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September 11, 2007

Mr. David Parson, P.G., C.E.G.
California Regional Water Quality Control Board
– North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

Subject: Treadwell & Rollo Comments on the Feasibility Study/Pilot Study Work Plan
E and Grotto Streets PCE Plume, Eureka, California

Dear Mr. Parson:

Pursuant to your request, West Environmental Services & Technology, Inc. (WEST) has reviewed the August 15, 2007 Treadwell & Rollo (T&R) letter regarding the June 2007 *Feasibility Study/Pilot Study Work Plan* (*FS/PS Work Plan*) for the E and Grotto Streets Plume in Eureka, California ("the Site"). T&R prepared their letter on behalf of the City of Eureka and provided comments on the *FS/PS Work Plan* and WEST's July 13 2007 response to the California Regional Water Quality Control Board – North Coast Region (Regional Board) comments.

BACKGROUND

Unocal Corporation (Unocal), now owned by Chevron Corporation (Chevron), operated a gasoline service station at the Site from 1964 to 1979 (Regional Board, 2003). Operation of the service station included the use of: two 10,000-gallon gasoline underground storage tanks (USTs); one 280-gallon waste oil UST; and fuel dispenser islands. The USTs and dispenser islands were removed in 1979 when the service station ceased operations. A dry cleaner has operated at the Site since 1980.

Soil and groundwater investigations have been conducted at the Site since 1998. Results of soil investigations revealed the presence of petroleum related hydrocarbons including: total petroleum hydrocarbons as gasoline (TPHg) up to 320 milligrams per kilogram (mg/kg); benzene up to 58 micrograms per kilogram (µg/kg); ethyl benzene up to 6,200 µg/kg; xylenes up to 35,700 µg/kg; 1,3,5-trimethylbenzene up to 6,300 µg/kg; and 1,2,4-trimethylbenzene up to 22,000 µg/kg. The 1998 investigations also revealed chlorinated volatile organic compounds (CVOCs) in soil including tetrachloroethene (PCE) up to 250,000 µg/kg and trichloroethene (TCE) up to 43 µg/kg.

Three monitoring wells were installed in 2000 (MW-1 to MW-3) and four additional monitoring wells were installed in 2002 (MW-4 to MW-7). Borings advanced for the monitoring well installations revealed an aquitard present at approximately 10 to 12 feet below ground surface separating the shallow groundwater (A-Zone) from the deeper groundwater (B-Zone). These monitoring wells were constructed across the aquitard to depths of 20 to 25 feet below ground

surface. Groundwater samples from the monitoring wells have revealed TPHg up to 21,000 micrograms per liter (µg/l; MW-3) and PCE up to 14,000 µg/l (MW-3).

In July 2003, the Regional Board issued a Cleanup and Abatement Order (CAO) for the groundwater contamination at the Site (Regional Board, 2003). The CAO required that the horizontal and vertical extent of the soil and groundwater contamination at the Site be determined and an appropriate feasibility study/remedial action plan be prepared to address the contamination. In 2003 and 2005, soil and groundwater investigations were conducted pursuant to the CAO. The investigations included the installation of nested groundwater-monitoring wells (MW-8A and MW-8B through MW-11A and MW-11B); and abandonment of monitoring wells MW-1 through MW-7. In 2006, additional soil and groundwater samples were collected to delineate the extent of PCE in shallow soil as well as delineate the lateral extent of PCE in shallow and deeper groundwater.

In February 2007, the *Site Investigation Work Plan* (WEST, 2007) was developed based on the results of the previous investigations. The *Site Investigation Work Plan* presented a scope-of-work to: evaluate the physical integrity of underground utilities; characterize soil gas conditions; and delineate the downgradient lateral and vertical extent of PCE in groundwater. In April 2007, on behalf of Norman's Dry Cleaners WEST performed: utility investigations; soil gas sampling; lithologic characterization; and groundwater sampling.

The utility investigations revealed defects in the sanitary sewer main downstream of the discharge from 2907 E Street. The defects observed in the sewer main included: broken pipe segments; offset joints; grease buildup; sags; and surcharged conditions. Laboratory analyses of the soil gas samples revealed PCE at 229,000 micrograms per cubic meter ($\mu g/m^3$) in the area behind the building at 2907 E Street and 408 $\mu g/m^3$ in the northwest corner of 2907 E Street.

Laboratory analyses of the groundwater samples revealed the presence of PCE at: 10,300 µg/l in the sample collected from 15-feet below ground surface approximately 190 feet downgradient of 2907 E Street; and at 14,300 µg/l in the sample collected from 22-feet below ground surface approximately 370 feet downgradient from 2907 E Street. The groundwater sample collected from 52 feet below ground surface did not reveal the presence of PCE above the laboratory-reporting limit of 0.5 µg/l. The downgradient groundwater sample collected in Lowell Street at 35-feet below ground surface revealed the presence of PCE at 136 µg/l.

The findings from the April 2007 investigations were used to update the Conceptual Site Model (CSM). Based on an analysis of the Site investigation data, it appears likely that PCE was released as a dense non-aqueous phase liquid (DNAPL) and has been retarded in its vertical movement by the presence of the A-Zone/B-Zone aquitard. The data also indicate that PCE was released from onsite operations at 2907 E Street and from defects in the sewer main beneath E Street. These findings were presented to representatives of the City of Eureka, Chevron and the Regional Board staff at a meeting on May 17, 2007.

Subsequent to the May 17, 2007 meeting, the findings were presented in the *FS/PS Work Plan* submitted on June 10, 2007 to the Regional Board, with copies provided to the City of Eureka and Chevron. The *FS/PS Work Plan* was prepared pursuant to the CAO and requirements of

State Water Resources Control Board Resolution 92-49 *Policies and Procedures for Investigation and Abatement of Discharges Under Water Code Section 13304* (SWRCB Resolution 92-49), to summarize the findings and present the proposed approach to evaluate potential remedial technologies to address the releases of petroleum hydrocarbons and VOCs at the Site. The preliminary remedial technology evaluations conducted in preparation of the *FS/PS Work Plan* indicated that further studies, i.e., pilot studies, are needed to evaluate potential technologies to address the DNAPL source-zone material and the dissolved-phase VOCs.

The Regional Board provided comments to the *FS/PS Work Plan* on June 28, 2007, which were discussed during the July 3, 2007 conference call with representatives of Chevron and the Regional Board; the City of Eureka declined participation. Chevron's consultant, ENSR, subsequently provided comments on the *FS/PS Work Plan* on July 6, 2007. In response to a request from the Regional Board, WEST forwarded a copy of the project file to T&R on July 11, 2007. WEST provided responses to the Regional Board comments to the *FS/PS Work Plan* on July 13, 2007. A conference call was held on July 17, 2007 during which the Regional Board indicated that there had been a meeting with the City of Eureka's consultant, T&R, on July 15, 2007. The Regional Board provided a summary of the technical issues raised by T&R, and indicated that T&R would provide comments on the *FS/PS Work Plan* by August 15, 2007 in advance of the project team meeting of August 20, 2007. In a subsequent conference call on July 25, 2007, the Regional Board provided oral approval for the *FS/PS Work Plan.*

WEST provided responses to ENSR's comments on the *FS/PS Work Plan* on July 27, 2007. On August 15, 2007, the City of Eureka's consultant, T&R, provided comments on the *FS/PS Work Plan* and the WEST July 13, 2007 response to the Regional Board's comments. T&R's comments were forwarded to WEST on August 17, 2007 and were discussed at the project meeting held at the Regional Board's office on August 20, 2007 with representatives of Chevron, the City of Eureka and Norman's Dry Cleaners; representatives of T&R did not attend. During the August 20, 2007 meeting, representatives of the Regional Board requested that Norman's Dry Cleaners respond to T&R's comments. As requested, responses to T&R's comments are provided below.

GENERAL COMMENTS

T&R's California Professional Geologist, Patrick Hubbard, P.G., C.E.G. and California Registered Environmental Assessor, Glenn Leong, R.E.A. (herein referred to as T&R) prepared the analysis presented in the August 15, 2007 letter. T&R provided comments on the *FS/PS Work Plan* that primarily focused on a critical review of the adequacy of the existing data to support the CSM. T&R identified the "need" for the addition of certain types of "crucial" and "critical" information, e.g., "accurate and detailed elevation plots," to support the CSM, but in general concluded that the CSM presented in the *FS/PS Work Plan* "is not supported by the data."

However, T&R has neither provided supporting bases for its contention that additional information is needed to support the *FS/PS Work Plan,* nor has T&R provided specific recommendations for the collection of samples to address what they opine are data gaps. In addition, T&R has inaccurately characterized the scope of the proposed pilot studies and offers

unsupported analysis of the adequacy of the engineering evaluations presented in the *FS/PS Work Plan.*

To the extent that there are data gaps that T&R believes exist, they should provide specific recommendations for additional sample collection to address these. As we have discussed, the investigative efforts are proceeding forward, subject to current delays in encroachment permitting. Specific responses to the T&R letter are interlineated below with T&R's comments in italics.

1. Sources – Significant and critical additional information on sources is needed to fully develop the Conceptual Site Model, before it may be used to accurately identify contributors to the contamination.

> We do not concur. T&R does not provide a basis to support their contention that the types of information identified by T&R are needed to support identification of a contributing contaminant source. The identification of contributing sources presented in the *FS/PS Work Plan* has been based on the existing data and an analysis of the CSM in a manner consistent with *SWRCB Resolution 92-49.* Specifically, *SWRCB Resolution 92-49* identifies that "any relevant evidence, whether direct or circumstantial including but not limited to...chemical use, storage or disposal information...Site characteristics and location in relation to other potential sources of a discharge...industry-wide operational practices that have led to discharges, such as leakage of pollutants from wastewater collection systems" shall be used to identify dischargers.[1]

The facilities and operations of Norman's Dry Cleaners and Unocal service station need to be investigated and the results presented relative to the known and potential releases of tetrachloroethene (PCE), benzene, and other contaminants of concern (COCs).

> The historical dry cleaner and service station operations have been investigated and are presented in Section 2.5 of the *FS/PS Work Plan.*

The conclusion that COCs have been released from the main and lateral sewer lines must be supported by evidence that significant quantities of COCs were discharged to the sewer lines, that COCs leaked from the sewers in the vicinity of the property, and that the COCs released from the sewer lines contributed to the contamination detected in the soil and/or groundwater.

> The conclusion regarding the sources of contamination has been developed based on an analysis of Site data using many lines of evidence. Data has been presented regarding the historical use and discharge of wastes to the sewer lines. It, however, is unclear what T&R believes constitutes a "significant" quantity. Our analysis of the Site data presented in Section 4.1 of the *FS/PS Work Plan* indicates that the presence of the PCE downgradient from the dry cleaner is consistent with a release originating from the City's wastewater collection system.

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[1] State Water Resources Control Board, *Resolution 92-49 Policies and Procedures for Investigation and Abatement of Discharges Under Water Code Section 13304,* October 2, 1996. (SWRCB Resolution 92-49).

The conclusions presented in the *FS/PS Work Plan* are supported by numerous studies including those presented in the California Regional Water Quality Control Board – Central Valley Region's (Central Valley Regional Board) *Dry Cleaners – A Major Source of PCE in Ground Water*, which identifies that typical dry cleaners used 15 to 40 gallons per month of PCE and that dry cleaning equipment was "designed to discharge wastewater to the sewer" and the "wastewater had been in direct contact with PCE" with as "much as 30 percent of some samples has been pure solvent."[2] As noted by *SWRCB Resolution 92-49*, "industry-wide" historical waste disposal practices, provide an adequate basis for characterizing a contributing source of contamination.

The Central Valley Regional Board study also acknowledged that "data strongly indicate that leakage through the sewer lines is the major avenue through which PCE is introduced to the subsurface" from the dry cleaner's discharge of wastewater containing PCE.[3] In the investigations conducted in the City of Eureka, the nature and distribution of the PCE found in the subsurface at the Site coincides with the observations of the defects in the City of Eureka's sewers. Based on this information and an analysis of other potential sources, the CSM explains a portion of the PCE as having originated from releases of wastewater containing PCE from the City sewer main.

In addition, other potential sources and impacts in the vicinity of the soil and groundwater contamination need to be investigated and the results presented. Based on the site COCs, these will include other dry cleaning facilities, laundries, paint dealers, print shops, and others (California Regional Water Quality Control Board – Central Valley, Dry Cleaners – A Major Source of PCE in Ground Water, 1992).

As communicated to T&R in the documents forwarded to them on July 11, 2007, historical documents including: Sanborn Fire Insurance Maps, historical aerial photographs and building plans, were reviewed to identify other potential contributors. However, the historical documents and the distribution of chemicals in the subsurface did not indicate other potential contributors. Further, the conclusions regarding the contributors are adequately explained by the CSM, i.e., there are no data gaps indicating another potential source. If T&R believes that there are other potential contributors, they should identify them specifically.

Where a source is identified, the identification needs to be supported by data that clearly link the source to the contamination. This support must include multiple lines of evidence, including information such as accurate plots of facilities and operations, COC uses and releases, accurate sample locations near release areas (especially compared to more distant locations), reliable and significant COC detections in soil, soil gas, etc., and others.

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[2] California Regional Water Quality Control Board – Central Valley Region, *Dry Cleaners – A Major Source of PCE in Ground Water*, March 27, 1992. (Central Valley Regional Board, 1992). pp. 2-10.

[3] Ibid, p. 2.

We do not concur with T&R regarding the level of information and detail that are needed to support identifying contributing sources of contamination. In addition, T&R's contention is not supported by regulatory criteria, which identify that "any relevant evidence, whether direct or circumstantial" shall be used in identifying dischargers of wastes.[4] However, the analysis of the data in the *FS/PS Work Plan* provides many lines of evidence, e.g., detections of PCE at higher concentrations in groundwater farther from the dry cleaner building, but downgradient of the sewer main; defects in the sewer main; location of the detections of PCE in groundwater in relation to other potential sources and relative to groundwater flow direction; and historical waste disposal practices. In addition, the analysis is supported by "industry-wide operational practices that have led to discharges, such as leakage of pollutants from wastewater collection systems."[5]

2. Pathways – The COC migration pathways, which are crucial elements in the Conceptual Site Model, are not fully and accurately developed for the site. Accurate and detailed elevation plots of excavations and backfill areas for foundations, pavement, tanks, pipelines, drains, hoists, wells/ borings, and other facilities must be added to the existing Conceptual Site Model to complete and support the analysis of COC migration.

We do not concur with T&R's characterization of the level of detail required in a CSM, or that detailed elevation plots "are crucial elements" of the CSM. The "degree and accuracy of a conceptual site model varies" based on the nature of the site conditions.[6] The *FS/PS Work Plan* CSM presents topographic information, as appropriate, to support the analysis. The addition of the other Site features and details, as proposed by T&R, is not only unnecessary, but would lead to obfuscation of the important concepts regarding sources and features controlling contamination migration.

For example, the investigation of the sewers and conclusions regarding sewers are inadequate and not supported by the data. No inspection was conducted of the sewer laterals from beneath the buildings or former buildings extending to the sidewalks. For the results that were presented, the locations and significance of apparent offsets or other features are not documented.

T&R does not provide any supporting basis for its conclusions regarding the adequacy of the sewer investigations and/or conclusions regarding the sewer mains. While, WEST was denied access to conduct the testing identified in the February 2007 *Site Investigation Work Plan,*[7] City staff acknowledged that the sewer mains leaked and therefore, such testing was not necessary.[8] Further, T&R appears to confuse the onsite sewer lateral investigation with the sewer main investigation, i.e., it is unclear how the

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[4] SWRCB Resolution 92-49.

[5] Ibid.

[6] California Environmental Protection Agency, *Guidelines for Hydrogeologic Characterization of Hazardous Substance Release Site,* July 1995. (CalEPA, 1995). Volume 1, p. 4.

[7] WEST, *Site Investigation Work Plan,* February 2007. (WEST, Site Investigation WP). Section 5.2, pp. 35-36.

[8] Personal communication, Peter E. Morris, P.G. with City of Eureka staff Laurie Shannon on April 9, 2007.

adequacy of the onsite sewer lateral inspection has relevance to the sewer main characterization. If T&R believes that there are data that do not support the conclusions presented in the CSM, they should identify them with specificity.

With regard to the identification of the locations of the sewer defects, the sewer video was presented to the City at the May 17, 2007 Regional Board meeting. If the City and/or its consultants wish to have a copy, it is available from our office by request.

The distribution of groundwater data do not support the conclusion that PCE was released from the sewer main near the site.

We do not concur with T&R's characterization, but without identification of specific data, it is not possible to respond to this statement with specificity.

The role of the groundwater monitoring wells in COC migration needs to be fully investigated, particularly for wells screened across aquitards.

Previous investigations have characterized the influence of the monitoring wells screened across the A-Zone/B-Zone aquitard. Further, the investigations proposed pursuant to the *FS/PS Work Plan* include additional testing that should provide information on the influence of the cross-contamination, e.g., aquifer pump testing, chemical testing, and soil sampling at the basal contact. These investigation techniques are among those used to characterize cross-contamination of aquifers.[9] If T&R believes that additional investigations of the influence of the monitoring wells screened across the A-Zone/B-Zone aquitard are needed, they should provide specific recommendations for what those should include.

Also, ground surface elevations need to be investigated and plotted considering that the City of Eureka has no storm drains in this area and considering the likely surface releases behind the dry cleaners.

Elevation data have been obtained from topographic surveys, including onsite and along City streets. The elevation data were provided in the documents forwarded to T&R on July 11, 2007. Portions of the topographic information have been plotted on Figures 2-2 and 4-1. In addition, the work scope in the *FS/PS Work Plan* includes the collection of additional topographic information.[10] To the extent that T&R believes additional surface elevation "investigations" are necessary, they should provide specific recommendations for what data should be collected.

The ground surface information will aid in estimating the direction and potential impacts of surface spills and leaks. Without accurately locating these pathways, with flow directions and related sample points, spatial relationships cannot be confidently developed. These types of data

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[9] Santi, P., McCray, J.E, and Martens, J., *Investigating Cross-Contamination of Aquifers,* Journal of Hydrogeology. (Santi and Martens). Volume 14. pp. 51-68.

[10] WEST, *FS/PS Work Plan*, June 2007. Section 7.4, p. 76.

are critical to establish reliable interpretations of potential sources and effective remediation strategies.

The ground surface and utility elevation data were used in estimating the direction of movement of spills and leaks. However, as noted above, we do not concur with T&R regarding the types of data that can be used for identifying contributing sources.

3. Data gap analysis and investigation tasks – The presentation of investigation data needs to be comprehensive to provide a clear understanding of the data gaps and necessary additional investigation tasks. This comprehensive presentation is typically included in a remedial investigation report or equivalent. A clear relationship between the objective of the investigation, data gap, and investigation location is needed to plan the next phase of investigation and to complete the update of the Conceptual Site Model.

The *FS/PS Work Plan* presents a comprehensive summary of all the investigation data, a data gap analysis, rationale for additional investigations and a work plan for additional investigations. To the extent that T&R believes that the presentation of the investigation data is not comprehensive, the data gap analysis is incomplete, and/or the scope of the next phase of investigation is inadequate; they should identify their supporting bases and recommendations for additional work.

A remedial investigation report is not planned for the Site. The existing CAO does not require the preparation of a "remedial investigation report," but requires the preparation of: a report of field work; a feasibility study and/or remedial action plan.[11] As described in the *FS/PS Work Plan*, the next anticipated submittal is the *Feasibility Study/Corrective Action Plan.*

Numerous data gaps remain in the Conceptual Site Model, and without these gaps being filled, remediation cannot be successful.

A data gap analysis is presented in the *FS/PS Work Plan* that identifies additional data to be collected to evaluate remedial options. Our analysis indicates that addressing the identified data gaps will allow for selection of an appropriate remedy. If T&R has identified specific data gaps, they should present those.

For characterization and planning for remedial design, acceptable screening levels need to be used to guide the location of investigation sampling for specific COCs.

Screening levels are presented in Section 4.2.2 of the *FS/PS Work Plan.* These screening levels are based on applicable published guidelines and standards and have been used to guide the investigations.

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[11] California Regional Water Quality Control Board – North Coast Region, *Cleanup and Abatement Order No. R1-2003-0088 for KFD Enterprises, Incorporated dba Norman's Dry Cleaners and Laundry,* July 28, 2003. (Norman's CAO). p. 5.

Relative to the assessment for DNAPL, for example, the proposed investigation locations do not cover the area where DNAPL is apparently suspected (i.e., where dissolved PCE concentrations exceed 1,500 ug/L). If a DNAPL area is not characterized, then the remediation is not likely to be effective.

> The *FS/PS Work Plan* includes an investigation of the areas of suspected DNAPL as depicted on Figure 7-1. The areas for DNAPL investigation were selected based on the CSM. WEST has not proposed to "cover the area" where PCE is present above 1,500 µg/l; as such an investigation is not warranted based on the Site data and the CSM.

For soil gas, additional soil gas locations are needed to achieve two objectives: 1) delineate the extent of contaminants above the screening assessment criteria and 2) identify potential sources. The soil gas sampling relative to the screening criteria will need to include appropriate reporting limits; locations to define the combined potential risk of COCs including PCE, benzene, and other compounds; and a sufficiently wide area to define the limits of soil gas above the criteria.

> The *FS/PS Work Plan* and the WEST July 13, 2007 response to the Regional Board's comments include the collection of samples to further delineate the extent of chemicals in soil gas above applicable screening criteria. If T&R believes that additional soil gas samples are warranted, they should identify why and where the samples are needed.

To identify potential sources, the potential sources need to be investigated and accurately located; the soil gas samples need to be accurately located relative to the potential sources; and a sufficient number of samples need to be located to provide background concentrations and for contouring, as appropriate.

> While we concur that soil gas sampling is a tool that can aid in Site characterization, the soil gas sampling presented in the *FS/PS Work Plan* is designed to complete the characterization of soil gas containing chemicals above screening levels. We do not agree that background soil gas sampling is warranted. Background soil gas sampling is generally used to discern anomalous subpopulations; such conditions do not exist at the Site.[12] An adequate number of soil gas sample results existed to develop the contours presented in the *FS/PS Work Plan.*

4. Remedial strategy - The Work Plan appears to outline a remediation strategy of performing a preliminary screening-level evaluation of several remediation options. This strategy retains those options which may meet basic site requirements, and then proceeds with an open-ended pilot testing approach to evaluate nearly all of the possible remedial options prior to attempting to remediate the site as a whole. This strategy will result in higher costs due to the pilot testing of several technologies that may never be implemented at the site. A more cost-effective approach would be to perform a bench-scale evaluation to narrow the likely remedial options,

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[12] American Society for Testing and Materials (ASTM), *Designation D 5314 – 92, Standard Guide of Soil Gas Monitoring in the Vadose Zone,* 1993. Section 6.7.2. p. 24.

then perform an engineering evaluation of those select remedial options to determine which one appears to be most appropriate for the site. Finally, the selected remedial option would then be pilot-tested to gather further site characterization data, evaluate the likelihood of success under field conditions, and gather information needed to design a full-scale system.

We do not concur with T&R's characterization of the proposed pilot-testing scope. The pilot-testing is not open-ended, as characterized by T&R. As explained in Section 6.7 of the *FS/PS Work Plan*, "the pilot study will be conducted in a phased-manner." For example, the *FS/PS Work Plan* explains, "the results from the groundwater extraction pilot test and DNAPL delineation will be used to evaluate whether pilot testing is warranted to evaluate enhanced recovery of DNAPL." The *FS/PS Work Plan* also explains, "if enhanced recovery is warranted, surfactant/cosolvent flushing will be pilot tested first. The results of the surfactant/cosolvent flushing will be used to determine whether further testing of enhanced DNAPL is warranted, i.e., ERH pilot testing."

Also as explained in Section 5.2.2 of the *FS/PS Work Plan*, there are several different media to be addressed, e.g., soil gas, DNAPL and dissolved-phase constituents. Therefore, it is inappropriate to attempt "to remediate the site as a whole," as a technology for one medium, e.g., dissolved-phase constituents, would likely not address other media, e.g., soil gas and/or DNAPL.

We also do not concur with the T&R geologist's assessment of the most cost-effective means to design a groundwater remedy. In our experience, and consistent our understanding of the California Engineers Act, the design and evaluation (including analysis of the cost-effectiveness) of groundwater treatment systems, is generally within the purview of registered professional Civil Engineers.[13] In particular, we do not agree with the T&R geologist's opinion that bench-scale testing is appropriate for the retained groundwater treatment technologies and T&R offers no supporting technical bases to support their recommendation. In fact, T&R's recommendation is technically unsound; as it is our experience that there are no means to bench-scale test: groundwater extraction; soil vapor extraction; ozone sparging; co-solvent flushing; and electrical-resistive heating.

TREADWELL & ROLLO SPECIFIC COMMENTS

5. Page 6, Section 2.2, Site Geology: Additional investigations are needed to adequately characterize the site for remediation. In particular, continuous soil sampling and surveying of the borings are needed to provide accurate stratigraphic depths of the aquifers and aquitards, particularly east and northeast of the site.

While, we do not concur with T&R's assessment of the adequacy of the existing lithologic characterization for Site remediation, the *FS/PS Work Plan* includes additional

[13] State of California, *Professional Engineers Act (Business and Profession Code 6700-6799)*. Chapter 7. Professional Engineers. Section 6731 defines Civil Engineering as including activities in connection with the purification of water.

investigations to support the selection of appropriate remediation technologies. The additional investigations include: the advancement of borings to the east and northeast of the dry cleaner building, surveying of monitoring wells and preparation of boring/well logs. There are over 15 well/boring logs that have been developed for the Site. In addition, cone penetrometer testing (CPT) was performed at four locations that provided additional lithologic characterization at transects downgradient of the Site.

Given the distribution of chemicals in the subsurface, it is unclear what benefit would be obtained by collecting additional lithologic data to the east and northeast of the Site beyond that currently proposed. However, if T&R has specific locations that they believe should be investigated, they should identify them and explain why such data are needed.

6. Page 8, Section 2.4, Surface Water: The surface water flow at the site needs to be investigated including the direction of storm water flow and presence of culverts and direction of flow.

The surface water flow has been investigated at the Site based on visual observations, review of topographic surveys and utility maps obtained from the City of Eureka. WEST was prepared to discuss these and other aspects of the data analysis at the August 20, 2007 meeting. If T&R believes that additional investigations of surface water flow are needed, they should provide specific recommendations.

7. Page 8, Section 2.5.2, Former Gasoline Service Station Operations: Additional investigation is needed of subsurface facilities including septic systems, sewer lines, foundations, dispenser lines, tanks, and other facilities. In addition, investigation of demolition activities, removal of above-and below-ground facilities, and grading and/or disposal of soil needs to be completed. Service station use of solvents, role of drain lines, use of the work sink, and waste handling practices also need to be investigated.

We concur that additional investigation of the former waste oil UST, product piping and associated appurtenances is appropriate. It is our understanding that the investigation of these facilities is being conducted pursuant to Chevron's work plan under oversight of the Regional Board.

We do not agree that investigation of septic systems is necessary. As documented in the drawings forwarded to T&R on July 11, 2007 and described in the Section 2.5.1 of the *FS/PS Work Plan*, a "drawing of the property prepared in 1966 depicted three sewer laterals draining the former locations of the residential dwellings." Therefore, there are no technical bases to support recommending investigation of septic systems. Further, the available records have been investigated with regard to: the removal of the USTs; grading; historical use of the drain lines; work sink; and waste handling practices. These aspects of the historical Site use are discussed in Section 2.5 of the *FS/PS Work Plan.* Additional details are also found in the documents forwarded to T&R on July 11, 2007.

If there are additional aspects of the historical gasoline service station that T&R believes should be investigated, they should provide specific recommendations.

8. Page 9, Section 2.5.3, Dry Cleaning Facility: An adequate characterization of the dry cleaning facility needs to include the following: 1) type of dry cleaning machine; 2) connections to sewer, if any, for the dry cleaning machine and related facilities; 3) location of chemical storage, storage operations, amounts and types of chemicals used; 4) nature of disposal area, types of containment, frequency of removal, etc; 5) reports of leaks, spills, and other releases including those by Safety Kleen or others; and 6) underground utilities, connections to sewer mains and maintenance of sewer laterals on Norman's Dry Cleaners property. With regard to data gaps, additional sampling will be needed below the foundation of the building and near key facilities and operational areas.

We do not concur with T&R's characterization of what constitutes an adequate characterization of the dry cleaner facility. However, information is presented in Section 2.5 of the *FS/PS Work Plan* and previous reports regarding the dry cleaning operations, including the types of dry cleaning equipment (dry-to-dry), connections to sewer (sewer piping depicted on Figures), location of chemical storage areas (W&K Figure 2), types of chemicals used (PCE and silicone-based), reports of spills (release of PCE in the CSM), underground utilities, etc. As described in the documents forwarded to T&R on July 11, 2007, "the cleaning solvent tetrachloroethene (PCE) was used in the fabric cleaning process at the site. Site operations include dry-to-dry cleaning system, used filters and still wastes containing PCE were discarded to the rear of the building in a dumpster for disposal at the local landfill. Since 1984, the used filters have been transported and recycled by Safety Kleen Corporation."[14]

We do not concur that sampling is needed below the concrete foundation of the building. The migration of liquid PCE through concrete floors, even heavily cracked, "is insignificant, especially when mechanisms such as evaporation are considered."[15] To the extent that T&R believes additional samples are needed near the dry cleaner, they should provide specific recommendations for the additional sampling.

9. Page 10, Section 3.1.1 UST Removal: As listed above, investigation is needed regarding the removal of the hoist and any other service station facility or equipment that may have extended into the subsurface. The resulting data should include accurate locations, including depths and types of backfill, any observations during demolition and removal of facilities such as plugging of underground utilities, tank corrosion, soil staining, etc. Results of soil sampling and analyses need to be included, especially near the waste oil tank, for COCs likely related to the service station operations.

As discussed during our August 20, 2007 meeting, the hoist was removed. We concur that collection of additional information regarding the condition of the UST excavation is appropriate. We understand that data on this portion of the Site will be generated pursuant to the current Chevron work plan. With regard to data collected near the waste oil tank, the *FS/PS Work Plan* presents all of the environmental data available for the

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[14] Norman's CAO, p. 1.

[15] Morrison, Robert D., *Environmental Forensics: Principles & Applications,* CRC Press. p. 306.

Site. As noted in the documents forwarded to T&R on July 11, 2007, "no environmental sampling was conducted at the time of tank removal."[16]

10. Pages 15 through 25, Sections 3.1.9 through 3.2: Selected data are presented for the groundwater results; data for the site need to be evaluated to meet data quality objectives and to be presented comprehensively in a remedial investigation report or equivalent to provide a clear and representative basis for remedial design. A number of various consultants have worked on this site; the resulting variability of objectives and data quality needs to be evaluated and included in the remedial investigation report.

We do not understand T&R's reference to "selected data." While, WEST has not attempted to include every groundwater result from every groundwater-monitoring event in the text of the report, all of the groundwater data have been presented in *FS/PS Work Plan* (Tables 2-1, 3-2 and 3-3). In Sections 3.1 and 3.2 of the *FS/PS Work Plan*, WEST has presented an analysis of temporal and spatial trends of the groundwater results.

While we agree that use of a data quality assurance project plan (QAPP) is appropriate for investigations conducted pursuant to *SWRCB Resolution 92-49*, analysis of data quality objectives (DQOs) is a task completed "*before* [emphasis in the original] the data are collected," not after, as proposed by T&R.[17]

11. Page 18, Section 3.2.1, A/B-Zone Wells: A thorough investigation of the role of the groundwater monitoring wells in COC migration needs to be provided, particularly with respect to the wells screened across the aquitard (MW-1 through MW-5).

The influence of the groundwater monitoring wells screened across the A-Zone/B-Zone aquitard in the migration of chemicals has been characterized in previous work. In addition, the *FS/PS Work Plan* includes investigations that should also aid in characterizing the influence of the cross-contamination from the monitoring wells screened across the A-Zone/B-Zone aquitard, e.g., aquifer pump testing, chemical testing, and soil sampling at the basal contact. As noted above in response to a similar comment, these investigation techniques are among those used to characterize cross-contamination of aquifers.[18] T&R should provide specific recommendations for what additional investigations they believe are necessary.

12. Page 25 through 26, Section 3.3.1 through 3.3.1.2, Sewer Investigation: The sewer investigation performed is inadequate for the purposes of source analysis and remedial design. No inspection was conducted of the sewer laterals from the sidewalk to the building at 2907 E St. The additional sewer investigation on the site needs to clearly and accurately document the

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[16] Norman's CAO, p. 1.

[17] USEPA, *Guidance for Data Quality Objectives Process,* EPA QA/G-4, EPA/600/R-96/055, August 2000. (USEPA, 2000). p. 0-7.

[18] Santi and Martens.

locations and condition of all sewer laterals, septic system, waste drain lines, and related connections.

As noted above, T&R does not provide supporting bases for its conclusions regarding the adequacy of the sewer investigations and/or conclusions regarding the sewer mains. While, WEST was denied access to conduct the testing identified in the February 2007 *Site Investigation Work Plan,*[19] City staff acknowledged that the sewer mains leaked and therefore, such testing was not necessary.[20] With regard to the necessity to "clearly and accurately document the location and conditions of all sewer laterals," we have provided information on the location of the laterals. Additional onsite investigations are planned, to the extent that they generate additional information regarding the sewer laterals, the information will be included in subsequent reports. As noted above, there is no history of septic system use on the property.

13. Specific data need to be gathered and reported regarding the sewer main features mentioned in the bullets, including distances in feet along the sewer, amount of offsets, amount of grease, elevations of sags, and nature of surcharging and the likely effects on sewer operation. Also, a copy of the closed-circuit television (CCTV) inspection needs to be included in the Work Plan.

We do not concur with T&R's assessment of the types of data needed to be included in the *FS/PS Work Plan.* It is our understanding that an adequate investigation work plan includes: a comprehensive description of the investigative activities; a sampling and analysis plan; and a quality assurance project plan.[21] In addition, an adequate work plan should include a conceptual site model.[22]

However, the *FS/PS Work Plan* includes an analysis of the effects of the sewer on the distribution of chemicals at the Site. In addition, details of the CCTV inspection were presented to City of Eureka representatives during our May 17, 2007 meeting. Excerpts from the CCTV inspection were also included the *FS/PS Work Plan.* If the City would like a copy of the video, we can provide one upon their request.

14. Page 27, Section 3.3.2, Soil Gas Sampling: The accuracy and reporting of the soil gas results fail to support the conclusion in the Work Plan. For example, the extent of the soil gas relative to the CHHSL of 603 micrograms per cubic meters ($\mu g/m^3$) is clearly not defined in most directions.

The issue of the adequacy of the soil gas sampling in delineating the extent of soil gas containing PCE above its CHHSL was addressed in the WEST July 13, 2007 response to the Regional Board, which T&R indicates they reviewed. T&R should identify what

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[19] WEST, Site Investigation WP, pp. 35-36.

[20] Personal communication, Peter E. Morris, P.G. with City of Eureka staff Laurie Shannon on April 9, 2007.

[21] SWRCB Resolution 92-49.

[22] CalEPA, 1995.

additional soil gas sampling they believe is required, beyond that proposed pursuant to the *FS/PS Work Plan.*

15. Page 27, Section 3.3.2.1, Soil Gas Sample Collection Methodology: The soil gas samples were collected from approximately 3 feet below ground surface. The 2003 Cal EPA Advisory cited in the section indicates that the minimum sample depth is generally at 5 feet below ground surface. Such a shallow sampling depth may result in an underestimate of soil gas concentrations at the sampling locations.

The soil gas sampling was conducted in accordance with the CalEPA *Advisory – Active Soil Gas Investigations*, which identifies that soil gas samples should be collected above the groundwater table, i.e., in the vadose-zone.[23] The depth to groundwater was measured at 4.85-feet in May 2007.[24] Therefore, it was neither practical nor possible to collect soil gas samples from 5-feet below ground surface, i.e., in the saturated zone.

Further, we do not concur with T&R's assessment that soil gas samples collected at 3-feet below ground surface would underestimate soil gas concentrations. Leak detection testing was performed at each sample location with a tracer gas (1,1,2,2-tetrafluoroethane). Analysis of the soil gas samples did not reveal the presence of the tracer gas above the laboratory-reporting limit of 2.00 ppm_v for samples collected at locations W-1, W-3, W-5 and W-11. The sample from location W-10 revealed 6.63 ppm_v of the tracer gas; the duplicate sample did not reveal the presence of the tracer gas above the laboratory-reporting limit. The highest concentration of the leak tracer gas was found in the sample from W-2 at 51.9 ppm_v; representing the intrusion of approximately one percent surface air. Given the recovery range of 60 to 140 percent for the quality control limits for USEPA Method TO-15, the introduction of the surface air at one percent was within the tolerable range of decision errors, i.e., provided sample data of reliable quality. Based on the laboratory analysis, the data do not support the conclusion that samples collected from three-feet below ground surface underestimated the soil gas concentrations.

16. Page 35 through 36, Section 4.1, Conceptual Site Model: For the Conceptual Site Model, all relevant facilities and operational areas need to be provided, including underground excavations and utilities that likely served as preferential pathways. A critical part of the Conceptual Site Model is presenting relevant COC data for the various media (such as soil gas) in the context of the assessment criteria (such as California Human Health Screening Levels (CHHSLs) or those provided by the North Coast Regional Water Quality Control Board) for this site. Extensive additional investigation is needed to update the Conceptual Site Model (Figure 4-1).

We do not concur with T&R's characterization of what is required to be included in a CSM. As noted by the CalEPA, the "degree of detail...varies according to the

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[23] CalEPA, *Advisory – Active Soil Gas Investigations,* January 28, 2003. p. 5.

[24] ENSR, *Second Quarter 2007 Quarterly Groundwater Monitoring and Sampling Report, Chevron Facility 306630 (former Unocal 5357), 2907 E Street, Eureka, California,* June 27, 2007. Table 1.

hydrogeologic setting and type of waste."[25] Further, the SWRCB does not require that the CSM include the types of data indicated by T&R. The SWRCB identifies that the CSM "is a written or graphical representation of the release scenario, site characteristics (geology, hydrogeology, etc.) and the likely distribution of chemicals at the site."[26]

We agree that the Site data should be presented with respect to applicable assessment criteria. Section 4.3 of the *FS/PS Work Plan*, provides an analysis of the data relative to the identified screening criteria. T&R should explain specifically what "extensive" additional data are needed to update the CSM.

17. Also, the Work Plan's claim that "sampling has revealed concentrations of PCE indicative of DNAPL near the sewers" is not supported by the data (see comments below regarding pages 37 and 42).

We do not concur with T&R's characterization of the Site data. Groundwater investigations revealed PCE at 10,300 µg/l in the sample from W-6 collected near and downgradient of the City sewer main (Figure 3-6). Based on the high probability of historical DNAPL release and the presence of PCE at greater than one percent of the aqueous solubility of 150,000 µg/l, the potential for DNAPL is considered to be "moderate" to "high."[27] Therefore, the Site data support the conclusion regarding the indication of PCE DNAPL near the sewer main.

18. Page 37, Section 4.1.2, Nature and Extent of Source: No site-specific documentation of PCE presence in the sewers is provided. The City of Eureka has no record of a discharge permit, which would have authorized Norman's Dry Cleaners to release dry cleaning chemicals into the sewer system. In addition, no releases or unauthorized operational discharges are documented to have occurred.

The discharge of wastewater containing PCE from the dry cleaners is well documented.[28] However, most municipalities did not prohibit the discharge of wastewater from dry cleaners until the early to mid-1990s. The lack of regulation of dry cleaner discharges by municipalities is consistent with the pretreatment evaluations performed by the United States Environmental Protection Agency (USEPA). Pursuant to the Clean Water Act requirements, the USEPA evaluated various potential categories of dischargers to publicly owned treatment works. Based on its 1982 evaluation of the dry cleaning category, the USEPA concluded "the toxicity and the amount of incompatible pollutants (taken together) introduced by such point sources [dry cleaners] into treatment works that

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[25] CalEPA, 1995.

[26] SWRCB, *Guidelines for Investigation and Cleanup of MTBE and Other Ether-Based Oxygenates,* March 27, 2000. Appendix C. p. 1.

[27] USEPA, *Estimating Potential for Occurrence of DNAPL at Superfund Sites,* Publication 9355.4-07FS, January 1992. p. 6.

[28] Central Valley Regional Board, 1992.

are publicly owned is so insignificant as not to justify developing a pretreatment regulation."[29]

However, as identified in subsequent evaluations, when defects are present in the sewer, e.g., sags, the immiscible microdroplets entrained in the PCE coalesce and settle out of the wastewater, rather than being carried downstream where they would have been dissolved and diluted.[30] It is the accumulation of the PCE in the sags and their subsequent release from the sewers that has led to the impacts to soil and groundwater associated with wastewater discharges from dry cleaners.[31]

19. Page 37, Section 4.1.2.1, DNAPL: An outline of the suspected extent of the PCE dense nonaqueous phase liquid (DNAPL) should be presented. The conclusion that PCE may have been released as DNAPL from the sewer main along E Street is not supported by the data (see comment below regarding Page 42).

We do not concur with T&R's characterization of the Site data. The presence of PCE at greater than one percent of the aqueous solubility near and downgradient to the sewer main at E and Grotto Streets is consistent with the release of PCE as DNAPL from the sewer main along E Street. The extent of DNAPL has been estimated and appears to coincide with the two areas of highest PCE at 14- to 18-feet below ground surface as presented on Figure 3-1. However, further investigation is proposed in the *FS/PS Work Plan* both onsite and along the City sewer main to characterize the extent of DNAPL (Figure 7-1).

20. Page 38 through 39, Section 4.1.2.2, Vadose-Zone Source: The buried drainage alignments described and the conclusion that concentrations follow the alignments are not documented. As a result, specific and accurate investigation of the buried drainage alignments is needed.

We do not agree with T&R's characterization that the conclusions regarding the chemical concentrations following the buried utility alignments are not documented. The distribution and conclusions regarding chemicals along the drain lines are documented in Sections 3.2.2, 4.1.2.1, 4.1.2.2, 4.1.2.3, 4.1.2.4, 4.1.2.6, Figures 3-1, 3-3, 3-5, and 3-7 of the *FS/PS Work Plan*. In addition, documentation of the alignment of the buried drainage alignments has been presented in the documents forwarded to T&R on July 11, 2007. T&R should identify what specific aspects they believe are not adequately documented.

21. No basis and percentage uncertainty are provided for the estimated mass in the vadose zone. It is unclear whether this calculation includes all phases of PCE including DNAPL, absorbed, dissolved, gas, and/or other and if this includes potential DNAPL under the foundations and pavement of the Norman's Dry Cleaners property.

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[29] USEPA, *Guidance Document for Effluent Discharges from the Auto and Other Laundries,* February 1982. p. 67.

[30] Central Valley Regional Board, 1992.

[31] Ibid.

As explained in the text of the report, the vadose-zone is limited to the lithology between ground surface and less than 5-feet below ground surface. Hence, the only vadose-zone data are the soil gas sample results. The mass was calculated using phase partition calculations to estimate the sorbed phase within the soil structure.[32] Given the nature of the estimate and findings to the CSM, a statistical analysis of uncertainty was inappropriate as the potential range of values was within the tolerable range of decision errors.[33]

22. Page 39 through 40, Section 4.1.2.3, Service Station Operations: PCE concentrations are elevated in the area behind the dry cleaner building in soil, soil gas, and groundwater. A more complete analysis of the source of these elevated levels needs to be conducted and presented.

The source of the PCE behind the dry cleaner building has been analyzed. As noted in previous reports the "highest concentrations [of PCE] were observed on the east side of the building in the area of the loading dock where an historic release has been documented."[34] While there are also potential contributions from the waste oil tank as indicated by the presence of degradation products and historic solvent use in automobile repair, the presence of PCE in this portion of the Site is consistent with the CSM. In addition, the *FS/PS Work Plan* includes sampling behind the dry cleaner building, which should generate additional data regarding the contribution of the waste oil tank to PCE and petroleum hydrocarbons to the subsurface in this area (Figure 7-1).

23. Regarding the potential correlation of the data to drain or sewer lines, the sample distribution is limited and the reporting limits are elevated so that such conclusions are not supportable. For example, no TCA or Freon 113 groundwater analyses were conducted at MW-1 through MW-8A/8B, MW-10A/10B, or MW-11A (Table 3-3) The Freon 113 reporting limits for soil gas sampling locations are all higher than the detected value at W-5 except at W-3 (Table 3-4).

We do not concur with T&R's characterization of the data interpretation. As the CSM "should reflect the best interpretation of available information at any point in time," the presence and distribution of the Freon 113 should be and are explained by the CSM.[35] Based on the historical Site use and the observed distribution, the conclusions are supported by the CSM. If T&R has an alternative explanation, they should provide this or identify what sampling is needed to address what they believe is a data gap.

24. Page 40 through 41, Section 4.1.2.4, Subsurface Utility Lines: Figure 3-3 data and the results at sample locations SP-14, SP-7, SP-2, and SP-6 do not support the correlation to drain

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[32] Feenstra, S., MacKay, D.M., and Cherry, J.A., 1991. *A Method for Assessing Residual NAPL Based on Organic Chemical Concentrations in Soil Samples.* Groundwater Monitoring Review, Spring 1991.

[33] USEPA, 2000.

[34] Calibre, *Technical Memorandum #1, Review of Initial Direct Push Investigation, Norman's Dry Cleaners & Laundry,* January 25, 2007. p. 1

[35] USEPA, *Conceptual Site Model, Part I,* October 2000.

lines. Because MW-5 was screened across the aquitard, the elevated PCE concentration could well have been in groundwater from the most permeable unit, i.e., the sands at the bottom of the well. Sample location MW-9B lies below an intervening aquitard, and thus, PCE release from a drain line is not a likely explanation for the value of 12,000 µg/L.

While it is difficult to discern the intent of T&R's above comment, the distribution of PCE in A-Zone groundwater as depicted on Figure 3-3 shows an orientation to the south and west relative to the release point at the rear of the dry cleaner building. Groundwater movement cannot explain the lateral distribution of PCE to the south in the A-Zone, as groundwater in this zone moves primarily to the west. However, the subsurface utilities provided a means for the migration of PCE to the south and west. This orientation is also found in the distribution of PCE in soil gas, as depicted on Figure 3-7. Therefore, data at sample locations SP-14, SP-7, SP-2 and SP-6 support the correlation of the movement of PCE along drain lines. If T&R does not believe the data support the correlation, then they should offer an alternative explanation for the distribution of PCE in the A-Zone groundwater.

We are also confused by T&R's reference to MW-5 and MW-9B, as these sample locations are not included in the contouring of the A-Zone distribution of PCE in groundwater presented on Figure 3-3. In addition, we do not understand T&R's logic in concluding that the presence of PCE at 12,000 µg/l in the sample from monitoring well MW-9B in November 2003 precludes a release from a drain line. As explained in the CSM, the presence of PCE in the B-Zone appears to have been influenced by the installation of monitoring wells across the aquitard, e.g., MW-5 was installed in November 2002 and there is a relatively steep downward hydraulic gradient. Monitoring wells MW-5 and MW-9A/MW-9B are also located near underground drain lines. In fact, the occurrence of PCE in groundwater at these locations is also consistent with movement along the drain lines; and does not appear to be consistent with migration in groundwater from the release behind the dry cleaner building, as these locations are cross-gradient to the groundwater flow direction, which is primarily to the northwest. In addition, as noted above the soil gas detections indicate higher concentrations in the vadose-zone in this portion of the Site, which also is consistent with the distribution having been influenced by migration along the buried drain lines.

25. Page 42, Section 4.1.2.6, Sewer Main: Rather than being relatable to the drain line, the PCE distribution is apparently closely related to likely releases behind the dry cleaner building. For example in Figure 3-3, sample SP-6 near the drain line shows a low PCE concentration of 1.6 micrograms per liter (ug/L). In addition, the correlation to the sewer is not consistent with the location of the screen intervals and stratigraphy displayed in Figure 4-1. The PCE in samples MW-3, MW-4, MW-9B, MW-11B, and SP- 14 are likely related to the B-Zone groundwater. This means that the elevated PCE concentrations more likely resulted from up-gradient sources rather than the sewer main.

While we concur that the distribution of PCE has been influenced by the release behind the dry cleaner building, this release cannot explain the distribution of PCE in soil, soil gas and groundwater at the Site. Further we do not understand T&R's characterization

that the detection of PCE at 1.6 µg/l at SP-6, which is not near the drain line, but located upgradient of the dry cleaner building is "closely related to likely releases behind the dry cleaner building."

T&R does not explain how the PCE concentrations in MW-3, MW-4, MW-9B, MW-11B and SP-14 "means that the elevated PCE concentrations more likely resulted from up-gradient sources rather than the sewer main." We concur that the groundwater samples collected from MW-9B, MW-11B and SP-14 (at 14-feet below ground surface), represent groundwater conditions in the B-Zone. However, it is unclear how the distribution at these B-Zone groundwater locations indicates that the PCE found at W-6 originates from "up-gradient sources," other than the sewer main, which is located upgradient of W-6. Further, the presence of 10,300 µg/l of PCE at W-6 does not appear to be consistent with a release originating from a source upgradient of the sewer main where PCE has been reported at 31 µg/l in MW-8B.

26. The data do not support the conclusion that PCE detected at sample location W-6 (west of the sewer main) is related to the sewer main. The PCE concentration at well MW-11A is 11 ug/L, and the sample was collected above the aquitard and approximately ten feet down-gradient of the sewer. In contrast, the sample at W-6 was collected below the aquitard. As a result, the sewer did not likely contribute to the PCE at W-6. Also, based on the rose diagram in Figure 2-4, sample location W-6 is down-gradient of MW-11B (3,200 ug/L). It is also down-gradient of PCE concentrations of 9,900 ug/L PCE at well MW-5 (Figure 3-3). Consequently, PCE at sample location W-6 more likely resulted from migration from MW-11B and MW-5. The PCE contamination in MW-11B and MW-5 cannot be attributed to releases from the sewer main. The aquitard likely acted as a barrier to potential vertical migration between the sewer main and MW- 11B, and well MW-5 is up-gradient from the sewer main. Alternative explanations could include migration within interbedded sands in the B-Zone aquifer from up-gradient sources (Figure 1).

We do not concur with T&R's assessment of the groundwater data. The presence of PCE at 11 µg/l in MW-11A, while within approximately 10-feet of the sewer main, is cross-gradient to the identified area of the suspected release point. As identified on the CSM (Figure 4-1), the suspected release point from the sewer is near the manhole at E and Grotto Streets. The occurrence of the leak in this area is consistent with the observations of the condition of the sewer in this area, i.e., broken pipe. Rather than as characterized by T&R, W-6 is located downgradient of the sewer at E and Grotto Streets, not downgradient of MW-11B. T&R proposes that groundwater flowed from MW-11B toward W-6, which is not supported by the data. The rose diagram referenced by T&R, does not indicate a single monitoring event indicating groundwater flow to the north-northwest, but rather west and northwest. If groundwater in the B-Zone flowed as proposed by T&R, there would be no explanation for the orientation of the plume, e.g., detection of PCE at W-9.

As explained in the *FS/PS Work Plan*, the presence of PCE at 31 µg/l in MW-8B, which is hydraulically upgradient of W-6, also needs to be explained by the CSM. However, T&R appears to be proposing that the PCE would have migrated from the release behind

the dry cleaner building from the general vicinity of monitoring well MW-3 toward MW-11B, in a primarily westerly flow direction, then inexplicably the migration would have shifted to north-northwest. Such a migration pattern does not appear to be reasonably explained in the absence of a preferential pathway, i.e., the movement and release of PCE from the sewer. T&R also appears to be attributing the presence of PCE at W-6 as having "migrated from MW-11B and MW-5." However, if the migration pathway were as proposed by T&R, then PCE should also be present in MW-8B and MW-10B at concentrations higher than those found in W-6, as higher concentrations are found in MW-3 than in either MW-11B or MW-5. In addition, T&R offers no explanation as to how higher concentrations are found farther from the source, i.e., 10,300 µg/l at W-6, than at locations that they describe as upgradient (MW-11B at 3,200 µg/l and MW-5 at 9,900 µg/l).

Lastly, T&R offers one more hypothesis to explain the distribution of PCE as having migrated in "interbedded sands in the B-Zone aquifer." To support this hypothesis, T&R prepared Figure 1, and proposes movement of the PCE from "upgradient sources." However, the sources located upgradient of W-6 do not exclude the sewer main at E and Grotto Streets. As explained above, if the source of PCE in W-6 occurred upgradient of the sewer main, then there should be PCE present in samples from MW-1, MW-8B and MW-10B at concentrations high enough to explain the presence of PCE at W-6 at 10,300 µg/l. However, as explained in the *FS/PS Work Plan*, the samples from MW-1, MW-8B, and MW-10B contained less than 100 µg/l of PCE. Therefore, the presence of PCE at W-6 appears to be most consistent with having originated from a release from a source downgradient of MW-8B and upgradient of W-6. The only identified potential source in the area downgradient of MW-8B and upgradient of W-6 is the sanitary sewer main. This latter finding is consistent with those reached by the California Regional Water Quality Control Board – Central Valley Region conclusion in its investigation of the release of PCE from dry cleaners when it concluded the "data strongly indicate that leakage through the sewer lines is the major avenue through which PCE is introduced to the subsurface."[36]

27. Page 43, Section 4.1.3, Soil Gas Characterization: The contours presented in Figure 3-7 are not supported by the available data points. For example, no soil gas data were collected south or east of sample location W-1. The extent of the soil gas relative to the CHHSL of 603 micrograms per cubic meters (µg/m^3) is clearly not defined in most directions.

The contouring of the soil gas data depicted on Figure 3-7 honors all of the sample data. However, we concur that additional soil gas samples are needed to further define the extent of soil gas relative to the CHHSL of 603 µg/m^3. As noted in the July 13, 2007 response to the Regional Board, additional soil gas samples will be collected to further define the extent of VOCs in soil gas.

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[36] Central Valley Regional Board, 1992, p.2.

28. Page 43, Section 4.1.4, Vertical Extent of PCE: The Conceptual Site Model provides no evidence of PCE having actually entered the sewer, nor does it provide a vertical pathway from the sewer to the location of the W-6 sample result of 10,300 ug/L PCE. It does, however, provide a pathway within the B-Zone sands

The CSM explains the presence of PCE as entering the sewer in historic wastewater discharges that contained PCE.[37] The vertical pathway to W-6, as depicted on the CSM Figure 4-1, is the seepage through the aquitard under the steep downward vertical gradient between the A-Zone and B-Zone groundwater. The migration of PCE to W-6 in the B-Zone sand is not supported by the data. The lack of detections of PCE above 100 µg/l in monitoring wells MW-8B in MW-10B is not consistent with the movement of PCE to W-6 at 10,300 µg/l in B-Zone groundwater.

29. The Conceptual Site Model needs to incorporate the 11 ug/L PCE result at well MW-11A. The attached alternative contouring to the Conceptual Site Model does incorporate the MW-11A result and provides a more accurate depiction of the vertical extent of PCE (Figure 1). This interpretation does not support the conclusion that that PCE was released from the sewer main and that such a hypothetical release contributed to the COCs in soil and groundwater.

The CSM does incorporate and explain the presence of PCE in MW-11A at 11 µg/l. T&R has not accounted for the lateral distance between MW-11A and the release point along the sewer main at E and Grotto Streets. Further, the contouring proposed by T&R on their Figure 1 does not honor the data, i.e., PCE has been detected at less than 10,000 µg/l between SP-4 and MW-8B. T&R, without any supporting data, and despite the detections of less than 10,000 µg/l of PCE at SP-14 and MW-8B, MW-9B, MW-10B projects a 10,000 µg/l PCE contour line below existing onsite data, which do not support such contouring and then, despite the steep downward vertical hydraulic gradient, depicts the 10,000 µg/l PCE contour rising over 10-feet vertically to appear at sample location W-6. T&R's contouring does not appear to be consistent with the physical properties that govern the movement of the PCE in the groundwater, including the relative density and the greater than 5-foot downward hydraulic head, which would work against the PCE rising in elevation.[38]

29. Page 45, Section 4.2.1, Exposure Pathways Evaluation: The subsection indicates that the only complete exposure pathways are for indoor air (inhalation) from COCs in soil gas, soil leaching to groundwater, and then direct groundwater exposure. However, Figure 4-2 (Conceptual Site Model Chart) indicates that dermal contact with soil less than 3 meters is considered complete. Figure 4-2 should be revised to accurately reflect Section 4.2.1.

We concur. The analysis should be revised to clarify the exposure pathway evaluation in the *Feasibility Study/Corrective Action Plan.*

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[37] Central Valley Regional Board, 1992.

[38] Even if PCE is not present as DNAPL at W-6, 10,300 µg/l of PCE in water has a specific gravity of approximately 1.006 grams per cubic centimeter.

30. Page 45, Section 4.2.1.1, Exposure Concentrations: The presentation of the screening exposure concentrations to the screening criteria needs to be clarified. A table of the comparison Reasonable Maximum Exposure (RME) concentrations and screening levels should be prepared or Tables 3-1 through 3-4 should be updated with the RME concentrations and screening levels. The WEST Response to Comments indicates that additional soil gas data and soil data will be collected and the RME concentrations will be revised to calculate the 95 percent Upper Confidence Limit (UCL) for comparison to screening levels. Section 4.2.1.1 of the Work Plan discusses the use of maximum concentrations for the RME concentrations in the exposure assessment, but the actual RME concentrations used in the Work Plan are not included in tabular form (only in the discussions). A definition of RME should also be included in the Work Plan.

We concur. A summary of the RME concentrations and applicable screening levels should be incorporated into the *Feasibility Study/Corrective Action Plan.*

31. Page 46, Section 4.2.2, Identification of Applicable Screening Criteria: The presentation of the applicable screening criteria needs to be clarified. A table of the screening criteria should be created or the values should be added to the summary tables for each medium. Section 4.3 indicates that the comparison criteria and analytical results are summarized in Tables 3-1 through 3-4, but only Table 3-4 includes screening criteria for soil gas. Additional information on PRGs should be provided to correlate with Section 4.3.1, which cites "resource protection criterion PRGs", which are generally the Soil Screening Level PRGs based upon the migration to groundwater, assuming a dilution attenuation factor of 1. The use of the CHHSLs should be clarified because only the commercial CHHSLs for soil gas were used in the screening assessment. In addition, the screening criteria and investigation activities for the Conceptual Site Model need to be updated according to the most recent criteria set by the North Coast Regional Water Quality Control Board for this site.

As noted above, we concur that a summary table would be useful.

32. Page 48 through 49, Section 4.3.1, Soil Conditions: A total petroleum hydrocarbon as gasoline (TPHg) "resource protection criterion of 100 mg/kg" is cited. A source of this screening value should be provided and cited in Section 4.2.2 since the 2004 US EPA preliminary remediation goals (PRGs) do not include total petroleum hydrocarbons. The 100 milligrams per kilogram (mg/kg) level is equal to the San Francisco Bay Regional Water Quality Control Board's 2005 Environmental Screening Level for TPHg based on soil leaching to a potential drinking water resource.

The 100 mg/kg resource protection criterion for TPHg was selected from the Leaking Underground Fuel Tank (LUFT) Field Manual.[39]

33. Additional information clarifying the screening levels for 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene should be supplied since both values cited were US EPA PRGs based on

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[39] SWRCB, *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure,* December 1987.

residential land use. This is likely because there are no Soil Screening PRGs for migration to groundwater for these two chemicals, but additional information should be cited here. The USEPA Region IX PRG for xylene migration to groundwater is incorrectly listed as 1,000 micrograms per kilogram (ug/kg), rather than 10,000 ug/kg. The reported PCE level in soil at MW-3 is incorrectly listed as 250,000 milligrams per kilogram (mg/kg). It should be 250,000 ug/kg.

We concur the typographical errors should be corrected. However, we are unclear what additional information is needed regarding the screening levels for 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene.

34. Figure 3-1 does not show any soil samples along the sewer main and portions of the sewer laterals. Soil sampling for PCE is needed along the sewer and in background areas to evaluate whether the sewer main and laterals may have released PCE.

Figure 7-1 identifies soil sample locations along the sewer main and along onsite utilities.

35. Page 49, Section 4.3.2, Soil Gas Conditions: Beyond PCE, this section should include a discussion of soil gas concentrations for other COCs exceeding the CHHSLs for commercial land use. Table 3-4 indicates that TCE also exceeded the CHHSLs, which should be included in the discussion in this section. Although no samples tested for benzene exceeded CHHSLs, laboratory detection limits for benzene often exceed the CHHSLs. With the elevated concentrations of benzene in MW-8A, it is possible that benzene was present in soil gas samples at a concentration below the laboratory reporting limits but above the CHHSL for benzene. Further field investigation using the appropriate reporting limits relative to the CHHSLs needs to be conducted.

While we concur that detection limits for benzene were above their applicable screening levels in four samples, this occurred due to the dilution required from the presence of relatively high concentrations of PCE in soil gas. In each of the samples, PCE was present above its screening level. The DQOs for the investigation identified the appropriate reporting-limits. However, due to the presence of relatively high concentrations of PCE, dilution of the samples was required, and hence the reporting limits were raised. This is an unavoidable outcome when encountering such conditions.

36. Page 61, Section 6.3, Groundwater Extraction and Treatment Pilot Testing: Groundwater pump and treat would not likely be an effective remedial action to remove COC mass (including DNAPL). As stated in the Work Plan, pump and treat may help to contain the PCE plume, however the low rate of PCE removal from groundwater extraction may result in a costly, extended cleanup. A technology that can actually remove mass from the plume to reach the cleanup standard is much preferred. Although this may require a higher upfront cost, it will reduce long-term operation and maintenance.

We do not concur with the T&R's geologist's assessment of the approach to develop the most cost-effective design for the groundwater treatment. As described in the *FS/PS Work Plan*, there are many types of groundwater extraction systems, including enhancements with injection of surfactants/cosolvents to augment the recovery of

DNAPL. However, as also explained in the *FS/PS Work Plan*, "the cost-effectiveness of these aggressive DNAPL zone remedial technologies versus conventional pump and treat varies by site and application (McDade, 2005)." The proposed pilot studies are designed to generate the data necessary to perform such a site-specific evaluation for the selection of the most cost-effective cleanup approach.

37. Page 81, Section 7.8.1, Pilot Study Equipment Installation: It is not clear that the ozone sparge pilot test would be able to evaluate the difference between the drilled in place and push-point sparge points. The Work Plan implies that the radius of influence of the sparge points will be determined by measuring pressure at various distances away from the sparge point. However, effective sparging requires actual ozone gas bubble distribution through groundwater to be effective, not just a pressure change. Just because pressure is present at a certain distance from the sparge point does not mean that bubbles are reaching this point.

The ozone sparge pilot tests have been designed to generate data regarding the difference between drilled in-place and push-point installation technologies. The *FS/PS Work Plan* does not, as characterized by T&R, imply that the radius of influence will be determined by measuring pressure at various distances. Rather the *FS/PS Work Plan* states "the relationship of sparge radius to applied pressure will also be measured for the two alternative sparge points." The data will then be used to analyze the relationship between pressure and gas yield, zone of influence and bubble region. The relationship between pressure and gas yield allows for an analysis based on a derivation of Darcy's Law, whereby the rate of gas discharge from the sparge point increases proportionately to the applied pressure.

38. Page 84, Section 7.9, Task 9: Surfactant/ Co-solvent Flushing Pilot Testing: It may be prudent to use multiple wells rather than a single well in the surfactant flushing pilot test. As stated in the Work Plan, a full-scale surfactant flushing system would involve injection wells, a zone for the surfactant to travel through, followed by extraction wells. Important factors in this process are: 1) the ability to direct the surfactant from the injection wells through the flushing zone, 2) the ability to re-capture all of the surfactant (i.e. to maintain proper hydraulic control), and 3) to achieve contact will all impacted zones. A multiple-well pilot test would likely be needed to address these important factors.

We do not concur with T&R's recommendation to use multiple wells rather than a single well to test the injection of surfactant/cosolvents. The single-well, push-pull method consists of the controlled injection of a prepared test solution into the aquifer followed by the recovery of the test solution/groundwater mixture from the same location. The goals of the push-pull testing include demonstrating the ability to recovery the injected chemicals and DNAPL, as well as to document that use of the injected chemicals does not have deleterious impacts on groundwater quality. In addition, during the testing stage it will be necessary to control the movement of the mobilized DNAPL until adequate data have been collected to allow for design of a multi-well flushing and capture system. Therefore, during the pilot scale, where it will be necessary to demonstrate that there will not be deleterious impacts from the use of injection of chemicals into the aquifer, the use of single well push-pull testing allow for the definition of the volume of the aquifer that is

interrogated; multi-well testing does not allow such control. In addition, single well testing is generally more cost-effective than multiple well testing.[40]

39. Table 5-1, Remedial Technology Screening: The retention of biodegradation as a technology appears to be warranted given that degradation products and anaerobic conditions have been identified near the former location of the waste oil tank and that bioremediation was identified as among the most inexpensive cleanup options. It appears that it may be possible to change the oxidation-reduction potential of groundwater to anaerobic conditions. A number of biological reagents have been demonstrated to effectively create anaerobic conditions even in aquifers that were previously aerobic.

We do not concur with T&R's assessment of the potential to change the oxidation-reduction (redox) potential of the groundwater to develop anaerobic conditions. While T&R is correct that there have been detections of degradation products near the location of the waste oil tank, degradation products of PCE do not exist in the B-Zone aquifer where the PCE plume is estimated at over 1,200 feet long.

Although, we are unaware of "biological reagents," there are chemicals that can be added to an aquifer to change its redox condition. However, addition of these chemicals has potentially significant deleterious impacts on water quality, e.g., addition of cheese-whey to develop anaerobic conditions contains over 10,000 milligrams per liter of total dissolved solids. In addition, the change in redox conditions to anaerobic would result in the generation of deleterious degradation products, e.g., chloroethene also known as vinyl chloride. The addition of chemicals that reduce the groundwater quality is inappropriate as it is not consistent with *State Water Resources Control Board Resolution 68-16 - Statement of Policy with Respect to Maintaining High Quality of Waters in California (SWRCB Resolution 68-16)*, also referred to as the *Anti-degradation Policy.* [41]

Air stripping may require the use of granular activated carbon (GAC) to avoid the discharge of PCE and other VOCs into the air used by the City of Eureka community. Therefore, it is prudent to retain GAC as a technology.

It appears that T&R is confused. The use of granular activated carbon (GAC) was not retained for treatment of the extracted groundwater due to its limitations for treating DNAPL. There has not been an evaluation of remedial technologies for off gas treatment from the air stripper. If air stripping is used, appropriate air permits will be obtained. To the extent that off gas abatement is required, it will be performed in accordance with the applicable regulatory requirements.

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[40] Field, J., *In Situ Field Scale Evaluation of Surfactant Enhanced DNAPL Recovery Using Single-Well Push-Pull Tests,* Oregon State University, 2007.

[41] SWRCB, *Resolution 68-16 Statement of Policy with Respect to Maintaining High Quality of Waters in California,* October 28, 1968.

WEST

We appreciate the opportunity to provide this response. Please contact either of the undersigned if you have any questions or wish to discuss our response.

Sincerely,

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