Pg. 41, Section 6.2.2, and Preliminary Screening: The Feasibility Study and Remedial Action Plan should address soil, soil gas, indoor air and groundwater, not just groundwater. Include an evaluation of the interim remedial action using soil vapor extraction currently ongoing at the Site, as well as proposing a final soil cleanup plan.

Pg. 47, section 6.4.1.8, Regulatory Acceptance: Regulatory acceptance of the RAP won't be known until after submittal of the RAP.

Pg. 48, section 6.5, RAP Preparation, and Pg. 53, section 7.4, Remedial Action Plan: It is unclear if a feasibility study (FS) will be submitted. The Workplan contains a workplan to conduct an FS, but then these sections only include submittal of a RAP and not an FS. Discuss whether an FS will be submitted.

Pg. 53, section 7.4, second sentence: Also include a summary of indoor air investigations in the FS/RAP.

Table A-1, Pg. 1, feasibility of air sparging: Correct the site address in this section.



# EXHIBIT C

**From:** King, Nathan@Waterboards <Nathan.King@waterboards.ca.gov>  
**Sent:** Tuesday, October 09, 2012 6:23 PM  
**To:** Reisch, Scott H.; Lori J. Gualco (ljgualco@gualcolaw.com)  
**Subject:** Moonlite Cleaners

Scott and Lori,

We are planning on moving forward with issuing an order that names Moonlite and UA as dischargers. Management believes there is enough circumstantial evidence to also name UA to this case. An Order is required at this point since cleanup of sites are not allowed under Section 13267 of the Water Code. Section 13304 allows us to require cleanup, and allows us to name multiple dischargers (amongst other things).

Prior to this occurring, we need to respond to the Feasibility Study/Pilot Study Workplan (Workplan ) submitted by Moonlite. Moonlite wants to proceed with getting the site cleaned up and this is an important step.

Regarding the Workplan, there are three possibilities 1) respond to Workplan and address our letter to Moonlite only 2) respond to Workplan and address our letter to both parties, which requires a 30 day notice since UA is then named or 3) delay our response by requiring this work as a task in the pending order, which also requires a 30 day notice.

I have been instructed that we only want to have one comment period, which eliminates the second possibility.

If possible, it would be constructive if Moonlite and UA could first correspond regarding these issues before responding. If it would help, I can facilitate this.

Please contact me to discuss as soon as possible. I will be in tomorrow after lunch, all day Thursday, and off all day Friday, returning Monday.

Sincerely,

Nathan King, PG  
Engineering Geologist  
San Francisco Bay Regional Water Quality Control Board  
Toxics Division  
(510) 622-3966

## EXHIBIT D

## **Review of Environmental Data**

**Former Moonlite Cleaners  
2640 El Camino Real  
Santa Clara, California  
(EKI B10003.00)**

12 March 2013

Submitted to:

California Regional Water Quality Control Board  
San Francisco Region

On Behalf of:

United Artists Theatre Circuit, Inc.



Consulting Engineers and Scientists  
1870 Ogden Drive  
Burlingame, California 94010  
(650) 292-9100  
Fax: (650) 552-9012



Former Moonlite Cleaners  
2640 El Camino Real, Santa Clara, California

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Former Moonlite Cleaners  
2640 El Camino Real, Santa Clara, California

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Attachment B	Summary of Unsaturated Flow and Transport Travel Time Analysis
Attachment C	Summary of Chemical Transport in Groundwater Calculations



## EXECUTIVE SUMMARY

United Artists Theatre Circuit, Inc. or its predecessors (“UATC”) formerly owned the property located at 2640 El Camino Real in Santa Clara, California (the “subject property” or “Site”) from at least 1962, when a drycleaner allegedly began operating at the Site, until November 1975. At that time, UATC sold the subject property and then leased it until September 1978, with no involvement with the Site subsequent to that time. A drycleaner continued to operate at the Site until October 1996. In September 2004, the current owner of the Site discovered perchloroethylene contamination, which is believed to have originated from the onsite drycleaner. In the absence of groundwater quality data or eyewitness testimony of perchloroethylene spills during the period of UATC’s ownership or tenancy at the Site, UATC asked Erler & Kalinowski, Inc. (“EKI”) to assess the likelihood of a pre-1978 release based on the currently available technical data.

Hydraulic conditions at the Site through time can be inferred based upon a correlation between groundwater elevation data from the Santa Clara Subbasin Index Well hydrograph (Figure 8) and local groundwater elevation data from a former Shell Service Station located in close proximity to the Site. This correlation leads EKI to conclude that from 1962 to the mid-1990s, groundwater elevations at the Site were relatively low and that Saratoga Creek was a losing stream, resulting in a northwest-trending groundwater gradient at the Site. As a result of that gradient, and because there is no evidence of any subsurface conditions that would alter groundwater flow directions, a hypothetical chemical release that reached groundwater during this time period (1962 to the mid 1990s) would have experienced a northwest groundwater gradient and resulted in a northwest-trending plume.

Analysis of chemical migration travel times indicates that if a release had occurred between 1962 and 1978, the period when a drycleaner allegedly operated on the property while UATC owned or leased the Site (the “relevant time period”), the release would have reached the groundwater table within approximately six years, generating a northwest-trending plume. Calculations show that evidence of a northwesterly-trending plume would be evident in the current analytical data for groundwater. As there is no evidence of a northwest-trending plume in the currently available analytical data for groundwater, EKI concludes that a pre-1978 release of chemical laden wastewater did not occur.

Instead, the documented chemical plume in groundwater trends northeast consistent with the currently measured groundwater gradient to the northeast that was initially established in the mid-1990s. A chemical release from the ground surface at the Site would have required several years to reach the groundwater table and establish a plume. Thus, a chemical release in approximately 1990 may have been the cause of the plume shown on Figure 13. Alternatively, a somewhat older release to groundwater, e.g., originating in the late 1980s, in the vicinity of the sewer line in the alley south of the former drycleaner operation may have reached groundwater with a northwesterly gradient and then shifted to a northeasterly gradient in 1994, giving rise to the plume shown on Figure 13. Given such release dates, calculations indicate that there was adequate time for the approximately 600-foot long plume observed today to become established.

The conclusion that the chemical plume post-dates the period when UATC owned or leased the Site is further supported by the vertical distribution of contaminants in shallow



groundwater that are more consistent with a post-1978 release when the water table was shallow than a pre-1978 release when the groundwater table was deep. Releases that occurred during a pre-1978 time period would have resulted in a deep groundwater plume consistent with groundwater elevations at the time. There is no evidence to support the occurrence of releases during this pre-1978 time period.





## 1 INTRODUCTION

On behalf of United Artists Theatre Circuit, Inc. and its predecessors (“UATC”), Erler & Kalinowski, Inc. (“EKI”) is pleased to present to the California Regional Water Quality Control Board, San Francisco Bay Region (“Water Board”) this report that presents a review of available environmental data for the former Moonlite Cleaners property at 2640 El Camino Real in Santa Clara, California (the “subject property” or “Site”).

UATC owned or leased the subject property during the period from 1962, when a drycleaner allegedly began operating at the Site, until November 1975. At that time, UATC sold the subject property and then leased it until September 1978, with no involvement at the Site subsequent to that time. A drycleaner continued to operate at the Site for approximately eighteen years, from 1978 until October 1996. In September 2004, the current owner of the Site discovered perchloroethylene (“PCE”, also known as tetrachloroethene) contamination, which is believed to have originated from the onsite drycleaner. Given the absence of groundwater quality data or eyewitness testimony of PCE spills during the period of UATC’s ownership or tenancy at the Site, UATC asked Erler & Kalinowski, Inc. (“EKI”) to assess the likelihood of a pre-1978 release based on the currently available technical data.

As discussed, below, our conclusion is that the current distribution of chemicals in the subsurface is consistent with a post-1978 release and that there is no evidence of a pre-1978 release.



## 2 SITE LOCATION AND SETTING

The former drycleaner operation was situated within a retail/commercial building (Moonlite Shopping Center) located at 2640 El Camino Real in Santa Clara, California (Figure 1).

The Moonlite Shopping Center is bounded to the north by El Camino Real, to the east by Bowe Avenue and Saratoga Creek beyond Bowe Avenue, to the south by a bowling alley and multi-family residential development, and to the west by Kiely Boulevard. The Site is located between Dynasty Food to the east and a Korean barbecue restaurant to the west.

The Site is located approximately 400 feet west of Saratoga Creek and approximately 2,500 feet east of Calabazas Creek. Review of topographic maps prepared by the United States Geological Survey (“USGS”) for 1899 and 1953 (Figures 2 and 3) confirms that the locations of these creeks have remained largely unchanged during the past 100 years. Given the close proximity of the Site to Saratoga Creek, it is expected that groundwater elevations and flow directions at the Site would be strongly influenced by hydrologic conditions of Saratoga Creek.

### 3 GEOLOGIC SETTING

In investigating current and historical groundwater flow conditions, it is important to understand the geology of the Site, specifically whether low permeability sediments are present at the Site that could affect groundwater velocities and flow directions.

The geology at the Site is depicted on a recent geologic map of the Cupertino and San Jose West Quadrangles (Dibblee, 2007), a portion of which is reproduced on Figure 4. The Site is directly located on silty clay and organic clay interpreted to represent an intra-alluvial fan area. These are relatively low permeability materials. However, the results of on-Site investigations indicate that these low permeability units are limited to the shallow subsurface and are largely above the water table (West, 2012). Sedimentary units at the Site below the water table are more permeable.

To assess the possible presence of low permeability units at the Site, EKI generated two cross-sections: cross section locations A1-A1' and B1-B1' as shown on Figure 5. Cross section A1-A1' (Figure 6) is oriented southwest-northeast, sub-parallel to the orientation of the alluvial fan bodies indicated on Figure 4. Cross section B1-B1' (Figure 7) is oriented northwest-southeast, transverse to the orientation of the alluvial fan bodies.

Review of cross section A1-A1' (Figure 6) indicates that the ground surface at the Site is at an elevation of approximately 80 feet above mean sea level ("msl"). There are approximately 6 feet of clay in the shallow subsurface beneath the Site that, combined with a silt unit, appear to thicken to the northeast toward Saratoga Creek. The 6-foot thick clay at the Site is underlain by approximately 30 feet of sands, silty sands and gravel with limited clayey intervals down to an elevation of approximately 43 feet msl. Below 43 feet msl, a clay body is present with a minimum thickness of 15 feet. As discussed below, the groundwater elevation during the third quarter 2012 was at approximately 68 feet msl at the Site and the local groundwater gradient was to the northeast, parallel to this line of section (P&D, 2012). The saturated subsurface sediments at the Site are sufficiently permeable that chemicals released to the subsurface have been able to migrate to the northeast parallel to the current groundwater gradient direction (Figures 6 and 13).

Cross section B1-B1' (Figure 7) depicts the subsurface sediments in a northwest-southeast transect beneath the Site. Drilling is somewhat limited at depth northwest of the Site. However, at both locations B17 and B22, silts and sands are encountered at and below the current water table. The subsurface sediments along this northwest-southeast cross section are similar to those observed on cross section A1-A1' and also appear to be relatively permeable. There is no evidence of a substantial clay body in the saturated zone that would deflect groundwater flow paths. Accordingly, if, as discussed below, a groundwater gradient to the northwest existed historically, chemicals released to the subsurface at the Site would have migrated to the northwest.



## 4 HYDRAULIC SETTING

### Historical Hydraulic Conditions

Groundwater elevation data for the Site do not exist prior to 2009. However, historical groundwater elevation data at the Site can be estimated based on (1) groundwater elevations measured in the Santa Clara Subbasin Index Well (“Index Well”) (Figure 8), located approximately 5 miles to the south-southeast of the Site from the 1930s through the present and (2) groundwater elevations measured between 1990 and 2000 at the former Shell Service Station located at 2540 El Camino Real, Santa Clara, CA, on the opposite side of Saratoga Creek from the Site (Figures 9 and 10). This service station is located at nearly the same distance from Saratoga Creek as the Site, and would therefore be expected to experience similar, yet mirrored, groundwater conditions (i.e., due to symmetry across Saratoga Creek).<sup>1</sup>

During the period 1962 to 1978, groundwater elevations within Santa Clara Valley were substantially lower than at present (SCVWD, 2001). Based on review of groundwater elevations measured in the Index Well (Figure 8), groundwater elevations in the area were at their lowest point on record in the early to mid-1960s and generally rose thereafter in response to active recharge and reduced pumping of the basin.<sup>2</sup> Between 1962 and 1978, groundwater elevations in the Index Well fluctuated within a range that was typically about 45 to 165 feet lower than current conditions.

To determine how these changes in the subbasin would have impacted groundwater conditions at the Site, EKI examined the correlation between groundwater elevations at the Index Well and those at the former Shell Service Station well for which there are groundwater elevation data for the period 1990 to 2000. Inspection of Figure 9 shows that when groundwater elevations in the Index Well are less than approximately 70 feet msl, a positive correlation exists between those groundwater levels and local groundwater levels, as measured in the former Shell Station monitoring well. This positive correlation is indicated by the upward sloping pattern of points on the left side of Figure 9. At a groundwater elevation of approximately 70 feet msl in the Index Well, a break in slope occurs. Above that elevation (i.e., on the right side of Figure 9), the paired local and Index Well groundwater elevation data indicate a lack of correlation; that is, at higher Index Well groundwater elevations, the local groundwater elevations do not increase. Rather, the local groundwater elevations appear to reach a maximum elevation of approximately 63 to 65 feet msl.

The change in the correlation pattern between local groundwater levels and (regional) Index

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<sup>1</sup> The groundwater elevation data for this former Shell Service Station were obtained from the Geotracker website maintained by the State Water Resources Control Board. The groundwater elevation data for the former Shell Service Station shown on Figure 9 have been adjusted to account for the use of a local datum by subtracting 23 feet from the original measuring point data, thereby placing both sets of data on the same datum by comparison. The 23-ft adjustment was determined by comparing the reported top of casing elevation data (i.e., approximately 100 ft) with the ground surface elevation as determined from topographic maps (i.e., approximately 77 feet msl).

<sup>2</sup> Santa Clara Valley Groundwater Management Plan (2001) states on p. 12: “While groundwater elevations in the well are not indicative of actual groundwater elevations throughout the County, they demonstrate relative changes in groundwater levels.”



Well groundwater levels (i.e., from being positively correlated when Index Well elevations are less than 70 feet msl to being uncorrelated when Index Well elevations are greater than 70 feet msl) can be attributed to the local effect of Saratoga Creek. As discussed below, the key feature of Saratoga Creek that bears on this issue is the elevation of its streambed at approximately 62 feet msl.

When the Index Well groundwater elevation is less than approximately 70 feet msl and the local former Shell Station groundwater elevation is less than the elevation of the Saratoga Creek streambed (i.e., approximately 62 feet msl), Saratoga Creek is a losing stream. Under losing stream conditions, local groundwater elevations are correlated (i.e., rise and fall in concert) with regional groundwater elevations.

When the Index Well groundwater elevation is greater than approximately 70 feet msl and the local former Shell Station groundwater elevation is above the elevation of the Saratoga Creek streambed (i.e., approximately 62 feet msl), Saratoga Creek becomes a gaining stream and begins to act as a drain for groundwater, preventing further large increases in groundwater levels. For this reason, local groundwater levels tend to reach a maximum just a few feet above the elevation of the streambed, regardless of whether regional groundwater levels are still increasing.

As stated above and shown on Figure 9, this transition from losing to gaining conditions occurs when Index Well groundwater elevations are at approximately 70 feet msl. The timing of this transition can be seen on Figure 8 which shows that Saratoga Creek was a losing stream prior to the mid-1990s and has been a gaining stream for most time periods thereafter.

#### Groundwater Elevation Configuration with Low Water Table and Saratoga Creek a Losing Stream

Based on the Index Well hydrograph (Figure 8) and the correlation to local conditions shown on Figure 9, during the entire period from 1962 to the mid-1990s, including the relevant time period (1962 to 1978), the groundwater table would have been below the bottom of Saratoga Creek, and the creek would have been a source of recharge to groundwater (i.e., a losing stream) when surface flows were present (i.e., typically in the wet winter months). Figure 10 illustrates the approximate groundwater elevations and gradients that would have prevailed under such losing conditions at Saratoga Creek. As shown on Figure 10, a hypothetical chemical release at the Site that reached groundwater during the 1962 to 1978 time period would have resulted in a northwest-trending plume.

#### Evidence for Groundwater Gradient Shift, Former Shell Service Station, East of Saratoga Creek

Based on the above analysis, Saratoga Creek would have been a losing stream from the 1940s until the mid-1990s, producing a northwest groundwater flow direction at the Site, and a gaining stream from the mid-1990s until 2000, yielding a northeastern groundwater flow direction at the Site. Because groundwater elevation data for the former Shell Station Site were available for both the period 1990 to mid-1990s and the period mid-1990s to 2000, EKI reviewed groundwater elevation data from the former Shell Station Site to determine if in fact a shift in groundwater gradient direction occurred as expected. Based on the results of 3-point



gradient calculations for monitoring wells MW-1, MW-2, and MW-3 at the former Shell Station site (see Attachment A), the data show that the gradient shifted from being, on average, to the northeast in the early 1990s, to the north/northwest in the later part of the decade. Because the former Shell Station is located on the opposite side of Saratoga Creek from the Site and the creek acts as a line of symmetry, the gradient directions at the Site are generally mirror images of the directions at the former Shell Station. Therefore, at the Site, the gradient shifted from being, on average, to the northwest in the early 1990s to the northeast in the later part of the decade.

This change in groundwater gradient direction on the east side of Saratoga Creek is consistent with EKI's conclusion that the general rise in groundwater levels observed over the 1990s caused Saratoga Creek to transition from losing stream conditions to gaining stream conditions, with a resulting shift in groundwater gradients and groundwater flow directions.

#### Groundwater Elevation Configuration With High Water Table and Saratoga Creek a Gaining Stream

Current conditions are depicted on Figure 11, reflecting the condition where Saratoga Creek is a gaining stream. Under such conditions, the groundwater gradient at the subject property is to the northeast rather than to the northwest. Accordingly, a chemical release to groundwater under the hydraulic conditions that have existed at the Site since the mid-1990s would result in a plume oriented to the northeast rather than to the northwest.



## 5 CONTAMINANT DISTRIBUTIONS

Data for PCE in soil gas samples collected from 1 foot below ground surface are reported in West (2012) and are posted on Figure 12. These data show that the most elevated concentrations of PCE in soil gas are from beneath the subject property, strongly suggesting that chemical releases occurred in this general area sometime in the past.

Data for PCE in grab groundwater samples from all depths as reported in West (2012) and P&D (2012) are posted on Figure 13 and contoured according to concentration. Review of the 200 microgram per liter (“ug/L”) PCE contour suggests that there is a plume of PCE that emanates from near the former Moonlite Cleaners and potentially a second plume related to a chemical release associated with a nearby sewer line. (There has been no sampling in the area between the two contour lines so it is not possible to tell if there is one plume or two distinct plumes.) The fact that PCE was detected at concentrations above 20 ug/L in most samples collected along the sewer line alignment, even in locations that would have been upgradient or cross-gradient from the former dry cleaners operation, suggests that the sewer line itself may have been a source of contamination to local groundwater. Previous video logging of portions of the sewer pipe (described in West, 2011) reportedly indicated compromised pipe integrity which may have resulted in leaking of wastewater from the sewer into the unsaturated zone soils. It is also possible that wastewater was conveyed in the granular backfill around such sewers.

Data for PCE in grab groundwater samples as reported in West (2012) and P&D (2012) are also posted on cross sections A1-A1’ and B1-B1’ (Figures 6 and 7). As shown on cross section A1-A1’, the core of the PCE plume occurs at an elevation of approximately 55 feet msl and extends down-gradient to the northeast. In contrast, as shown on cross section B1-B1’, PCE concentrations in groundwater northwest of the Site at boreholes B17 and B22 are low. This suggests that the PCE was discharged to the subsurface at or near the subject property and impacted groundwater when the groundwater table was relatively shallow and when the groundwater gradient was to the northeast rather than the northwest.

There are no available analytical data for soil.





## 6 DATA EVALUATION

In this section, the available data are evaluated with respect to timing of chemical releases.

The available chemical data for soil gas and groundwater indicate that PCE was released to the subsurface at and in the vicinity of the onsite drycleaner operation. The concentrations of PCE detected in groundwater are relatively low, consistent with a discharge of PCE dissolved in wastewater rather than as a separate phase dense non aqueous phase liquid<sup>3</sup>. A release of wastewater would have migrated primarily vertically downwards through the unsaturated zone to the groundwater table beneath the Site (Stephens, 1996). In addition, it appears that some wastewater may have been conveyed along sewer lines, possibly in backfill, to locations distant from the Site (see 200 ug/L PCE contour south of Savemart on Figure 13), where it migrated vertically downward through the unsaturated zone to the groundwater table.

### Assessment of Fate and Transport of Hypothetical Release During the Period 1962 to 1978

During the relevant time period of 1962 to 1978, the groundwater table was significantly deeper than it is today. In order for a release during this time period to have not resulted in a northwest-trending plume, it would have had to not reach the groundwater table before the mid-1990s, when the current northeasterly gradient was established. This means the release would have had to have taken more than approximately 16 to 33 years to travel through the vadose zone (i.e., unsaturated zone above the water table) to reach the groundwater table by 1995.

To evaluate the timing of such a hypothetical release, EKI performed travel time calculations for a dissolved solute released in the shallow subsurface and traveling vertically downwards through the unsaturated zone to the groundwater table. The physical transport processes considered in the evaluation include steady-state advection and sorption. Details of the analysis, including the method and assumptions, are included in Attachment B. Results from the analysis indicate that advective transport of PCE through the vadose zone to the groundwater table would have occurred within approximately six years under a loading rate of approximately 5.8 feet per year. The loading rate is limited by the saturated hydraulic conductivity of the least permeable soil within the soil profile. Previous studies by others (e.g., USEPA, 1989b) of leakage rates from older vitrified clay sewer pipes in northern California indicate that loading rates of this magnitude or greater are reasonable.

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<sup>3</sup> U.S. Environmental Protection Agency (1989a) guidance indicates that “sampled groundwater concentrations in excess of 1% effective solubility...indicate that the sampled groundwater may have come in contact with DNAPL [Dense Non-Aqueous Phase Liquid]”. The concentrations of volatile organic compounds, including PCE, detected in groundwater at the Site are less than 1% effective solubility. For example, the most elevated concentrations of volatile organic compounds detected to date in groundwater from the Site were from groundwater sample B33-W which contained PCE at a concentration of 1,020 ug/L and TCE at a concentration of 30.6 ug/L (West, 2012). These concentrations are at 0.51% effective solubility, significantly less than 1% effective solubility. Therefore, there is no evidence of DNAPL discharge to the subsurface and a release of PCE in wastewater is the likely source of the site contamination.





Therefore, if a release had occurred between 1962 and 1978, it would have reached the groundwater table within approximately six years, arriving between approximately 1968 and 1984. Under the groundwater conditions prevailing during that period (1968 to 1984), the groundwater gradient and flow direction would have been to the northwest. Therefore, a pre-1978 release of chemical-laden wastewater that reached the groundwater table would have experienced a northwest groundwater gradient and would have begun to spread into a northwest-trending plume. The absence of such a plume today suggests that no such release occurred.

Given the change in gradient to the northeast in the mid-1990s, the question arises whether evidence of a northwest-trending plume would still be evident today if a release occurred prior to 1978. Accordingly, EKI specifically considered whether such a plume would have dissipated or migrated to the northeast once the gradient shifted in the mid-1990s. Calculations of saturated zone transport of chemicals of concern performed using the REMChlor model (Falta, 2007) were performed and indicate that evidence of a northwesterly-trending plume would be observable in the current analytical data for groundwater if a pre-1978 release had occurred (see Attachment C). Specifically, total chlorinated compound concentrations on the order of 100 ug/L to 200 ug/L should be detected in groundwater at locations northwest of the Site. As there are no such chemical concentrations detected in the currently available analytical data for groundwater to the northwest of the Site (see Figure 13), EKI concludes that a pre-1978 release of chemical-laden wastewater did not occur at the Site.

#### Documented Northeast-Trending Chemical Plume in Groundwater Consistent with Post-1978 Release

Having concluded that the current plume is inconsistent with a pre-1978 release date, EKI considered whether the plume could be explained by a release of chemical-laden wastewater in the period from the late 1980s through October 1996. As discussed in Section 4, starting in the mid-1990s onward, the groundwater table at the Site was relatively high, estimated to be approximately 65 feet msl. Since the streambed elevation of Saratoga Creek in this area is approximately 62 feet msl, the local groundwater gradient on the west side of Saratoga Creek would have been to the northeast reflecting the condition where Saratoga Creek was a gaining stream.

Review of Figure 13 shows that the existing chemical plume in groundwater trends to the northeast, consistent with the current northeasterly groundwater gradient which was initially established in the mid-1990s. A chemical release at or just below the ground surface would likely have required fewer than six years to reach the shallow groundwater table and establish a plume because the groundwater table in the 1990s was shallower than it was during the relevant time period. Thus, a chemical release from the former drycleaner operation in the early 1990s would explain the plume shown on Figure 13. Alternatively, a somewhat older (e.g., mid-1980s) release to groundwater, in the vicinity of the sewer line in the alley south of the former dry cleaner operation may have reached groundwater with a northwesterly gradient and then shifted to a northeasterly gradient in the mid-1990s, giving rise to the plume shown on Figure 13. Calculations indicate that a release during the period from the mid-1980s through October 1996 would have had adequate time to form the approximately 600 foot long



plume observed today.<sup>4</sup>

### Measured Elevated PCE Concentrations in Shallow Subsurface Consistent with Post-1978 Release

As shown on Figures 6 and 7, most of the elevated concentrations of PCE detected in grab groundwater samples and monitoring wells are from elevations in the shallow subsurface at approximately 55 feet msl.

Because of the substantially lower groundwater levels during the period of UATC Site ownership or tenancy and the corresponding thick vadose zone, a pre-1978 release of wastewater would have migrated vertically downward through the vadose zone under gravity. Thus, it is expected that significant contamination would be present at depth, having penetrated down at least as far as the thick clay that underlies former Moonlite Cleaners at an elevation of approximately 40 to 45 feet msl. Instead, the core of the plume appears to be at an elevation of 55 feet msl and PCE concentrations decline substantially with depth. Therefore, the vertical distribution of contaminants in groundwater are more consistent with a post-1978 release when the water table was shallow than a pre-1978 release when the groundwater table was deep.

Finally, the data for the deepest groundwater samples collected at the Site, from an elevation of approximately 30 feet msl, (Figure 12) do not support the concept of a deep contaminant plume related to a pre-1978 release:

- B26A-W from 48 – 50 feet below ground surface, collected 7/28/2010:
  - 0.55 ug/L PCE
  - 0.59 ug/L TCE
  - <0.5 ug/L cis-1,2-DCE
- B32A-W from 48 – 50 feet below ground surface, collected 7/27/2010:
  - <0.5 ug/L PCE
  - <0.5 ug/L TCE
  - <0.5 ug/L cis-1,2-DCE
- MW-4A from 45 – 50 feet below ground surface, collected 9/19/2012:
  - 2.39 ug/L PCE
  - 17.5ug/L TCE
  - <0.5 ug/L cis-1,2-DCE

PCE concentrations in groundwater samples from 30 feet msl range from below the detection limit to 2.39 ug/L. Such low PCE concentrations are consistent with a post-1978 release into shallow groundwater.

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<sup>4</sup> A release reaching groundwater in the early 1990s would have had approximately 20 years to grow to its current dimensions. The center of mass of the plume appears to be approximately 375 feet from the assumed source (i.e., the former drycleaner operation), which implies a solute advective velocity of approximately 19 feet per year. That velocity, when compared to a computed water velocity of 68 feet per year (based on hydraulic conductivity of 11 feet per day, gradient of 0.0057, and effective porosity of 0.353), implies a retardation coefficient of 3.611 which is a reasonable value for this area and this chemical. Hydraulic conductivity and effective porosity values are for loamy sand (Carsel and Parrish, 1988). Hydrodynamic dispersion has resulted in the leading edge of the plume extending further than the center of mass.



## 7 CONCLUSIONS

Hydraulic conditions at the Site through time can be inferred based upon a correlation between groundwater elevation data from the Santa Clara Subbasin Index Well hydrograph (Figure 8) and local groundwater elevation data from a former Shell Service Station located in close proximity to the Site. This correlation leads EKI to conclude that from 1962 to the mid-1990s, groundwater elevations at the Site were relatively low and that Saratoga Creek was a losing stream, resulting in a northwest-trending groundwater gradient at the Site. Thus, a hypothetical chemical release during this time period would have experienced a northwest groundwater gradient and resulted in a northwest-trending plume.

Analysis of chemical migration travel times indicates that if a release had occurred between 1962 and 1978, the period when UATC owned or leased the Site while dry-cleaning operations allegedly occurred, it would have reached the groundwater table within approximately six years, generating a northwest-trending plume. Calculations show that evidence of a northwesterly-trending plume would be evident in the current analytical data for groundwater. As there is no evidence of a northwest-trending plume in the currently available analytical data for groundwater, it is concluded that a pre-1978 release of chemical laden wastewater did not occur.

Instead, the documented chemical plume in groundwater trends northeast consistent with the currently measured groundwater gradient to the northeast that was initially established in the mid-1990s. A chemical release at or just below the ground surface at the former drycleaner operation would have required several years to reach the groundwater table and establish a plume. Thus, a chemical release from the early 1990s would explain the plume shown on Figure 13. Alternatively, a somewhat older (e.g., mid-1980s) release to groundwater in the vicinity of the sewer line in the alley south of the former drycleaner operation may have reached groundwater with a northwesterly gradient and then shifted to a northeasterly gradient in 1994, giving rise to the plume shown on Figure 13. Given such release dates, calculations indicate that there was adequate time for the approximately 600 foot long plume observed today to become established.

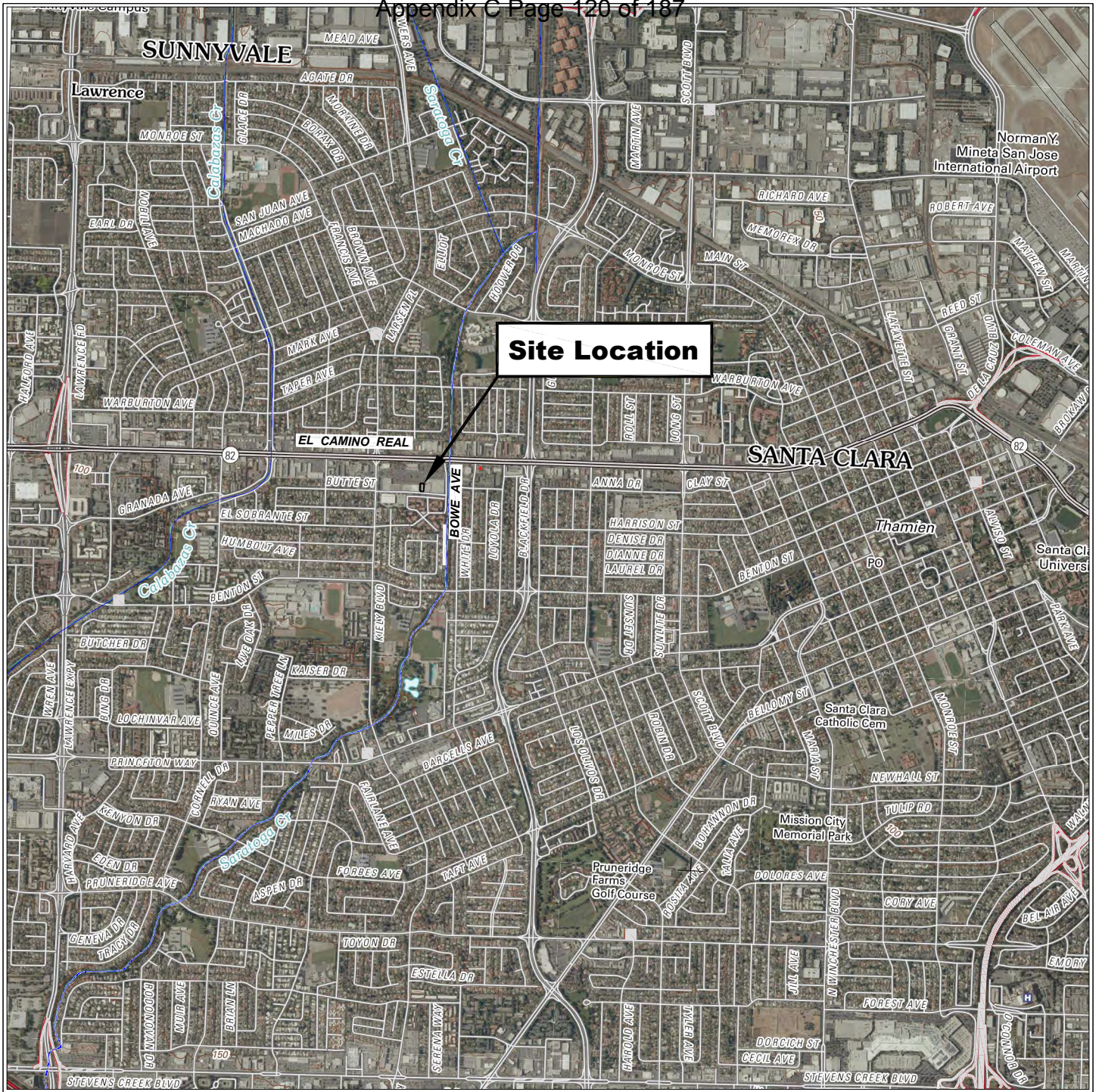
The conclusion that the chemical plume post-dates the period when UATC owned or leased the Site is further supported by the vertical distribution of contaminants in shallow groundwater that are more consistent with a post-1978 release when the water table was shallow than a pre-1978 release when the groundwater table was deep. Releases that occurred during a pre-1978 time period would have resulted in a deep groundwater plume consistent with groundwater elevations at the time. There is no evidence to support the occurrence of releases during this time period.



## 8 REFERENCES

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**Notes:**

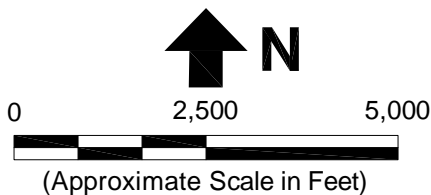
1. All locations are approximate.
2. USGS = United States Geological Survey
3. Basemap source: USGS GeoPDF, San Jose West, CA. 2012

**Erler & Kalinowski, Inc.**

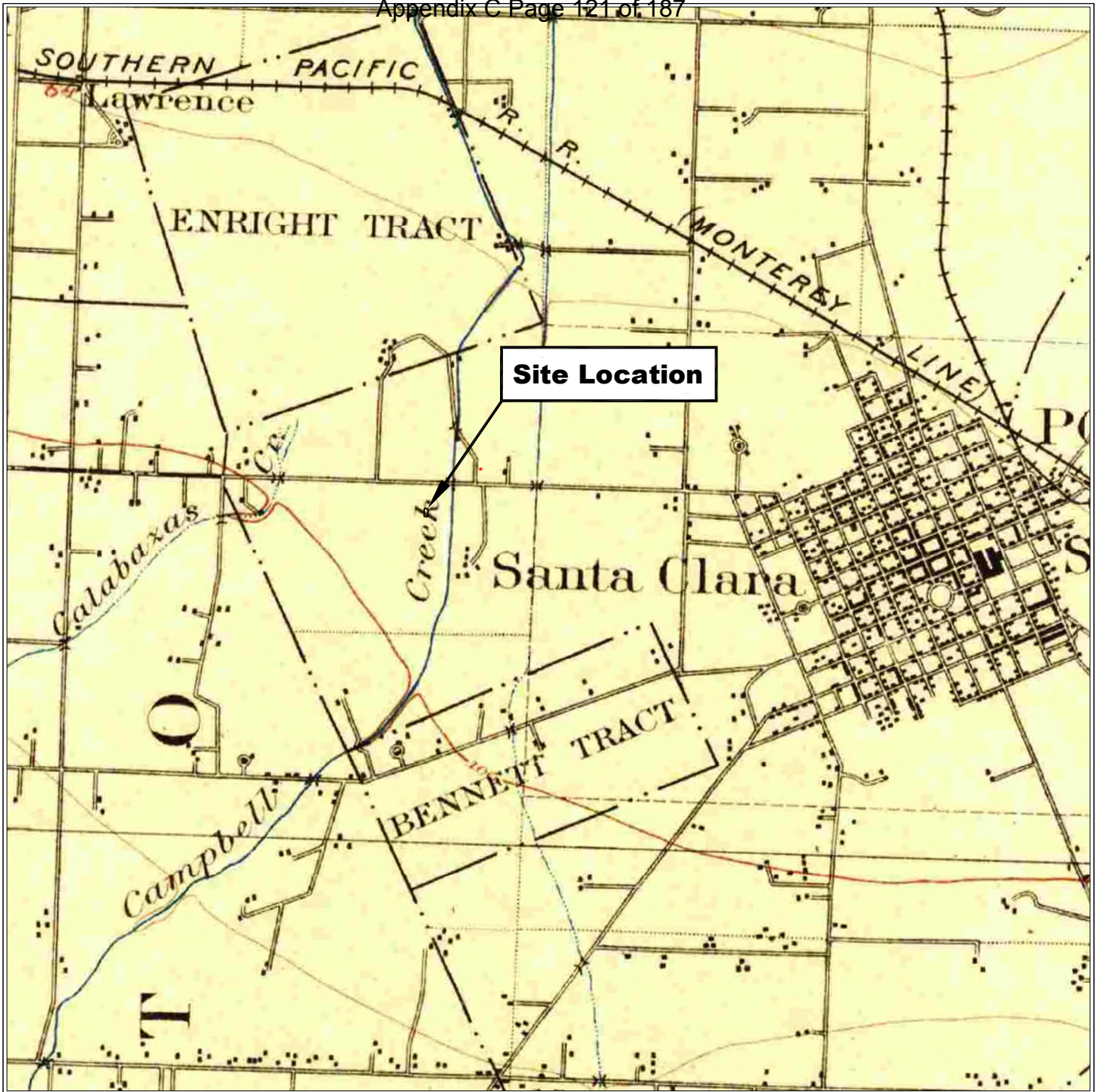
**Site Location**

Former Moonlite Cleaners  
 2640 El Camino Real  
 Santa Clara, CA  
 March 2013  
 EKI B10003.00

**Figure 1**







**Notes:**

1. All locations are approximate.
2. USGS = United States Geological Survey
3. Basemap source: USGS Topographic Map, San Jose, CA. May 1, 1899.

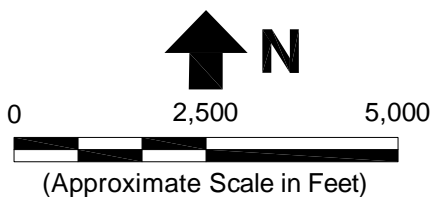
**Erler & Kalinowski, Inc.**

Site Location on 1899  
USGS Topographic Map

Former Moonlite Cleaners  
2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

**Figure 2**







**Notes:**

1. All locations are approximate.
2. USGS = United States Geological Survey
3. Basemap source: USGS Topographic Map, San Jose West, CA. 1953.

**Erler & Kalinowski, Inc.**

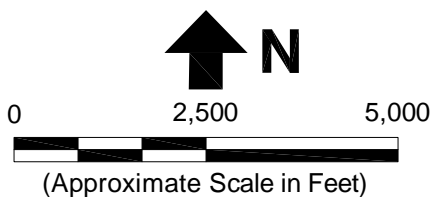
Site Location on 1953  
USGS Topographic Map

Former Moonlight Cleaners

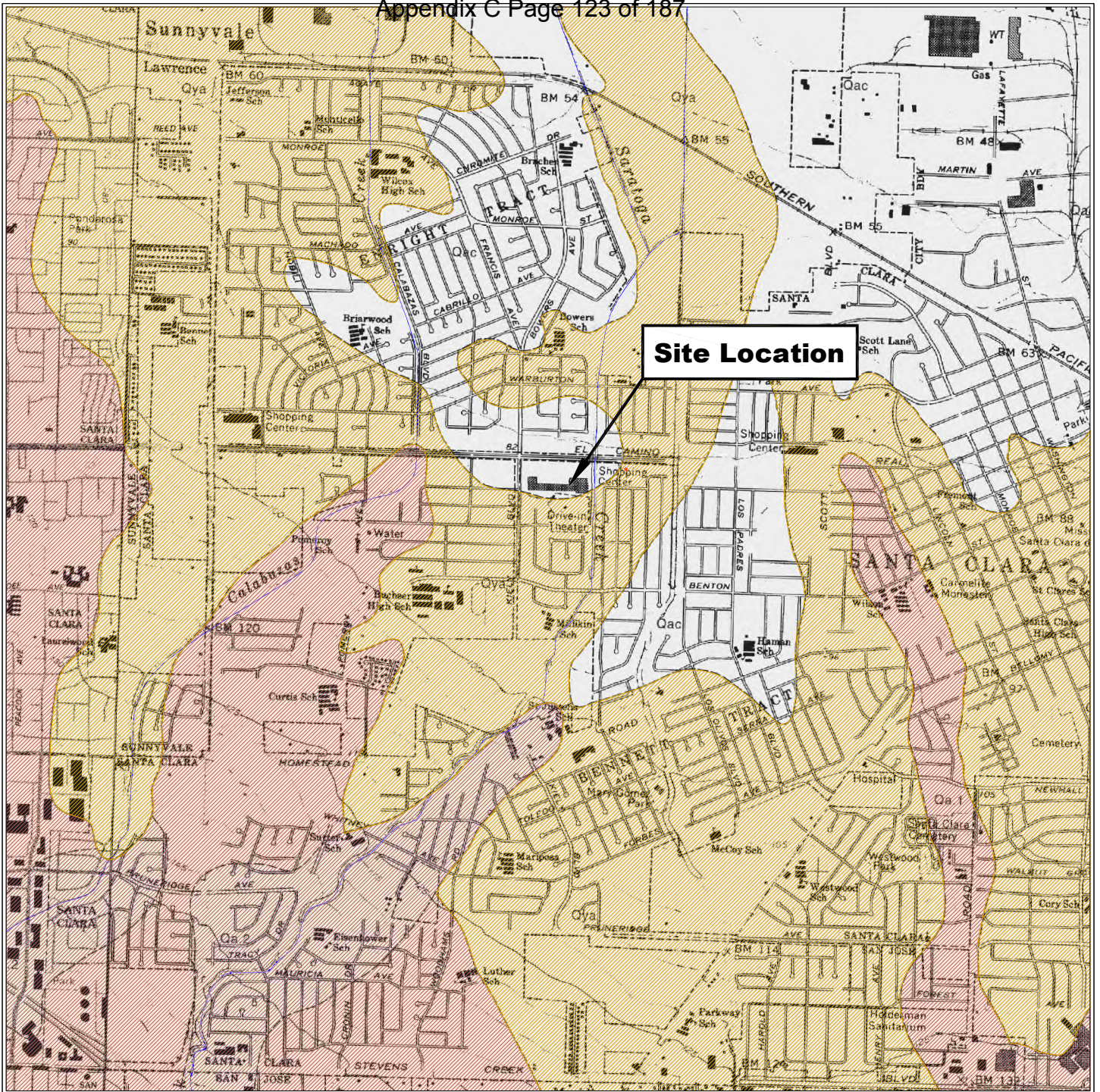
2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

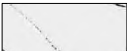


Figure 3





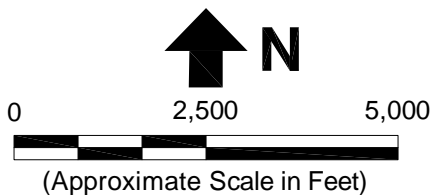


**Legend:**

-  Intra-Fan Area
-  Distal Alluvial-Fan
-  Upper Alluvial-Fan

**Notes:**

1. All locations are approximate.
2. Basemap source: Dibblee 2007.



**Erler & Kalinowski, Inc.**

Site Location Relative to  
Surficial Geology

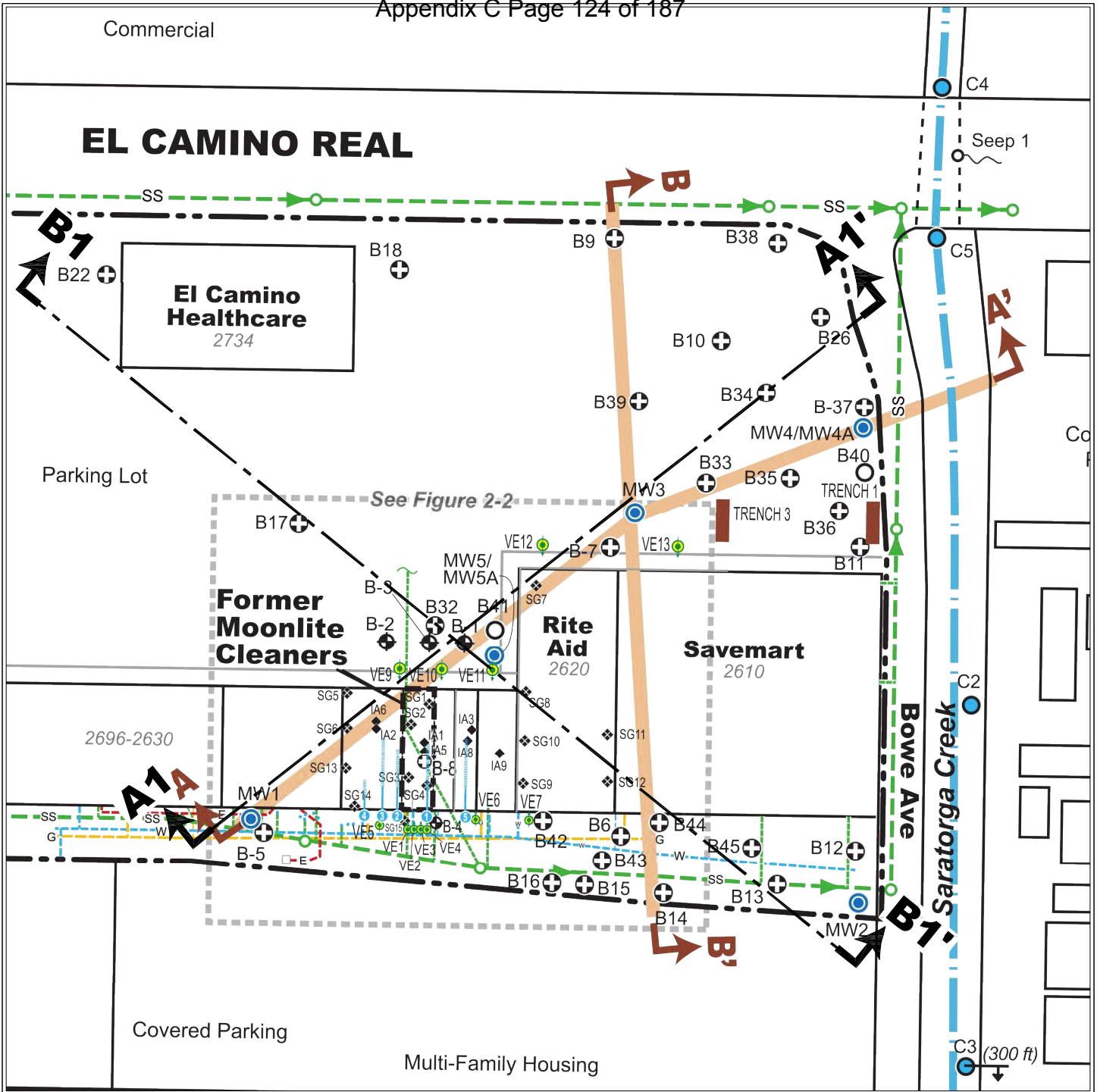
Former Moonlite Cleaners

2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

Figure 4





**EXPLANATION**

- Vertical SVE monitoring well
- Monitoring well location
- Water sample location
- P&D indoor air sample collection location (3/2009)
- Approximate PSI boring location
- P&D groundwater sample location
- P&D soil gas sample location
- P&D vapor well location
- P&D lithologic boring location
- Trench location
- Sub-slab horizontal piping showing slotted interval / ID
- Gas line
- Water line / cleanout
- Sanitary Sewer line / flow direction / manhole
- Electrical line
- Subject property line
- Geologic cross-section locations

**Notes:**

1. All locations are approximate.
2. Basemap source: WEST, Feasibility Study/Pilot Study Work Plan, Dated Sep. 2012.

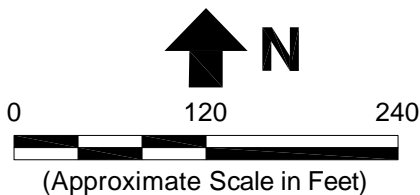
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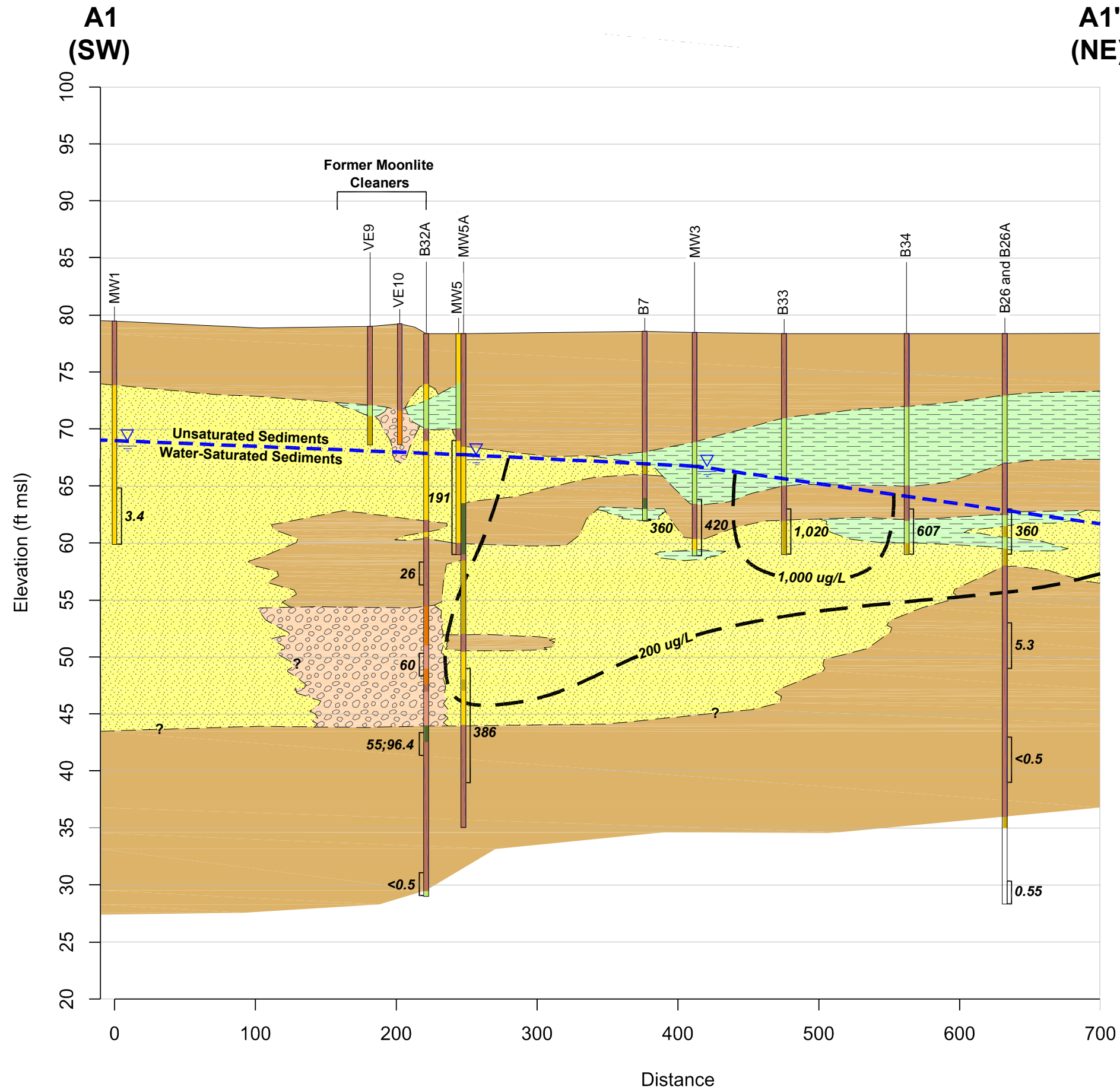
**Site Plan and Cross-Section A1-A1' and B1-B1' Locations**

Former Moonlite Cleaners  
2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

**Figure 5**



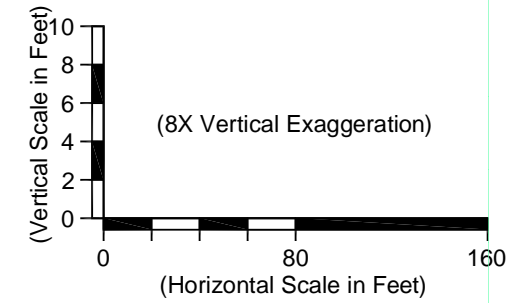
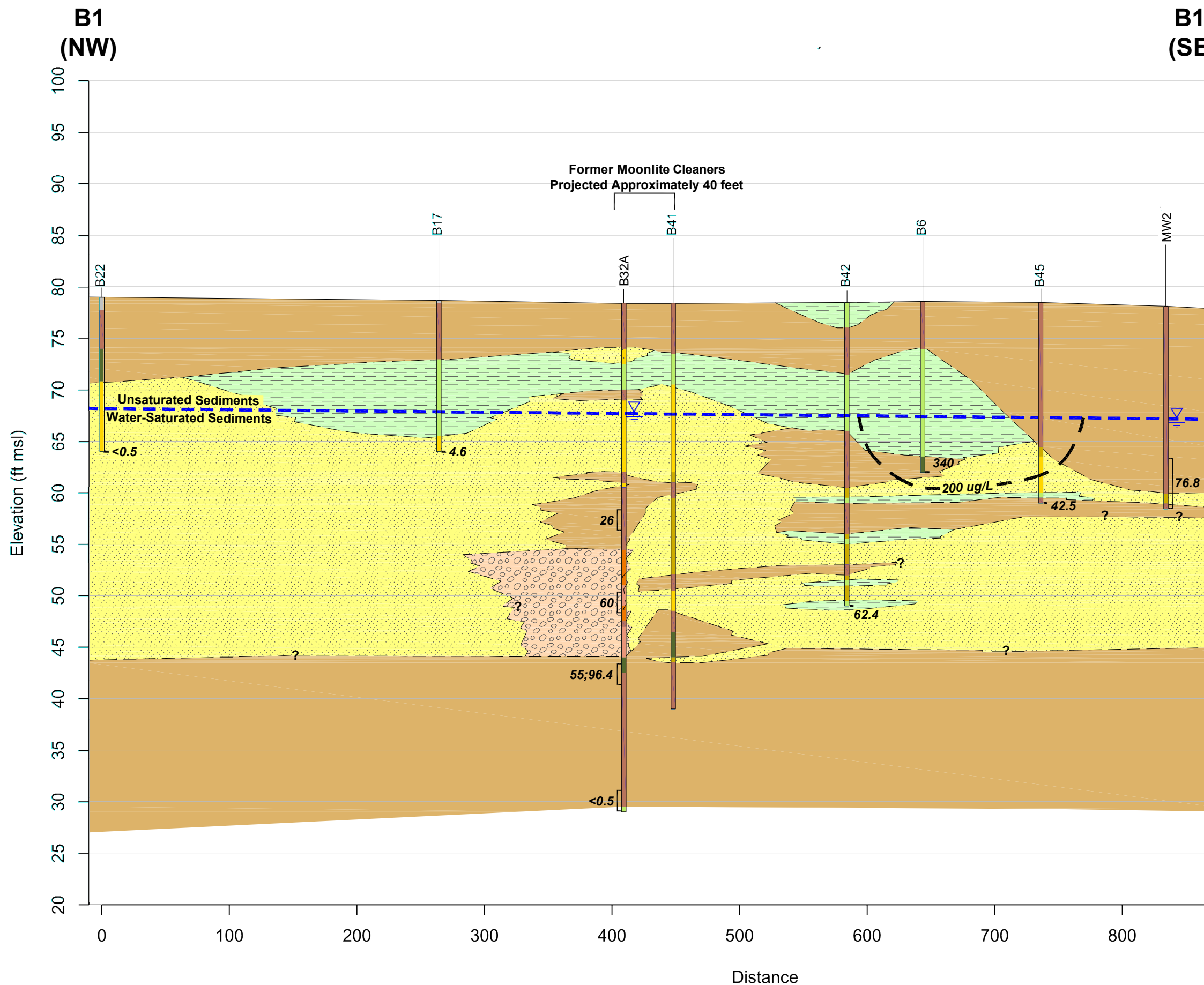


**Erler & Kalinowski, Inc.**

Cross Section A1-A1'

Former Moonlite Cleaners  
 2640 El Camino Real  
 Santa Clara, CA  
 March 2013  
 EKI B10003.00

Figure 6



**Legend:**

**Lithologic Interpretation**

- Clay + Clayey Sand
- Silt
- Sand
- Gravel

**Borehole Lithology (USCS Classification)**

- CL
- ML
- SM
- SW
- SP
- GW
- GC
- SC
- GM

- Approximate Water Table (19 September 2012)
- 200 ug/L PCE Isoconcentration Contour
- 26 PCE Concentration (ug/L)

**Notes:**

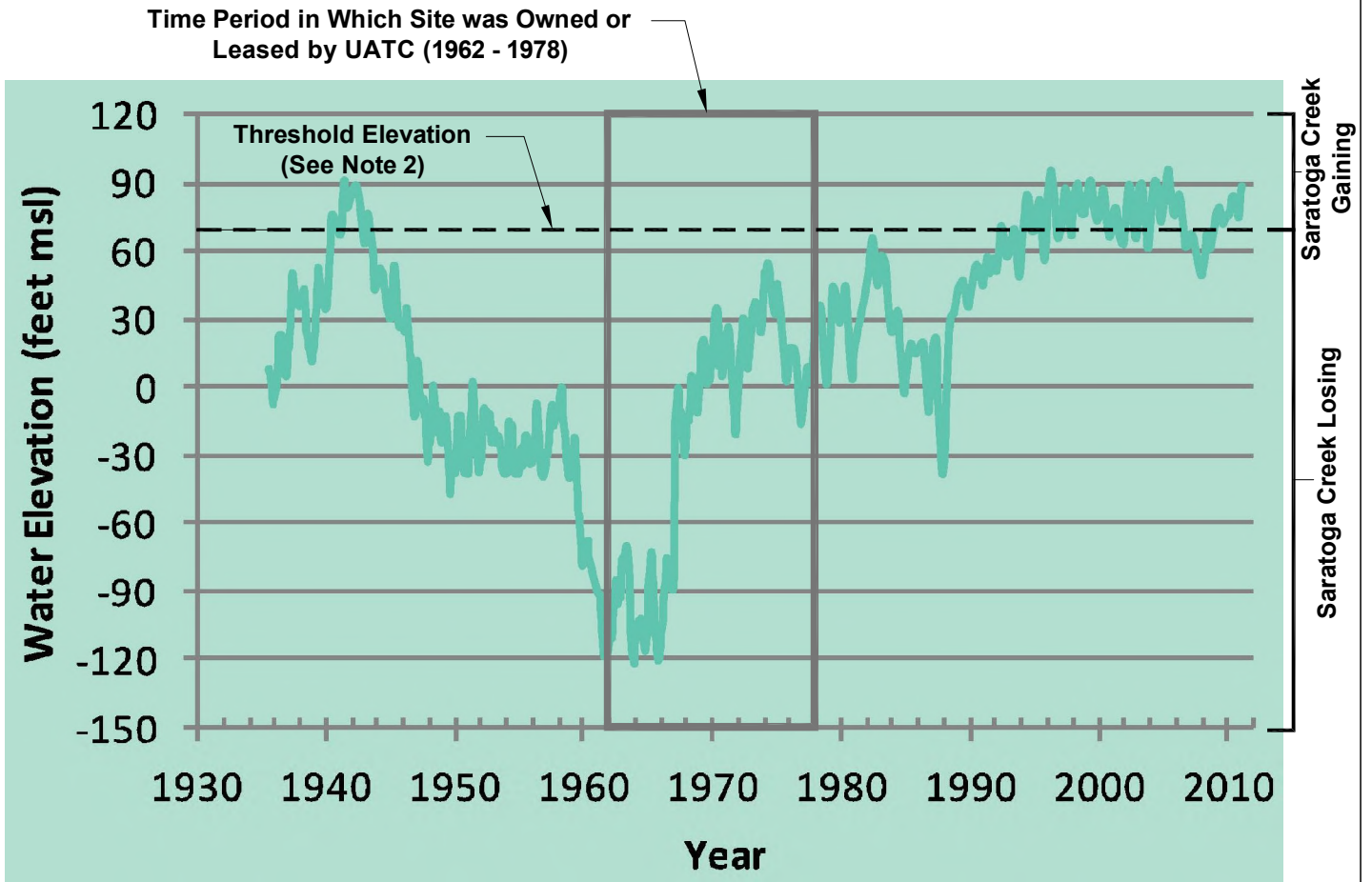
1. All locations are approximate.
2. Units in micrograms per liter (ug/L).
3. Groundwater monitoring well data for MW2 from P&D (2012); grab groundwater data collected 2009-2011 from West (2012).

**Erler & Kalinowski, Inc.**

Cross Section B1-B1'

Former Moonlite Cleaners  
 2640 El Camino Real  
 Santa Clara, CA  
 March 2013  
 EKI B10003.00

Figure 7



**Notes:**

1. Reference: Santa Clara Water District, 2012, 41st Annual Report, FY 2012-13 Protection and Augmentation of Water Supplies, February 2012, Figure 1-2.2.
2. Approximate groundwater elevation threshold above which Saratoga Creek is gaining stream and below which Saratoga Creek is a losing stream in vicinity of Site.

**Erler & Kalinowski, Inc.**

Groundwater Elevations in  
Santa Clara Subbasin Index Well

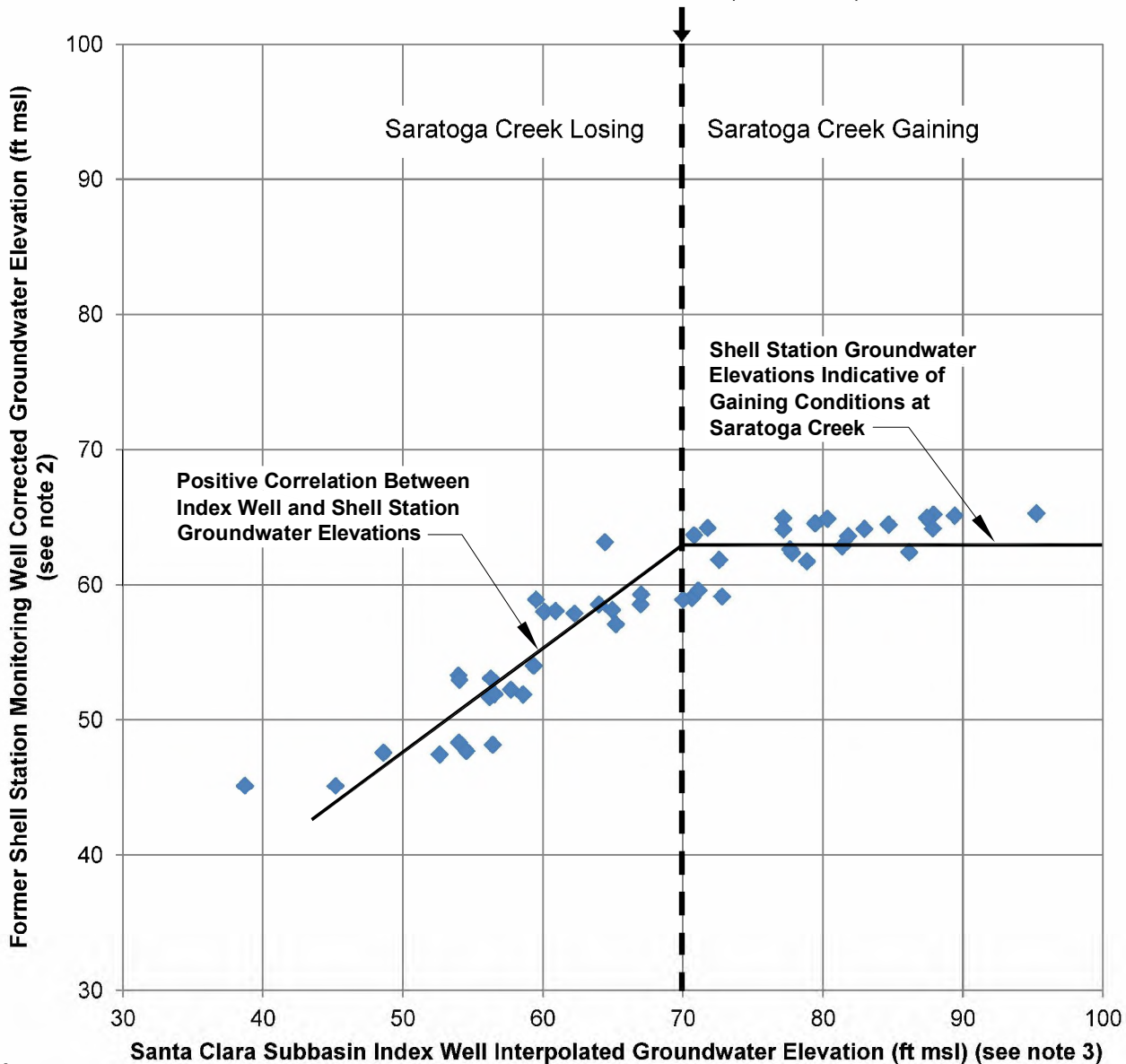
Former Moonlite Cleaners

2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

Figure 8

Threshold Elevation (see note 4)



**Notes:**

1. Groundwater elevation data from 1990 - 2000.
2. Groundwater elevation data from the former Shell Station located at 2540 El Camino Real, Santa Clara, California were adjusted downward by 23 ft to correct for the use of a local vertical datum in the data tables included in the Site Closure Summary report.
3. Santa Clara Subbasin Index Well groundwater elevations are interpolated from the data shown on Figure 8 to the dates when monitoring wells at the former Shell Station were monitored.
4. The threshold elevation is the approximate elevation of groundwater in the Santa Clara Subbasin Index Well below which Saratoga Creek is a losing stream and above which Saratoga Creek is a gaining stream. The elevation is estimated from the break in slope in the data shown on this figure.
5. "ft msl" = feet above mean sea level.

**Erler &  
Kalinowski, Inc.**

Santa Clara Subbasin Index Well Groundwater Elevations  
vs. Groundwater Elevation Data for Shell Service Station  
at 2540 El Camino Real, Santa Clara, CA

2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

Figure 9

**Legend:**

◆ MW-1



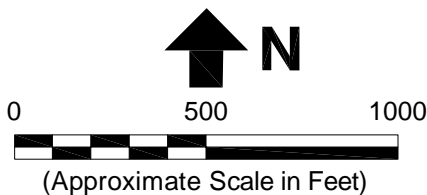


**Legend:**

- 40 - Conceptual Groundwater Elevation Contour when Saratoga Creek is a Losing Stream
- Hypothetical Chemical Plume in Groundwater
- Groundwater Gradient Direction

**Notes:**

1. All locations are approximate.
2. Basemap source: USGS Aerial April 2011.



**Erler & Kalinowski, Inc.**

**Site Relative to Saratoga Creek Under Losing Conditions**

Former Moonlite Cleaners  
 2640 El Camino Real  
 Santa Clara, CA



March 2013  
 EKI B10003.00

**Figure 10**



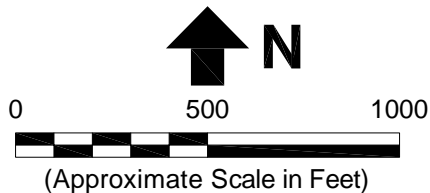


**Legend:**

- 65 - - - - - Conceptual Groundwater Elevation Contour when Saratoga Creek is a Gaining Stream
-  Documented Chemical Plume in Groundwater
-  Groundwater Gradient Direction

**Notes:**

1. All locations are approximate.
2. Basemap source: USGS Aerial April 2011.



**Erler & Kalinowski, Inc.**

Site Relative to Saratoga Creek  
Under Gaining Conditions

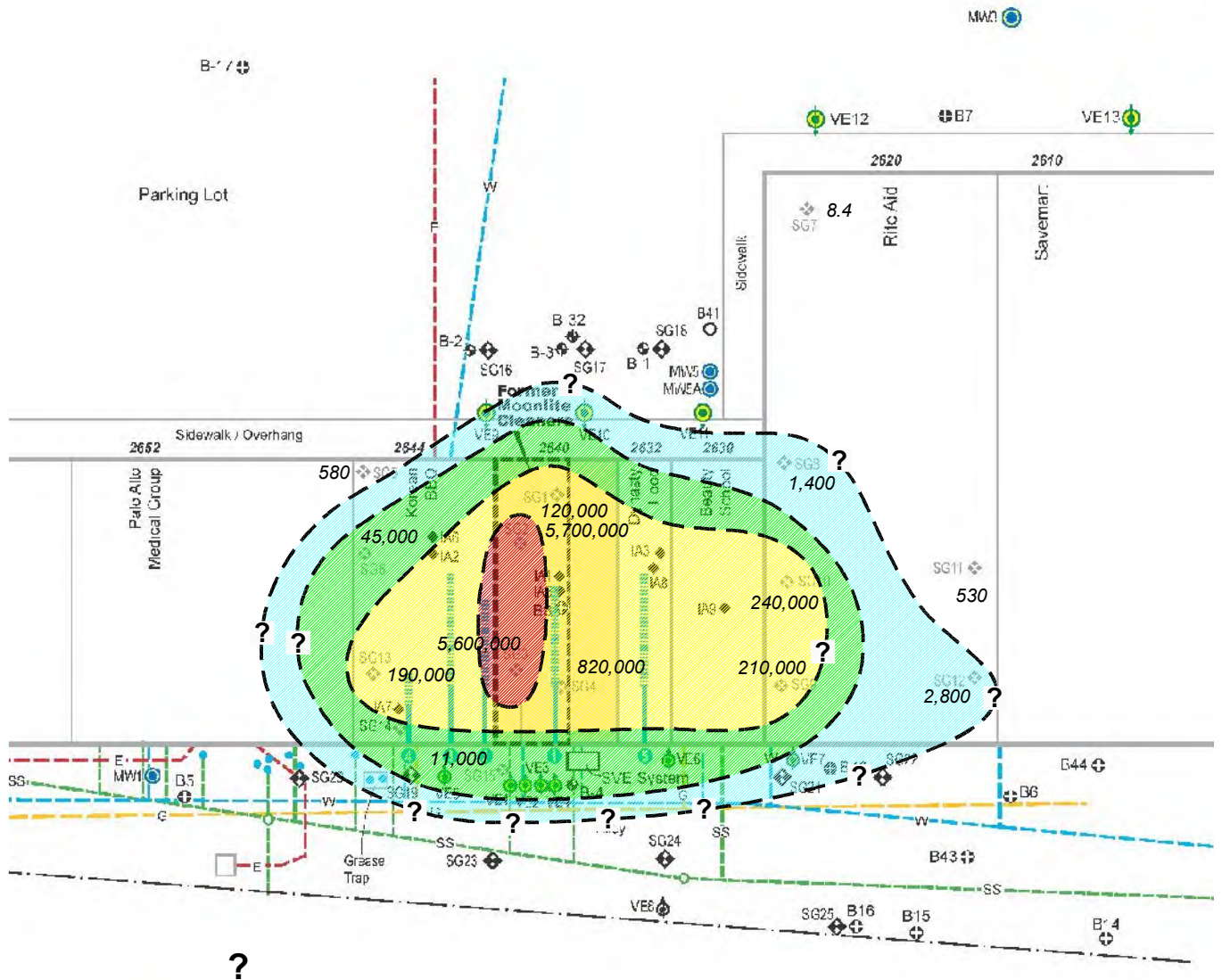
Former Moonlite Cleaners

2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

**Figure 11**





EXPLANATION

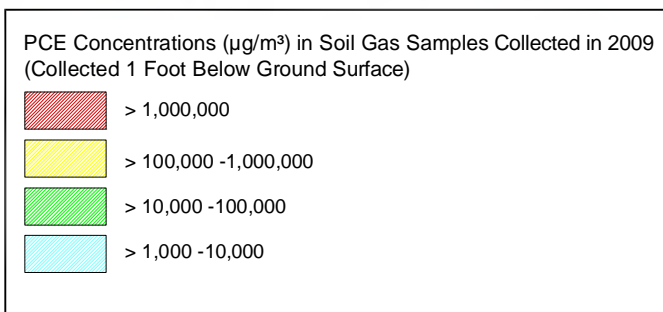
- Vertical SVE monitoring well
- Soil gas sample location
- P&D monitoring well location
- Approximate PSI boring location
- P&D groundwater sample location
- P&D soil gas sample location
- P&D indoor air sample collection location
- Sub-slab horizontal piping showing slotted interval / ID
- Property line
- Gas line
- Water line / cleanout
- Sanitary Sewer line / manhole
- Electrical line

Notes:

1. All locations are approximate.

Source:

Base Map Source: West, *Feasibility Study/Pilot Study Work Plan* (2012).



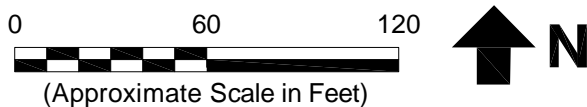
# Erler & Kalinowski, Inc.

## PCE Concentrations in Shallow Soil Gas Samples

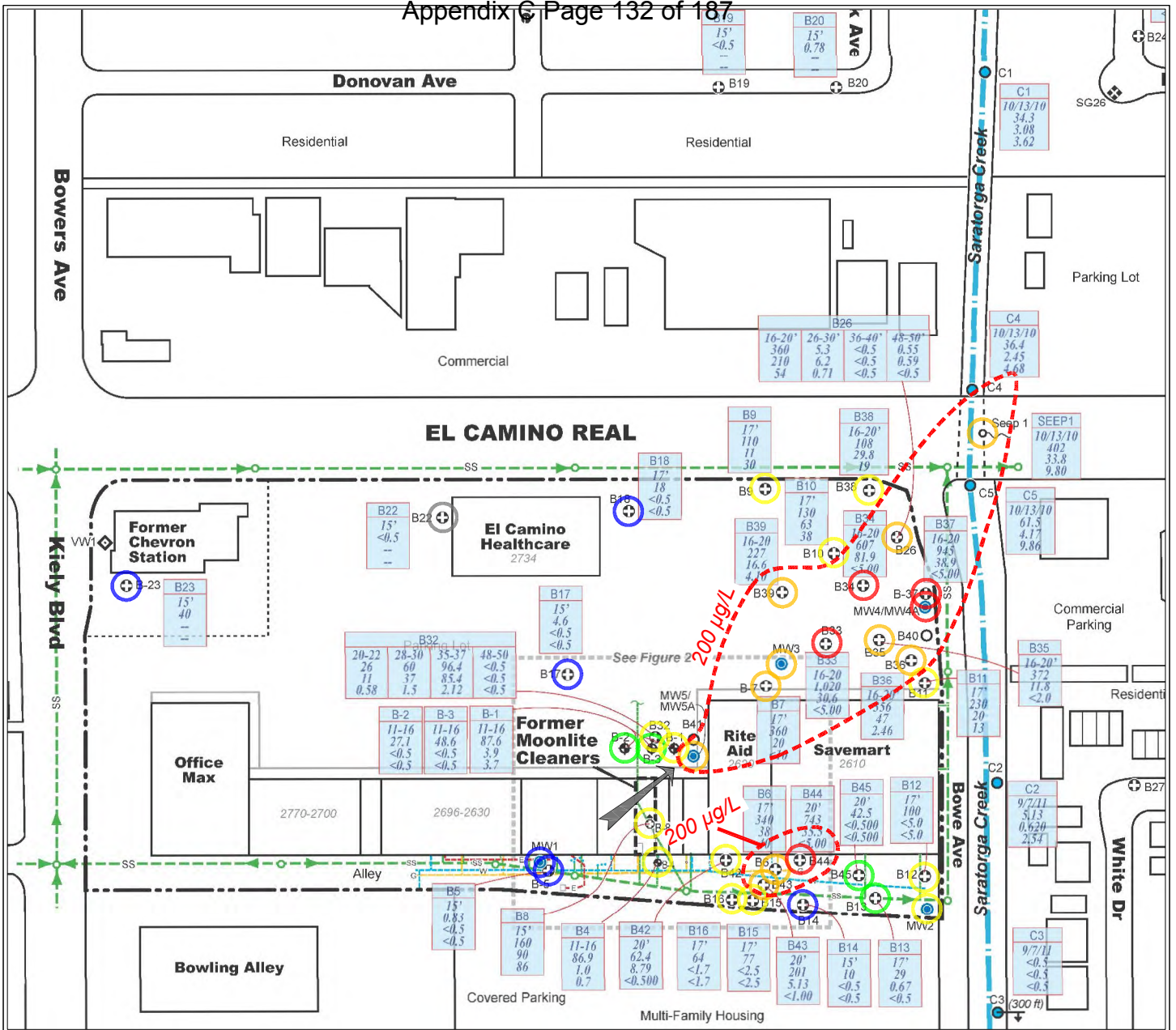
Former Moonlite Cleaners  
2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

Figure 12







**EXPLANATION**

- Monitoring well location
- Water sample location
- Approximate PSI boring location
- P&D groundwater sample location
- P&D vapor well location
- P&D lithologic boring location
- G Gas line
- w Water line / cleanout
- SS Sanitary Sewer line / flow direction / manhole
- E Electrical line
- Subject property line

Approximate Lateral Extent of PCE in Groundwater at 200 µg/L and Above

Groundwater Gradient Direction (2012)

PCE Concentrations (µg/L) in Groundwater

- > 500
- > 200 - 500
- > 50 - 200
- 20 - 50
- 0.05 - 20
- < 0.05

B13	Sample ID
18'	Depth (feet)
<0.5	PCE (µg/l)
<0.5	TCE (µg/l)
<0.5	DCE (µg/l)

**Notes:**

1. All locations are approximate.

**Source:**

Base Map Source: West, *Feasibility Study/Pilot Study Work Plan* (2012). P&D Environmental, *Quarterly Monitoring Report, Third Quarter 2012* (2012).

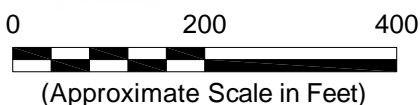
**Erler & Kalinowski, Inc.**

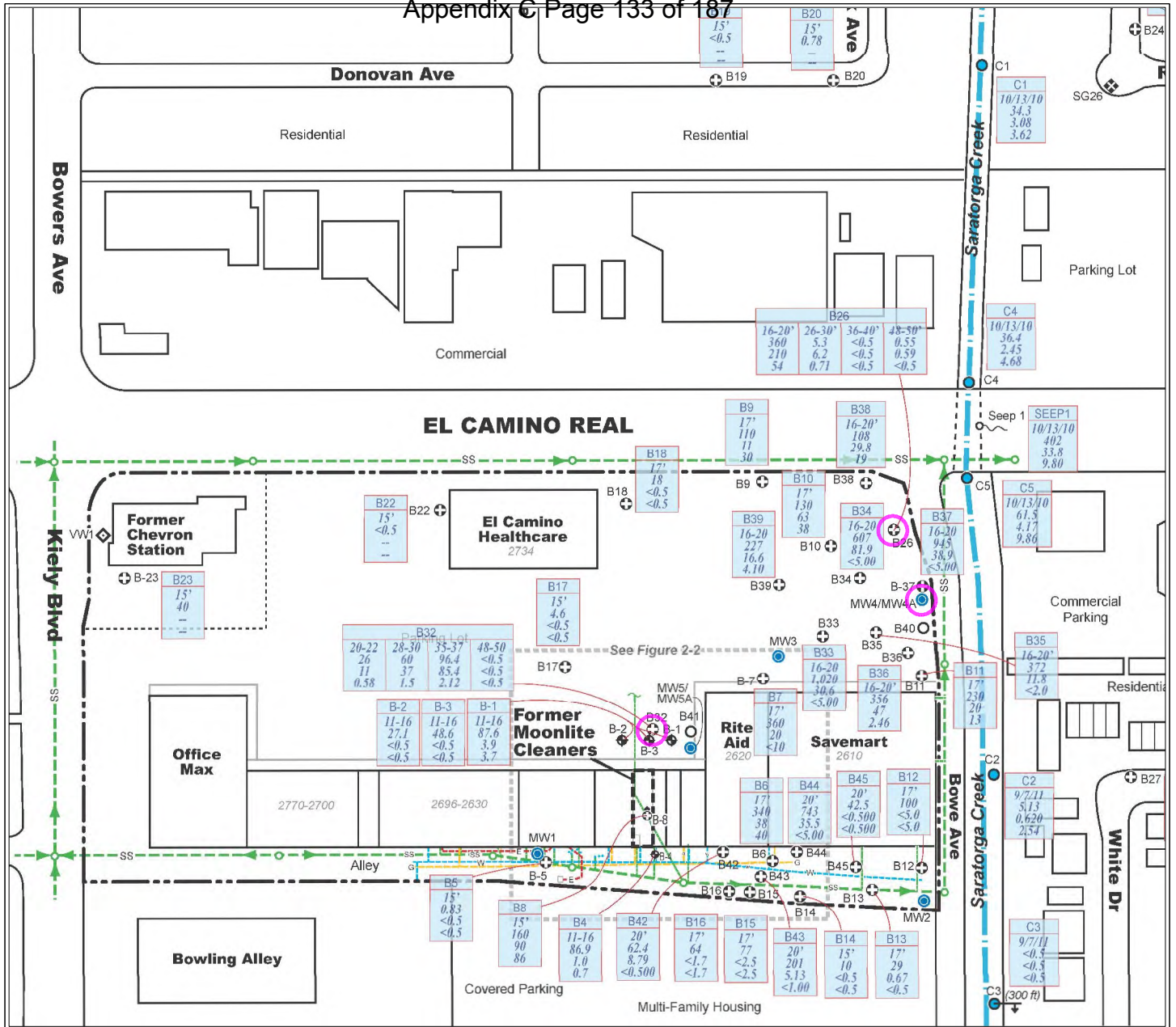
**Approximate Extent of PCE in Groundwater and Groundwater Gradient Direction**

Former Moonlite Cleaners  
2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

**Figure 13**





**EXPLANATION**

- Monitoring well location
- Water sample location
- Approximate PSI boring location
- P&D groundwater sample location
- P&D vapor well location
- P&D lithologic boring location
- G Gas line
- W Water line / cleanout
- SS Sanitary Sewer line / flow direction / manhole
- E Electrical line
- Subject property line

Sample >= 50' Below Ground Surface

**Notes:**

1. All locations are approximate.

**Source:**

Base Map Source: West, *Feasibility Study/Pilot Study Work Plan* (2012). P&D Environmental, *Quarterly Monitoring Report, Third Quarter 2012* (2012).

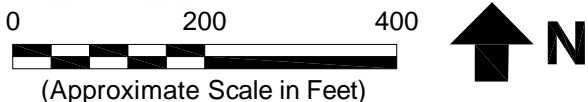
**Erler & Kalinowski, Inc.**

**Approximate Location of Deep Groundwater Samples ~50 Feet Below Ground Surface**

Former Moonlite Cleaners  
2640 El Camino Real  
Santa Clara, CA

March 2013  
EKI B10003.00

**Figure 14**



## ATTACHMENT A

Analysis of Gradient Direction 1990 – 2000  
Former Shell Service Station, 2540 El Camino Real, Santa Clara, CA

EKI evaluated groundwater gradients in the vicinity of the property located at 2640 El Camino Real in Santa Clara, California (the “subject property” or “Site”) during the 1990s by examining groundwater levels measured at a corollary site located on the opposite side of Saratoga Creek at approximately the same distance. The corollary site, the former Shell Service Station site located at 2540 El Camino Real in Santa Clara, CA, had a network of groundwater monitoring wells from which depth-to-water (“DTW”) measurements were collected on a roughly quarterly basis from September 1990 through January 2000. To evaluate groundwater gradient direction at that site, DTW data from three of the monitoring wells, those which had the longest period of record (wells MW-1, MW-2, and MW-3) and a favorable geometry for gradient determination, were analyzed.

The first step in the analysis was to convert the DTW data into groundwater elevation data. Although measuring point (i.e., top of casing) elevations for each well were given in the data table included in the Site Closure Summary report, it appears that a local vertical datum was used rather than a datum corresponding to mean sea level. Therefore, an adjustment of -23 feet was applied to the measuring point elevations to make them more consistent with ground surface elevations for the site (approximately 77 ft above mean sea level) determined from the USGS topographic map. The adjustment was applied equally to all three wells.<sup>5</sup> The adjusted measuring point elevations were used along with the DTW data to calculate groundwater elevations for each well on each measurement date. Groundwater gradient directions and magnitude were then calculated using the 3-point method.

Results from the analysis indicate that the groundwater gradient direction in the early 1990s was typically to the northeast on the east side of Saratoga Creek. Over the course of the decade, the direction shifted counterclockwise. By the end of the decade the gradient direction was approximately north-northwesterly. The total angular shift from 1990 to 2000 was approximately 60 degrees (see Table A-1, at back of Attachment A).

Table A-1: Calculation of Groundwater Gradients Based on Depth-To-Water Data from the Former Shell Service Station Located at 2540 El Camino Real, Santa Clara, CA

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<sup>5</sup> Note that this adjustment did not affect the gradient direction analysis in any way. However, it did allow comparison of groundwater elevation data from the former Shell Service Station to nearby features such as the bottom elevation of the Saratoga Creek streambed as discussed in Section 4.

**TABLE A-1**  
**CALCULATION OF GROUNDWATER GRADIENTS BASED ON DEPTH-TO-WATER DATA**  
**FROM THE FORMER SHELL SERVICE STATION LOCATED AT 2540 EL CAMINO REAL, SANTA CLARA, CA**  
Former Moonlite Cleaners  
Santa Clara, California

Date	Former Shell Station Monitoring Well Groundwater Elevation (ft msl) (a)			Gradient Direction (deg) (b), (c)	Gradient Magnitude (%) (b)
	MW-1	MW-2	MW-3		
9/21/1990	68.13	68.08	68.1	78.5	0.10%
12/18/1990	68.12	68.04	68.07	80.3	0.16%
3/25/1991	71.32	71.17	71.21	87.9	0.30%
6/20/1991	71.16	71.12	71.19	12.1	0.15%
8/13/1991	70.7	70.67	70.69	58.9	0.06%
9/18/1991	70.44	70.41	70.45	23.4	0.08%
11/18/1991	70.58	70.53	70.57	49.8	0.10%
2/21/1992	74.66	74.51	73.99	149.2	1.51%
3/25/1992	76.98	76.14	76.21	-80.7	1.85%
5/21/1992	76.26	76.21	76.29	15.5	0.17%
6/17/1992	75.92	75.87	75.94	21.2	0.15%
8/24/1992	75.2	75.15	75.22	21.2	0.15%
9/24/1992	74.85	74.91	74.97	-46.9	0.25%
10/28/1992	74.86	74.81	74.89	15.5	0.17%
12/23/1992	76.03	75.95	76.01	53.1	0.16%
2/16/1993	80.1	80	80.09	43.5	0.21%
4/11/1993	82.15	82.1	82.05	133.1	0.21%
6/10/1993	82.04	81.95	82.06	27.6	0.23%
6/28/1993	81.92	81.87	81.83	129.7	0.19%
8/10/1993	81.16	81.11	81.17	28.5	0.13%
9/23/1993	81.03	80.97	81.05	23.4	0.17%
11/17/1993	80.9	81.87	81.23	-120.6	1.90%
12/21/1993	81.56	81.49	81.58	25.1	0.19%
2/4/1994	81.56	81.51	81.53	78.5	0.10%
5/2/1994	82.59	82.5	82.56	58.9	0.18%
6/21/1994	82.3	82.27	82.41	-9.3	0.32%
8/5/1994	81.92	81.86	81.96	13.9	0.21%
11/3/1994	81.08	81.09	81.07	-172.4	0.04%
2/16/1995	84.74	84.69	84.51	149.5	0.52%
5/4/1995	85.42	85.75	85.81	-67.8	0.85%
8/1/1995	85.36	85.47	85.21	-177.2	0.55%
11/2/1995	84.85	84.7	84.87	31.4	0.37%
1/26/1996	85.64	85.59	85.67	15.5	0.17%
5/2/1996	86.6	86.57	86.69	-7.4	0.27%
8/9/1996	86.16	86.05	86.25	10.7	0.41%
11/15/1996	85.84	85.28	85.93	30.1	1.40%
2/13/1997	88.26	87.65	88.49	21.9	1.76%
5/27/1997	87.45	87.52	87.44	-149.1	0.17%
8/15/1997	87.21	87.08	87.28	17.1	0.41%
10/31/1997	86.69	86.62	86.8	0.7	0.38%
1/30/1998	87.88	88.2	88.16	96.9	0.69%
5/4/1998	88.19	88.22	88.59	-23.3	0.96%
8/6/1998	87.91	87.89	88.32	-17.8	1.04%
10/30/1998	87.09	87.01	87.22	0.2	0.45%
2/16/1999	88.1	88.16	88.31	-34.2	0.46%
5/5/1999	87.94	87.85	88	13.9	0.31%
8/6/1999	87.54	87.46	87.82	-8.9	0.81%
11/2/1999	87.13	87.09	87.41	-14.0	0.75%
1/2/2000	87.17	87.09	87.22	14.9	0.27%



**TABLE A-1**  
**CALCULATION OF GROUNDWATER GRADIENTS BASED ON DEPTH-TO-WATER DATA**  
**FROM THE FORMER SHELL SERVICE STATION LOCATED AT 2540 EL CAMINO REAL, SANTA CLARA, CA**  
Former Moonlite Cleaners  
Santa Clara, California

**Abbreviations:**

deg	degrees
ft msl	feet above mean sea level
SCVWD	Santa Clara Valley Water District

**Notes:**

(a) The groundwater elevations for the three monitoring wells at the former Shell Service Station (MW-1, MW-2, and MW-3) were calculated based on the measuring point elevations and depth-to-water measurements shown in the Table "Well Concentrations" in the Site Closure Report for the former Shell Station site (SCVWD, 2001). All groundwater elevation data were adjusted by -23 feet to account for the use of a local datum in the measuring point elevation rather than a ft msl datum. Monitoring well coordinates were determined from the figure "Offsite Plot Plan" in the Site Closure Report.

(b) Groundwater gradients were calculated using the 3-point method.

(c) Gradient directions, in degrees, are based on the following assignments to cardinal directions: North = 0, West = -90, East = 90, South = +/-180.

## ATTACHMENT B

## Summary of Unsaturated Flow and Transport Travel Time Analysis

In order to estimate the time that it would take a release of contaminated water to travel through the unsaturated zone and reach the groundwater table at the property located at 2640 El Camino Real in Santa Clara, California (the “subject property” or “Site”), an analysis of steady-state unsaturated flow and advective solute transport with retardation was performed. The analysis involved the following steps:

- 1) Determining a representative soil profile for the unsaturated zone region of interest, which extends from 5 ft bgs (i.e., the depth of the hypothetical leaking sewer pipe) to the bottom of the coarse (sand) soils at approximately 33.5 to 35 ft bgs;
- 2) Estimating a representative or reasonable value for the rate of leakage from the hypothetical leaking sewer pipe;
- 3) Determining the maximum steady-state vertical flow rate through the soil profile which is equivalent to the saturated hydraulic conductivity of the least permeable soil in the profile;
- 4) Setting the vertical flux rate to be the lesser of the rates determined in Steps 2 and 3;
- 5) Determining the water content of each soil type within the profile at the specified vertical flux rate through use of the van Genuchten (1980) equation for unsaturated soil water retention and conductivity;
- 6) Calculating the advective velocity of water through each soil type at the water content determined in Step 5;
- 7) Calculating a Retardation Factor for each soil based on the water content, bulk density, and partitioning coefficient for the contaminant of concern (“COC”);
- 8) Calculating the advective velocity of the dissolved COC based on the advective velocity of water divided by the Retardation Factor;
- 9) Calculating the time required for the COC to travel through each layer based on the advective solute velocity and the layer thickness; and
- 10) Calculating the total transport time as the sum of the transport times through each individual layer within the soil profile.

Details of each step are provided in the paragraphs below.

### Step 1

The representative soil profile was determined from the borehole logs for boreholes B32, B42, and MW5a. Boreholes B32 and MW5a were 50 and 44 ft deep, respectively, and so encompassed the entire unsaturated zone region of interest. Borehole B42 only extended to 30 ft bgs, and therefore it was assumed for this analysis, based on the conceptual cross section shown on Figure 6, that the soil type from 30 to 31 ft bgs was a silt and from 31 to 33.5 ft bgs was a sand.

Step 2

A representative or reasonable value for the rate of leakage from the hypothetical leaking sewer pipe is estimated based on the lower end of the range given in USEPA (1989b) for older vitrified clay pipes in northern California. The range given in USEPA (1989b) is 2,400 to 8,300 gallons per day per inch diameter per mile, and therefore the value assumed herein is, to be conservative, the lower end of the range – 2,400 gallons per day per inch diameter per mile, which translates to approximately 18 feet per year assuming the leakage spreads over a width of 10 feet. Obviously, when subsurface soils are unable to transmit water at this rate, the water will spread out to greater widths until the increased area is capable of transmitting this flux.

Step 3

The maximum steady-state vertical flow rate was determined to be 5.76 ft/year, based on the limiting hydraulic conductivity of the silty clay soil layers. Saturated hydraulic conductivity values for each soil type were based on the values in Carsel and Parrish (1988).

Step 4

The vertical flux rate is the lesser of the two rates determined in Steps 2 and 3, namely 5.76 ft/yr. Because the vertical flux rate turns out to be limited by the hydraulic conductivity of the silty clay soils, from Step 3, it does not matter that the lower end of the leakage rate range was used in Step 2.

Step 5

The water content of each soil type within the soil profile at the steady-state flux rate from Step 4 is determined using the van Genuchten (1980) equations. For the silty clay layers which are limiting in terms of the vertical flux rate, the water content is equal to the saturated water content. For all other soil types, the water content is unsaturated to some extent.

Step 6

The advective velocity of water through the soil type at the water content calculated from Step 5 is calculated using Darcy's Law as follows:

$$v_{water} = \frac{Qi}{\theta}$$

where  $v_{water}$  is the advective velocity of the water,  $Q$  is the vertical flux rate,  $i$  is the hydraulic gradient (equal to 1 in the case of vertical unsaturated steady-state flow), and  $\theta$  is the water content.

Step 7

The Retardation Factor for each soil type is calculated as follows:

$$R = 1 + \frac{\rho_b}{\theta} K_d$$

where  $R$  is the Retardation Factor,  $\rho_b$  is the bulk density, and  $K_d$  is the soil-water partitioning coefficient. For this analysis,  $K_d$  was assumed to equal 0.590 L/kg based on observed plume travel distance (discussed further in Attachment C), and  $\rho_b$  was calculated from the Carsel and Parrish (1988) saturated water content value and an assumed particle density of 2.65 g/cm<sup>3</sup>.

### Step 8

The advective velocity of the retarded solute is calculated as follows:

$$v_{solute} = \frac{v_{water}}{R}$$

where  $v_{solute}$  is the advective velocity of the retarded solute.

### Step 9

The time required for the COC to travel through each layer is calculated as follows:

$$t_{layer} = \frac{z_{layer}}{v_{solute}}$$

where  $t_{layer}$  is the time required and  $z_{layer}$  is the layer thickness.

### Step 10

The total time required for the COC, i.e., PCE, to travel through the soil profile is calculated as the sum of the travel times through each layer in the profile.

## Results

Results of the analysis are presented in Table B-1. As shown on Table B-1 (at back of Attachment B), the time required for PCE to travel through the 5 to 35 ft bgs portion of the B32 soil profile is approximately 5.9 years. In the B42 soil profile, the required travel time through the 5 to 33.5 ft bgs portion is approximately 6.1 years. In the MW5a profile, the required travel time through the 5 to 35 ft bgs portion is approximately 5.7 years.

To provide an estimate of uncertainty in the travel time estimates, two single-parameter sensitivity analyses were performed. The first parameter that was adjusted for the sensitivity analysis was the saturated hydraulic conductivity, as that parameter is arguably the one with the greatest variability. The values of saturated hydraulic conductivity for each soil type were adjusted upwards and downwards by 20 percent from the original, “base case” values (i.e., the values shown in Table B-1, upon which the above travel time estimates are based). Because the vertical flux rate is limited by the minimum saturated hydraulic conductivity (see Step 4), the flux rate was also adjusted. The water content within each soil type is also dependent on the steady-state flux rate (see Step 5); however, the difference in water content between the different steady-state flux rates is negligible, and therefore the base case water content values were used in all cases. Table B-2 below shows the effect of those adjustments on the calculated travel times for the B32, B42, and MW5a soil profiles.



Table B-2. Sensitivity of Estimated Travel Time to Saturated Hydraulic Conductivity

<b>Saturated Hydraulic Conductivity Relative to Base Case</b>	<b>Estimated Travel Time for B32 Soil Profile (years)</b>	<b>Estimated Travel Time for B42 Soil Profile (years)</b>	<b>Estimated Travel Time for MW5a Soil Profile (years)</b>	<b>Average Estimated Travel Time (years)</b>	<b>Percent Difference from Base Case</b>
20 Percent Lower	7.4	7.6	7.1	7.4	+25%
Base Case	5.9	6.1	5.7	5.9	-
20 Percent Higher	4.9	5.1	4.8	4.9	-17%

As shown in Table B-2, the estimated travel time is slightly more sensitive to downwards adjustments to the soils' hydraulic conductivity than to upwards adjustments. It should be noted that, while the hydraulic conductivity of any particular soil type is subject to some uncertainty, it is unlikely that every soil within the profiles would be uniformly lower (or higher) than the base case values, and therefore the range of travel time estimates shown in Table B-2 is likely inclusive of all probable scenarios.

A second single-parameter sensitivity analysis was performed to investigate the effect of solute retardation on travel time. For this analysis, the value of the partitioning coefficient was adjusted upwards and downwards by 20 percent. Results from that sensitivity analysis are presented in Table B-3 below.

Table B-3. Sensitivity of Estimated Travel Time to Partitioning Coefficient

<b>Partitioning Coefficient Relative to Base Case</b>	<b>Estimated Travel Time for B32 Soil Profile (years)</b>	<b>Estimated Travel Time for B42 Soil Profile (years)</b>	<b>Estimated Travel Time for MW5a Soil Profile (years)</b>	<b>Average Estimated Travel Time (years)</b>	<b>Percent Difference from Base Case</b>
20 Percent Lower	4.9	5.2	4.8	5.0	-15%
Base Case	5.9	6.1	5.7	5.9	-
20 Percent Higher	6.9	7.0	6.7	6.9	+17%

The results shown in Table B-3 indicate that the travel time is somewhat less sensitive to changes in the partitioning coefficient than it is to changes in the saturated hydraulic conductivity.

If the hydraulic conductivity values and the partitioning coefficient values are adjusted simultaneously towards the ends of their ranges that produce shorter travel times (i.e., higher hydraulic conductivity and lower partition coefficient), the resulting travel times range from 4.0 to 4.3 years. If these parameters are adjusted simultaneously towards the ends of their ranges that produce longer travel times (i.e., lower hydraulic conductivity and higher partitioning coefficient), the resulting travel times range from 8.3 to 8.8 years.

Table B-1: Calculation of Unsaturated Flow and Transport Travel Time

**TABLE B-1**  
**CALCULATION OF UNSATURATED FLOW AND TRANSPORT TRAVEL TIME**  
 Former Moonlite Cleaners  
 Santa Clara, California

**Borehole B32**

Top of Interval (ft bgs)	Bottom of Interval (ft bgs)	Interval Thickness (ft)	Top of Interval (m bgs)	Bottom of Interval (m bgs)	Interval Thickness (m)	Top of Interval (m below sewer pipe) (a)	Bottom of Interval (m below sewer pipe) (a)	USCS Code in Log	Soil Description in Log	Corresponding Carseil and Parrish (1988) Texture	Carseil and Parrish (1988) Unsaturated Hydraulic Property Data					Saturated Hydraulic Conductivity (m/day)	Bulk Density (g/cm <sup>3</sup> ) (b)	Water Content at Maximum Flux Rate (-) (c)	Water Travel Time Through Layer at Maximum Flux Rate (days)	Retardation Factor (-)	Solute Travel Time Through Layer at Maximum Flux Rate (days)	
											Saturated Water Content (-)	Residual Water Content (-)	van Genuchten Alpha (1/m)	van Genuchten Beta ("n") (-)	van Genuchten "m" (-)							
0	5	5	0.00	1.52	1.52	-1.52	0.00	CL	silty clay	silty clay	0.36	0.07	0.5	1.09	0.0826	5.56E-08	4.80E-03	1.696	0.36	114	3.78	432
5	6.5	1.5	1.52	1.98	0.46	0.00	0.46	SW	gravelly sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	11	8.89	96
6.5	9	2.5	1.98	2.74	0.76	0.46	1.22	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	67	2.99	201
9	10	1	2.74	3.05	0.30	1.22	1.52	CL	clay	clay	0.38	0.068	0.8	1.09	0.0826	5.56E-07	4.80E-02	1.643	0.38	24	3.55	86
10	15	5	3.05	4.57	1.52	1.52	3.05	SW	gravelly sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	36	8.89	319
15	16	1	4.57	4.88	0.30	3.05	3.35	SP	fine sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	7	8.89	64
16	17	1	4.88	5.18	0.30	3.35	3.66	SW	gravelly sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	7	8.89	64
17	18	1	5.18	5.49	0.30	3.66	3.96	CL	silty clay	silty clay	0.36	0.07	0.5	1.09	0.0826	5.56E-08	4.80E-03	1.696	0.36	23	3.78	86
18	18.5	0.5	5.49	5.64	0.15	3.96	4.11	SP	fine sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	4	8.89	32
18.5	20	1.5	5.64	6.10	0.46	4.11	4.57	CL	silty clay	silty clay	0.36	0.07	0.5	1.09	0.0826	5.56E-08	4.80E-03	1.696	0.36	34	3.78	129
20	24.5	4.5	6.10	7.47	1.37	4.57	5.94	CL	silty clay	silty clay	0.36	0.07	0.5	1.09	0.0826	5.56E-08	4.80E-03	1.696	0.36	103	3.78	388
24.5	28	3.5	7.47	8.53	1.07	5.94	7.01	GW	sandy gravel	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	25	8.89	223
28	30	2	8.53	9.14	0.61	7.01	7.62	GC	clayey gravel	loamy sand	0.41	0.057	12.4	2.28	0.5614	4.05E-05	3.50E+00	1.5635	0.149	19	7.19	136
30	31.5	1.5	9.14	9.60	0.46	7.62	8.08	GW	sandy gravel	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	11	8.89	96
31.5	32	0.5	9.60	9.75	0.15	8.08	8.23	CL	sandy clay	sandy clay	0.38	0.1	2.7	1.23	0.1870	3.33E-07	2.88E-02	1.643	0.376	12	3.58	43
32	35	3	9.75	10.67	0.91	8.23	9.14	GC	clayey sandy gravel	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	22	8.89	191
35	36.5	1.5	10.67	11.13	0.46	9.14	9.60	SC	clayey sand	loamy sand	0.41	0.057	12.4	2.28	0.5614	4.05E-05	3.50E+00	1.5635	0.149	14	7.19	102
36.5	49.5	13	11.13	15.09	3.96	9.60	13.56	CL	clay	clay	0.38	0.068	0.8	1.09	0.0826	5.56E-07	4.80E-02	1.643	0.38	313	3.55	1,113
49.5	50	0.5	15.09	15.24	0.15	13.56	13.72	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	13	2.99	40
<b>Total Travel Time from 5 ft bgs to 35 ft bgs</b>																		404	days	2,153	days	
																		1.1	years	5.9	years	

**Borehole B42**

Top of Interval (ft bgs)	Bottom of Interval (ft bgs)	Interval Thickness (ft)	Top of Interval (m bgs)	Bottom of Interval (m bgs)	Interval Thickness (m)	Top of Interval (m below sewer pipe) (a)	Bottom of Interval (m below sewer pipe) (a)	USCS Code in Log	Soil Description in Log	Corresponding Carseil and Parrish (1988) Texture	Carseil and Parrish (1988) Unsaturated Hydraulic Property Data					Saturated Hydraulic Conductivity (m/day)	Bulk Density (g/cm <sup>3</sup> ) (b)	Water Content at Maximum Flux Rate (-) (c)	Water Travel Time Through Layer at Maximum Flux Rate (days)	Retardation Factor (-)	Solute Travel Time Through Layer at Maximum Flux Rate (days)		
											Saturated Water Content (-)	Residual Water Content (-)	van Genuchten Alpha (1/m)	van Genuchten Beta ("n") (-)	van Genuchten "m" (-)								
0	0.5	0.5	0.00	0.15	0.15	-1.524	-1.372	-	asphalt/base rock														
0.5	3	2.5	0.15	0.91	0.76	-1.372	-0.610	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	67	2.99	201	
3	7.5	4.5	0.91	2.29	1.37	-0.610	0.762	CL	clay	clay	0.38	0.068	0.8	1.09	0.0826	5.56E-07	4.80E-02	1.643	0.38	108	3.55	385	
7.5	13	5.5	2.29	3.96	1.68	0.762	2.438	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	148	2.99	443	
13	18.5	5.5	3.96	5.64	1.68	2.438	4.115	CL	clay	clay	0.38	0.068	0.8	1.09	0.0826	5.56E-07	4.80E-02	1.643	0.38	133	3.55	471	
18.5	19.5	1	5.64	5.94	0.30	4.115	4.420	SM	silty fine sand	loamy sand	0.41	0.057	12.4	2.28	0.5614	4.05E-05	3.50E+00	1.5635	0.149	9	7.19	68	
19.5	20	0.5	5.94	6.10	0.15	4.420	4.572	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	13	2.99	40	
20	23	3	6.10	7.01	0.91	4.572	5.486	CL	silty clay	silty clay	0.36	0.07	0.5	1.09	0.0826	5.56E-08	4.80E-03	1.696	0.36	69	3.78	259	
23	23.5	0.5	7.01	7.16	0.15	5.486	5.639	SM	silty fine sand	loamy sand	0.41	0.057	12.4	2.28	0.5614	4.05E-05	3.50E+00	1.5635	0.149	5	7.19	34	
23.5	24	0.5	7.16	7.32	0.15	5.639	5.791	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	13	2.99	40	
24	26	2	7.32	7.92	0.61	5.791	6.401	SM	fine sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	14	8.89	127	
26	27	1	7.92	8.23	0.30	6.401	6.706	CL	silty clay	silty clay	0.36	0.07	0.5	1.09	0.0826	5.56E-08	4.80E-03	1.696	0.36	23	3.78	86	
27	27.5	0.5	8.23	8.38	0.15	6.706	6.858	SM	silty fine sand	loamy sand	0.41	0.057	12.4	2.28	0.5614	4.05E-05	3.50E+00	1.5635	0.149	5	7.19	34	
27.5	28	0.5	8.38	8.53	0.15	6.858	7.010	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	13	2.99	40	
28	29.5	1.5	8.53	8.99	0.46	7.010	7.468	SM	fine sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	11	8.89	96	
29.5	30	0.5	8.99	9.14	0.15	7.468	7.620	ML	silt	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	13	2.99	40	
30	31	1	9.14	9.45	0.30	7.620	7.925	(d)	(d)	silt	0.46	0.034	1.6	1.37	0.2701	6.94E-07	6.00E-02	1.431	0.424	27	2.99	80	
31	33.5	2.5	9.45	10.21	0.76	7.925	8.687	(d)	(d)	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	18	8.89	159	
<b>Total Travel Time from 5 ft bgs to 33.5 ft bgs</b>																		575	days	2,233	days		
																		1.6	years	6.1	years		

**TABLE B-1**  
**CALCULATION OF UNSATURATED FLOW AND TRANSPORT TRAVEL TIME**  
 Former Moonlite Cleaners  
 Santa Clara, California

Top of Interval (ft bgs)	Bottom of Interval (ft bgs)	Interval Thickness (ft)	Top of Interval (m bgs)	Bottom of Interval (m bgs)	Interval Thickness (m)	Top of Interval (m below sewer pipe) (a)	Bottom of Interval (m below sewer pipe) (a)	USCS Code in Log	Soil Description in Log	Corresponding Carsel and Parrish (1988) Texture	Carsel and Parrish (1988) Unsaturated Hydraulic Property Data					Saturated Hydraulic Conductivity (m/day)	Bulk Density (g/cm <sup>3</sup> ) (b)	Water Content at Maximum Flux Rate (-) (c)	Water Travel Time Through Layer at Maximum Flux Rate (days)	Retardation Factor (-)	Solute Travel Time Through Layer at Maximum Flux Rate (days)	
											Saturated Water Content (-)	Residual Water Content (-)	van Genuchten Alpha (1/m)	van Genuchten Beta ("n") (-)	van Genuchten "m" (-)							Saturated Hydraulic Conductivity (m/sec)
0	10.5	10.5	0.00	3.20	3.20	-1.524	1.676	CL	clay	clay	0.38	0.068	0.8	1.09	0.0826	5.56E-07	4.80E-02	1.643	0.38	253	3.55	899
10.5	15	4.5	3.20	4.57	1.37	1.676	3.048	SW	gravelly sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	32	8.89	287
15	15.5	0.5	4.57	4.72	0.15	3.048	3.200	SP	fine sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	4	8.89	32
15.5	20	4.5	4.72	6.10	1.37	3.200	4.572	SC	clayey gravelly sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	32	8.89	287
20	20.5	0.5	6.10	6.25	0.15	4.572	4.724	CL	clay	clay	0.38	0.068	0.8	1.09	0.0826	5.56E-07	4.80E-02	1.643	0.38	12	3.55	43
20.5	25.5	5	6.25	7.77	1.52	4.724	6.248	SM	silty gravelly sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	36	8.89	319
25.5	27	1.5	7.77	8.23	0.46	6.248	6.706	SM	silty fine sand	loamy sand	0.41	0.057	12.4	2.28	0.5614	4.05E-05	3.50E+00	1.5635	0.149	14	7.19	102
27	28.5	1.5	8.23	8.69	0.46	6.706	7.163	CL	silty clay	silty clay	0.36	0.07	0.5	1.09	0.0826	5.56E-08	4.80E-03	1.696	0.36	34	3.78	129
28.5	31	2.5	8.69	9.45	0.76	7.163	7.925	SP	gravelly sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	18	8.89	159
31	32	1	9.45	9.75	0.30	7.925	8.230	SM	clayey silty fine sand	loamy sand	0.41	0.057	12.4	2.28	0.5614	4.05E-05	3.50E+00	1.5635	0.149	9	7.19	68
32	35	3	9.75	10.67	0.91	8.230	9.144	SP	sand	sand	0.43	0.045	14.5	2.68	0.6269	8.25E-05	7.13E+00	1.5105	0.113	22	8.89	191
35	44	9	10.67	13.41	2.74	9.144	11.887	CL	clay	clay	0.38	0.068	0.8	1.09	0.0826	5.56E-07	4.80E-02	1.643	0.38	217	3.55	771

Total Travel Time from 5 ft bgs to 35 ft bgs			
346	days	2,087	days
0.9	years	5.7	years

**Abbreviations:**

ft bgs feet below ground surface  
 g/cm<sup>3</sup> grams per cubic centimeter  
 K hydraulic conductivity  
 m bgs meters below ground surface  
 USCS Unified Soil Classification System

**Notes:**

- (a) The sewer pipe is approximately 5 feet below ground surface.
- (b) Bulk density is calculated from the saturated water content and an assumed particle density of 2.65 g/cm<sup>3</sup>.
- (c) The maximum flux rate through the unsaturated zone is equal to the minimum saturated hydraulic conductivity within the soil profile.
- (d) The soil type in borehole B42 from 30 to 31 ft bgs is assumed to be the same as the soil type observed from 29.5 to 30 ft bgs (silt). Below 31 ft bgs, the soil type is assumed to be sand.

## ATTACHMENT C

## Summary of Chemical Transport in Groundwater Calculations

An analysis of the evolution of chemical of concern (“COC”) concentrations in groundwater was performed for the specific scenario of flushing of a COC plume with COC-free water following a shift in groundwater gradient direction. This scenario is based on what would be expected to have occurred if a COC release had occurred at the property located at 2640 El Camino Real in Santa Clara, California (the “subject property” or “Site”) during the period of UATC ownership or tenancy, between 1962 and 1978. Under this scenario, a plume with a northwest orientation would have been created due to the prevailing northwest groundwater gradients. Then, in the mid-1990s, as the groundwater gradient direction shifted to its current northeast direction, the northwest-oriented plume would be subject to flushing by COC-free groundwater flowing from the upgradient (southwest) direction.

To evaluate the scenario described above, the REMCHLOR model (Falta, 2007) was used. REMChlor is a model of advective-diffusive-reactive transport specifically designed for chlorinated solvents such as PCE and its daughter products. The model allows for simulation of the fate of a COC source of a user-specified mass and concentration. The reader is directed to Falta (2007) for more information on the REMChlor model. The model set-up and results for this analysis are described below.

**Model Setup**

This section describes the REMChlor model input parameters. Parameterization was based on site specific data, where available, and on professional judgment otherwise. It should be noted that certain input parameters, or the parameters on which they are based (e.g., hydraulic conductivity, soil-water partitioning coefficient, source zone mass), are inherently uncertain, and therefore results should be considered approximations rather than exact predictions of COC fate and transport processes at the Site.

**Source Parameters**

Source parameters in REMChlor include the source zone concentration (i.e., the flow-averaged concentration of the chemical leaving the source zone); the source zone mass; a parameter,  $\Gamma$ , which controls the rate of change in source zone concentration as source zone mass is depleted; the source zone width and vertical height; the effective porosity; and parameters related to source remediation. For this evaluation, the parameters were set as follows:

- Source zone concentration: 1,000 micrograms per liter (“ug/L”)
- Source zone mass: 4.97 kg, based on the calculated concentration of PCE sorbed to the soil within a 5,400-m<sup>3</sup> source zone (60 m wide x 30 m long x 3 m thick), assuming an aqueous concentration of 1,000 ug/L and a partitioning coefficient of 0.590 L/kg. The source zone dimensions were approximated based on the observed dimensions of the core of the current northeast-trending plume.

- $\Gamma$  parameter: 1, based on the default value; this value results in a linear relationship between the change in source zone mass and source zone concentration. Other values of  $\Gamma$  were used as well, with little effect on the overall results.
- Source zone width: 60 m
- Source zone height: 3 m
- Effective porosity: 0.353, based on the difference between the saturated and residual water content for loamy sand from the Carsel & Parrish (1988) soil property database
- Source remediation: none, i.e., no mechanisms for source zone mass depletion except for flushing

### Transport Parameters

REMChlor uses the concept of one-dimensional streamtubes to model the advection-dispersion transport process. The user specifies a number of streamtubes and the model applies a log-normally distributed velocity field over the streamtube to represent hydrodynamic dispersion. Transport parameters in REMChlor include the Darcy velocity; the Retardation Factor; a parameter,  $\sigma_{\text{mv}}$ , equal to the coefficient of variation for the velocity field, which allows for scale-dependent dispersivity; minimum and maximum normalized streamtube velocities; the number of streamtubes; and the dispersivity in the transverse horizontal and vertical directions. For this evaluation, the parameters were set as follows:

- Darcy velocity: 7.285 m/yr, based on a hydraulic gradient of 0.0057 (from the 3<sup>rd</sup> Quarter 2012 Groundwater Monitoring Report; P&D, 2012) and a hydraulic conductivity of 3.5 m/day, from the Carsel & Parrish (1988) soil properties database
- Retardation factor: 3.611, based on the observed travel distance (375 ft) of the center of mass of the current northeast-trending plume, a travel time of 20 years, and a groundwater velocity of 68 ft/yr, calculated from the Darcy velocity and effective porosity
- $\sigma_{\text{mv}}$ : 0.44721, based on REMChlor guidance and resulting in a longitudinal dispersivity which is 0.1 times the average travel distance
- Minimum normalized streamtube velocity: 0, based on REMChlor
- Maximum normalized streamtube velocity: 3, based on REMChlor guidance
- Number of streamtubes: 100
- Transverse horizontal dispersivity: 1 m
- Transverse vertical dispersivity: 0.1 m

### Simulation Parameters

Simulation parameters in REMChlor include the spatial and temporal discretization. For this analysis the spatial domain was discretized using 2-m intervals in the longitudinal direction, 3-m intervals in the transverse horizontal direction, and had a single layer in the vertical direction. The modeled domain was 300 m in length and 60 m wide. The total simulated time was 50 years with a timestep of 0.25 years.

### Plume Reaction Parameters

For this analysis, the output variable of interest is the total concentration of chlorinated solvent COCs, rather than individual compounds such as PCE. Therefore, in the interest of simplicity, the reaction parameters were set to zero so that no reactions that transform the source zone COC into daughter products occur.

### **Results**

Given that the purpose of this analysis is to assess whether the absence of significant concentrations in the area to the northwest of the Site is evidence that a northwest-trending plume never existed, the results of the REMChlor simulations were evaluated in terms of the maximum total chlorinated solvent concentrations that would be expected to be present following 10, 15, and 20 years of flushing of a northwest-trending plume by COC-free groundwater. Table C-1 below shows the maximum total chlorinated solvent concentrations at 10 years, 15 years, and 20 years along the plume centerline as well as 15 m and 30 m away from the plume centerline.

Table C-1. Simulated Maximum Total Chlorinated Solvent Concentrations

<b>Elapsed Time Since Release</b>	<b>Simulated Maximum Concentration (ug/L)</b>		
	<b>Centerline of Plume Axis</b>	<b>15 m Away from Plume Centerline</b>	<b>30 m Away from Plume Centerline</b>
10 years	227	216	114
15 years	140	126	71
20 years	94	84	49

The REMChlor simulation results shown in Table C-1 above indicate that detectable concentrations of chlorinated solvent COCs would be expected to be present even following 20 years of flushing of the source zone and even at distances of 30 m (approximately 100 ft) away from the plume centerline.

### **References**

- Carsel, R.F., and Parrish, R.S., 1988. *Developing Joint Probability Distributions of Soil Water Retention Characteristics*, Water Resources Research, v. 24, no. 5, p. 755-769.
- Falta, R.W., 2007, *REMChlor Remediation Evaluation Model for Chlorinated Solvents, User's Manual Version 1.0*, 7 September 2007.
- P&D, 2012. *Quarterly Monitoring Report, Third Quarter 2012, Former Moonlite Cleaners, 2640 El Camino Real, Santa Clara, California*, P&D Environmental, Inc., 30 October 2012.

# EXHIBIT E





# Ground Water Issue

## Assessment and Delineation of DNAPL Source Zones at Hazardous Waste Sites

Bernard H. Kueper\* and Kathryn L. Davies\*\*

### 1.0 - Introduction

Groundwater contamination from classes of chemicals such as chlorinated solvents, polychlorinated biphenyls (PCBs), creosote, and coal tar is frequently encountered at hazardous waste sites (40, 43). These types of contaminants have low solubilities in water and have densities greater than that of water. Therefore, they can exist in the subsurface as Dense, Non-Aqueous Phase Liquids (DNAPLs) and have the potential to migrate as a separate liquid phase to significant distances below the water table in both unconsolidated materials and fractured bedrock. Because of the physicochemical properties associated with DNAPLs, they migrate through the subsurface in a very selective and tortuous manner (13, 27, 29). Thus, the majority of DNAPL present in the subsurface may not be found immediately below the entry location and directly encountering DNAPLs with conventional drilling techniques may be difficult.

Determining the presence or absence of a DNAPL is an important component of the conceptual site model and is critical to the proper selection of the remediation approach. Subsurface DNAPL acts as a long-term source for dissolved-phase contamination and determines the spatial distribution and persistence of contaminant concentrations within the dissolved-phase plume. Once it has been determined that DNAPL exists within the subsurface, subsequent characterization activities are typically conducted to better delineate the boundaries of the DNAPL source zone. The DNAPL source zone is the overall volume of the subsurface containing residual and/or pooled DNAPL. It should be recognized that there will be uncertainty associated with the delineation of the DNAPL source zone. In addition to the DNAPL, there may be significant amounts of contaminant mass that have diffused into low permeability zones. Back diffusion of contaminant mass from these zones may sustain dissolved-phase plumes for significant periods of time, even after DNAPL has been removed. Establishing the presence and locations of such non-DNAPL sources is beyond the scope of this document.

In January 1992, EPA published a Fact Sheet entitled 'Estimating Potential for Occurrence of DNAPL at Superfund Sites' (42) with the goal to help site personnel determine if DNAPL-based characterization strategies should be employed at a particular site. In September 1994, EPA issued a subsequent Fact Sheet entitled 'DNAPL Site Characterization' (39) discussing direct and indirect methods to assess the presence of DNAPL in the subsurface. Since

the publication of the initial fact sheets, there have been advancements in characterization tools, site investigation approaches (14) and knowledge of DNAPL source zone architecture within the subsurface. This document builds on information from the previous fact sheets to provide a framework for not only assessing the presence of DNAPL, but also for delineating the spatial extent of the DNAPL source zone, a priority at many sites due to the more prevalent use of *in-situ* remediation technologies (38). The strategy described in the present document utilizes converging lines of evidence that incorporate the scientific advancements in the field and expands the applicability of the document to include both unconsolidated deposits and fractured bedrock. An iterative, flexible site investigation approach (7) is encouraged.

### 2.0 - Nature of the DNAPL Source Zone

Upon release to the subsurface, DNAPL will distribute itself in the form of disconnected blobs and ganglia of organic liquid referred to as residual DNAPL, and in connected distributions referred to as pooled DNAPL (Figure 1). Residual DNAPL is found both above and below the water table within the pathways of DNAPL migration, and typically occupies between 5% and 30% of pore space in porous media (6, 27, 44) and in rock fractures (21). Residual DNAPL is trapped by capillary forces, and typically will not enter an adjacent monitoring well, even under the influence of aggressive groundwater pumping (6, 27).

Pooling of DNAPL can occur above capillary barriers, which are typically layers and lenses of slightly less permeable material (Figure 1). Pooling can therefore occur at any elevation in the subsurface, and not just at the base of permeable zones. Absence of pooling above clay aquitards and bedrock may be due to the presence of dipping fractures, bedding planes, joints and faults which may allow the continued downward migration of the DNAPL. Pools represent a continuous distribution of DNAPL, and typically correspond to DNAPL saturations of between 30% and 80% of pore space in both porous media and fractures. The frequency of pool occurrence and the thickness of pools are increased by the presence of horizontal capillary barriers, lower DNAPL density, higher interfacial tension, and an upward component to groundwater flow (17, 22). The thickness of pools typically ranges from fractions of an inch to a few feet, depending on fluid and media properties (36) as well as the volume released. Because pools represent a connected distribution of DNAPL, the pooled DNAPL is susceptible to mobilization through drilling activities and can short-circuit along existing monitoring wells and piezometers. In addition, pools may also be mobilized in response to changes in hydraulic gradient. The gradient required to mobilize a pool is a function of the DNAPL-water interfacial

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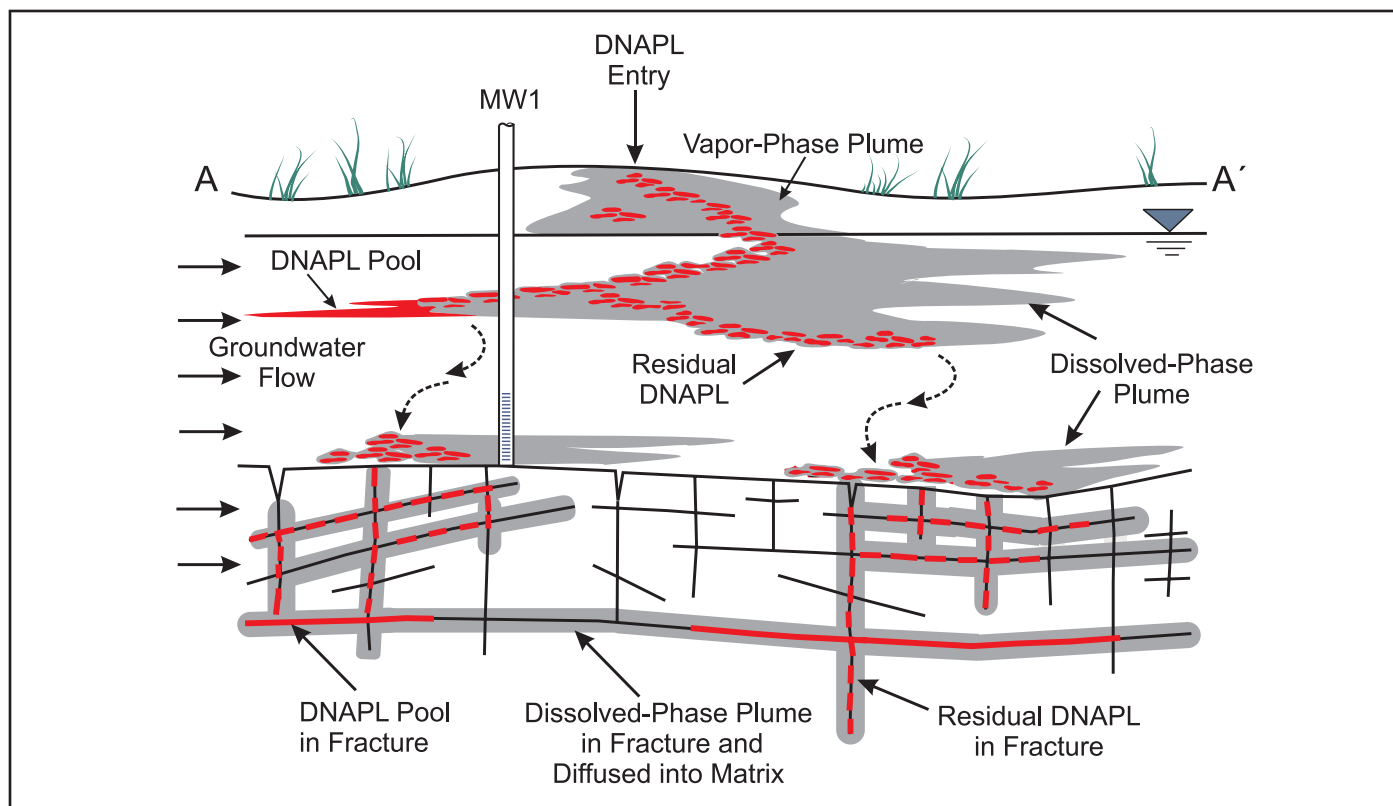


Figure 1 – Schematic illustration of contamination associated with a DNAPL release. Note that DNAPL migrates in three dimensions, and that residual DNAPL accumulated above bedrock is the result of the release at ground surface. The reader is referred to Figure 2 for a depiction of matrix diffusion. Figure is not to scale.

tension, the pool length, and the permeability of the surrounding material (6, 27). Pumping groundwater from beneath DNAPL pools, for example, can lead to an increase in capillary pressure and subsequent downward DNAPL mobilization.

The spatial distribution of residual and pooled DNAPL is strongly influenced by geology, and also by DNAPL properties and release history (frequency, intensity, duration, volume and location). DNAPL migration can occur through lenses and laminations of porous media at the scale of inches or less (17, 29). For DNAPLs that are non-wetting (see wettability in glossary) with respect to water (which is usually the case), migration below the water table is typically through the larger pores (and hence higher permeability regions) in unconsolidated media and larger aperture fractures in bedrock. The orientation of stratigraphic and structural features will largely determine the degree of lateral and vertical DNAPL spreading. DNAPL migration from the release location can occur in any direction, and is typically not greatly influenced by low ambient hydraulic gradients except for creosotes and coal tars which have densities close to that of water.

The overall region of the subsurface containing residual and pooled DNAPL is referred to as the DNAPL source zone. For high density and low viscosity DNAPLs (such as chlorinated solvents), migration in relatively permeable media can cease as soon as a few months to a few years following the time of release (3, 17, 27, 29). Some geological conditions, such as horizontal to sub-horizontal fractures, gently dipping strata and sand seams

in low permeability media can give rise to longer time scales for migration of chlorinated solvent DNAPLs, particularly for large volume DNAPL sources. For low density and high viscosity DNAPLs (such as creosote and coal tar), migration has the potential to continue for many decades (12). The overall depth of DNAPL migration is dependent not only on the presence or absence of capillary barriers, but also on the volume released, the interfacial tension, the degree of lateral spreading, and the bulk retention capacity (see glossary) of the medium. Because fractured rock has very low bulk retention capacity, small volumes of DNAPL can migrate greater distances in bedrock in comparison to the same volume released into unconsolidated deposits (18).

Groundwater flowing past residual and pooled DNAPL will result in dissolved-phase plumes of contamination. Complete dissolution of all DNAPL as a result of natural groundwater flow is expected to take from several decades to hundreds of years for most DNAPLs. For multi-component DNAPLs, the presence of more than one component typically suppresses the aqueous solubility of the other components in the DNAPL (6, 27). Exceptions to this can occur, however, when co-solvents such as alcohols are present in the DNAPL. In the absence of co-solvents, the concentration of any particular component dissolving into groundwater can often be approximated using Raoult's Law (2, 6, 27). Early in the dissolution process, the plume chemistry will be dominated by the higher effective solubility components which tend to be those present in the largest mass fraction within the DNAPL, and those

with the highest single-component (handbook) solubility values (24). The concentration of any or all components in groundwater downgradient of a multi-component-DNAPL source zone will typically be lower than expected using a single component solubility limit. With time, both the DNAPL composition and the plume composition will change in response to the dissolution process. The dissolved components that comprise the plume will migrate in groundwater subject to advection, dispersion, sorption, volatilization, and degradation processes.

Both residual and pooled DNAPL, and dissolved-phase plumes that are in direct contact with clays, silts, or a porous bedrock matrix, can diffuse into the low permeability media (forward diffusion). If concentrations outside of the low permeability zone become lower than those inside, diffusion will occur back into the higher permeability zone (back diffusion) and can result in plume persistence (5, 33). The forward and back diffusion processes are collectively referred to as matrix diffusion (Figure 2). The persistence of DNAPL in fractures in bedrock, saprolite and clay can be shortened by the matrix diffusion process (19, 28). In addition, the rate of advance of a dissolved-phase plume in fractured rock with a porous matrix can be strongly attenuated by the matrix diffusion process (20, 35). The influence of matrix diffusion on dissolved-phase plume migration in fractured rock and clay relative to other processes such as advection, dispersion, sorption, and possible degradation processes will vary depending on site specific geological conditions and contaminant properties.

In general, matrix diffusion has a greater influence on dissolved-phase plume migration in the case of wider fracture spacing, smaller fracture aperture, lower hydraulic gradient, higher matrix porosity, and higher matrix organic carbon.

Above the water table, volatile DNAPL can vaporize into air filled pore spaces (Figure 1). For DNAPLs with significant vapor pressure, this can lead to expanded vapor-phase plumes in the unsaturated zone. The concentration of contaminants in the vapor phase will be governed by the vapor pressure, and for a multi-component DNAPL can often be approximated using Raoult's Law. In relatively warm and dry environments, the persistence of some DNAPLs (e.g., chlorinated solvents) can be relatively short (on the order of months to a few years) in unsaturated media. The absence of residual and pooled DNAPL in the unsaturated zone may not, therefore, be sufficient evidence to conclude that DNAPL has not migrated below the water table at the site of interest.

### 3.0 - Types of DNAPLs

**Coal Tar** is a complex mixture of hydrocarbons produced through the gasification of coal that was produced as a by-product of manufactured gas operations as early as 1816 in the United States. It is still produced as a by-product of blast furnace coke production. Coal tar contains hundreds of hydrocarbons, including light oil fractions, middle oil fractions, heavy oil fractions, anthracene oil, and pitch. The low density (typically 1.01 g/cc to 1.10 g/cc

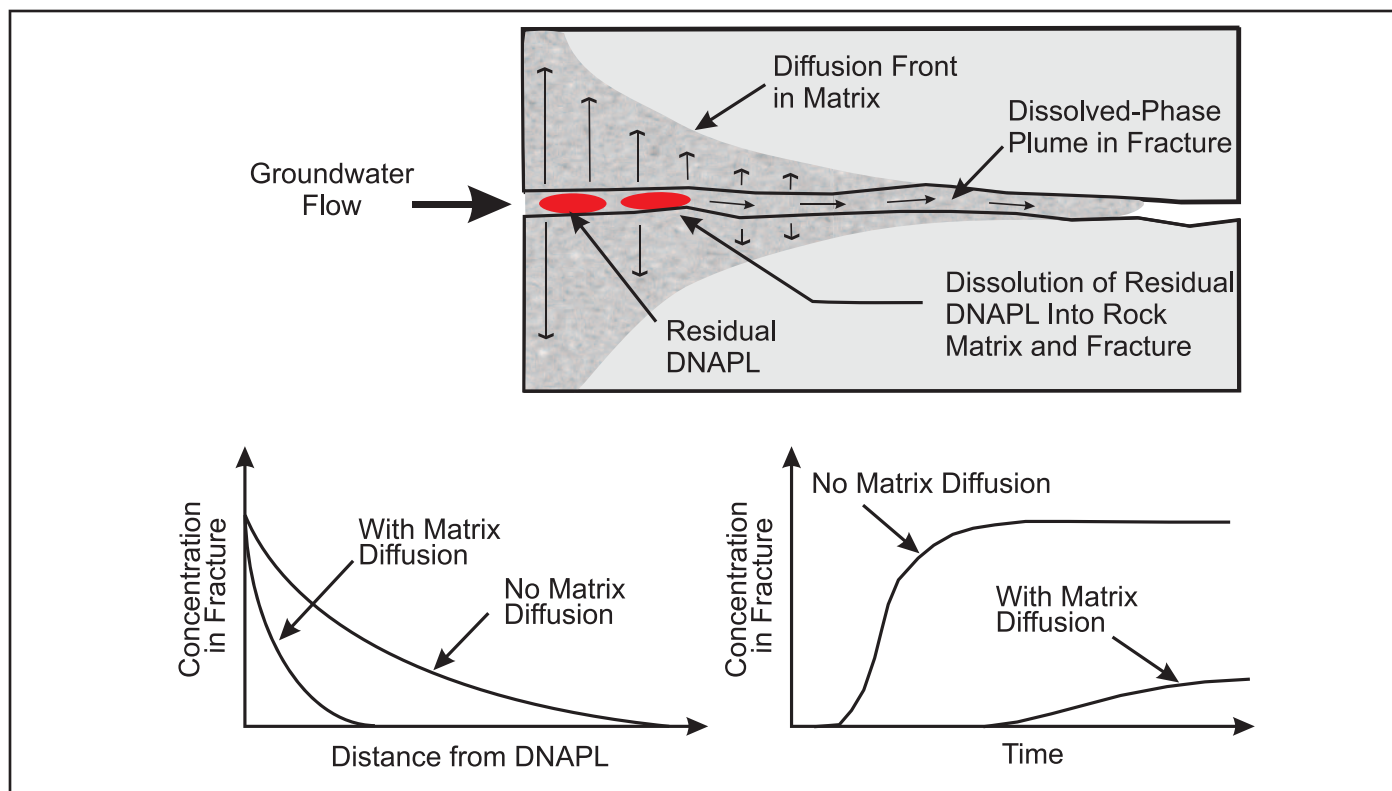


Figure 2 – Matrix diffusion of dissolved-phase contaminants adjacent to DNAPL and along length of plume in fracture. Matrix diffusion can attenuate the rate of plume advance in fractured rock (bottom left concentration vs distance plot), and can result in delayed breakthrough curves (bottom right concentration vs time figure). These factors need to be considered when relying upon groundwater concentration data to assess DNAPL presence.



compared to 1.00 g/cc of water [at 4°C]) and high viscosity (up to 200 to 300 times, or more, than that of water) facilitate long time-scales of migration, with the possibility of movement continuing for many decades following initial release. Due to the lengthy list of compounds present in coal tar, many investigators select a sub-set of coal tar compounds based on mobility and toxicity to assess water quality. These compounds may include benzene, toluene, ethylbenzene, xylenes (BTEX), benzo[a]pyrene, naphthalene, and phenanthrene. Depending on the age of the DNAPL and groundwater velocity, some of the lower molecular weight and more soluble compounds of the coal tar may have been leached out of the DNAPL by the time a site investigation is initiated. Naphthalene is often the dominant compound in present day coal tar (9). In addition, the various components in the plume will migrate at different velocities because of varying degrees of sorption and degradation (often aerobic conditions). The lower molecular weight, less sorbing compounds (e.g., BTEX) can migrate significantly further in groundwater than the higher molecular weight, more sorbing compounds (e.g., PAHs).

**Creosote** is composed of various coal tar fractions and was commonly used to treat wood products. It is still used today in certain wood treating operations and as a component of roofing and road tars. Creosote is a multi-component DNAPL that contains many hydrocarbons, primarily polycyclic aromatic hydrocarbons (PAHs), phenolic compounds, and carrier fluids such as diesel. The low density (typically 1.01 g/cc to 1.13 g/cc) and high viscosity (typically 20 to 50 times that of water) of creosote facilitate long time-scales of migration, with the possibility of movement continuing for many decades following initial release. Most investigators select a sub-set of creosote compounds, based on mobility and toxicity to characterize water quality, such as naphthalene, benzo(a)pyrene, and phenanthrene.

**Polychlorinated Biphenyls (PCBs)** are a class of 209 chemical compounds referred to as congeners, in which between one and ten chlorine atoms are attached to a biphenyl molecule. The majority of PCBs were manufactured between 1930 and 1977 under the trade-name Aroclor for use in capacitors, transformers, printing inks, paints, pesticides, and other applications. Aroclors differ based on the amount and types of congeners present. PCBs by themselves are DNAPLs, and were often blended with carrier fluids such as chlorobenzenes and mineral oil prior to distribution. The density of most PCB oils ranges from 1.10 g/cc to 1.50 g/cc, while the viscosity ranges from 10 to 50 times that of water. Most congeners are very hydrophobic and their transport can be retarded strongly relative to the rate of groundwater migration. In some cases, however, PCB transport in groundwater can be facilitated through the formation of emulsions or the presence of colloids.

**Chlorinated Solvents** such as trichloroethene (TCE), tetrachloroethene (PCE) and carbon tetrachloride (CT) have been produced in large quantities since the mid 1900's. Some chlorinated solvents contain trace amounts of stabilizers, preservatives and impurities. Typical uses vary widely and include dry cleaning, metal degreasing, pharmaceutical production, pesticide formulation, and chemical intermediates. Chlorinated solvents can be encountered as single component DNAPLs (e.g., as primarily PCE at a dry cleaning facility, or as primarily TCE at a vapor degreasing facility), or as part of a multi-component DNAPL containing other organic compounds. The relatively high density (typically

1.10 g/cc to 2.20 g/cc) and low viscosity (typically ranging from half to twice that of water) of chlorinated solvents can result in a relatively short time-scale of migration following release compared to coal tar and creosote. In a dissolved-phase plume, most chlorinated solvents are not retarded strongly relative to the rate of groundwater flow.

**Mixed DNAPLs** A DNAPL that contains two or more compounds is referred to as a multi-component DNAPL (e.g., creosote). A mixed DNAPL is a multi-component DNAPL that contains a wide variety of organic compounds as a result of blending and mixing prior to disposal operations, or as a result of cotemporaneous disposal. Examples include DNAPLs encountered at former solvent recycling facilities and industrial disposal sites. Such DNAPLs can contain aromatic compounds normally associated with LNAPLs (e.g., toluene) along with chlorinated solvents, PCBs, alcohols, ketones, and tetrahydrofuran. The density of mixed DNAPLs typically ranges from 1.01 g/cc to 1.60 g/cc, and the dissolved-phase plumes associated with mixed DNAPLs usually contain a wide variety of compounds with varying mobility.

#### 4.0 – DNAPL Source Zone Investigation Methods

This section presents various site investigation methods and related interpretation techniques that can be useful when characterizing a DNAPL source zone. These methods and techniques will be relied upon in Sections 5 (Assessing DNAPL Presence) and 6 (Delineation of the DNAPL Source Zone). Additional information is provided in (6, 26, 37).

##### A Visual Observation

DNAPL obtained from the bottom of a monitoring well or as an emulsion from a pumped water sample is conclusive evidence of DNAPL presence (pooled DNAPL). Monitoring wells can be sampled for DNAPL using bottom loading bailers lowered to the bottom of the well or pumping from the bottom of the well. If an interface probe indicates DNAPL presence, then the sample should be retrieved and it should be confirmed (visually, or through laboratory analysis) that the substance is DNAPL. If DNAPL is visually observed in drill cuttings or in a soil sample for the first time, then a sample should be sent to the laboratory for confirmatory evidence. This line of evidence is applicable in both unconsolidated deposits and fractured rock, but it should be noted that visual observation of DNAPL in rock core is rare because of the aggressive flushing nature of the drilling process. Because of the typically sparse and tortuous nature of DNAPL distribution in the subsurface, DNAPL is not encountered and visually observed within many DNAPL source zones.

##### B Chemical Concentrations in Soil Above Threshold DNAPL Saturation

Chemical concentrations in soil exceeding the value corresponding to a threshold DNAPL saturation are conclusive evidence of DNAPL presence (see Calculation 1). The threshold DNAPL saturation for use in Calculation 1 should be set to be between 5% and 10% of pore space for all DNAPL types. The particular threshold satura-

tion chosen should result in a chemical concentration in soil that is an order of magnitude higher than that determined in line of evidence C. It follows that high organic carbon content soils and highly hydrophobic chemicals may require the use of threshold saturations toward the higher end of the above range. This method is applicable to unconsolidated media both above and below the water table, but is not applicable in fractured rock. The calculation requires knowledge of site-specific parameters and a quantitative chemical analysis of the soil. Care should be taken to sample soil horizons in core exhibiting the highest headspace readings and the strongest visual indication of DNAPL presence. The use of fixed depth intervals or compositing from several depth intervals is discouraged when collecting soil samples to evaluate the presence of DNAPL. Methanol preservation or a similar technique to reduce VOC losses during handling and transport of soil samples should be employed.

### **C** Chemical Concentrations in Soil Above Partitioning Threshold

Chemical concentrations in soil exceeding the value corresponding to equilibrium partitioning relationships (see Calculation 2) are consistent with DNAPL presence (11). The composition of the DNAPL need not be known (see Calculation 4). The calculation is applicable to unconsolidated media both above and below the water table, but is not applicable in fractured rock. The calculation requires knowledge of site-specific parameters and a quantitative chemical analysis of the soil. Measured concentrations that only marginally exceed the calculated partitioning threshold may be false positives primarily because of uncertainty associated with estimating the soil-water partition coefficient.

### **D** Site Use/Site History

Investigations during the past 30 years have shown that the subsurface occurrence of DNAPL is often associated with the industries, practices, and processes outlined in Table 1. Site Use/Site History can be ascertained using methods such as employee interviews, company purchase

and sale records, aerial photographs, and building plans. Former lagoons, underground tanks, floor drains and leach fields are sometimes coincident with the location of DNAPL source areas.

### **E** Vapor Concentrations

The location of a vapor-phase plume may be coincident with the current or former presence of DNAPL in the vadose zone. Mapping the vapor-phase plume may be useful in deciding where to collect additional data. Because some DNAPLs can completely vaporize in relatively short time periods (yet the vapors will persist much longer), the presence of vapors and the mapping of a vapor-phase plume should generally not be used in isolation to conclude that DNAPL is present in the vadose zone, or to delineate the spatial extent of the DNAPL source. Care should also be taken to avoid mistaking vapors derived from off-gassing of a groundwater plume with vapors derived from DNAPL sources. In-situ vapor concentrations can be sampled using invasive techniques (soil vapor surveys), and can be monitored during drilling. This line of evidence is not applicable to DNAPLs lacking a significant vapor pressure (e.g., coal tar, creosote, PCBs).

### **F** Hydrophobic Dye Testing

Hydrophobic dyes such as Oil Red O will partition into DNAPL, imparting a red color to the organic liquid. Dye techniques are particularly useful when encountering a colorless DNAPL. Hydrophobic dye techniques include the jar shake test in which a soil or water sample is placed into a jar with a small amount of dye (6), and down-hole samplers that force a dye-impregnated absorbent ribbon against the borehole wall in either fractured rock or a direct push borehole (30). It should also be noted that the absence of staining on a down-hole ribbon sampler is not evidence of the absence of DNAPL, since only pooled DNAPL can migrate towards the sampler (residual DNAPL may be present in the formation adjacent to the sampling interval, and remain undetected).

Table 1 – Industries and Industrial Processes Historically Associated With DNAPL Presence (modified after USEPA, 1992).

<i>Industry</i>	<i>Industrial Process</i>
Manufactured gas plant, Wood preservation (creosote), Electronics manufacturing, Solvent production/recycling, Pesticide/Herbicide manufacturing, Dry cleaning, Instrument manufacturing, Metal product manufacturing, Engine manufacturing, Steel industry coking operations (coal tar), Chemical production, Airplane maintenance, Transformer oil production	Storage of solvents in uncontained drum storage areas, Metal cleaning/degreasing, Metal machining, Tool and die operations, Paint stripping, Use of vapor and liquid degreasers, Storage and transfer of solvents in above and below ground tanks and piping, Burning waste liquids, Storage and treatment of waste liquids in lagoons, Use of on-site disposal wells, Loading and unloading of solvents, Transformer reprocessing, Disposal of solvents in unlined pits.

The following lines of evidence G1 through G6 all make use of groundwater quality data and can be evaluated every sampling round.

### **G1 Magnitude of Groundwater Concentrations**

Sampled groundwater concentrations in excess of 1% effective solubility (see Calculation 3) indicate that the sampled groundwater may have come in contact with DNAPL. If the composition of the DNAPL is not known, Calculation 6 can be used. The distance to the possible DNAPL locations cannot be determined from the magnitude of the concentration alone. Sampled groundwater concentrations downgradient of a DNAPL source zone can be significantly less than the effective solubility because of hydrodynamic dispersion, wellbore dilution, non-optimal monitoring well placement, and degradation processes. In cases where significant degradation is occurring in the dissolved-phase plume, daughter product concentrations can be converted to equivalent parent product concentrations before comparing to the 1% effective solubility threshold (see Calculation 8). However, it should be noted that daughter product compounds may also be part of a multi-component DNAPL. Monitoring well points where groundwater concentrations exceed 1% effective solubility can also be useful in locating additional sampling points potentially nearer to the possible DNAPL source zones. The interpretation of groundwater concentrations exceeding 1% effective solubility is discussed further in (27).

### **G2 Persistent Plume**

The presence of a contiguous and persistent plume extending from suspected release locations in the downgradient direction is evidence of a continuing source (e.g., DNAPL). If 'sufficient time' has passed since the last possible introduction of contaminant to the subsurface and the plume has not 'detached' itself from the suspected release locations, a DNAPL source may be present. The 'sufficient time' is dependent on site-specific conditions such as groundwater velocity and the amount of sorption occurring (see Calculation 7). This line of evidence is applicable to both unconsolidated deposits and fractured rock, but can be inconclusive in environments subject to significant amounts of back diffusion (e.g., fractured bedrock with a porous matrix, fractured clay). Significant amounts of back diffusion can be the source of a persistent plume even if DNAPL is not present. This line of evidence is therefore most applicable to high permeability settings.

### **G3 Presence of Contamination in Apparently Anomalous Locations**

The presence of contaminated groundwater in locations that are not downgradient of known or suspected sources may be evidence of DNAPL presence hydraulically upgradient of the monitoring point in question. An example includes the presence of dissolved-phase contamination in groundwater that is older than the potential

contaminant release (using age dating) or in groundwater on the other side of a flow divide located between the monitoring location and suspected release locations. In Figure 1, for example, the presence of contamination in the illustrated monitoring well cannot be explained without the upgradient presence of DNAPL. This line of evidence is not contingent on any concentration threshold. Temporal changes in hydraulic heads and groundwater flow directions, as well as changes in historic pumping patterns should be considered at sites where groundwater extraction has, or is, occurring. Consideration should also be given to the presence of unknown or off-site sources that may account for the observed contamination.

### **G4 Groundwater Concentration Trends with Depth**

Abrupt reversals of groundwater contaminant concentration levels with depth or increasing concentrations with depth can be associated with DNAPL presence. Concentration trends can be best detected using small interval sampling techniques [e.g., direct push sampling devices; short well screens; multilevel completions; cone penetrometer equipped with measurement probes (16, 26)]. Multilevel monitoring completions can be incorporated into open holes in bedrock to provide concentration as a function of depth. Other methods in bedrock include the use of temporary straddle-packer assemblies to sample specific depth intervals, and the use of diffusion bag samplers placed at specific depths. Use of these latter methodologies should be made only when intraborehole flow conditions have been adequately characterized.

### **G5 Groundwater Concentration Trends with Time**

Groundwater downgradient of a multi-component DNAPL may exhibit a temporal decline in the concentration of the higher effective solubility compounds and a stable or increasing trend in time of the lower effective solubility compounds. Highly soluble and mobile compounds, such as low molecular weight alcohols, furans, ketones and some solvents such as methylene chloride may show a decreasing concentration versus time signature downgradient of a DNAPL source zone while at the same time higher molecular weight alcohols and semi-volatile compounds may show a stable concentration trend. This line of evidence is primarily applicable to mixed DNAPLs. Consideration should be given to compound specific biodegradation, which may result in the concentration of certain compounds decreasing and others (such as low molecular weight daughter products) increasing within the plume. Dissolved-phase concentrations downgradient of a single component DNAPL may decline due to removal of some of the source mass during dissolution; a declining concentration versus time signature does not preclude the presence of DNAPL.

### **G6 Detection of Highly Sorbing Compounds in Groundwater**

The detection of highly sorbing and low solubility compounds which have low mobility in groundwater may be



associated with a nearby DNAPL source. This line of evidence can be useful in delineating the extent of the DNAPL in the downgradient direction. Examples of compounds that have very low mobility in groundwater (absent transport facilitated by colloids, cosolvents, or emulsions) include PCBs and high molecular weight PAHs.

**H Other Types of Methods**

Partitioning interwell tracer tests (PITTs) [1, 4, 15] involve the injection and withdrawal of a tracer that has the ability to partition into the DNAPL. While the method can be used to detect the presence of DNAPL, given the significant effort involved in conducting tracer tests, PITTs are typically employed after some level of source zone characterization has been completed. Literature sources suggest (for certain sites with appropriate geologic conditions and contaminant properties) measuring a depletion of Radon-222 in groundwater (34). Direct push platforms can be used to deploy a variety of probes to vertically profile contaminant concentrations. These probes include laser induced fluorescence (LIF) measurement devices (6, 31, 32) such as ROST (rapid optical screening tool) and TarGOST (tar-specific green optical screening tool), which is specifically designed for detecting the presence of coal tar and creosote (32); and probes employing Raman methods (31). LIF techniques respond well to the presence of NAPLs containing aromatic hydrocarbons, but may not be suitable for many chlorinated solvent DNAPLs. Direct push platforms can also be used to deploy a membrane interface probe (MIP) or a hydrosparge probe (8), both of which transfer contaminants to a flowing gas stream for analysis at the

surface. Another measurement probe is the precision injection/extraction (PIX) device (23). The use of measurement probes with direct push platforms is becoming increasingly popular, but care should be taken in interpreting results with respect to DNAPL presence given that most of these devices provide a relative measure of total concentration. Consideration of the potential for, and consequences of, false positives should be given to each of these methods.

**5.0 - Assessing DNAPL Presence**

Determining the presence or absence of DNAPL is an important component of the site characterization process and subsequent development of a conceptual site model. The length of time and degree of effort required to determine the presence or absence of DNAPL will vary from site to site. Once it has been determined that DNAPL resides in the subsurface, the objectives for further investigation and potential remediation strategies can be established. This section focuses on methods to assess the presence of DNAPL; Section 6 of this document focuses on methods to delineate the DNAPL source zone.

Converging lines of evidence can be used to determine whether or not DNAPL is present in the subsurface. Figure 3 presents a graphical summary of the converging lines of evidence approach. Example calculation procedures are contained in Appendix A. All lines of evidence are discussed in Section 4, and are applicable to both unconsolidated deposits and fractured rock, unless noted otherwise. As indicated in Figure 3, either line of evidence A or B will lead to the conclusion that DNAPL is present. If A and B are both found to be negative, then the determination of whether DNAPL is present must be made on the basis of a weight of evidence approach, with multiple converging lines of evidence

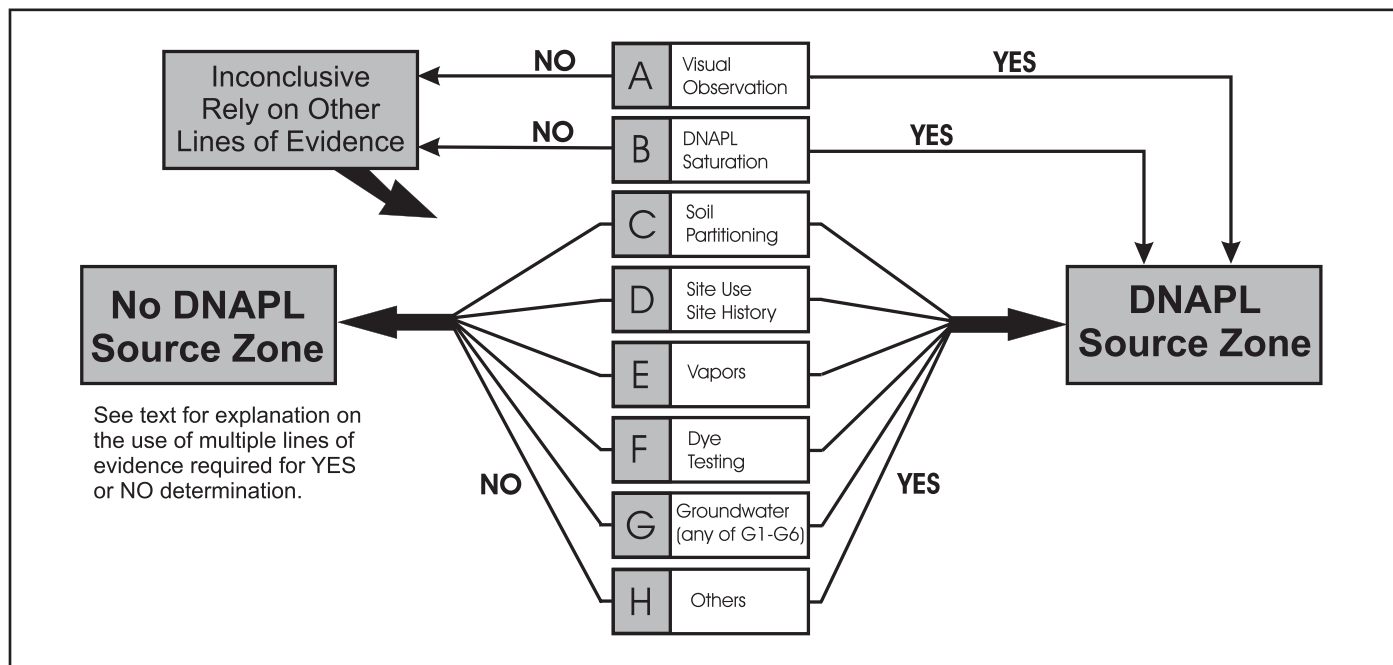


Figure 3 – Converging lines of evidence approach to assessing DNAPL presence. Methods B and C are not applicable to fractured rock.

combining to form either a positive or negative determination. Note that it is not likely that all of C through H will be satisfied at any one particular site, and that neither A nor B are necessary requirements to conclude that DNAPL is present. Most confirmed DNAPL source zones will have some of A through H determined to be negative. Because conditions vary from site to site, this document does not prescribe a specific number of lines of evidence that must be satisfied to arrive at either a positive or negative determination.

If the various lines of evidence contradict each other, it may be necessary to collect more data. It is possible that a minority of positive determinations can outweigh a majority of negative determinations if the positive lines of evidence cannot be explained without the presence of DNAPL. It should also be noted that not all sites lend themselves to collecting all of the types of data outlined here. In fractured rock, for example, soil vapor data and partitioning calculations would not be relied upon.

Evaluating the presence of DNAPL is an iterative process that incorporates new data as they are obtained. It is recognized here that certain types of data are more likely to be collected in the early stages of site investigation, while others (e.g., groundwater concentrations) can be collected on a routine basis throughout the investigation process. The fact that a number of lines of evidence are outlined in Figure 3 does not suggest that they should all be pursued at any one particular site. Site specific conditions will dictate what lines of evidence should be pursued. Care should be taken, however, to ensure that a negative response to the various lines of evidence is not simply attributable to inadequate characterization and an insufficient amount of data.

## 6.0 - Delineation of the DNAPL Source Zone

Depending on the spatial density of sampling points installed during initial investigation efforts, the general area within which the DNAPL resides may have been identified. Once it has been determined that DNAPL is present in the subsurface, the objectives for delineation of the source zone can be established. These objectives can vary from site to site, but typically involve one or more of the following:

- Delineation of the DNAPL source zone to ensure that the flow paths and quality of the groundwater downgradient of the source zone are monitored for the presence of dissolved-phase contaminants to assess protection of current and potential receptors.
- Delineation of the DNAPL source zone to facilitate proper design of containment systems involving groundwater extraction and/or physical barriers.
- Delineation of the DNAPL source zone to facilitate implementation of DNAPL mass removal technologies.
- Delineation of the DNAPL source zone as part of establishing boundaries for institutional controls.
- Delineation of the DNAPL source zone as part of Technical Impracticability assessments (41).

Given the selective nature of DNAPL migration, it is not feasible to determine the exact location and extent of individual DNAPL migration pathways within the overall confines of the source zone in either unconsolidated deposits, or fractured bedrock. Because

data collection efforts typically involve a finite number of local-scale measurements taken at discrete locations (e.g., water quality samples, soil samples, etc.), some uncertainty will exist regarding the delineated spatial extent of the source zone.

To address the issue of uncertainty, it is recommended that both a 'Confirmed/Probable' DNAPL source zone be delineated, as well as a 'Potential' DNAPL source zone (see Figure 4). The Confirmed/Probable source zone is the volume within which compelling and multiple lines of evidence indicate that DNAPL is present. Note that what may be a compelling line of evidence at one site may not be so at another site (e.g., G2 Persistent Plume, is a stronger line of evidence in a high permeability setting than at a site where back-diffusion may dominate). The Potential source zone is of larger spatial extent, and is defined as that volume of the subsurface within which some lines of evidence indicate that DNAPL may be present, but the lines of evidence are not as numerous, consistent, or compelling as within the Confirmed/Probable source zone. Defining a Potential source zone outside of the Confirmed/Probable source zone addresses the uncertainty associated with finite amounts of data. This can be particularly useful in the hydraulically downgradient direction where it is often difficult to determine the distance to the edge of the DNAPL source zone based on groundwater quality data (e.g., using lines of evidence G1 through G6).

With respect to the various criteria for assessing DNAPL presence outlined in Section 4, lines of evidence A and B will both fall within the Confirmed/Probable source zone. All other lines of evidence (C through H) could fall within either the Confirmed/Probable source zone, or the Potential source zone. Note also that positive determinations for lines of evidence A and B are not necessary to define a Confirmed/Probable source zone. The defining feature of the Confirmed/Probable source zone is that multiple lines of evidence indicate that DNAPL is present. In practice, this will manifest itself as various lines of evidence all plotting within the same general spatial area on plan view and cross-section figures (see Figure 4 for plan view example). Within the Potential source zone, there will be fewer lines of evidence, and their occurrence may not be as contiguous as within the Confirmed/Probable source zone. Consideration should be given to known DNAPL release locations and structural aspects of the geology (e.g., dipping beds, dipping fractures) when delineating both the Confirmed/Probable and Potential source zones.

There is no prescriptive number of lines of evidence that separate the two source zone delineations. The individual lines of evidence cannot be weighted either, as the strength of the uncertainty/certainty determination is dependent on how often more than one line of evidence occurs at a particular location and how many contiguous locations have multiple lines of evidence; assigning a weighting factor to each line would negate this objectivity. Furthermore, many factors influence the transport of the DNAPL and the associated concentration of the dissolved-phase constituents such that a weighting factor could not be fairly assigned for all types of hydrogeologic environments and types of DNAPL contaminants.

The amount of acceptable uncertainty in delineating the source zone boundaries is likely to be dependent on the remedial actions considered. If hydraulic or physical containment of the DNAPL source zone were a component of the remedial actions, for example, an accurate delineation of the Potential source zone would be war-



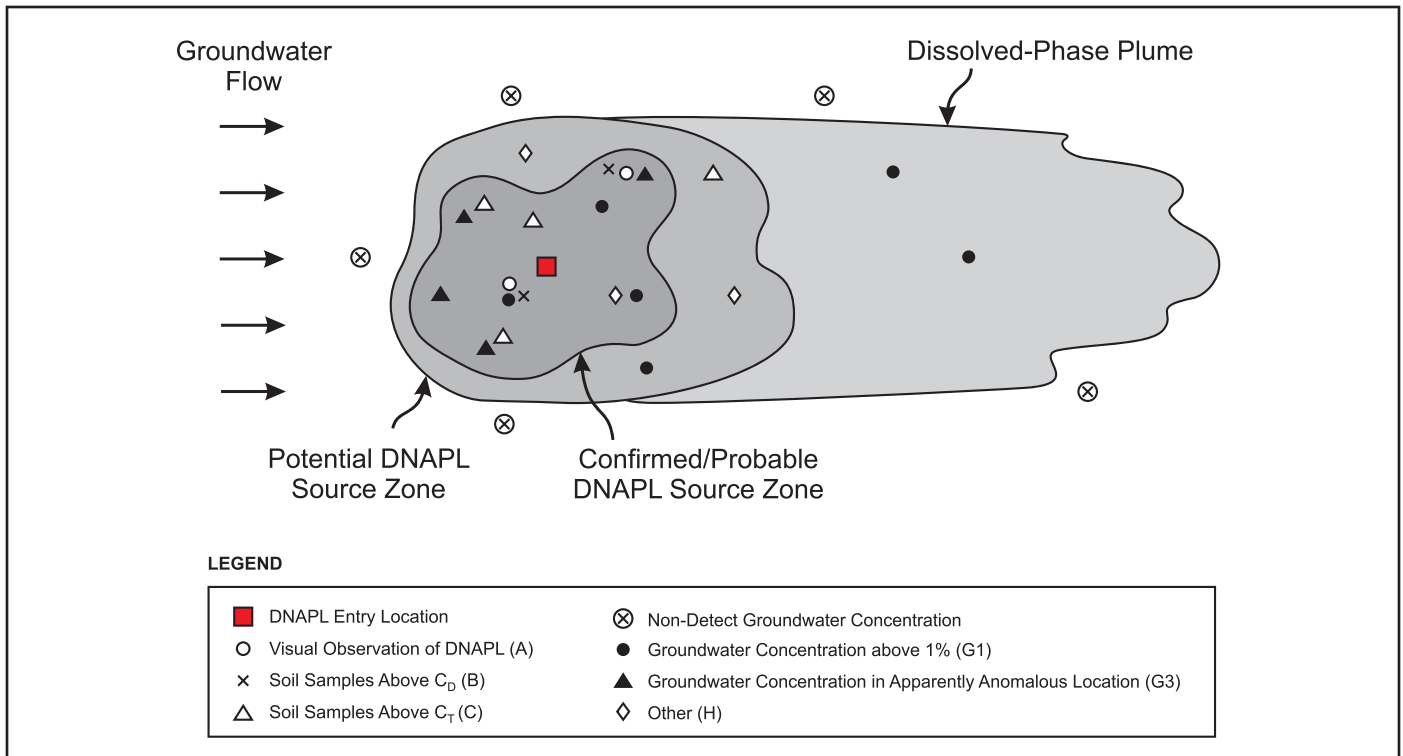


Figure 4 – Example of plan view schematic illustrating confirmed/probable and potential DNAPL source zones. Note that not all lines of evidence are depicted. Types and distribution of lines of evidence will vary from site to site.

ranted (the likely target for hydraulic containment) and accurate delineation of the Confirmed/Probable source zone may not be necessary. If the remedial actions included implementation of a DNAPL mass removal technology, however, then an accurate delineation of the Confirmed/Probable DNAPL source zone (the likely target for mass removal) would be warranted. A similar approach may be appropriate for designating a zone of technical impracticability (TI). Overestimating the size of the Confirmed/Probable source zone could overstate costs for technology application and may result in a particular technology being screened out. Underestimating the size of the Confirmed/Probable source zone, on the other hand, could lead to underestimation of costs and the perception of poor performance following completion of technology application. Monitoring points outside of an underestimated source zone may provide data showing little, if any, benefit resulting from source zone removal or treatment.

Typically, to refine the locations of the boundaries, additional drilling and sampling may be required between the Confirmed/Probable and Potential DNAPL areas. Figure 5 depicts an iterative process of data collection. Usually the degree of uncertainty in delineating these two zones will be greater in a more complex hydrogeologic environment. Although additional sampling points may be easily installed in shallow, unconsolidated materials, the same level of effort may not be feasible or may be cost prohibitive in deep fractured rock. Care must also be taken to ensure that drilling and sampling activities do not mobilize DNAPL deeper in to the subsurface. Strategies in place of extensive drilling to depth within the source zone include drilling adjacent to the suspected

source zone and using lines of evidence such as G1 through G6 to infer DNAPL presence in the upgradient direction.

In all environments, the risks of potentially mobilizing the DNAPL and the associated incremental costs of additional sampling points should be compared to the benefits of increased ability to evaluate the spatial extent of the DNAPL. Additionally, site investigators should have a DNAPL Contingency Plan on hand in the field to address actions to be taken if pooled DNAPL is encountered during drilling. At some sites, it may be desirable to adopt an ‘outside in’ approach to reduce the number of invasive borings that need to be placed within the DNAPL source zone.

In addition to delineating the spatial extent of the source zone, investigators may need to assess whether or not DNAPL is still migrating within the subsurface. The assessment of mobility can be carried out using screening calculations (27) and observations such as an expanding area of lines of evidence indicating DNAPL presence. Other features of the source zone that may be of interest include the mass of DNAPL present, the mass flux downgradient of the source zone, and the relative proportions of residual versus pooled DNAPL. Calculation 1 can be used to distinguish between residual and pooled DNAPL in soil samples by selecting a saturated threshold above which DNAPL is considered pooled. Also of note is the fact that residual DNAPL will not enter monitoring wells, implying that the accumulation of DNAPL in a well indicates the presence of pooled DNAPL in the formation. Details regarding how to estimate the mass of DNAPL present in a source zone or the distribution of mass flux downgradient of the source zone, however, are beyond the scope of this document.

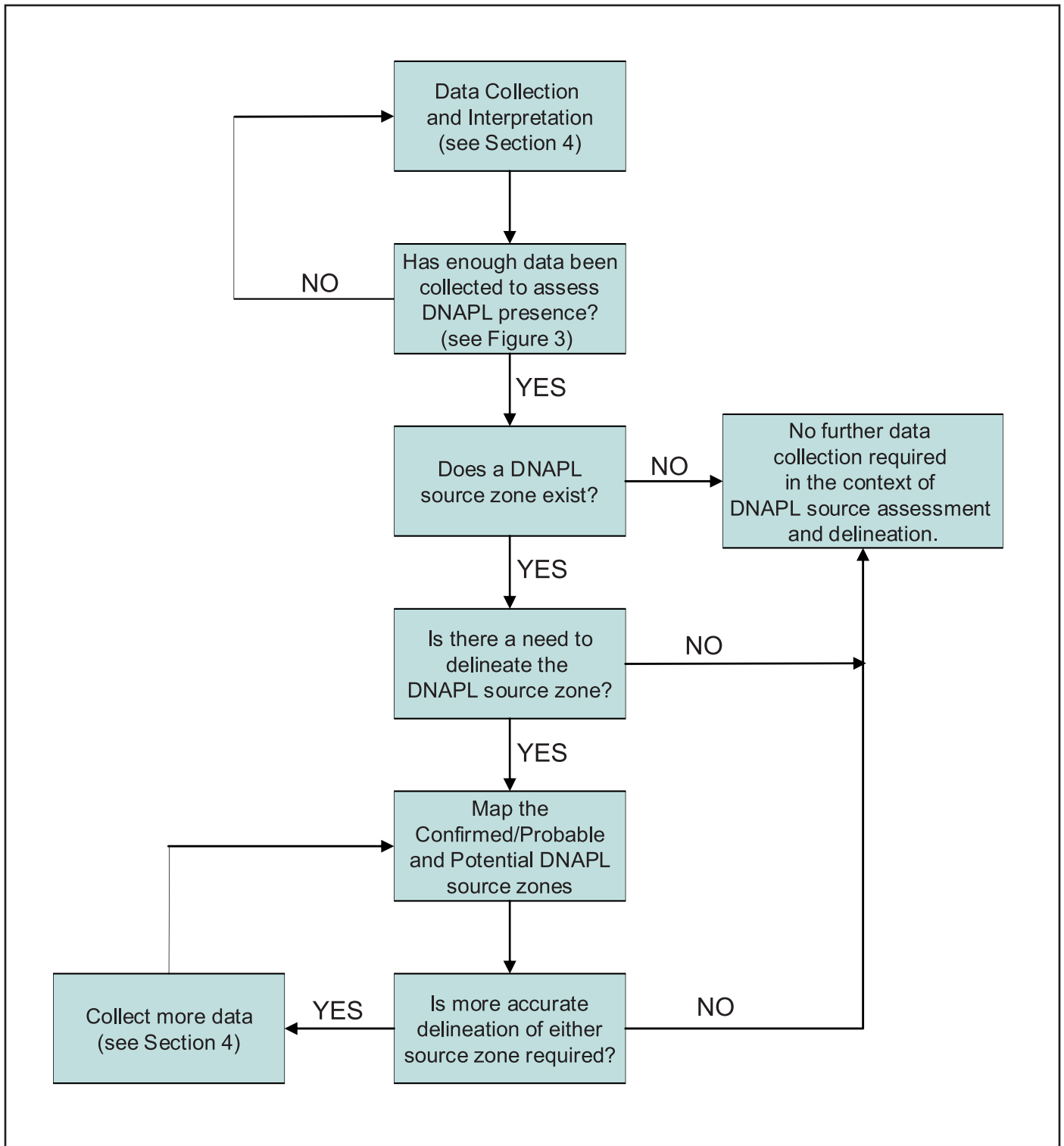


Figure 5 - Flowchart depicting iterative data collection process used in refining the DNAPL source zone boundaries.

## 7.0 - Glossary

**Bulk Retention Capacity** is defined as the total volume of DNAPL that has been retained as residual and pooled DNAPL in a unit volume of the subsurface. The bulk retention capacity accounts for the fact that not all lenses, laminations and geological units within a source zone contain DNAPL (27), and it is a function of the release history, geology and DNAPL properties. In unconsolidated media, the bulk retention capacity can be in the range from 0.005 to 0.03 (36). In fractured media, the bulk retention capacity can be in the range of 0.0002 to 0.002 (36). Fractured rock and clay cannot retain as much DNAPL per unit volume as unconsolidated deposits.

**Capillary Barriers** are fine grained lenses, layers and laminations upon which lateral spreading and pooling of DNAPL can occur. Even if the capillary barrier is penetrated by the DNAPL, it is likely that lateral spreading will have occurred along the top surface of the barrier prior to the capillary pressure having exceeded the entry pressure of the barrier. The finer grained the capillary barrier, the higher the pool height of DNAPL that it can support (17).

**Capillary Pressure** is the pressure difference between two immiscible liquids and arises because of interfacial tension. It is calculated as the non-wetting phase pressure minus the wetting phase pressure. If the DNAPL is the non-wetting phase and water is the wetting phase, for example, the capillary pressure would be the DNAPL pressure minus the water pressure.

**DNAPL** (Dense, Non-Aqueous Phase Liquid) is an organic liquid that is more dense than water and does not mix freely with water. A **single-component DNAPL** is composed of only one chemical. A **multi-component DNAPL** is composed of two or more chemical components.

**DNAPL Source Zone** The DNAPL source zone is the overall volume of the subsurface containing residual and/or pooled DNAPL. Not all portions (e.g., lenses, laminations, or fractures) of the source zone will contain residual and/or pooled DNAPL. The **Confirmed/Probable DNAPL Source Zone** is the part of the source zone within which it is known or highly likely that DNAPL exists. The **Potential DNAPL Source Zone** is the part of the source zone within which it is possible that DNAPL exists, but the lines of evidence indicating DNAPL presence are either fewer or are not as strong as those associated with the Confirmed/Probable DNAPL Source Zone.

**Dissolved-phase Plume** The zone of contamination containing dissolved-phase constituents resulting from groundwater flowing past residual and pooled DNAPL. The contaminants present in the plume are subject to advection, dispersion, and possibly sorption, decay, and matrix diffusion. Dissolved-phase plumes can be sustained by back diffusion from low permeability regions in the absence of DNAPL.

**Effective Solubility** For a multi-component DNAPL, the equilibrium solubility in water of any component of the DNAPL is referred to as the component's effective solubility. In general, the various components of a DNAPL suppress each other's aqueous solubility implying that effective solubilities are typically less than single-component (handbook) solubilities. For structurally similar compounds, the effective solubility can be estimated using Raoult's Law (2).

**Interfacial Tension (IFT)** is a tensile force that exists in the interface separating DNAPL and water. Because of interfacial tension, DNAPLs do not mix freely with water and exist in the subsurface as a separate liquid phase. IFT is a site-specific value that can be assessed with a simple laboratory test if a sample of DNAPL can be obtained. Literature values tend to overestimate the IFT encountered at sites. In general, higher IFT leads to more lateral spreading of DNAPL in horizontally bedded deposits, stronger capillary trapping forces, and a greater tendency for DNAPL pooling.

**Mole Fraction** refers to the proportion of a component, on the basis of moles, in a multi-component DNAPL. The sum of all the mole fractions is unity. Mass fractions, as provided by laboratory analysis, can be converted to mole fractions using the molecular weight of each component (see calculation 5).

**1% Rule of Thumb** is a generality that sampled groundwater concentrations in excess of 1% effective solubility (see Calculation 3) indicate that DNAPL may be present in the vicinity of (any direction) the monitoring point of interest. The distance between the monitoring point in question and the DNAPL source zone varies from site to site and is generally difficult to quantify with a high degree of accuracy.

**Pooled DNAPL** refers to local, continuous distributions of DNAPL that accumulate above capillary barriers. The capillary barriers are typically lower permeability horizons, and they can occur at any elevation in the subsurface. Within the pool, the DNAPL saturation is typically between 30% and 80% of pore space in both porous media and fractures (27). Because pools are contiguous through the pore structure they are potentially mobile and can migrate into monitoring wells, and can be mobilized by increases in the hydraulic gradient or lowering of IFT.

**Raoult's Law** is given by  $C_i = m_i S_i$  where  $C_i$  is the effective solubility (mg/l) of component  $i$ ,  $m_i$  is the mole fraction (unitless) of component  $i$  in the DNAPL, and  $S_i$  is the single-component (handbook) solubility of component  $i$  (2). This expression assumes ideal partitioning behavior and is used to estimate the maximum concentrations in groundwater immediately adjacent to residual and pooled DNAPL.

**Residual DNAPL** refers to disconnected blobs and ganglia of the DNAPL, trapped by capillary forces in the pore space of both porous media and fractures (21, 27, 44). The blobs and ganglia are typically from 1 to 10 grain diameters in size in unconsolidated deposits (44), and are left behind in the pathways that DNAPL has migrated through.

**Residual Saturation** refers to the volume of residual DNAPL present in a unit volume of pore space. Residual DNAPL saturations typically vary between 5% and 30% of pore space in both porous media and fractures (21, 27, 44).

**Source Zone Architecture** refers to (i) the overall shape and dimensions of the source zone, (ii) the ratio of residual to pooled DNAPL (also referred to as the ganglia to pool ratio), (iii) the lateral continuity of zones of residual DNAPL and DNAPL pools, (iv) the thickness of zones of residual DNAPL and DNAPL pools, and (v) the portion of lenses and layers containing DNAPL versus those void of DNAPL. The source zone architecture influences the downgradient dissolved-phase plume concentrations and mass flux distribution.

**Wettability** refers to the affinity of the DNAPL for a solid surface in the presence of water (6, 27). Many DNAPLs are non-wetting, implying that they will preferentially occupy the pore spaces within coarser grained lenses and laminations, and larger aperture fractures. Some DNAPLs are wetting with respect to water, however, implying that they will preferentially coat the aquifer materials and thereby occupy the pore spaces of the finer grained media. Coarser grained horizons and larger aperture fractures represent capillary barriers to DNAPLs that are wetting with respect to water.

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## Appendix A - Example Calculations

Note that the following calculations are generally subject to uncertainty because of input parameter variability. This variability may stem from spatial or temporal variation in site-specific conditions, or variation in textbook parameters such as contaminant chemical properties. The investigator is advised to make conservative choices with respect to input parameters and consider using a range of either measured or estimated values when performing calculations.

### Calculation 1 – Chemical Concentration in Soil Corresponding to Threshold DNAPL Saturation

$$C_D = \frac{S_r \phi \rho_N 10^6}{\rho_b} + C^T$$

- $C_D$  = soil concentration (mg/kg) corresponding to threshold DNAPL saturation [calculated],
- $S_r$  = threshold DNAPL saturation [set between 0.05 and 0.10],
- $\phi$  = effective porosity (unitless) [site specific measurement],
- $\rho_N$  = DNAPL density (g/cc) [site specific measurement],
- $\rho_b$  = dry soil bulk density (g/cc) [site specific measurement],
- $C^T$  = amount of contaminant (mg/kg) present in the soil sample in the aqueous, vapor, and sorbed phases [see Calculation 2 to evaluate  $C^T$ ].

#### Example Calculation

PCE DNAPL ( $\rho_N = 1.62$  g/cc) in a soil sample with  $S_r = 0.05$ ,  $\phi = 0.25$  and  $\rho_b = 2.0$  g/cc corresponds to (ignoring the  $C^T$  fraction)  $C_D = 10,125$  mg/kg. Note that the quantity  $C^T$  is typically negligible compared to the DNAPL saturation term. The above equation is applicable to single-component DNAPLs in unconsolidated porous media. See reference (25) for the relationship between  $C_D$  and DNAPL saturation for a multi-component DNAPL. It should be noted that  $0.05 \leq S_r \leq 0.10$  is suitable for geologic deposits having typical ranges of  $f_{oc}$  values (i.e., less than 2%). In general, the value of  $S_r$  should be chosen such that the resulting  $C_D$  is at least an order of magnitude higher than the  $C^T$  in calculation 2 arrived at using the highest  $f_{oc}$  value measured at the site.

### Calculation 2 – Threshold Chemical Concentration in Soil Based on Partitioning Relationships (see Ref. 11)

$$C_i^T = \frac{C_i}{\rho_b} (K_d \rho_b + \theta_w + H' \theta_a)$$

- $C_i^T$  = soil concentration (mg/kg) threshold for component  $i$  [calculated],
- $C_i$  = effective solubility (mg/l) [see Calculation 3] of component  $i$  [calculated],
- $\rho_b$  = dry soil bulk density (g/cc) [site specific measurement],
- $K_d$  = soil-water partition coefficient (ml/g) [calculated using  $K_d = K_{oc} f_{oc}$ ],
- $\theta_w$  = water-filled porosity (unitless) [calculated from site specific measurement of moisture content],
- $H'$  = unitless Henry's constant [handbook],
- $\theta_a$  = air-filled porosity (unitless) [site specific measurement],
- $K_{oc}$  = organic carbon - water partition coefficient (ml/g),
- $f_{oc}$  = fraction organic carbon (unitless) [site specific measurement].

$C_i^T$  represents the maximum amount of contaminant  $i$  that can be present in a porous media sample in the sorbed, aqueous, and vapor phases without a DNAPL phase present. The calculation can be applied below the water table by setting  $\theta_a = 0$ . Note that the water-filled porosity and the air-filled porosity sum to the total porosity. Note also that the calculation of  $C_i^T$  is typically more sensitive to  $f_{oc}$  than it is to the porosity values.

*Example Calculation*

Consider a single-component DNAPL composed of TCE ( $C_i = 1100$  mg/l,  $K_{oc} = 126$  ml/g,  $H' = 0.31$ ) in a soil sample having  $\theta_w = 0.15$ ,  $\theta_a = 0.10$ ,  $\rho_b = 2.0$  g/cc, and  $f_{oc} = 0.003$ . The corresponding value of  $C^T$  is 515 mg/kg. For a multi-component DNAPL, a separate value of  $C_i^T$  would be calculated using the above equation for each component detected in the soil sample.

**Calculation 3 – Effective Solubility Calculated Using Raoult's Law (see Ref. 2)**

$$C_i = m_i S_i$$

- $C_i$  = effective solubility (mg/l) of component  $i$  [calculated],  
 $m_i$  = mole fraction (unitless) of component  $i$  in the DNAPL [site specific measurement],  
 $S_i$  = single-component solubility (mg/l) of component  $i$  [handbook].

*Example Calculation*

Consider a 3-component DNAPL composed (by mass) of 25% TCE ( $S_i = 1100$  mg/l), 35% PCE ( $S_i = 200$  mg/l), and 40% toluene ( $S_i = 500$  mg/l); the corresponding mole fractions (see Calculation 5) are 0.23, 0.25, and 0.52 respectively, and the corresponding effective solubilities are 250 mg/l, 50 mg/l, and 260 mg/l respectively. Sampled groundwater concentrations in excess of 1% of any of these effective solubilities are evidence of possible DNAPL presence in the vicinity of the monitoring point. The distance to the DNAPL cannot be determined on the basis of the magnitude of the groundwater concentration alone. In cases where some of the components of the DNAPL are not known, the unknown mass fraction can be assigned an estimated molecular weight, or the average of the molecular weights of the known components.

**Calculation 4 – Threshold Chemical Concentration in Soil Based on Partitioning Relationships Where Composition of DNAPL is Not Known**

$$\sum_{i=1}^n \frac{C_{obs,i}^T}{C_{S,i}^T} \geq 1$$

- $C_{obs,i}^T$  = reported concentration (mg/kg) of component  $i$  [site specific measurement],  
 $C_{S,i}^T$  = single component soil partitioning concentration (mg/kg) of component  $i$  (see  $C_i^T$  in Calculation 2),  
 $n$  = number of components observed in the soil sample [site specific measurement].

For a multi-component DNAPL of unknown composition, the sum of the mole fractions must equal unity. DNAPL will therefore be present in a soil sample if sum of  $\frac{C_{obs,i}^T}{C_{S,i}^T}$  exceeds unity.

Note that  $C_{S,i}^T$  is calculated for each component in the summation using Calculation 2 with the single-component solubility as input. The presented technique can be prone to false negatives in cases where the soil sample was not analyzed for some of the components of the DNAPL. Because of this, it may be prudent in some cases to only use the calculation for demonstrating that DNAPL was present in a soil sample and not rely upon it to demonstrate that DNAPL was absent from a soil sample.

*Example Calculation*

The table below provides an example calculation for a soil sample in which 5 components have been detected. The sample is characterized by a porosity of 25%, a fraction organic carbon of 0.003, and a dry bulk density of 1.99 g/cc. The last column of the table sums to greater than 1.0, indicating that DNAPL was present in the soil sample.

Compound	$C_{obs,i}^T$ (mg/kg)	$K_{OC}$ (l/kg)	Handbook Solubility (mg/l)	$C_{S,i}^T$ (mg/kg)	$\frac{C_{obs,i}^T}{C_{S,i}^T}$
Trichloroethylene	145	126	1100	554	0.262
Tetrachloroethylene	155	364	200	244	0.636
Carbon Tetrachloride	200	439	790	1140	0.175
Chlorobenzene	177	330	500	558	0.317
1,1,1-Trichloroethane	213	152	1320	768	0.277
				<b>SUM =</b>	<b>1.668</b>

#### Calculation 5 – Mole Fraction (*n*-component DNAPL)

$$m_i = \frac{\frac{ms_i}{mw_i}}{\frac{ms_i}{mw_i} + \frac{ms_{i+1}}{mw_{i+1}} + \dots + \frac{ms_n}{mw_n}}$$

$m_i$  = mole fraction of component *i* (unitless) in the DNAPL [calculated],

$ms_i$  = mass fraction of component *i* (unitless) in the DNAPL [measured],

$mw_i$  = molecular weight (g/mol) of component *i* [handbook].

#### Example Calculation

Consider a 3-component DNAPL composed by mass of 25% TCE ( $mw = 131.5$  g/mol), 35% PCE ( $mw = 165.8$  g/mol), and 40% toluene ( $mw = 92.1$  g/mol). The corresponding mole fractions are 0.23, 0.25, and 0.52 respectively. In cases where some of the components of the DNAPL are not known, the unknown mass fraction can be assigned an estimated molecular weight, or the average of the molecular weights of the known components.

#### Calculation 6 – 1% Effective Solubility Threshold Not Knowing DNAPL Composition

$$\sum_{i=1}^n \frac{C_i^{obs}}{S_i} = \alpha$$

$C_i^{obs}$  = sampled groundwater concentration (mg/l) of component *i* [site specific measurement],

$S_i$  = single-component solubility (mg/l) of component *i* [handbook],

$\alpha$  = cumulative mole fraction of the sample [set],

$n$  = number of components in groundwater sample.

Calculation assumes that the degree of borehole dilution, dispersion, and degradation is identical for each component of interest in an obtained groundwater sample. If the 1% rule-of-thumb is used, DNAPL may be present in the vicinity of a monitoring well if  $\alpha > 0.01$ . The procedure can be applied on a sample-by-sample basis without having to make the assumption that the DNAPL composition is spatially uniform in the subsurface. If it is believed that a value other than 1% effective solubility indicates DNAPL presence,  $\alpha$  can be set to the corresponding value. The presented technique can be prone to false negatives where the groundwater sample was not analyzed for some of the components of the DNAPL. Because of this, it may be prudent in some cases to only use the calculation for demonstrating that  $\alpha$  has been exceeded in a sample and not rely upon it to demonstrate that  $\alpha$  was not exceeded in a sample.



*Example Calculation*

The table below presents an example calculation for 5 components. Although each component has been detected at a concentration less than 1% of  $S_i$ , the cumulative mole fractions sum to 3.4%, providing evidence of possible DNAPL presence in the vicinity of the monitoring location. If the groundwater sample is not analyzed for all components present in the DNAPL, or if any compounds are degrading in the aqueous phase, the calculation procedure will underestimate the likelihood of DNAPL presence.

<b>Compound</b>	$C_i^{obs}$ (mg/l)	$S_i$ (mg/l)	$\frac{C_i}{S_i}$
Trichloroethene	4.4	1100	0.004
Tetrachloroethene	1.8	200	0.009
Toluene	3.5	500	0.007
Chlorobenzene	4.0	500	0.008
Trichloromethane	48.0	8000	0.006
$\sum \frac{C_i^{obs}}{S_i}$			<b>0.034</b>

**Calculation 7 – Plume Detachment Time**

$$t = \frac{LR}{v}$$

- $t$  = time (yrs) required for contaminants to migrate through source zone of length  $L$  in the direction of groundwater flow,  
 $v$  = average linear groundwater velocity (m/yr) [site specific],  
 $R$  = retardation factor (unitless) for the contaminant of interest [site specific measurement – see calculation below],  
 $L$  = length (m) of source zone in direction of flow [site specific measurement].

Calculation assumes unidirectional, steady-state flow conditions subject to advection and sorption only (dispersion and matrix diffusion are ignored). The calculation assumes that contaminant mass is not being added to the saturated flow system from any unsaturated zone sources (e.g., leaching and desorption). Note that  $R$  is often approximated in unconsolidated media by

$$R = 1 + \frac{\rho_b}{\phi} K_{oc} f_{oc}$$

where  $\rho_b$  is the dry bulk density (g/cc),  $\phi$  is the porosity (unitless),  $K_{oc}$  is the organic-carbon partition coefficient (ml/g), and  $f_{oc}$  is the fraction organic carbon (unitless). Calculations considering dispersion and degradation can be found in (10).

*Example Calculation*

Using  $L = 50$  m,  $v = 25$  m/yr, and  $R = 5$ , the source zone should be flushed of dissolved and sorbed contaminants in approximately 10 years following the last release of contaminants. Dispersion, which always occurs, will lengthen this time as will back-diffusion, if it is occurring. In cases where complicated flow conditions exist and where it is desired to account for dispersion and back-diffusion, numerical models can be used to perform the assessment.

**Calculation 8 – Conversion to Parent Compound**

Daughter product concentrations can be converted to equivalent parent product concentrations by converting the daughter mass/volume concentrations to moles/volume, attributing that number of moles to the parent, and then converting the parent concentration to mass/volume.

*Example Calculation*

Consider a groundwater sample containing 500 ppb PCE, 400 ppb TCE, 1300 ppb cis-1,2 DCE and 44 ppb VC at a site where it is known that only PCE was released to the subsurface. It is assumed that biodegradation has not progressed beyond VC. The PCE concentration of 500 ppb is less than 1% of the PCE solubility (1% PCE solubility is 2000 ppb). Given TCE, cis-1,2 DCE and VC molecular weights of 131.5, 97.0 and 62.5 g/mol, respectively, the groundwater concentrations of these compounds are equal to  $3.042\text{E-}06$  mol/l,  $1.340\text{E-}05$  mol/l and  $7.040\text{E-}07$  mol/l, respectively. Assuming that each mole of daughter product derives from one mole of parent product, the equivalent total concentration of parent product is  $2.016\text{E-}05$  mol/l. This corresponds to an equivalent parent (PCE) concentration of 3343 ppb (PCE molecular weight 165.8 g/mol), which exceeds the 1% solubility value of 2000 ppb.





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# EXHIBIT F

# Chemicals Used In Drycleaning Operations

January, 2002  
Revised July 2009

[Chemicals Search Menu](#)

The following resource was developed for the State Coalition for Remediation of Drycleaners (SCRD) using material safety data sheets (MSDS) and other sources. The report was prepared by Bill Linn, Florida Department of Environmental Protection (FDEP). Scott Stupak, North Carolina Superfund Section, provided technical support for database development.

## INTRODUCTION

A wide variety of chemicals has been used and is currently utilized in drycleaning operations. Using material safety data sheets (MSDS) and other sources; a drycleaning chemical data base was developed that includes many of the chemicals that have been used in drycleaning operations. These data and the accompanying text are intended to aid those engaged in the assessment and remediation of contaminated drycleaning sites and to assist regulators conducting compliance inspections at drycleaning facilities. Some of the chemicals/products listed on the spreadsheet are no longer manufactured, marketed or used in drycleaning operations.

### Drycleaning Chemical Data Spread Sheet

The spread sheet is divided into the following categories:

- Chemical product or trade name (as listed on the MSDS)
- Chemical manufacturer or distributor
- Use or function of the product
- Additional information
- Chemical constituent(s) as listed on the MSDS
- Chemical Abstract Numbers (CAS #s) for listed constituents
- Relative concentration of the constituent in the product

All product ingredients or constituents that appear on the MSDS were listed on the spread sheet – both hazardous and non-hazardous. The manner in which product constituents are reported on MSDS varies widely. Many manufacturers/vendors simply list all ingredients as being proprietary (trade secrets). Others indicate that there are hazardous constituents in the product, but do not identify the constituents. Some MSDS include statements to the effect that there are no hazardous

constituents in the product based on current regulations as they (the vendor/manufacturer) interpret them. Therefore, some of the products listed on the spreadsheet have no data listed for constituents. Some of the chemical manufacturers, however, do offer fairly comprehensive data on constituents in their MSDS.

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Chemicals used in drycleaning operations can be grouped into five broad categories:

- Drycleaning Solvents
- Other Chemicals Used In the Drycleaning Machine
- Pre-cleaning/Spotting Agents
- Garment Treatment Chemicals
- Chemicals Used In Solvent & Equipment Maintenance

## **DRYCLEANING SOLVENTS**

Historically, a number of different chemicals have been utilized as drycleaning solvents. These include: camphor oil, turpentine spirits, benzene, kerosene, white gasoline, petroleum solvents (primarily petroleum naphtha blends), chloroform, carbon tetrachloride, perchloroethylene, trichloroethylene, 1,1,2-trichlorotrifluoroethane, glycol ethers, 1,1,1-trichloroethane, decamethylcyclopentasiloxane, n-propyl bromide and liquid carbon dioxide.

### **Petroleum Drycleaning Solvents**

Petroleum-based compounds have been the most widely used solvents in drycleaning. At the beginning of the twentieth century, raw white gasoline was the drycleaning solvent of choice in the United States. Because of fires and explosions associated with the use of gasoline, drycleaning facilities were unable to obtain insurance and many cities banned drycleaning operations within their city limits. Due to these circumstances, a drycleaner from Atlanta named William Joseph Stoddard worked with Lloyd E. Jackson of the Mellon Research Institute and the petroleum refining industry to develop a less volatile petroleum drycleaning solvent in 1924 which is now known as Stoddard solvent. In 1928, the U.S. Department of Commerce promulgated Commercial Standard CS3-28 which required that petroleum drycleaning solvents must have a minimum flash point of 100 degrees Fahrenheit. Drycleaners began using Stoddard solvent in 1928 (Martin, 1958). From the late 1920s until the late 1950s Stoddard solvent was the predominant drycleaning solvent in the United States.

Stoddard solvent is a mixture of petroleum distillate fractions (petroleum naphtha) which is composed of over 200 different compounds. These solvents are composed predominantly of alkanes and cycloalkanes, with some aromatic compounds. Although many people refer to any petroleum drycleaning solvent as Stoddard solvent, this is incorrect. More properly, Stoddard solvent is a mixture of C<sub>5</sub> – C<sub>12</sub> petroleum hydrocarbons containing 30 – 50% straight- and branched –chained



alkanes, 30 – 40% cycloalkanes, and 10 – 20 % alkyl aromatic compounds (Sciences International, 1995).

The high aromatic content petroleum solvents are no longer widely used in drycleaning (Schreiner, 2001). Since the introduction of Stoddard solvent, the industry trend has been towards the development of higher flash point petroleum drycleaning solvents which have little to no aromatic hydrocarbon content. In 1950, the National Institute of Cleaning and Dyeing worked with the U.S. Bureau of Standards to develop standards for a higher flash point petroleum drycleaning solvent known as 140-F solvent (Michelsen, 1957). Beginning in the early 1990s petroleum drycleaning solvents with even higher flash points were developed such as:

- **Drycleaning Fluid-2000 or DF-2000™ Fluid:** This solvent is manufactured by ExxonMobil Chemical Company and was first marketed by Exxon Chemicals in 1994. It is described as synthetic, hydro-treated aliphatic hydrocarbons. More specifically, it is composed of C<sub>11</sub> to C<sub>13</sub> hydrocarbons (isoparaffins and cycloparaffins). It contains no aromatic compounds. It has a flash point of 147° F.
- **EcoSolv® Dry Cleaning Fluid:** This solvent is manufactured by Chevron Phillips Chemical Company LP. It was originally marketed under the name of HC-DCF High Flash. It is described as a mixture of aliphatic hydrocarbons, but more specifically it is composed of a mixture of C<sub>10</sub> – C<sub>13</sub> isoparaffins. It has a flash point of 142° - 144° F.
- **Hydroclene® Drycleaning Fluid:** This solvent is manufactured by Shell Chemical Company but is marketed by Caled Chemical. It "...is a mixture of normal-, iso- and cyclo-paraffins..." (CARB, 2005). It has a flash point of 145° F.
- **Shell Sol 140 HT:** This solvent is manufactured by Shell Chemical Company. It is mixture of predominantly C<sub>9</sub> – C<sub>12</sub> hydrocarbons. It has a flash point of 145° F.

One of the problems associated with petroleum drycleaning solvents is biodegradation. Bacteria introduced into the drycleaning system through the clothing or in water introduced into the system will feed on the petroleum solvent, detergents, oils and fatty acids producing "sour smells". To combat this problem, bactericides or antioxidants are added to the system, normally in detergents. The biocides used today are reportedly similar to those used in shampoos, laundry products and cosmetics. In the past, PCE was added to drycleaning soaps used with petroleum drycleaning solvents as a bacterial inhibitor (Albergo, 1997). Butylated hydroxytoluene (BHT), an anti-oxidant or oxygen stabilizer is added (10 ppm) to EcoSolv®, the high-flash petroleum drycleaning solvent manufactured by Chevron Phillips Chemical Company LP (CARB, 2005).

Two products currently marketed to inhibit biodegradation of petroleum drycleaning solvents include:

- **Desolan NT:** This product is manufactured by SEITZ GmbH Chemische Fabrik and is described as an odor eliminator. It contains an ingredient described as "bacteriostatics".

- Varnicide: This product is manufactured by Adco, Inc. It is described as an “antioxidant/microbial – to prevent the development of rancid odors.”

### **Carbon Tetrachloride**

Carbon tetrachloride was the first chlorinated solvent used in drycleaning operations. It was first imported to the United States from Germany by Ernest C. Klipstein in 1898 and was sold as a drycleaning and spot-removing agent under the trade name of Carbona (Doherty, 2000). It was commonly used in drycleaning by the 1930s. By 1940 annual carbon tetrachloride use by the U.S. drycleaning industry was estimated to be 45 million pounds versus 12 million pounds of Perchloroethylene and 5 million pounds of trichloroethylene (Michelsen, 1957). Carbon tetrachloride was sometimes blended with other solvents for use as a drycleaning solvent. Because of its high toxicity and tendency to contribute to machinery corrosion, carbon tetrachloride is no longer used in drycleaning operations. Carbon tetrachloride was phased out as a drycleaning solvent in the early 1950s (Kirk-Othmer, 1965).

### **Trichloroethylene**

In 1930, trichloroethylene (TCE) was introduced as a drycleaning solvent in the United States (Martin, 1958). TCE causes bleeding of some acetate dyes at temperatures exceeding 75 degrees Fahrenheit. It was never widely used in this country as a primary drycleaning solvent. TCE is, however, still widely used as a dry-side pre-cleaning or spotting agent and in water repellent agents. TCE is the principle ingredient in Fast PR, 2-1 Formula, Picrin, Puro, SemiWet Spotter, Spra-Dri and Volatile Dry spotter (V.D.S.).

### **Perchloroethylene**

The first commercial production of perchloroethylene (PCE) in the United States occurred in 1925 (U.S. E.P.A., 1989). However, the first documented use of PCE as a drycleaning solvent in the United States was in 1934 (Martin, 1958). The superior cleaning ability of PCE, coupled with some municipal fire codes prohibiting the use of petroleum solvents in drycleaning operations resulted in the increasing use of PCE in drycleaning operations. By 1948, perchloroethylene replaced carbon tetrachloride as the leading chlorinated solvent used in drycleaning (Chemical Week, 1957). In 1962, PCE became the drycleaning solvent of choice in the United States and drycleaning accounted for 90% of PCE consumption (Chemical Engineering News, 1963).

In general, there are four grades of manufactured PCE: a drycleaning grade, a vapor degreasing grade for metal degreasing, a technical grade for the manufacture of other chemicals and a high purity grade used for extraction. Drycleaning-grade PCE is produced in the United States by Dow Chemical (trade name DowPer™), Vulcan Chemicals (trade name PerSec®), and PPG Industries, Inc. Drycleaning-grade PCE is also produced by ICI (Ineos Chlor Americas) under the trade names Perklone™ D and Perklone™ DX, and exported to the United States.

Material Safety Data Sheets for drycleaning-grade PCE indicate that it has a purity ranging from 99% to 99.9%. Some of the documented impurities are: 1,1,1-trichloroethane, carbon tetrachloride, dichloromethane, trichloroethylene, water and other chlorinated solvents (European Communities,

2005). Perchloroethylene is a highly oxidized compound and has been called the most stable of the chlorinated solvents. However, PCE degrades in the presence of light, heat and oxygen to form trichloroacetyl chloride and tetrachloroethylene oxide. If water is present hydrochloric acid is generated (Knight, 1969). Water is present in the drycleaning machine and distillation of spent solvent at high temperatures can result in PCE breakdown. The presence of impurities in PCE, such as 1,1,1-trichloroethane and trichloroethylene and the presence of those compounds in some dry-side spotting and pre-cleaning agents used in drycleaning contributes to the formation of hydrochloric acid and corrosion of metals in the drycleaning machine. Both 1,1,1-trichloroethane and trichloroethylene degrade at lower temperatures than PCE.

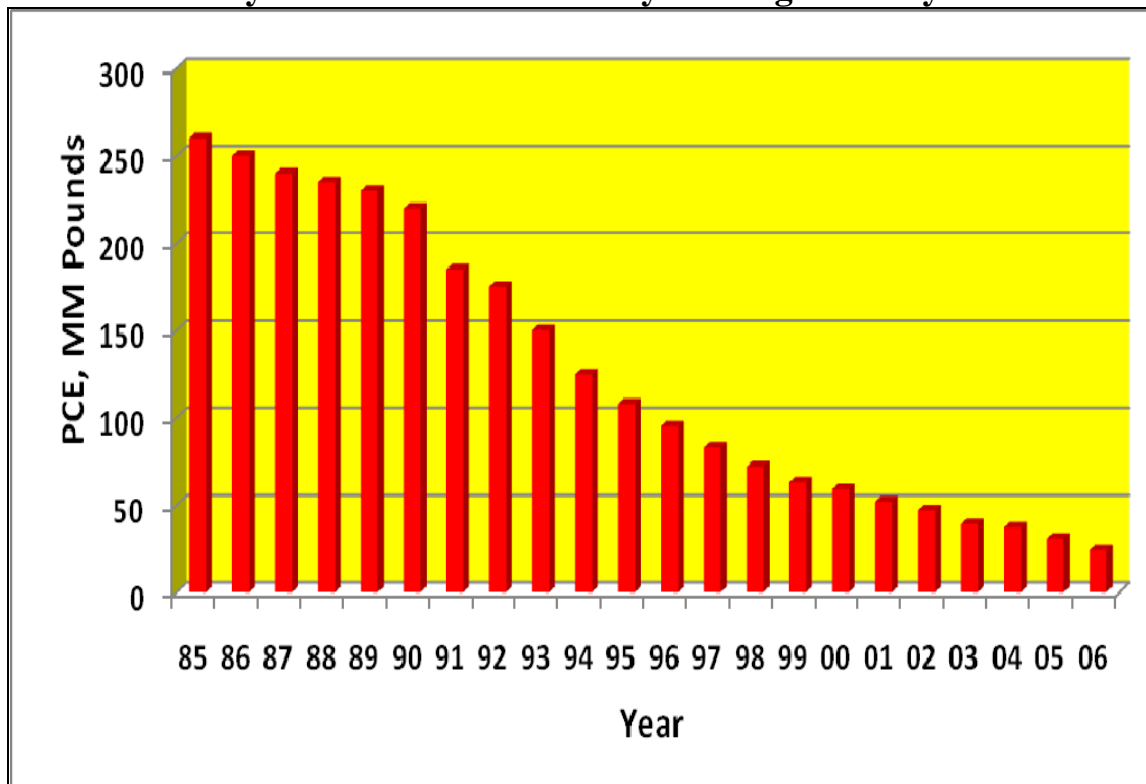
To combat this problem, drycleaning solvent manufacturers add stabilizers to PCE. These stabilizers function as antioxidants or oxidation inhibitors and acid acceptors, neutralizing the acidic PCE. Some of the early drycleaning-grade PCE stabilizers were benzotriazole related compounds (Knight, 1969). Other compounds that have been used to stabilize drycleaning-grade PCE are 4-methylmorpholine, diallylamine, tripropylene, cyclohexane oxide, betaethoxypropionitrile, and 4-methoxyphenol. Concentrations of stabilizers in PCE range from 0.005% to 0.5% (by volume). In general, the concentrations of stabilizers in drycleaning grade PCE are lower than the concentrations of stabilizers in PCE and PCE/solvent blends using in degreasing operations. Other compounds that have been used as PCE stabilizers are 2,3-epoxypropyl isopropylether, 2,6-bis (1,1-dimethylethyl)-4-methylphenol, 2,4-di-tert-butylphenol, di-isopropylamine, tert-amylphenol and tert-butylglycidylether (European Community, 2005).

Some drycleaners purchase and use reclaimed PCE. This reclaimed solvent has a reported purity of 95 – 99%. Typical impurities in reclaimed PCE are: methyl ethyl ketone, mineral spirits, toluene, 1,1,1-trichloroethane and other chlorinated solvents. The spent PCE that is reclaimed does not come solely from drycleaning operations. Generally, stabilizers are not added to reclaimed PCE prior to it being sold. Reclaimed PCE is often blended by the drycleaner with commercial (stabilized) PCE prior to use in drycleaning. Drycleaning wholesale supply facilities sell PCE stabilizers. An example of such a product is Perchlor Type 236, marketed by PPG Industries, Inc. It is described as a perchloroethylene stabilizer concentrate and contains cyclohexane oxide, beta-ethoxy propionitrile, n-methyl morpholine, and 4-methoxyphenol (PPG Industries, 1999).

PCE use in the United States peaked in 1980 and drycleaning was the largest user of PCE (Dougherty, 2000). Based on data collected in the 1980 Census, approximately 86.7% of U.S. drycleaners used PCE in 1980 (USDC, 1986). In 1990, the United States Environmental Protection Agency (U.S. E.P.A.) proposed national emission standards to limit PCE emissions from drycleaning plants. More drycleaners replaced transfer machines with dry-to-dry machines and improvements in the design of these machines resulted in reduced PCE emissions and higher solvent mileage, the amount of fabric cleaned per a quantity of solvent. As late as 1996, the drycleaning industry was still the largest user of PCE in the United States (Leder, 1999). In September of that year, E.P.A. issued National Emission Standard Hazardous Air Pollutants (NESHAP) Requirements which obligated PCE drycleaners to monitor emissions and keep records of drycleaning machine maintenance. In January of 2006, the California Air Resources Board voted to phase out PCE drycleaning by 2023 (California E.P.A., 2007). Under the Final Rule - National Perchloroethylene Air Emission Standards for Dry Cleaning Facilities, transfer machines could no longer be used in PCE drycleaning operations after July 27, 2008 (E.P.A., 2006). These actions have resulted in a

decline in the amount of PCE used by drycleaners and stimulated the introduction of alternative drycleaning solvents. According to the Halogenated Solvents Industry Alliance, by 2007, PCE was used by approximately 70% of U.S. commercial drycleaners and only 10% of the PCE used in the U.S. was for drycleaning/textile processing (HSIA, 2008).

### Perchloroethylene Demand in U.S. Drycleaning Industry 1985 - 2006



Source: Textile Care Allied Trades Association

### 1,1,2-Trichlorotrifluoroethane

In 1964 E.I. DuPont de Nemours & Company introduced a chlorofluorocarbon drycleaning solvent known as 1,1,2-trichlorotrifluoroethane or Freon 113 (Johnson, 1971). Its trade name was Valclene<sup>®</sup>. Since the vapor pressure of Valclene<sup>®</sup> is approximately 20 times that of PCE, clothes cleaned in Valclene<sup>®</sup> could be dried at lower temperatures and it was therefore promoted as the solvent of choice for the drycleaning of delicate fabrics. Freon 113 is one of the chlorofluorocarbons subject to the Montreal Protocols and is no longer manufactured. It was never widely used in drycleaning and Valclene<sup>®</sup> drycleaning operations have either shut down or converted to other solvents.

### 1,1,1-Trichloroethane

In the early 1980s, Dow Chemical began marketing 1,1,1-trichloroethane (a.k.a. methyl chloroform or TCA) as a drycleaning solvent under the name Dowclene LS<sup>®</sup>. It was used particularly in leather cleaning operations. Reportedly, only approximately fifty (50) drycleaning plants in the United States ever used TCA as a primary solvent. TCA is not a very stable solvent and was heavily

stabilized. Despite this, there were problems with machine and equipment corrosion. TCA has been used as a pre-cleaning and spotting agent. It has also been used as a carrying agent in fabric waterproofing and in stain repellents.

### Glycol Ethers

- **RYNEX<sup>®</sup> Biodegradable Dry Cleaning Solution:** Rynex<sup>®</sup> was the first glycol ether based drycleaning solvent. It was first marketed in 1999 (Hayday, 2007). It is a mixture or blend of aliphatic propylene glycol ethers. An earlier formulation of Rynex<sup>®</sup> reportedly contained propylene glycol t-butyl ether (PGtBE). The current product reportedly contains dipropylene glycol tert-butyl ether (DPTB) and is called Rynex<sup>®</sup> 3 (CARB, 2008). Rynex<sup>®</sup> has a flashpoint of  $>200^{\circ}$  F and a specific gravity of 0.91.
- **Impress<sup>™</sup>** is described as aliphatic propylene glycol ethers. It has a flash point of  $190.4^{\circ}$  F and a relative density of  $\sim 0.922$ . It is manufactured by Lyondell Chemical Company and was first marketed in April of 2004 (Liotta, 2007).
- **GEN-X Drycleaning Fluid** is a blend of aliphatic Propylene Glycol Ether and hydrotreated heavy naphtha. It has a flashpoint of  $160^{\circ}$  F and a relative density of 0.830. It is marketed by Caled Industries.
- **Solvair<sup>™</sup> Drycleaning System** is actually a drycleaning process that uses Solvair<sup>™</sup> Fluid or dipropylene glycol n-butyl ether (dripropylene glycol normal butyl ether or DPnB) as a base cleaning fluid and then utilizes liquid carbon dioxide to rinse the garments. The system is marketed by R.R. Street.

### Decamethylcyclopentasiloxane (GreenEarth<sup>™</sup>)

GreenEarth is a silicon-based solvent which was first marketed as a drycleaning solvent in 1999 (Maxwell, 2007). The chemical name for GreenEarth is decamethylcyclopentasiloxane, a.k.a D5. Its molecular formula is  $C_{10}H_{30}O_5Si_5$ . GreenEarth has a flash point of  $170.6^{\circ}$  F. and a specific gravity of 0.95.

### n-Propyl Bromide

In October 2006 Drycleaning Technologies<sup>™</sup>, a division of Environ Tech International, Inc. began marketing Dry-Solv<sup>™</sup>, an n-propyl bromide (1-bromopropane) based drycleaning solvent (Roccon, 2007). The molecular formula for n-propyl bromide is  $C_3H_7Br$ . It has a specific gravity of 1.33. The MSDS for Dry-Solv<sup>™</sup> indicates that the product is greater than 95% by weight n-propyl bromide. Dry-Solv<sup>™</sup> is stabilized with nitromethane ( $<0.6\%$ ) and 1,2-butylene oxide ( $<0.6\%$ ).

In 2008, Tech Chem began marketing Tech Kleen for Dry Cleaning. Based on its MSDS, Tech Kleen for Drycleaning is  $>94\%$  n-propyl bromide by weight and is stabilized with 1,2-epoxy butane ( $<1\%$ ).

## **PureDry™**

PureDry™ was developed by Niran Technologies and was first marketed in 2000 (Eastern Research, 2005). It is described as a “hybrid” solvent and is a mixture containing 95% isoparaffinic hydrocarbons, (C<sub>9</sub> – C<sub>12</sub> hydrocarbons), hydrofluoroethers (HFEs) and perfluoroisobutylethers (Eastern Research, 2005). PureDry™ has a flashpoint of 350 degrees F and a specific gravity of 0.80.

## **Liquid Carbon Dioxide**

Liquid carbon dioxide is a cleaning process whereby carbon dioxide in a liquid state (operating under a pressure of between 700 to 800 pounds per square inch) is utilized as a solvent. The first commercial liquid carbon dioxide drycleaning plant opened in Wilmington, North Carolina in 1999 (Wentz, 2001).

## **OTHER CHEMICALS USED IN THE DRYCLEANING MACHINE**

### **Detergents**

Detergents are used in the drycleaning process. They perform three different functions:

- carry moisture to aid in the removal of water soluble soils;
- suspend soil after it has been removed from the fabric;
- and act as a spotting agent to penetrate the fabric so that the solvent and water can remove stains.

Based on their charge and how they carry water, there are three classifications of detergents:

- anionic detergents – are negatively charged and carry water by means of solubilization;
- non-anionic detergents - carry no charge and carry water by solubilization;
- cationic detergents – are positively charged and carry water by means of an emulsion. Most cationic detergents are pre-charged with moisture.

Detergents are introduced into the drycleaning machine by two different systems:

- In charged systems, detergent is added to the solvent or “charged” as a certain percentage of the solvent (normally 1 to 2%) to maintain a continuous concentration of detergent. Charged systems use anionic detergents. “Pre-charged solvent” (solvents containing the detergent) have been marketed in the industry, particularly for use in coin-operated drycleaning machines.
- In injection systems, also known as batched detergent injection, solvent is added to the wheel of the drycleaning saturating the garments and then detergent is injected into the flow line or into the drum of the drycleaning machine by a pump or dump method. Cationic detergents are used in injection systems.

The earliest drycleaning detergents were soaps. There were three different types: paste soaps, gel soaps and liquid soaps. Most of these soaps were composed of surfactants, Stoddard solvent, free

fatty acids and some moisture to create an emulsion. When filtration was first utilized in the drycleaning process to purify dirty solvent, it was discovered that paste and gel soaps, also known as “true soaps”, tended to plug or “slime” the filters, so these soaps became obsolete. The liquid soaps, also known as “filter soaps”, sometimes contained a co-solvent such as butyl cellosolve, hexylene glycol, isopropanol, cyclohexanol, ethanolamine or n-butanol, which was used to disperse moisture. By the early 1950s, the industry trend was from liquid soaps to the use of synthetic detergents.

Synthetic detergents are surfactants or mixtures of surfactants with solvents. The following surfactants have been used in commercial drycleaning detergents: soap-fatty acid mixtures; “mahogany” or petroleum sulfonates; sodium sulfosuccinates; sodium alkylarenesulfonates; amine alkylarenesulfonates; fatty acid esters of sorbitan, etc; ethoxylated alkanolamides; ethoxylated phenols; and ethoxylated phosphate esters (Kirk-Othmer, 1965).

The constituents listed for the drycleaning detergents in the drycleaning chemical data spreadsheet include surfactants: phosphate esters, linear alkylbenzenesulfonic acid salt, oxyethylated isononylphenol, diethanolamine, alkearyl sulfonate, sodium sulfonate, and sulfosuccinate. They also include drycleaning solvents and co-solvents that function as carriers. These include perchloroethylene, petroleum solvents and the following cosolvents – butyl cellosolve, hexylene glycol, 2-propanol, isopropyl alcohol, 2-butoxyethanol, diethylene glycol monobutylether, dipropylene glycol monomethylether and glycol ether. The most common solvent contained in the drycleaning detergent mixtures listed on the spreadsheet is petroleum drycleaning solvent (petroleum naphtha blends).

## **Sizing**

Sizing is a type of finish used in drycleaning to restore shape, body and texture to a fabric. Sizing is actually applied to fabrics when they are manufactured and is depleted after several fabric cleanings. Most sizing used in drycleaning operations today is composed of hydrocarbon resins (plastic-based). Alpha methylstyrene and styrene have been used in sizing in the past. There are two forms of sizing used in drycleaning operations, a solid (in a powder or bead form), and a liquid. The solid form of sizing - the bead form - is commonly used in PCE drycleaning systems. Most of the liquid sizing used today has a petroleum solvent carrier. It is not uncommon for liquid sizing to contain over 50% petroleum solvent (petroleum naphtha blends) by volume. Anti static agents and optical brighteners are commonly added to sizing.

Sizing can be applied in three different ways: by a continuous bath in the drycleaning machine; by dipping garments in a tank of sizing; or by spraying sizing in an aerosol form (generally containing a propane/isobutane carrier) on the garments after they have been drycleaned.

In the continuous bath application method a 0.5 to 1.5% charge of sizing is added to the drycleaning machine. The concentration of sizing used in the dipping application method ranges from 1 to 4% (Eisenhauer).



## **Other Chemicals**

Other chemicals used in the drycleaning machine include: optical brighteners, bactericides, fabric conditioners, and anti-static/anti-lint agents

Optical brighteners, also known as fluorescent whitening agents, optical bleaches or optical dyes are used to “make whites whiter”. These chemicals absorb the ultraviolet and violet region of colors in a fabric. These chemicals are normally added to drycleaning detergents or sizing. Optical brighteners have been widely used in laundry detergents for many years. In recent years, they have been used in drycleaning.

Some fabric conditioners are added to the drycleaning process. These are used primarily to condition or restore luster and shine to suede, leathers and silks. These products are typically solvent based – petroleum naphtha or perchloroethylene.

Anti-static agents and anti-lint agents (to prevent lint buildup and retention) are available for drycleaning operations. Some chemicals used in anti-static agents are sulfonated polystyrene or sulfonated polystyrene/maleic anhydride polymers.

## **PRE-CLEANING/SPOTTING AGENTS**

The greatest number and variety of chemicals used in drycleaning operations are used in pre-cleaning and spot cleaning or operations. Prior to being placed in the drycleaning machine, heavily stained garments are usually pre-cleaned or pre-spotted with cleaning chemicals. The types of chemicals used depend on the type of stain and the type of fabric being cleaned. After they are drycleaned, garments that are still stained or soiled are spot cleaned using the same chemicals as in pre-cleaning. There are three types of pre-cleaning/spotting agents: wet-side agents, dry-side agents and bleaches.

### **Wet-side Spotting Agents**

Wet-side pre-cleaning/spotting agents are used to clean water soluble stains from clothing. Wet-side agents can be subdivided into three different classes: neutral, alkaline, and acidic.

Neutral Wet-Side Agents – Neutral spotting agents include water and neutral synthetic detergents (which contain surfactants). These agents are used to remove water-soluble stains, food, beverages and water-soluble dyes.

Alkaline Wet-Side Agents – Alkaline spotting agents include lye, ammonia, potassium hydroxide, sodium hydroxide and so-called protein formula home detergents. Protein formula detergents contain digester enzymes - Amylase, Cellulase, Lipase and Protease. Digesters can be used to remove: starch, cellulose, fats and oils, and protein stains.

Acidic Wet-Side Agents – Acid agents include acetic acid, hydrofluoric acid, oxalic acid, glycolic acid and sulfuric acid. Tannin or plant-based stains can be removed with wet-side spotting agents also known as tannin formula agents.

## Dry-Side Spotting Agents

Dry-side pre-cleaning/spotting agents are used to remove oily-type stains, stains including fats, waxes, grease, cosmetics, paints and plastics. The primary constituents of dry-side agents are non-aqueous solvents and alcohols and include, or have included: perchloroethylene, trichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, methylene chloride, amyl acetate, acetone, ethanol, methanol, isopropyl alcohol and petroleum solvents. In general, from a contamination and regulatory standpoint, dry-side spotting agents include some of the most toxic chemicals used in drycleaning operations.

## Bleaches

Bleaches are used in stain removal when other spotting techniques have failed to remove a stain. This process is known as “spot bleaching”. Bleaches are also used in conventional laundry operations which are conducted at most drycleaning plants. Bleaches can be classified as either oxidizing or reducing.

### Oxidizing Bleaches

Sodium Perborate  
Hydrogen Peroxide  
Sodium Percarbonate  
Sodium Hypochlorite

### Reducing Bleaches

Sodium Bisulfite  
Sodium Hydrosulfite  
Titanium Sulfate  
Oxalic Acid

## GARMENT TREATMENT CHEMICALS

A number of different chemicals are used to treat garments after they are drycleaned. The functions of these chemicals include waterproofing, flame retardants, refurbishing, deodorizing, stain repellents and pest control.

### Waterproofing

Waterproofing of garments by the clothing manufacturer is a relatively recent development. Historically, much of garment waterproofing was performed by drycleaners. In the past, the water proofing agent was usually a wax-based product and the predominant carrying agent for waterproofing agents has been nonaqueous solvents – perchloroethylene and petroleum solvents. Several methods have been used to apply the waterproofing agent, including immersion in the waterproofing agent in a dip tank; spraying the waterproofing agent on the garments in a tank; applying the waterproofing agent in the form of an aerosol spray; and in some cases applying the waterproofing agent in an auxiliary tank in a drycleaning machine (Rising, 1997).

## **Flame Retardants**

Flame retardants are normally applied to garments by garment or textile manufacturers. Flame retardants can be depleted through repeated conventional laundering and drycleaning of garments. In the past, some drycleaners have treated or re-treated garments with flame retardants. Some of the chemicals used in flame retardants include: decabromodiphenyl oxide (DBDPO), organophosphates, phosphate salts and phosphated esters. Dry-side application of flame retardants used drycleaning solvent as the carrying agent. The flame retardant chemicals were applied by immersion or dipping in a tank or by spraying the garment with the flame retardant (IFI, 1995).

## **Fabric Conditioner**

Chemicals are applied to refurbish garments after drycleaning. Typically, these garments can include suedes, leathers, silks, wools and vinyls. These chemicals are usually applied by spraying the garment (using a spray bottle or aerosol spray). Plasticizers such as di-N-butyl phthalate and di-2-ethylhexyl adipate are used to re-condition vinyl garments.

## **Stain Repellents**

Stain repellents are generally applied by the garment manufacturer, but some drycleaners do apply stain repellents. Historically, these products have been silicone based and the carrying agent has been 1,1,1-trichloroethane (no longer used) or petroleum naphtha (IFI, 1994). Stain and water repellent chemicals used in drycleaning today use non-aqueous solvents as carrying agents (PCE, TCE, methylene chloride and petroleum solvents). A common constituent of many of these repellents is aluminum alcoholates. Most stain repellents can be applied as an aerosol spray.

## **CHEMICALS USED IN SOLVENT & EQUIPMENT MAINTENANCE**

### **Solvent Maintenance & Treatment**

From the early part of the twentieth century until the early 1950s, both alkalis and sulfuric acid were used to clarify spent petroleum drycleaning solvent. The most common alkali used was caustic soda (sodium hydroxide) in an 8-10% solution. The solvent was bubbled through or agitated with the caustic soda solution to help remove soap-fatty acid type detergents. Sulfuric acid was mixed and agitated with the spent solvent and the solids were then allowed to settle out (Martin, 1958).

Distillation of PCE solvent at high temperatures (> 300° F.) can result in the formation of hydrochloric acid in the distillation unit. Several chemicals have been used to neutralize acidic solvent/still bottoms in the distillation unit. These chemicals include sodium carbonate (soda ash), calcium carbonate and Alkanon, an alkali-aluminum silicate. The neutralization process consists of introducing an aqueous solution of the buffering compound into the distillation unit distilling the solvent.

Anti-foaming agents (commonly fluorosilicates) are sometimes added to the distillation unit to prevent contaminants in the spent solvents (pigments, fatty acids, filter powder, detergents water repellents and retexturing agents) from causing excessive foaming during the distillation process.

Detergents are sometimes added to the system to clean the drum and button trap of the drycleaning machine.

### **Filter Maintenance**

Trisodium Phosphate was once used to clean tubular (regenerative) filters – used in powder filtration systems. It is doubtful that any of these tubular filters are still being utilized in drycleaning operations.

### **Detergent Maintenance**

In charged systems, where anionic detergents are used, it is important to maintain a constant detergent concentration. Test kits are utilized to titrate solvent/detergent mixtures to measure the amount of detergent in the system. Chemicals used in these test kits can include: 1,2-dichloroethane, methylene chloride, and chloroform.

### **Boiler Maintenance**

The use of untreated water in a boiler can cause scale buildup and corrosion. Treating the boiler water with chemicals - known as boiler feed water treatment - will increase the life of the boiler and reduce maintenance costs. Scale is formed from calcium and magnesium salts that are carried in solution in the water used in the boiler. Treatment of the boiler water by raising the pH with the addition of alkaline salts – such as sodium or potassium hydroxide – will prohibit most of the calcium and magnesium salts from precipitating and causing scale buildup in the boiler. Sodium sulfite is a constituent of some boiler feed water treatments. This constituent acts as an oxygen scavenger. The presence of oxygen in boiler water will lead to corrosion of the boiler (Faig, 1990). A chelating agent, sodium hexametaphosphate is sometimes added to boiler water to inhibit hard water salts from precipitating to form scale. Hydrochloric acid is sometimes utilized in acid boils to remove scale from the boiler.

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# EXHIBIT G



## Safety Meeting Topics (Bilingual)

### Dry Cleaner Safety

Dry cleaners use chemicals, heat, and steam to clean and press clothing and other fabrics. While helping their customers look spotless, dry cleaners need to be aware of their workplace hazards.

The use of chemicals is the primary hazard in a dry cleaner. Almost all dry cleaning is done with perchlorethylene (PERC), a solvent. Inhaling PERC can lead to serious health effects such as liver and kidney damage, dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. PERC is also a suspected carcinogen.

To avoid overexposure, use PERC in closed-loop dry cleaning equipment that controls the vapors. Check equipment for leaks and fix them promptly. Keep the lids tightly closed on fresh and waste solvent containers. Maintain good ventilation in areas where PERC is used.

Dry cleaners often use "secret-recipe" stain removers and spot cleaning solutions. These recipes may contain highly concentrated PERC and other unknown chemicals. You have the right to know what chemicals are in the spot cleaner you use and their potential hazards. To avoid dermatitis, a skin-irritation caused by chemical exposure, wear gloves and avoid skin contact with PERC and spot cleaning chemicals.

Fire is another hazard in dry cleaning. PERC has low flammability, but Stoddard solvent, an older dry cleaning solution and sometime spot-cleaning solvent, is very flammable. Store solutions and waste in properly closed containers. Check dry cleaning equipment for leaks and repair them immediately. Keep heating elements clear of clothing and lint so heat does not build up and cause a fire.

Dry cleaners suffer ergonomic injuries at a high rate if they do not use safe work practices. The high volume and fast pace of work can lead to fatigue. Take micro breaks every 20-30 minutes. Moving heavy clothing and fabrics requires the use of proper lifting techniques. Folding, pressing, and bagging clothing are repetitive motions. Rotate tasks throughout your day to give your different muscles a break. Try to keep your work at waist level to avoid awkward postures such as reaching and bending.

Watch for pinch and caught/crush injuries when using overhead conveyor systems. Make sure that you and your clothing are clear of the conveyor before activating it. Watch for pinch points on presses and folding machines. Keep an eye on your hands and your mind on your work when you are doing your job.

Dry cleaners are often hot, humid environments, so wear light layers of clothing and drink fluids throughout the day. Watch presses for hot surfaces and steam that can cause burn hazards. Label equipment hot surfaces with warning signs. Water and chemicals can cause spills in the workplace, so clean them up immediately to reduce the chance of a slip, trip, or fall.

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*The above evaluations and/or recommendations are for general guidance only and should not be relied upon for legal compliance purposes. They are based solely on the information provided to us and relate only to those conditions specifically discussed. We do not make any warranty, expressed or implied, that your workplace is safe or healthful or that it complies with all laws, regulations or standards.*

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Supervisor's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Location: \_\_\_\_\_

Meeting Attended By: