

Yvonne J. Meeks Site Remediation · Portfolio Manager Environmental Affáirs

6588 Ontario Road San Luis Obispo, CA 93405 *Mailing Address* 4325 South Higuera Street San Luis Obispo, CA 93401

805.546.5243 Internal: 664.5243 Fax: 805.546.5232 E-Mail: YJM1@pge.com

September 14, 2006

Mr. Christopher Guerre California Department of Toxic Substances Control Senior Engineering Geologist 5796 Corporate Avenue Cypress, CA 90630

### Subject: Groundwater Background Study Information and Data Request PG&E Topock Compressor Station, Needles, California

Dear Mr. Guerre:

This letter transmits the information and data requested by DTSC in Condition 3 of the approval letter of the final set of background wells dated October 11, 2005. The information and data transmitted include:

- Electronic copy of the validated data set (in excel format).
- Index of laboratory reports for the background data set.
- Electronic copy of laboratory reports for the background data set.
- Electronic copy of field documentation for the background data set.
- A summary of quality assurance/quality control issues for the background data set.
- A summary of data quality issues with the background data set.
- A summary of the initial data evaluation (details of this request were provided in the memorandum dated October 7, 2005 prepared by the Geological Services Unit (GSU) of DTSC).
- A flowchart of the proposed approach for deriving background concentrations.
- Proposed table of contents for the Step 3 report.

If you have any questions, please do not hesitate to call me.

Sincerely,

Julie Eakins for yvonne Meks

Enclosure

cc: Kate Burger/DTSC Aaron Yue/DTSC

# Preliminary Evaluation of Data for the Groundwater Background Study PG&E Topock Facility

### Prepared for

### **California Department of Toxic Substances Control**

### on behalf of

### Pacific Gas and Electric Company

September 14, 2006

This work plan was prepared under supervision of a California Professional Geologist

nian Selvioth

Brian Schroth, Professional Geologist No. 7423 Senior Technologist

# Preliminary Evaluation of Data for the Groundwater Background Study, Pacific Gas and Electric Company (PG&E) Topock Compressor Station, Needles, California

PREPARED FOR:	Department of Toxic Substances Control
PREPARED BY:	Pacific Gas and Electric Company
DATE:	September 14, 2006

# 1.0 Introduction

In a letter dated October 11, 2005, the Department of Toxic Substances Control (DTSC) provided conditional approval of the final set of background wells in response to the Step 2 Background Study Report. This letter from DTSC will be referred to herein as the DTSC Step 2 Conditional Approval Letter. The DTSC Step 2 Conditional Approval Letter stipulated the following three specific conditions:

- 1. The well identified as Topock-3 shall be removed from the list of final background study wells.
- 2. PG&E shall meet with DTSC to discuss the background data set and approach to be used to calculate the background concentrations. This meeting shall occur prior to the preparation of the Step 3 report and prior to the calculation of background concentrations.
- 3. At least 14 days in advance of the meeting outlined in Condition 2, PG&E shall provide:
  - Electronic copy of the validated data set (in excel format).
  - Index of laboratory reports for the background data set.
  - Electronic copy of laboratory reports for the background data set.
  - Electronic copy of field documentation for the background data set.
  - A summary of quality assurance/quality control issues for the background data set.
  - A summary of data quality issues with the background data set.
  - A summary of the initial data evaluation (details of this request were provided in the memorandum dated October 7, 2005 prepared by the Geological Services Unit (GSU) of DTSC).
  - A flowchart of the proposed approach for deriving background concentrations.

• Proposed table of contents for the Step 3 report.

This technical memorandum and associated attachments provides the information and data requested by DTSC in Condition 3.

# 1.1 Validated Background Data Set

The CD included as Attachment 1 contains a Microsoft Excel file with the full set of analytical data collected during the six rounds of groundwater sampling (background data set) for the Topock Groundwater Background Study.

# 1.2 Index of Laboratory Reports

Attachment 2 contains an index of the laboratory reports for the background study data set.

# 1.3 Copy of Laboratory Reports

The CD included as Attachment 3 contains an electronic copy of all laboratory reports for the background study. The electronic copies of the laboratory reports on the CD are set up as searchable .pdf files to facilitate the easy location of specific laboratory reports.

# 1.4 Copy of Field Documentation

The CD included as Attachment 3 also contains an electronic copy of the field purge/sampling sheets for the background study data set. The electronic copies of the field purge/sampling sheets on the CD are also set up as searchable .pdf files to facilitate the easy location of specific field documentation.

# 1.5 Summary of Quality Assurance/Quality Control Issues

A summary of the data quality and any data quality/quality control issues are summarized in the data quality evaluation (DQE) reports for each round of sampling. The six DQE Reports are contained in Attachment 4.

# 2.0 Summary of Initial Data Evaluation

# 2.1 Introduction

The GSU of DTSC prepared a memorandum dated October 7, 2005 (which was cited in the DTSC Step 2 Conditional Approval Letter) requesting that PG&E conduct an initial data evaluation to include:

- 1. Descriptive statistics for the data set.
- 2. An outline of potentially-redundant data within the data set. Wells in proximity to one another may contribute redundant data that may skew the background concentration estimates inappropriately by counting one location's data twice.
- 3. Evaluation of data set for multiple populations. Data may indicate that wells located in different locations or depths could represent more than one population, which may necessitate that more than one background concentration be calculated for each metal.

- 4. Analysis for outlier concentrations and/or wells. Anomalously high concentrations of metals in some locations may be perceived as outliers (i.e., unrepresentative of natural background conditions in the region).
- 5. An outline of data set distribution before and after outlier removal.

Data from the six background study groundwater sampling events were examined in order to address DTSC's specific requests forfor data analysis. Potentially-redundant data are addressed by statistical comparison of the wells in question (Section 2.2). A combination of geochemical analysis and statistical treatment is used to assess the data for outliers and potential multiple populations in Section 2.3. The descriptive statistics and an outline of the data set distribution before and after removal of outliers are provided in Section 2.4. Conclusions from this initial data evaluation are presented in Section 2.5.

## 2.2 Wells in Proximity

The October 2005 DTSC letter noted three well pairs that could potentially provide redundant data that could skew the results of the background study: Needles MW-11 and Needles MW-12, GSWC-3 and GSWC-4, and Topock-2 and Topock-3. In the DTSC Step 2 Conditional Approval Letter, DTSC requested that Topock-3 be dropped from the study (this was done) and that data from the other two pairs be examined at the conclusion of data collection to evaluate redundancy. The pump in well GSWC-3 broke down during the course of the data collection period and was not repaired or replaced by the well owner, so this well was eliminated from the background study due to lack of data. The remaining pair with a complete data set is the Needles MW-11/12 pair. A brief statistical analysis of the data is presented in this section.

For each of the dissolved metals, a Wilcoxon Rank Sum comparison was performed to evaluate if the chemistries are statistically similar or different. This is a nonparametric version of a comparison between the mean concentrations from each well. The results of this evaluation are provided in Table 2-1. Data in Table 2-1 indicate that Needles MW-11 concentrations are significantly more elevated than Needles MW-12 concentrations for arsenic, boron, chromium (total and hexavalent), molybdenum, potassium, selenium, and vanadium (at the 0.05 significance level). The Needles MW-12 concentrations are significantly higher for calcium, magnesium, manganese, and nickel.

These significant differences demonstrate that the chemistries from Needles MW-11 and Needles MW-12 are distinctive. Thus, their proximity does not prevent each from providing useful representation of background conditions; therefore, both are recommended to be retained. Although details of the screened intervals for these wells is not known, the total depth of Needles MW-11 is 60 feet deeper (280 feet deep) than Needles MW-12 (220 feet deep).

## 2.3 Potential Outliers and Multiple Populations

The data set was analyzed to identify outliers and evaluate the possibility that there are multiple populations represented. The following sections describe the methods and results of this analysis.

### 2.3.1 Statistical Analysis

Groundwater samples were analyzed from six sampling events between May 2005 and June 2006. The total number of results per chemical constituent is 150 (25 wells times six events).

Because elevated concentrations of metals in one or a few wells can potentially have a large influence on the magnitude of a background threshold value, a statistical review of the elevated concentrations was performed. This review included both an outlier analysis (to determine whether any concentrations appear significantly different from the rest of the data set) using Rosner's test and a mean rank evaluation to determine whether the most elevated concentrations appear clustered at any individual wells. The latter analysis was performed by evaluating the patterns of the five most elevated concentrations for each parameter.

For both of these statistical analyses, the mean concentrations for each constituent and well were calculated. Thus for each constituent, 25 mean concentrations were used instead of the 150 individual concentrations. Using the means is seen as preferable to obtain the desired information on which well(s) appear different from the others. Because the concentrations of a specific parameter from an individual well are typically more similar to one another than concentrations between wells, an outlier analysis of individual concentrations would typically list multiple concentrations from the well or wells with the highest concentrations. This would cloud the main objective of identifying wells with anomalous concentrations.

In cases of field duplicate pairs, this evaluation only included the parent sample concentrations. The field duplicate concentrations were not included in the data set. Non-detects were assigned a value of one of half the detection limit for the purposes of statistical analysis.

**Outlier Analysis**. Outlier analyses were performed on the highest five mean concentrations for each parameter using a significance level of 0.05. In accordance with United States Environmental Protection Agency (USEPA) guidance (USEPA 2000), Rosner's test was applied since at least 25 samples were available. This outlier test is based on an assumption that the remaining concentrations represent a normal distribution (after the potential outlier is excluded). This assumption was typically not true, based on the Shapiro-Wilk test using a significance level of 0.05.

Since the tests of normality for the non-outlier concentrations did not typically support assumptions of normality, the data were transformed as suggested by guidance (USEPA 2000). Three different transformations were conducted for each potential outlier; these were the square root transformation, the cubic root transformation, and the natural logarithmic transformation. The logarithmic transformation is a standard transformation in environmental applications, while the square root and cubic root offer options appropriate for intermediate levels of skewness in the data. The data set for each parameter that best adhered to normality (either the untransformed data or one of the three transformed data sets) was used in the outlier testing.

Based on this evaluation, the mean concentrations that qualified as statistical outliers are reported in Table 2-2. In assessing these results, it is important to note that these tests help demonstrate when elevated concentrations are unlikely to belong to the same population as

the lower concentrations. These tests do not prove that these elevated concentrations are unworthy members of the background data set. Geochemical analysis presented in Section 2.3.2 will address this issue.

**Mean Rank Evaluation**. A second method of evaluating elevated concentrations was to determine whether there were unusual patterns of the highest concentrations at given wells for multiple constituents. The five most-elevated mean concentrations (Top 5) for each constituent were determined. The proportion of Top 5 occurrences were then calculated for each well. If a random distribution of data is assumed, then for each metal there is a 0.192 (25 wells divided by 26 constituents times five elevated concentrations]) expectation that a given well would produce a Top 5 concentration. Wells were evaluated for their deviation from this statistical result.

The mean concentrations for each constituent and well are presented for each dissolved metal in Table 2-3. The same information for general chemistry parameters is provided in Table 2-4. A matrix providing the mean ranks of the metal concentrations is provided in Table 2-5. A similar matrix for general chemistry parameters is provided in Table 2-6. The concentrations ranked 1 through 5 for each metal in Table 2-5 were then used to determine the actual proportion of Top 5 concentration values for each well.

Since mean ranks were employed, a few parameters with equal concentrations (tied concentrations) did not have discrete concentrations for ranks 1, 2, 3, 4, and 5 since the mean of these tied ranks was chosen. This usually occurs when all the individual results are proxy values for non-detects (one-half the detection limit). For instance, dissolved cobalt has a 1- and a 2-ranked mean concentration, but the rest of the concentrations are ranked 14, the mean rank of the remaining tied concentrations (calculated from all non-detects). The absence of some ranks 1 through 5 when many concentrations are tied is consistent with the intent of this evaluation. The Top 5-ranked mean concentrations represent potential indications of individual wells with multiple constituents bearing the most elevated concentrations. When five distinct Top 5 mean concentrations for a given constituent are not available, one would not desire that five individual wells be identified as having one of the five highest mean concentrations.

A summary of the analysis of the results in Table 2-5 is provided in Table 2-7. These results show that wells MW-17, Needles MW-12, PGE-09S, and Sanders had a statistically-larger number of Top 5 concentrations associated with them (10, 10, 12, and 8 Top 5 concentrations, respectively). These wells were found to be elevated in Top 5 metals, compared to the expected result from random data, at a 0.05 significance level. Inspection of Table 2-5 reveals that that the metals with Top 5 rankings differ between these four wells, suggesting the wells are not associated with a common source of metals. This will be discussed further in Section 2.3.2.

### 2.3.2 Geochemical Analysis

In addition to statistical analysis, a preliminary assessment of hydrogeochemistry was performed to address comments in DTSC's Step 2 Conditional Approval Letter. Criteria for constituents or wells that may be excluded from a background study cannot be defined on the basis of statistics alone. They must be shown to be anomalous relative to the rest of the data on the basis of mineralogy sources specific to a small area or due to human sources

(e.g., local contamination or well materials influence). Concentrations at the high or low end of a range help define the natural range but do not define anomalous data. Identification of a concentration falling above the 96 percent confidence limit, for example, simply means that the sample is one in 20 samples that would be expected in that range. It is then up to the analyst to determine whether the concentration truly represents an exceptional environment or source that does not belong to a collection of natural background data. The discussion below will evaluate the data to determine whether the results identified as outlier concentrations or wells in Section 2.2.1 represent an exceptional environment or source.

Figure 2-1 is a piper plot of the mean concentration of major ion water chemistry for wells in the study. The plot shows that, although there is a wide range of chemistry in the region, there are no isolated wells with distinctly different chemistry from all those around them. The variation forms a continuous region of the diamond plot area rather than isolated groupings. This is an indication of natural variation in chemistry; samples in proximity may have similar chemistry (e.g., EPNG-2 and ADOT New Well) or distinctly different chemistry (e.g., P-2 and MW-16). Conversely, wells located significant distances apart may have similar (e.g., Tayloe Well and Topock-2) or different (e.g., BOR-2 and GSRV-2) chemistry.

Source minerals and rocks for the groundwaters of the study region are a mixture of:

- Fluvial material of variable composition that has been transported great distances.
- Alluvial material derived from the Chemehuevi and Sacramento Mountains, generally having a dioritic composition (between granitic and mafic).
- Alluvial material derived from the Black Mountains to the east, which contain a mixture of volcanic rocks ranging from rhyolite to basalt (i.e., granitic to mafic).

Figure 2-2 shows the stable isotopes, <sup>18</sup>O (oxygen-18) and <sup>2</sup>H (deuterium) for groundwater samples from these three groups. The fluvial wells screened in shallow zones are grouped with a lighter isotopic signature to the lower left side of the plot. This signature is typical of river water values for the area. Fluvial wells screened in deeper zones are isotopically heavier (PGE-9S and Sanders Well), showing values closer to those of the alluvial wells. Alluvial wells from the California and Arizona sides of the river show overlapping isotopic signatures suggesting that, although the source rocks may be different, the isotopic signatures are not affected.

The source rocks to the east are likely to be more mafic than those to the west, though the compositions do overlap strongly. Even within a given source material, mineralogy may be highly variable. For example, in the area surrounding wells Topock-2, Sanders Well, and PGE-9S, there may be some influence of hydrothermal activity, evidenced by elevated temperatures recorded in some samples from Topock-2. The somewhat higher concentrations of arsenic in this area appear to support this (Figure 2-3).

The statistical analysis noted elevated concentrations in PGE-9S relative to the other wells. However, monitoring wells on the Topock site (i.e., the California side of the river) show high total dissolved solids (TDS) in deeper zones of the fluvial material. This is true in wells both inside and outside the site plume. For example, well MW-33-150 routinely shows a TDS of 10,000 milligrams per liter (mg/L), even greater than that of PGE-9S, yet contains hexavalent chromium [Cr(VI)] at an average of 5 micrograms per liter ( $\mu$ g/L), below those ofmany background wells. The elevated TDS of MW-33-150 is not the result of the plume

influence, because the Cr(VI) concentration would be higher if this was the case., Chromium has not been removed by reduction because field measurements at this well indicate a chemically oxidizing, rather than reducing, environment. Based on this evidence, along with that from other non-plume wells, it must be concluded that deep zones of the Alluvial Aquifer contain high TDS, resulting in elevated levels of sodium, potassium, chloride, and many trace elements relative to the lower TDS wells in the region. Because the majority of background study wells are water supply wells, which have been deliberately screened in zones of low TDS, concentrations from well PGE-9S are at the high end of the range for this study. This is not an indicator of anomalous geologic environment, but simply indicates that high TDS water is present in the deep Alluvial Aquifer zone, which also happens to coincide with the elevation of the Cr(VI) plume.

An exception to this interpretation of elevated concentrations at PGE-9S is the case of zinc. The average concentration of this metal was  $656 \ \mu g/L$ , over eight times the next greatest average in the background study. Concentrations of zinc in regional wells, as well as in Topock Site monitoring wells, are typically below  $100 \ \mu g/L$ . Although concentrations above  $100 \ \mu g/L$  are not rare, no well has consistently shown zinc levels this high, and the concentrations recorded at PGE-9S for this study are the highest known. It is considered unlikely that the zinc concentrations in PGE-9S represent natural occurrence. This well has sat idle with an installed pump for the last 9 years. It is likely that the standpipe, pump column, and the pump itself have some galvanized (i.e., zinc-coated) parts and, though zinc is rust-resistant, the high TDS water in this well may still corrode the galvanic layer. In addition, this well produced highly-turbid samples and, though the samples were filtered, some of the suspended colloids probably passed through the filter. On the basis of the observed data, it is recommended that the zinc concentrations for PGE-9S be excluded from the background calculations. Other metals concentrations for this well were either low or consistent with the range observed in the region for other wells.

Another natural geochemical variation in the background study region is that of redox environment. The Colorado River and associated wetlands contribute organic carbon to the sediment. Microorganisms use this as a food source, and their metabolic activity creates localized reducing conditions. In fluvial material that is geologically young enough to still contain carbon, reducing conditions influence the groundwater chemistry, most notably by reducing Cr(VI) to trivalent chromium and removing it from solution. In deep fluvial zones, the material is older, and all the carbon has been used up. With no carbon source, microbial communities cannot proliferate, and these zones have returned to more oxidizing conditions. Alluvial materials in the area have always been carbon-poor, so that wells screened in these materials mostly exhibit oxidizing conditions. The exception is in a few deep alluvial wells, where old saline water is poorly circulated. The redox influence on water chemistry is illustrated by maps of dissolved iron concentration (Figure 2-4) and field-measured oxidation-reduction potential (Figure 2-5). Note that elevated levels of iron are associated with strongly-negative (i.e., reducing) oxidation-reduction potential values. Where conditions are oxidizing, iron readily precipitates out of solution as an oxide. The same is generally true of manganese and chromium.

Reducing and oxidizing areas are not necessarily linked to lithology but rather to carbon sources and microbial activity. Therefore, there is no basis for separating background study populations on the basis of fluvial versus alluvial, since both may contain similar chemistry. It is also not appropriate to separate oxidizing from reducing zones, since these are redox conditions that control the background chemistry. 3.0 Descriptive Statistics and Data Set Distribution

Summary statistics for each constituent based upon the mean result (for the multiple background sampling events) from each sample location are presented in Table 3-1. These summary statistics include the mean, median, standard deviation, maximum detect, number of detects, number of samples, and percent detects. They also include the p-values for normality and lognormality (calculated with the Shapiro-Wilk test).

When such a p-value is above 0.05, the assumption of normality (or lognormality) can be accepted. When neither p-value is above 0.05, a nonparametric approach will be used to calculate the background upper tolerance limit (UTL). The distribution approach chosen based on these p-values is provided. This approach is either normal, lognormal, or nonparametric.

In Table 2-2, statistical outliers were identified. It is not recommended that these results be excluded from the background data set, except for zinc in PGE-9S, but an evaluation was performed to assess what the impact on the distribution would be if these results were removed from the data set. The resulting p-values for normality and lognormality after these results were excluded are presented in Table 3-1. Also, the distribution chosen based on these p-values is provided.

Two of the six general chemistry parameters with outliers changed distributional approaches from after the results were removed. The distributional assumptions for specific conductance and TDS changed from nonparametric to lognormal after outliers were removed. Six of the eight metals that had statistical outliers changed distributional approaches. Arsenic shifted from normal to lognormal; copper, nickel, and sodium shifted from nonparametric to lognormal to nonparametric; and vanadium shifted from nonparametric to normal.

# 4.0 Conclusions

Although the statistical analysis has identified some wells (PGE-9S, MW-17, Needles MW-12, and Sanders Well) that tend to contain somewhat higher concentrations of some constituents, it is believed that there is no geochemical or hydrogeologic reason to exclude these wells from the background study. These wells are scattered geographically and are in geologically-variable materials that would be expected to produce variation in groundwater chemistry. The aquifer beneath the Topock site contains the same variable material as is exhibited in the background study region and therefore the data set appears to be representative.

There is no basis for separating the background study data set into separate populations on the basis of lithology (i.e., fluvial vs. alluvial), since both contain similar chemistry, or on the basis of redox conditions (i.e., oxidizing vs. reducing), since redox conditions are linked to carbon sources and microbial activity that control the background chemistry. An individual constituent, zinc, at well PGE-9S is recommended for exclusion from the background calculations on the basis of the anomalously high concentration compared to other wells along with the likely zinc sources and corrosive waters in this well. Therefore, it is recommended that a single background concentration be calculated for each of the trace metals identified in Table 4-1. The data set to be used for the calculation of the background concentrations is recommended to be the six rounds of analytical data from the list of wells provided in Table 4-2, with the exception of the zinc analytical data from PGE-9S.

# 5.0 Proposed Approach for Deriving Background Concentrations

The following procedure will be used to calculate background concentration estimates for the southern Mohave Valley region:

- 1. Calculate mean concentrations for each well location, given the six rounds of samples, and remove outliers (zinc in PGE-9S).
- 2. Conduct a Shapiro-Wilk test for normality or log-normality for each constituent. Calculate normal or lognormal UTLs when the respective Shapiro-Wilk p-value is greater than 0.05. When both of the p-values for normality or log-normality are less than 0.05, a nonparametric UTL will be calculated.
- 3. Calculate UTL for each constituent as described in Section 5.1.

The calculated UTL will be deemed a tentative background concentration, meaning that if concentrations above this value are found in the future, then closer examination of local geochemical environment would be necessary to determine whether the sample is natural or anthropogenic in nature.

# 5.1 Calculation of Background Concentration (UTL)

The background statistic will be calculated as a 95 percent/95 percent background UTL; that is, an upper-bound (with 95-percent confidence) of the background 95th percentile. The calculation of the UTLs depends on the distributional assumption. When the Shapiro-Wilk p-value for normality is greater than 0.05, the normal UTL will be calculated using the following equation:

$$UTL = \overline{x} + (K \times s), \tag{1}$$

where:

 $\overline{x}$  is the sample mean. K is the tolerance factor. s is the sample standard deviation.

For data sets that appear to be lognormally distributed, based on a Shapiro-Wilk p-value greater than 0.05, a lognormal UTL will be calculated using the following equation:

$$UTL = e^{\overline{y} + (K \times s_x)}, \tag{2}$$

where:

 $\overline{y}$  is the sample mean of the log-transformed sample data.

K is the tolerance factor.

 $s_x$  is the sample standard deviation of the log-transformed sample data.

For data sets that do not appear to be normally or lognormally distributed, nonparametric UTLs will be calculated. A nonparametric UTL is computed by first ranking the concentrations and then choosing the lowest-ranked detected concentration that provides coverage of 95-percent with 95-percent confidence. For data sets with less than 59 concentrations, 95-percent coverage is not possible with 95-percent confidence, even when the maximum concentration is assigned as the UTL. In this study, the estimated percentile (95th or lower) associated with the highest concentration will be reported. This percentile is calculated using the following equation:

$$p = B_{0.95,n,1} \tag{3}$$

where B is a beta distribution defined by n (the number of sample results) and 1 (since the highest ranked concentration is being used).

Given the 25 results available from this study and the desired 95-percent confidence, coverage of 89 percent will be available. Thus, these nonparametric UTLs will represent a 95-percent confidence upper limit of the 89<sup>th</sup> percentile of the background population. Thus, there is a slightly greater opportunity for declaring a result to be in exceedance of background.

# 6.0 Proposed Table of Contents for Step 3 Background Study Report

The following table of contents is proposed for the Step 3 Background Study Report:

- 1.0 Introduction (include a summary of meeting with DTSC to discuss this Technical Memorandum)
- 2.0 Background Study Data Set (confirmation of which wells and analytes will be used in background study data set)
- 3.0 Background Concentrations (use the approach outlined in Section 5.0 (or alternative approach agreed upon with DTSC) of this technical memorandum to calculate background concentrations)
- 4.0 Background Concentration Review (review background concentrations per Section 3.4 of the Background Study Work Plan)
- 5.0 Conclusions

# Tables

# TABLE 2-1Needles MW-11 (A) versus Needles MW-12 (B)Two-tailed Wilcoxon Rank Sum ComparisonsPG&E Background StudyPG&E Topock Compressor Station and Vicinity

Parameter	Probability that the Observed Differences Would Occur Purely by Chance	Statistical Decision with 0.05 Signficance Level	Mean A	Mean B	Median A	Median B	A Detection Frequency	B Detection Frequency	Percent Detects
Aluminum	0.422	< 25% Detects	48.2	25	25	25	1/6	0/6	8
Antimony	1.000	0% Detects	1	1	1	1	0/6	0/6	0
Arsenic	0.017	A > B	6.25	3.59	6.05	3.55	6/6	6/6	100
Barium	0.054	ns	27.6	32.1	27.6	31.5	6/6	6/6	100
Beryllium	1.000	0% Detects	0.5	0.5	0.5	0.5	0/6	0/6	0
Boron	0.017	A > B	0.543	0.386	0.542	0.386	6/6	6/6	100
Cadmium	1.000	0% Detects	0.5	0.5	0.5	0.5	0/6	0/6	0
Calcium	0.017	B > A	107	153	107	153	6/6	6/6	100
Chromium	0.012	A > B	2.78	0.5	2.77	0.5	6/6	0/6	50
Cobalt	0.203	< 25% Detects	0.5	0.727	0.5	0.5	0/6	2/6	17
Copper	0.875	ns	3.53	4.8	3.94	3.98	6/6	6/6	100
Hexavalent chromium	0.014	A > B	2.38	0.167	2.35	0.1	6/6	0/6	50
Iron	1.000	0% Detects	0.05	0.05	0.05	0.05	0/6	0/6	0
Lead	0.477	ns	0.655	1.32	0.5	0.5	1/6	2/6	25
Magnesium	0.023	B > A	46	61.2	45.7	61.4	6/6	6/6	100
Manganese	0.017	B > A	16.7	592	18.6	585	6/6	6/6	100
Mercury	1.000	0% Detects	0.1	0.1	0.1	0.1	0/6	0/6	0
Molybdenum	0.017	A > B	17	11.2	16.8	11.1	6/6	6/6	100
Nickel	0.014	B > A	0.587	10.6	0.5	3.92	1/6	6/6	58
Potassium	0.017	A > B	13	9.42	12.5	9.5	6/6	6/6	100
Selenium	0.012	A > B	4.02	0.5	3.89	0.5	6/6	0/6	50
Silver	1.000	0% Detects	0.5	0.5	0.5	0.5	0/6	0/6	0
Sodium	0.121	ns	328	294	327	303	6/6	6/6	100
Thallium	0.422	< 25% Detects	0.5	0.62	0.5	0.5	0/6	1/6	8
Vanadium	0.017	A > B	10.7	5.63	10.7	5.49	6/6	6/6	100
Zinc	0.528	ns	17.4	19.6	11.5	18.4	3/6	5/6	67

ns = no significant difference

# TABLE 2-2Statistical Outliers (at 0.05 significance level)PG&E Background StudyPG&E Topock Compressor Station and Vicinity

Parameter	Location
Metals	
Arsenic	PGE-09S
Arsenic	Sanders
Arsenic	BOR-2
Arsenic	Topock-2
Arsenic	Lily Hill
Copper	Topock-2
Nickel	Needles MW-12
Nickel	MW-16
Selenium	MW-17
Vanadium	Sanders
Zinc	PGE-09S
General Chemistry	
Alkalinity, bicarb. as CaCO3	PGE-09S
Chloride	PGE-09S
Chloride	P-2
Potassium	PGE-09S
Specific conductance	PGE-09S
Specific conductance	P-2
Sodium	PGE-09S
Total dissolved solids	PGE-09S
Total dissolved solids	P-2
Total organic carbon	PGE-09S
Total organic carbon	BOR-2
Total organic carbon	Needles MW-12
Total organic carbon	New Farm Well
Turbidity	PGE-09S
Turbidity	MW-16
Turbidity	BOR-2
Turbidity	Topock-2

### TABLE 2-3

Mean Concentrations for Trace Dissolved Metals from Each Well PG&E Background Study PG&E Topock Compressor Station and Vicinity

Location	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Hexavalent Chromium	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
ADOT New Well	55.8	1.0	5.5	85.5	0.5	0.5	7.7	0.5	4.91	7.4	0.5	0.1	10.0	1.5	0.7	0.5	0.5	11.5	38.5
BOR-2	30.2	1.0	17.4	67.0	0.5	0.5	0.5	0.5	0.8	0.1	0.5	0.1	5.6	1.83	0.5	0.5	0.5	0.7	21.7
CA Agriculture Station	54.7	1.0	3.2	31.8	0.5	0.5	2.3	0.5	1.5	1.9	0.5	0.1	21.8	0.5	2.9	0.5	0.5	14.3	47.7
EPNG-2	46.9	1.0	5.0	91.5	0.5	0.5	10.6	0.5	2.3	8.7	0.5	0.1	9.0	0.5	1.3	0.5	0.5	13.8	30.1
GSRV-2	29.2	1.2	5.6	57.2	0.7	0.5	29.1	0.5	1.5	27.1	0.5	0.1	6.6	0.6	1.7	2.13	0.91	16.3	9.3
GSWC-1	40.5	1.0	7.0	41.2	0.5	0.5	13.4	0.5	4.3	12.7	1.24	0.1	7.4	1.2	4.53	1.53	0.5	19.7	13.5
GSWC-2	25.0	1.0	8.0	50.2	0.5	0.5	5.9	0.5	4.7	5.0	1.0	0.1	7.3	0.7	1.8	0.67	0.5	18.9	13.0
GSWC-4	25.0	1.0	8.1	46.5	0.5	0.5	10.9	0.5	2.4	10.1	0.7	0.1	7.1	1.0	1.1	1.09	0.5	22	14.8
Langmaack	36.8	1.0	6.1	25.2	0.5	0.5	22.2	0.5	6.01	20.7	0.6	0.1	3.6	3.89	1.8	1.07	0.5	18.3	20.0
Lily Hill	40.0	1.0	13.3	59.2	0.5	0.5	7.8	0.5	6.4	7.4	1.28	0.1	14.6	1.6	2.99	0.5	0.61	20.5	21.1
MW-16	34.0	1.0	9.5	29.3	0.5	0.5	10.7	0.5	2.0	8.8	0.5	0.1	12.7	9.12	1.7	0.5	0.5	32.4	12.3
MW-17	25.0	1.0	1.5	35.6	0.5	0.5	13.7	0.5	7.14	13.8	9.82	0.1	18.4	2.81	12.9	0.6	0.5	4.5	72.7
MW-18	35.0	1.0	1.0	70.2	0.5	0.5	35.3	0.5	1.6	31.8	0.5	0.1	4.8	0.9	2.99	0.5	0.5	4.8	19.3
Needles MW-10	42.2	1.0	3.7	20.7	0.5	0.5	0.6	0.5	1.4	0.1	0.5	0.1	10.3	0.6	1.0	0.5	0.5	5.2	15.8
Needles MW-11	48.2	1.0	6.3	27.6	0.5	0.5	2.8	0.5	3.5	2.4	0.7	0.1	17.0	0.6	4.02	0.5	0.5	10.7	17.4
Needles MW-12	25.0	1.0	3.6	32.1	0.5	0.5	0.5	0.73	4.8	0.2	1.32	0.1	11.2	10.6	0.5	0.5	0.6	5.6	19.6
New Farm Well	29.8	1.0	5.4	69.0	0.5	0.5	0.5	0.5	1.6	0.1	0.5	0.1	6.1	0.6	0.5	0.5	0.5	0.5	13.4
P-2	25.0	1.0	2.2	149	0.5	0.5	3.4	0.5	2.1	2.9	0.6	0.1	5.6	0.8	1.8	0.5	0.5	11.9	22.3
PGE-09S	25.0	1.0	38.5	121.0	0.5	0.5	0.5	0.84	4.4	0.5	1.0	0.1	17.8	1.4	0.5	0.5	0.5	0.7	656
PMM-Supply	30.8	1.0	1.7	156	0.5	0.5	9.5	0.5	1.8	7.7	0.7	0.1	5.4	0.9	1.6	0.6	0.5	9.4	28.7
Sanders	33.1	1.0	33.7	48.7	0.5	0.5	0.7	0.5	3.5	0.4	0.5	0.1	36.3	1.2	3.32	0.5	0.61	59.9	77.7
TMLP-2	31.1	1.0	5.2	48.9	0.5	0.5	21.6	0.5	2.7	0.6	1.9	0.1	10.8	0.6	2.1	0.5	0.5	8.0	70.1
Tayloe	32.3	1.0	5.9	15.9	0.5	0.5	0.8	0.5	0.9	17	0.5	0.1	5.5	0.6	0.7	0.5	0.5	19.7	13.2
Topock-2	91.3	1.0	15.5	85.2	0.5	0.5	12.7	0.6	37.1	7.8	12	0.1	23.3	1.5	0.6	1.0	0.5	22.7	22.9
USFW-5	29.8	1.0	3.9	44.7	0.5	0.5	0.7	0.5	1.8	0.1	0.5	0.1	5.0	0.9	0.5	0.5	0.5	0.5	23.5

Notes:

All concentrations in ug/L (micrograms per liter)

# TABLE 2-4 Mean Concentrations for General Chemistry Parameters from Each Well PG&E Background Study PG&E Topock Compressor Station and Vicinity

Location	Alkalinity	Boron, Dissolved	Calcium, Dissolved	Chloride	Deuterium	Dissolved Organic Carbor	Fluoride	lodide	Iron, Dissolved	Magnesium, Dissolved	Manganese, Dissolved	N-Ammonia	N-Nitrate	N-Total Kjeldahl Nitrogen	Oxygen-18	Hq	Potassium, Dissolved	Silica, Soluble	Sodium, Dissolved	Sulfate	Total Dissolved Solids
Units	mg/L	mg/L	mg/L	mg/L	0/00	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	0/00	pH units	mg/L	mg/L	mg/L	mg/L	mg/L
ADOT New Well	86	0.543	39	209	-73.1	0.8	4.0	0.3	0.1	6	2	0.25	1.9	0.3	-10.4	7.9	6	25	178	68	627
BOR-2	209	0.23	80	151	-101.0	4.7	0.4	0.3	1.6	70	254	0.509	0.3	1.1	-12.9	7.9	5	24	230	405	1180
CA Agriculture Station	89	0.611	62	258	-64.1	0.8	1.4	0.3	0.1	17	3	0.25	1.8	0.6	-9.0	7.9	5	29	242	213	926
EPNG-2	91	0.51	38	196	-74.6	0.6	3.6	0.3	0.1	7	1	0.25	1.9	0.3	-10.4	7.8	6	25	174	66	602
GSRV-2	159	0.16	44	51	-68.9	2.5	2.0	0.3	0.1	15	3	0.25	3.0	0.4	-10.0	7.7	5	34	64	39	388
GSWC-1	124	0.27	41	78	-66.1	0.8	0.9	0.3	0.1	17	1	0.25	4.4	0.4	-9.4	7.9	6	32	91	88	498
GSWC-2	127	0.25	31	99	-69.9	0.8	0.8	0.3	0.1	12	1	0.25	1.6	0.4	-9.5	8.0	5	33	103	59	469
GSWC-4	156	0.23	26	49	-69.5	0.8	0.9	0.3	0.1	9	1	0.25	1.8	0.3	-9.9	7.8	5	34	84	35	372
Langmaack	142	0.20	30	47	-67.2	0.7	0.8	0.3	0.1	13	2	0.25	3.2	0.3	-9.8	7.9	5	33	67	36	352
Lily Hill	160	0.39	50	134	-81.5	0.7	1.7	0.3	0.1	20	8	0.25	3.6	0.3	-11.2	8.0	7	34	172	180	755
MW-16	100	0.31	30	184	-63.3	1.5	2.4	0.3	0.1	6	2	0.25	2.9	0.3	-9.1	8.1	4	23	214	130	669
MW-17	70	0.24	123	102	-58.6	1.0	1.8	0.3	0.1	19	4	0.25	3.7	0.4	-7.9	7.6	10	18	278	692	1360
MW-18	84	0.20	86	285	-65.1	0.7	0.5	0.3	0.1	14	2	0.25	3.8	0.3	-9.4	7.4	8	23	170	89	847
Needles MW-10	146	0.17	74	95	-98.3	1.5	0.7	0.3	0.1	27	34	0.25	0.3	0.3	-12.8	7.7	4	25	144	262	787
Needles MW-11	204	0.543	107	300	-102.0	2.1	1.6	0.3	0.1	46	17	0.25	1.7	0.3	-13.5	7.5	13	39	328	438	1500
Needles MW-12	238	0.39	153	250	-97.5	3.0	0.8	0.3	0.1	61	592	0.25	0.7	0.3	-12.5	7.7	9	29	294	556	1620
New Farm Well	189	0.17	114	106	-98.8	4.0	0.3	0.3	0.5	36	497	0.25	0.3	0.3	-12.5	7.8	6	22	145	317	955
P-2	51	0.53	267	1500	-69.2	0.7	1.9	0.3	0.1	53	1	0.25	2.5	0.3	-9.8	7.5	10	22	687	202	3150
PGE-09S	514	1.45	400	3830	-85.1	7.7	0.4	0.3	5.6	154	1320	0.66	0.3	1.1	-11.4	7.7	19	30	2620	888	8500
PMM-Supply	80	0.20	89	327	-69.0	0.7	2.2	0.3	0.1	18	1	0.25	3.1	0.3	-9.2	7.7	7	21	161	64	906
Sanders	263	0.958	55	283	-72.2	1.0	6.5	0.8	0.1	7	100	0.25	2.5	0.3	-10.3	7.6	3	48	357	184	1130
TMLP-2	107	0.13	23	138	-60.6	0.7	0.8	0.3	0.1	10	3	0.25	1.6	0.3	-8.4	7.9	6	23	57	87	793
Tayloe	143	0.35	35	25	-68.5	0.8	1.2	0.3	0.1	5	1	0.25	3.6	0.3	-10.1	7.9	4	34	145	16	280
Topock-2	80	0.645	43	372	-70.8	0.8	3.9	0.3	1.9	5	30	0.25	2.0	0.3	-10.0	7.8	7	26	297	101	912
USFW-5	145	0.13	90	80	-97.3	1.7	0.3	0.3	0.5	31	299	0.25	0.3	0.3	-12.4	7.8	5	20	101	234	701

# TABLE 2-5Mean Ranks for Mean Concentrations of Dissolved MetalsPG&E Background Study

PG&E Topock Compressor Station and Vicinity

TORE TOPOCK COMPLES.	501 510	uion a		<i>iiii</i> ty												_	_		
Location	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Hexavalent chromiun	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
ADOT New Well	2	13.5	14	5	13.5	13	13	14.5	5	12	19.5	12.5	12	7	19	17	15	14	6
BOR-2	16	13.5	3	9	13.5	13	23.5	14.5	25	23.5	19.5	12.5	20	5	23	17	15	23	12
CA Agriculture Station	3	13.5	21	20	13.5	13	17	14.5	22	17	19.5	12.5	3	24.5	7	17	15	11	5
EPNG-2	5	13.5	17	4	13.5	13	10	14.5	14	9	19.5	12.5	13	24.5	15	17	15	12	7
GSRV-2	19	1	13	11	1	13	2	14.5	21	2	19.5	12.5	17	22	12	1	1	10	25
GSWC-1	7	13.5	9	17	13.5	13	7	14.5	9	6	6	12.5	14	11	2	2	15	6	20
GSWC-2	22.5	13.5	8	12	13.5	13	14	14.5	7	14	7	12.5	15	17	10	6	15	8	23
GSWC-4	22.5	13.5	7	15	13.5	13	8	14.5	13	7	11	12.5	16	12	16	3	15	4	19
Langmaack	9	13.5	11	23	13.5	13	4	14.5	4	3	12	12.5	25	3	9	4	15	9	14
Lily Hill	8	13.5	5	10	13.5	13	12	14.5	3	13	5	12.5	7	6	5	17	3	5	13
MW-16	11	13.5	6	21	13.5	13	9	14.5	16	8	19.5	12.5	8	2	13	17	15	2	24
MW-17	22.5	13.5	24	18	13.5	13	6	14.5	2	5	2	12.5	4	4	1	8	15	21	3
MW-18	10	13.5	25	7	13.5	13	1	14.5	19	1	19.5	25	24	13	6	17	15	20	16
Needles MW-10	6	13.5	19	24	13.5	13	21	14.5	23	23.5	19.5	12.5	11	20	17	17	15	19	18
Needles MW-11	4	13.5	10	22	13.5	13	16	14.5	10	16	10	12.5	6	23	3	17	15	15	17
Needles MW-12	22.5	13.5	20	19	13.5	13	23.5	2	6	21	4	12.5	9	1	23	17	2	18	15
New Farm Well	18	13.5	15	8	13.5	13	23.5	14.5	20	23.5	19.5	12.5	18	18.5	23	17	15	24.5	21
P-2	22.5	13.5	22	2	13.5	13	15	14.5	15	15	13	12.5	19	16	11	17	15	13	11
PGE-09S	22.5	13.5	1	3	13.5	13	23.5	1	8	19	8	12.5	5	9	23	17	15	22	1
PMM-Supply	15	13.5	23	1	13.5	13	11	14.5	17	11	9	12.5	22	15	14	7	15	16	8
Sanders	12	13.5	2	14	13.5	13	19	14.5	11	20	19.5	12.5	1	10	4	17	4	1	2
TMLP-2	13	13.5	12	25	13.5	13	5	14.5	24	4	19.5	12.5	21	21	18	17	15	7	22
Tayloe	14	13.5	16	13	13.5	13	18	14.5	12	18	3	12.5	10	18.5	8	17	15	17	4
Topock-2	1	13.5	4	6	13.5	13	3	3	1	10	1	12.5	2	8	20	5	15	3	10
USFW-5	17	13.5	18	16	13.5	13	20	14.5	18	23.5	19.5	12.5	23	14	23	17	15	24.5	9

# TABLE 2-6 Mean Ranks for Mean Concentrations of General Chemistry Parameters PG&E Background Study PG&E Topock Compressor Station and Vicinity

Location	Alkalinity, as carbonate	Alkalinity, bicarb. as CaCO3	Alkalinity, total as CaCO3	Ammonia as nitrogen	Boron	Calcium	Chloride	Deuterium	Dissolved organic carbon	Dissolved oxygen	Fluoride	lron	Magnesium	Manganese	Nitrate as Nitrogen	Oxidation reduction potential	Oxygen 18	Potassium	рН	Sodium	Soluble silica	Specific conductance	Sulfate	Temperature	Total dissolved solids	Total Kjeldahl Nitrogen	Total organic carbon	Total suspended solids	Turbidity
ADOT New Well	13	22	20	14	6	18	10	16	17	11	2	18.5	22	16	14	5	17	14	16	11	15	18	6	20	18	16	15.5	9	8.5
BOR-2	13	3	4	2	17	10	13	24	2	23	22	3	2	5	23	25	24	15	17	9	14	5	21	1	6	2	2	3	4
CA Agriculture Station	13	21	19	14	4	12	8	4	16	2	12	18.5	13	12	15	16	3	16	11	8	9	9	15	3	9	21.5	15.5	7	7
EPNG-2	13	20	18	14	8	19	11	17	25	12	4	18.5	20	24	13	4	16	13	14	12	16	19	3	20	19	21.5	15.5	17	12.5
GSRV-2	13	7	8	14	23	15	22	9	5	1	7	11	14	14	8	2	12	19	3	24	21	22	10	7	22	12	15.5	22.5	19
GSWC-1	13	14	15	14	13	17	21	6	15	13	15	18.5	12	25	1	11	6	10	9	21	19	16	8.5	6	20	21.5	15.5	16	5
GSWC-2	13	13	14	14	14	21	18	13	14	22	17	18.5	17	21	19	13	8	18	8	19	20	21	4	4	21	21.5	15.5	14	2.5
GSWC-4	13	8	9	14	16	24	23	12	13	17	14	7	19	23	16	15	11	21	5	22	23	24	5	20	23	21.5	15.5	22.5	14
Langmaack	13	11	13	14	18	23	24	7	21	4	19	18.5	16	17	6	12	9	17	7	23	24	23	16	14	24	14	15.5	22.5	8.5
Lily Hill	13	12	7	14	9.5	14	15	18	22	3	10	18.5	9	10	5	1	18	8	4	13	22	12	18	20	15	17	15.5	22.5	2.5
MW-16	13	17	17	14	12	22	12	3	9	8	5	18.5	23	18	9	20	4	23	19	10	12	13	11	9	17	7	1	2	1
MW-17	13	23	24	14	15	4	17	1	10	14	9	18.5	10	11	3	14	1	3	25	7	7	2	8.5	5	5	9	15.5	15	21.5
MW-18	13	24	21	14	20	9	6	5	23	9	21	6	15	15	2	3	7	6	18	14	8	15	14	20	12	21.5	15.5	8	25
Needles MW-10	13	15	10	14	22	11	19	22	8	6	20	9	8	7	23	21	23	22	15	18	13	7	25	20	14	6	15.5	13	16.5
Needles MW-11	13	6	5	14	5	6	5	25	6	7	11	18.5	5	9	17	10	25	2	2	4	3	4	19	20	4	8	15.5	12	24
Needles MW-12	13	4	3	14	9.5	3	9	21	4	5	16	18.5	3	2	20	7	21.5	5	12	6	5	3	23	12	3	3	15.5	22.5	20
New Farm Well	13	5	6	14	21	5	16	23	3	16	24.5	5	6	3	23	22	21.5	12	21	16	10	6	22	8	8	4	15.5	5	15
P-2	13	25	25	14	7	2	2	11	19	10	8	18.5	4	22	10.5	6	10	4	22	2	2	10	12.5	11	2	21.5	4	19	23
PGE-09S	13	1	1	1	1	1	1	19	1	25	23	1	1	1	23	23	19	1	10	1	1	1	20	2	1	1	3	1	18
PMM-Supply	13	18	22	14	19	8	4	10	20	18	6	8	11	19	7	17	5	9	23	15	11	20	12.5	13	11	11	15.5	11	16.5
Sanders	13	2	2	14	2	13	7	15	11	24	1	18.5	21	6	10.5	9	15	25	1	3	4	11	17	20	7	10	15.5	18	21.5
TMLP-2	13	10	12	14	25	25	25	8	12	20	13	10	18	13	4	18	14	11	6	25	25	25	2	20	25	21.5	15.5	10	10
Tayloe	13	16	16	14	11	20	14	2	24	19	18	18.5	24	20	18	8	2	24	20	17	18	17	7	10	13	15	15.5	22.5	6
Topock-2	13	19	23	14	3	16	3	14	18	15	3	2	25	8	12	19	13	7	13	5	6	14	1	20	10	13	5	4	11
USFW-5	13	9	11	14	24	7	20	20	7	21	24.5	4	7	4	23	24	20	20	24	20	17	8	24	20	16	5	15.5	6	12.5

# TABLE 2-7 Statistical Evaluation of How Unusual "Top 5" Concentrations are for Dissolved Metals Via Binomial Distribution PG&E Backaround Study

PG&E Background Study PG&E Topock Compressor Station and Vicinity

Location	Number of Mean Concentrations Ranked in the Top Five	Number of Mean Concentrations (Constituents) Evaluated	Probability that the Number of Top Five Concentrations Would Occur by Chance	Is this Probability Significant at the 0.05 Level
ADOT New Well	3	26	0.765	
BOR-2	5	26	0.383	
CA Agriculture Station	4	26	0.578	
EPNG-2	2	26	0.901	
GSRV-2	6	26	0.221	
GSWC-1	2	26	0.901	
GSWC-2	0	26	0.996	
GSWC-4	2	26	0.901	
Langmaack	5	26	0.383	
Lily Hill	6	26	0.221	
MW-16	2	26	0.901	
MW-17	9	26	0.018	Yes
MW-18	2	26	0.901	
Needles MW-10	0	26	0.996	
Needles MW-11	6	26	0.221	
Needles MW-12	8	26	0.048	Yes
New Farm Well	3	26	0.765	
P-2	5	26	0.383	
PGE-09S	12	26	0.000	Yes
PMM-Supply	1	26	0.972	
Sanders	8	26	0.048	Yes
TMLP-2	2	26	0.901	
Tayloe	2	26	0.901	
Topock-2	12	26	0.000	Yes
USFW-5	2	26	0.901	

# TABLE 3-1 Summary Statistics for Wells Sampled in Background Study Events 1-6 PG&E Topock Background Study PG&E Topock Compressor Station and Vicinity

						Number	Number					Normality p- value after	Lognormality p- value after	Distributional Assumption
				Standard	Maximum	of	of	Percent	Normality p	Lognormality p-	Distributional	Outliers	Outliers	after Outliers
Parameter	Units	Mean	Median	Deviation	Detect	Detects	Samples	Detects	value	value	Assumption	Removed	Removed	Removed
Aluminum	ug/L	36.9	32.3	14.6	91.3	18	25	72	0.0000	0.0073	Nonparametric			
Antimony	ug/L	1.01	1	0.044	1.22	1	25	4	0.0000	0.0000	Normal			
Arsenic	ug/L	8.66	5.62	9.24	38.5	25	25	100	0.0000	0.6512	Lognormal	0.8148	0.0433	Normal *
Barium	ug/L	60.3	48.9	37.2	156	25	25	100	0.0043	0.9719	Lognormal			
Beryllium	ug/L	0.507	0.5	0.0327	0.663	1	25	4	0.0000	0.0000	Normal			
Boron	mg/L	0.391	0.266	0.3	1.45	25	25	100	0.0001	0.2731	Lognormal			
Cadmium	ug/L	0.5	0.5	0	NA	0	25	0			Normal			
Calcium	mg/L	85.2	54.8	84.4	400	25	25	100	0.0000	0.1343	Lognormal			
Chromium	ug/L	9.37	7.73	9.84	34.1	21	25	84	0.0014	0.0052	Nonparametric			
Cobalt	ug/L	0.527	0.5	0.0819	0.843	3	25	12	0.0000	0.0000	Nonparametric			
Copper	ug/L	4.44	2.41	7.04	37.1	24	25	96	0.0000	0.0479	Nonparametric	0.0272	0.4483	Lognormal *
Hexavalent chromium	ug/L	7.8	7.37	8.7	31.8	19	25	76	0.0008	0.0042	Nonparametric			
Iron	mg/L	0.446	0.05	1.17	5.61	11	25	44	0.0000	0.0000	Nonparametric			
Lead	ug/L	1.55	0.587	2.85	12	13	25	52	0.0000	0.0000	Nonparametric			
Magnesium	mg/L	27.1	16.8	32	154	25	25	100	0.0000	0.2362	Lognormal			
Manganese	ug/L	127	2.81	295	1320	24	25	96	0.0000	0.0035	Nonparametric			
Mercury	ug/L	0.0993	0.1	0.00333	NA	0	25	0	0.0000	0.0000	Normal			
Molybdenum	ug/L	11.3	8.96	7.63	36.3	25	25	100	0.0005	0.3831	Lognormal			
Nickel	ug/L	1.85	0.932	2.54	10.6	22	25	88	0.0000	0.0012	Nonparametric	0.0001	0.0667	Lognormal *
Potassium	mg/L	6.92	5.53	3.42	19.3	25	25	100	0.0000	0.0659	Lognormal	0.0060	0.3911	Lognormal
Selenium	ug/L	2.16	1.67	2.52	12.9	20	25	80	0.0000	0.0937	Lognormal	0.0103	0.0454	Nonparametric *
Silver	ug/L	0.687	0.5	0.398	2.13	8	25	32	0.0000	0.0000	Nonparametric			
Sodium	mg/L	296	172	501	2620	25	25	100	0.0000	0.0183	Nonparametric	0.0004	0.7971	Lognormal *
Thallium	ug/L	0.53	0.5	0.0872	0.908	4	25	16	0.0000	0.0000	Nonparametric			
Vanadium	ug/L	14.1	11.9	12.7	59.9	23	25	92	0.0005	0.0019	Nonparametric	0.2636	0.0004	Normal *
Zinc	ug/L	52.6	21.1	127	656	25	25	100	0.0000	0.0001	Nonparametric	0.0000	0.0336	Nonparametric

\* The distributional assumptions for arsenic, copper, nickel, selenium, sodium, and vanadium were different after outliers were removed.

### TABLE 4-1

Recommended Metals for Calculation of a Background Concentration PG&E Topock Background Study PG&E Compressor Station and Vicinity

Metal	Will a background concentration be calculated for the metal?
Aluminum	Yes
Antimony	Yes
Arsenic	Yes
Barium	Yes
Beryllium	Yes
Cadmium	Yes
Chromium	Yes
Cobalt	Yes
Copper	Yes
Hexavalent chromium	Yes
Lead	Yes
Mercury	Yes
Molybdenum	Yes
Nickel	Yes
Selenium	Yes
Silver	Yes
Thallium	Yes
Vanadium	Yes
Zinc*	Yes

Note: \*zinc concentrations from PGE-9S will not be used in the calculation of the background concentration of zinc.

### TABLE 4-2

Final Wells Selected for Use in Calculating Background Concentrations PG&E Topock Background Study PG&E Compressor Station and Vicinity

Well	State	Is the well selected to be used for the calculation of the background concentration?
ADOT New Well	AZ	Yes
Sanders	AZ	Yes
Topock-2	AZ	Yes
EPNG-2	AZ	Yes
GSWC-1	AZ	Yes
GSWC-2	AZ	Yes
GSWC-4	AZ	Yes
PGE-09S*	AZ	Yes
Langmaack	AZ	Yes
GSRV-2	AZ	Yes
TMLP-2	AZ	Yes
BOR-2	AZ	Yes
New Farm Well	AZ	Yes
USFW-5	AZ	Yes
CA Agriculture Station	CA	Yes
Needles MW-10	CA	Yes
Needles MW-11	CA	Yes
Needles MW-12	CA	Yes
Lily Hill	CA	Yes
Tayloe	CA	Yes
MW-16	CA	Yes
MW-17	CA	Yes
MW-18	CA	Yes
P-2	CA	Yes
PMM-Supply	CA	Yes

Note: \*zinc concentrations from PGE-9S will not be used for calculation of the zinc background concentration

Figures











# Attachment 1 Validated Background Data Set

(Attachment 1 included on CD-ROM and posted on ftp site)

Attachment 2 Index of Laboratory Reports

# Summary of Background Study Samples

PG&E Topock Background Metals Study

Location ID 2005-BKG-001	l ab Sample	Sample	Sample		LA	AB	
ID	ID	Туре	Date	Truesdail	Emax	Zymax	Severn Trent
2005-BKG-001							
ADOT New Well	ADOT New Well-BKG-001	LS	5/18/2005	942928-005	E175-05	39715-26	E5E240252033
BOR-2	BOR-2-BKG-001	LS	5/11/2005	942924-001	E088-01R	39704-8	E5E240252004
BOR-3	BOR-3-BKG-001	LS	5/11/2005	942924-002	E088-02R	39704-9	E5E240252005
CA Agriculture Station	CA-AG Station-BKG-001	LS	5/16/2005	942925-001	E140-01R	39715-17	E5E240252019
EPNG-2	EPNG-2-BKG-001	LS	5/18/2005	942928-004	E175-04	39715-25	E5E240252032
GSRV-2	GSRV-2-BKG-001	LS	5/19/2005	942929-001	E189-01R	39715-8	E5E240252036
GSRV-2	MW-94-BKG-001	LFD	5/19/2005	942929-004	E189-04R	39715-11	E5E240252039
GSWC-1	GSWC-1-BKG-001	LS	5/17/2005	942926-004	E153-04R	39715-15	E5E240252027
GSWC-2	GSWC-2-BKG-001	LS	5/17/2005	942926-005	E153-05R	39715-16	E5E240252028
GSWC-3	GSWC-3-BKG-001	LS	5/18/2005	942928-003	E175-03R	39715-24	E5E240252031
GSWC-4	GSWC-4-BKG-001	LS	5/18/2005	942928-002	E175-02R	39715-23	E5E240252030
Langmaack	Langmaack-BKG-001	LS	5/17/2005	942926-003	E153-03R	39715-14	E5E240252026
Lily Hill	Lily Hill-BKG-001	LS	5/16/2005	942925-005	E140-05R	39715-21	E5E240252023
MW-01	MW-01-BKG-001	LS	5/9/2005	942927-001	E065-01R	39704-5	E5E240252001
MW-03	MW-03-BKG-001	LS	5/9/2005	942927-002	E065-02R	39704-6	E5E240252002
MW-04	MW-04-BKG-001	LS	5/9/2005	942927-003	E065-03R	39704-7	E5E240252003
MW-05	MW-05-BKG-001	LS	5/13/2005	942923-001	E116-01RE	39715-1	E5E240252012
MW-06	MW-06-BKG-001	LS	5/13/2005	942923-002	E116-02	39715-2	E5E240252013
MW-07	MW-07-BKG-001	LS	5/13/2005	942923-003	E116-03	39715-3	E5E240252014
MW-08	MW-08-BKG-001	LS	5/13/2005	942923-004	E116-04R	39715-4	E5E240252015
MW-16	MW-16-BKG-001	LS	5/13/2005	942923-006	E116-06R	39715-6	E5E240252017
MW-16	MW-90-BKG-001	LFD	5/13/2005	942923-007	E116-08R	39715-7	E5E240252018
MW-16	MW-16-EB-BKG-001	LEB	5/13/2005	942699-007	E116-07		
MW-17	MW-17-BKG-001	LS	5/19/2005	942929-002	E189-02	39715-9	E5E240252037
MW-17	MW-91-BKG-001	LFD	5/19/2005	942929-003	E189-03	39715-10	E5E240252038
MW-18	MW-18-BKG-001	LS	5/11/2005	942922-002	E105-02RE	39704-2	E5E240252009
Needles MW-10	MW-10-BKG-001	LS	5/16/2005	942925-002	E140-02R	39715-18	E5E240252020
Needles MW-11	MW-11-BKG-001	LS	5/16/2005	942925-003	E140-03R	39715-19	E5E240252021
New Farm Well	New Farm Well-BKG-001	LS	5/12/2005	942922-003	E105-03	39704-3	E5E240252010
P-2	P-2-BKG-001	LS	5/13/2005	942923-005	E116-05	39715-5	E5E240252016
PGE-09N	PGE-9N-BKG-001	LS	5/11/2005	942924-003	E088-03R	39704-10	E5E240252007
PGE-09S	PGE-9S-BKG-001	LS	5/11/2005	942924-004	E088-04R	39704-11	E5E240252006
PMM-Supply	PMM-Supply-BKG-001	LS	5/18/2005	942928-006	E175-06	39715-27	E5E240252034
PMM-Supply	MW-92-BKG-001	LFD	5/18/2005	942928-007	E175-07	39715-28	E5E240252035
Sanders	Sanders-BKG-001	LS	5/18/2005	942928-001	E175-01R	39715-22	E5E240252029
Tayloe	Tayloe-BKG-001	LS	5/16/2005	942925-004	E140-04	39715-20	E5E240252022
TMLP-2	TMLP-2-BKG-001	LS	5/12/2005	942922-001	E105-01R	39704-1	E5E240252008
Topock-3	TOPOCK-3-BKG-001	LS	5/17/2005	942926-001	E153-01R	39715-12	E5E240252024
Topock-3	MW-93-BKG-001	LFD	5/17/2005	942926-002	E153-02R	39715-13	E5E240252025

### Summary of Background Study Samples

PG&E Topock Background Metals Study

Location ID	Lab Sample ID	Sample Type	Sample Date	LAB			
				Truesdail	Emax	Zymax	Severn Trent
USFW-5	USFW-5-BKG-001	LS	5/12/2005	942922-004	E105-04	39704-4	E5E240252011
2005-BKG-001a							
Needles MW-12	Needles MW-12-BKG-001	LS	6/22/2005	943940-001	F217-01R	39754-1	E5F240231001
Topock-2	TOPOCK-2-BKG-001	LS	6/22/2005	943940-002	F217-02R	39754-2	E5F240231002
2005-BKG-002							
ADOT New Well	ADOT NEW WELL-BKG-002	LS	7/25/2005	945040-005	G222-05	39802-5	E5G270146005
BOR-2	BOR-2-BKG-002	LS	7/20/2005	944914-006	G162-06R	39796-6	E5G250238006
BOR-3	BOR-3-BKG-002	LS	7/21/2005	944956-001	G182-01	39803-1	E5G250237001
CA Agriculture Station	CA Agriculture Station-BKG-002	LS	7/25/2005	945040-003	G222-03	39802-3	E5G270146003
EPNG-2	EPNG-2-BKG-002	LS	7/25/2005	945040-006	G222-06	39802-6	E5G270146006
GSRV-2	GSRV-2-BKG-002	LS	7/22/2005	944993-005	G190-05	39802-5	E5G270146012
GSRV-2	MW-94-BKG-002	LFD	7/22/2005	944993-006	G190-06	39802-5	E5G270146013
GSWC-1	GSWC-1-BKG-002	LS	7/22/2005	944993-001	G190-01R	39802-1	E5G270146008
GSWC-2	GSWC-2-BKG-002	LS	7/22/2005	944993-002	G190-02	39802-2	E5G270146009
GSWC-3	GSWC-3-BKG-002	LS	7/22/2005	944993-003	G190-03	39802-3	E5G270146010
GSWC-4	GSWC-4-BKG-002	LS	7/22/2005	944993-004	G190-04	39802-4	E5G270146011
Langmaack	LANGMAACK-BKG-002	LS	7/25/2005	945040-004	G222-04	39802-4	E5G270146004
Lily Hill	LILY HILL-BKG-002	LS	7/25/2005	945040-001	G222-01	39802-1	E5G270146001
MW-01	MW-01-BKG-002	LS	7/18/2005	944787-001	G126-01T	39795-1	E5G190345001
MW-03	MW-03-BKG-002	LS	7/18/2005	944787-002	G126-02T	39795-2	E5G190345002
MW-04	MW-04-BKG-002	LS	7/18/2005	944787-003	G126-03T	39795-3	E5G190345003
MW-05	MW-05-BKG-002	LS	7/18/2005	944787-004	G126-04T	39795-4	E5G190345004
MW-06	MW-06-BKG-002	LS	7/18/2005	944787-005	G126-05	39795-5	E5G190345005
MW-07	MW-07-BKG-002	LS	7/18/2005	944787-006	G126-06T	39795-6	E5G190345006
MW-08	MW-08-BKG-002	LS	7/18/2005	944787-007	G126-07T	39795-7	E5G190345007
MW-16	MW-16-BKG-002	LS	7/26/2005	945101-003	G232-03R	39804-2	E5G270364002
MW-16	MW-90-BKG-002	LFD	7/26/2005	945101-004	G232-04	39804-3	E5G270364003
MW-17	MW-17-BKG-002	LS	7/26/2005	945101-005	G232-05	39804-4	E5G270364004
MW-17	MW-91-BKG-002	LFD	7/26/2005	945101-006	G232-06	39804-5	E5G270364005
MW-18	MW-18-BKG-002	LS	7/26/2005	945101-007	G232-07	39804-6	E5G270364006
Needles MW-10	Needles MW-10-BKG-002	LS	7/21/2005	944956-004	G182-04	39803-4	E5G250237004
Needles MW-11	Needles MW-11-BKG-002	LS	7/21/2005	944956-005	G182-05R	39803-5	E5G250237005
Needles MW-12	Needles MW-12-BKG-002	LS	7/21/2005	944956-006	G182-06	39803-6	E5G250237006
New Farm Well	New Farm Well-BKG-002	LS	7/20/2005	944914-005	G162-05	39796-5	E5G250238005
P-2	P-2-BKG-002	LS	7/26/2005	945101-001	G232-01	39804-1	E5G270364001
P-2	P-2-EB-BKG-002	LEB	7/26/2005	945101-002	G232-02		
PGE-09N	PGE-9N-BKG-002	LS	7/20/2005	944914-003	G162-03R	39796-3	E5G250238003
PGE-09S	PGE-9S-BKG-002	LS	7/20/2005	944914-002	G162-02R	39796-2	E5G250238002
PMM-Supply	PMM-Supply-BKG-002	LS	7/21/2005	944956-007	G182-07	39803-7	E5G250237007
PMM-Supply	MW-92-BKG-002	LFD	7/21/2005	944956-003	G182-03	39803-3	E5G250237003

### Summary of Background Study Samples

PG&E Topock Background Metals Study

Location ID	Lab Sample ID	Sample Type	Sample Date	LAB			
				Truesdail	Emax	Zymax	Severn Trent
Sanders	SANDERS-BKG-002	LS	7/25/2005	945040-007	G222-07	39802-7	E5G270146007
Tayloe	TAYLOE-BKG-002	LS	7/25/2005	945040-002	G222-02	39802-2	E5G270146002
TMLP-2	TMLP-2-BKG-002	LS	7/20/2005	944914-001	G162-01R	39796-1	E5G250238001
Topock-2	Topock-2-BKG-002	LS	7/21/2005	944956-002	G182-02	39803-2	E5G250237002
Topock-3	TOPOCK-3-BKG-002	LS	8/11/2005	945709-001	H122-01	39846-1	E5H120316001
Topock-3	MW-93-BKG-002	LFD	8/11/2005	945709-002	H122-02	39846-2	E5H120316002
USFW-5	USFW-5-BKG-002	LS	7/20/2005	944914-004	G162-04	39796-4	E5G250238004
2005-BKG-003							
ADOT New Well	ADOT New WeLL-BKG-003	LS	11/3/2005	948506-001	K047-01R	39924-7	
BOR-2	BOR-2-BKG-003	LS	11/1/2005	948423-004	K026-04R	39924-4	
BOR-2	BOR-2-EB-BKG-003	LEB	11/1/2005	948423-005	K026-05		
CA Agriculture Station	CA Agriculture Station-BKG-003	LS	11/3/2005	948506-012	K047-12	39924-18	
EPNG-2	EPNG-2-BKG-003	LS	11/3/2005	948506-002	K047-02	39924-8	
GSRV-2	GSRV-2-BKG-003	LS	11/2/2005	948461-001	K033-01	39924-19	
GSRV-2	MW-94-BKG-003	LFD	11/2/2005	948461-003	K033-02	39924-20	
GSRV-2	GSRV-2-EB-BKG-003	LEB	11/2/2005	948461-002	K032-02		
GSWC-1	GSWC-1-BKG-003	LS	11/2/2005	948461-005	K033-04	39924-22	
GSWC-2	GSWC-2-BKG-003	LS	11/2/2005	948461-006	K033-05	39924-23	
GSWC-4	GSWC-4-BKG-003	LS	11/2/2005	948461-007	K033-06	39924-24	
Langmaack	Langmaack-BKG-003	LS	11/2/2005	948461-004	K033-03	39924-21	
Lily Hill	Lily Hill-BKG-003	LS	11/3/2005	948506-010	K047-10	39924-16	
MW-16	MW-16-BKG-003	LS	11/3/2005	948506-007	K047-07	39924-13	
MW-16	MW-90-BKG-003	LFD	11/3/2005	948506-008	K047-08	39924-14	
MW-17	MW-17-BKG-003	LS	11/2/2005	948461-011	K033-10	39924-28	
MW-17	MW-91-BKG-003	LFD	11/2/2005	948461-012	K033-11	39924-29	
MW-18	MW-18-BKG-003	LS	11/3/2005	948506-006	K047-06	39924-12	
Needles MW-10	Needles MW-10-BKG-003	LS	11/3/2005	948506-004	K047-04	39924-10	
Needles MW-11	NEEDLES MW-11-BKG-003	LS	11/3/2005	948506-009	K047-09	39924-15	
Needles MW-12	Needles MW-12-BKG-003	LS	11/3/2005	948506-005	K047-05	39924-11	
New Farm Well	NEW FARM WELL-BKG-003	LS	11/1/2005	948423-003	K026-03	39924-3	
P-2	P-2-BKG-003	LS	11/30/2005	949384-001	L008-01R	39956-2	
PGE-09S	PGE-9S-BKG-003	LS	10/31/2005	948365-001	K011-01R	39924-5	
PGE-09S	MW-92-BKG-003	LFD	10/31/2005	948365-002	K011-02R	39924-6	
PMM-Supply	PMM-SUPPLY-BKG-003	LS	11/2/2005	948461-010	K033-09	39924-27	
Sanders	SANDERS-BKG-003	LS	11/3/2005	948506-003	K047-03	39924-9	
Tayloe	TAYLOE-BKG-003	LS	11/3/2005	948506-011	K047-11	39924-17	
TMLP-2	TMLP-2-BKG-003	LS	11/1/2005	948423-001	K026-01	39924-1	
Topock-2	TOPOCK-2-BKG-003	LS	11/2/2005	948461-008	K033-07	39924-25	
Topock-2	MW-93-BKG-003	LFD	11/2/2005	948461-009	K033-08	39924-26	
USFW-5	USFW-5-BKG-003	LS	11/1/2005	948423-002	K026-02	39924-2	

### Summary of Background Study Samples

PG&E Topock Background Metals Study

Location ID	Lab Sample ID	Sample Type	Sample Date	LAB			
				Truesdail	Emax	Zymax	Severn Trent
2005-BKG-004							
ADOT New Well	ADOT NEW WELL-BKG-004	LS	12/20/2005	950084-001	L172-01R	39969-5	
BOR-2	BOR-2-BKG-004	LS	12/21/2005	950115-004	L182-04	39969-4	
BOR-2	BOR-2-EB-BKG-004	LEB	12/21/2005	950115-005	L182-05		
CA Agriculture Station	CA Agriculture Station-BKG-004	LS	12/19/2005	950009-009	L158-09	39969-23	
EPNG-2	EPNG-2-BKG-004	LS	12/20/2005	950084-002	L172-02	39969-6	
GSRV-2	GSRV-2-BKG-004	LS	12/22/2005	950147-001	L187-01	39977-1	
GSRV-2	MW-94-BKG-004	LFD	12/22/2005	950147-006	L187-06	39977-5	
GSRV-2	GSRV-2-EB-BKG-004	LEB	12/22/2005	950147-002	L187-02		
GSWC-1	GSWC-1-BKG-004	LS	12/19/2005	950009-005	L158-05	39969-19	
GSWC-2	GSWC-2-BKG-004	LS	12/19/2005	950009-006	L158-06	39969-20	
GSWC-4	GSWC-4-BKG-004	LS	12/19/2005	950009-007	L158-07	39969-21	
Langmaack	Langmaack-BKG-004	LS	12/19/2005	950009-002	L158-02	39969-16	
Lily Hill	LILY HILL-BKG-004	LS	12/20/2005	950084-007	L172-07	39969-11	
MW-16	MW-16-BKG-004	LS	12/22/2005	950147-003	L187-03	39977-2	
MW-16	MW-90-BKG-004	LFD	12/22/2005	950147-004	L187-04	39977-3	
MW-17	MW-17-BKG-004	LS	12/22/2005	950147-005	L187-05	39977-6	
MW-17	MW-91-BKG-004	LFD	12/22/2005	950147-007	L187-07	39977-4	
MW-18	MW-18-BKG-004	LS	2/9/2006	951652-001	B080-01	39999-1	
Needles MW-10	NEEDLES MW-10-BKG-004	LS	12/20/2005	950084-004	L172-04	39969-8	
Needles MW-11	Needles MW-11-BKG-004	LS	12/20/2005	950084-005	L172-05	39969-9	
Needles MW-12	Needles MW-12-BKG-004	LS	12/20/2005	950084-006	L172-06	39969-10	
New Farm Well	New Farm Well-BKG-004	LS	12/21/2005	950115-002	L182-02	39969-2	
P-2	P-2-BKG-004	LS	12/21/2005	950115-001	L182-01	39969-1	
PGE-09S	PGE-09S-BKG-004	LS	12/20/2005	950084-009	L172-09R	39969-13	
PGE-09S	MW-92-BKG-004	LFD	12/20/2005	950084-008	L172-08	39969-12	
PMM-Supply	PMM-SUPPLY-BKG-004	LS	12/19/2005	950009-008	L158-08	39969-22	
Sanders	SANDERS-BKG-004	LS	12/20/2005	950084-003	L172-03	39969-7	
Tayloe	TAYLOE-BKG-004	LS	12/20/2005	950084-010	L172-10	39969-14	
TMLP-2	TMLP-2-BKG-004	LS	12/19/2005	950009-001	L158-01R	39969-15	
Topock-2	TOPOCK-2-BKG-004	LS	12/19/2005	950009-003	L158-03	39969-17	
Topock-2	MW-93-BKG-004	LFD	12/19/2005	950009-004	L158-04	39969-18	
USFW-5	USFW-5-BKG-004	LS	12/21/2005	950115-003	L182-03	39969-3	
2006-BKG-005							
ADOT New Well	ADOT New Well-BKG-005	LS	2/23/2006	952092-002	B194-02	40010-18	
Blank-Blank	BLANK-BLANK	LEB	3/22/2006	953046-002	C217-02		
BOR-2	BOR-2-BKG-005	LS	2/21/2006	951993-002	B173-07	40010-8	
BOR-2	BOR-2-EB-BKG-005	LEB	2/21/2006	951993-001	B173-01		
CA Agriculture Station	CA Agriculture Station-BKG-005	LS	2/22/2006	952059-008	B183-08	40010-16	
EPNG-2	EPNG-2-BKG-005	LS	2/22/2006	952059-002	B183-02R	40010-10	

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### Summary of Background Study Samples

PG&E Topock Background Metals Study

Location ID	Lab Sample ID	Sample Type	Sample Date	LAB			
				Truesdail	Emax	Zymax	Severn Trent
GSRV-2	GSRV-2-BKG-005	LS	3/21/2006	952979-002	C198-02	40051-2	
GSRV-2	MW-94-BKG-005	LFD	3/21/2006	952979-003	C198-03R	40051-3	
GSRV-2	GSRV-2-EB-BKG-005	LEB	3/22/2006	953046-001	C217-01		
GSWC-1	GSWC-1-BKG-005	LS	2/20/2006	951934-001	B156-01	40010-1	
GSWC-2	GSWC-2-BKG-005	LS	2/20/2006	951934-002	B156-02	40010-2	
GSWC-4	GSWC-4-BKG-005	LS	2/23/2006	952092-003	B194-03R	40010-19	
Langmaack	LANGMAACK-BKG-005	LS	2/21/2006	951993-003	B173-02R	40010-3	
Lily Hill	Lily Hill-BKG-005	LS	2/22/2006	952059-007	B183-07R	40010-15	
MW-16	MW-16-BKG-005	LS	3/1/2006	952323-001	C035-01	40026-1	
MW-16	MW-90-BKG-005	LFD	3/1/2006	952323-005	C035-05	40026-5	
MW-17	MW-17-BKG-005	LS	3/1/2006	952323-002	C035-02	40026-2	
MW-17	MW-91-BKG-005	LFD	3/1/2006	952323-006	C035-06	40026-6	
MW-18	MW-18-BKG-005	LS	3/1/2006	952323-003	C035-03	40026-3	
Needles MW-10	Needles MW-10-BKG-005	LS	2/22/2006	952059-004	B183-04R	40010-12	
Needles MW-11	Needles MW-11-BKG-005	LS	2/22/2006	952059-005	B183-05R	40010-13	
Needles MW-12	Needles MW-12-BKG-005	LS	2/22/2006	952059-006	B183-06R	40010-14	
New Farm Well	New Farm Well-BKG-005	LS	2/21/2006	951993-007	B173-06	40010-7	
P-2	P-2-BKG-005	LS	3/21/2006	952979-001	C198-01	40051-1	
PGE-09S	PGE-09S-BKG-005	LS	2/21/2006	951993-004	B173-03R	40010-4	
PGE-09S	MW-92-BKG-005	LFD	2/21/2006	951993-006	B173-05R	40010-6	
PMM-Supply	PMM-Supply-BKG-005	LS	2/22/2006	952059-001	B183-01	40010-9	
Sanders	SANDERS-BKG-005	LS	3/1/2006	952323-004	C035-04	40026-4	
Tayloe	TAYLOE-BKG-005	LS	2/22/2006	952059-003	B183-03	40010-11	
TMLP-2	TMLP-2-BKG-005	LS	2/23/2006	952092-001	B194-01R	40010-17	
Topock-2	TOPOCK-2-BKG-005	LS	2/23/2006	952092-004	B194-04	40010-20	
Topock-2	MW-93-BKG-005	LFD	2/23/2006	952092-005	B194-05	40010-21	
USFW-5	USFW-5-BKG-005	LS	2/21/2006	951993-005	B173-04	40010-5	
2006-BKG-006							
ADOT New Well	ADOT New Well-BKG-006	LS	5/2/2006	954435-001	E021-05	40085-1	
BOR-2	BOR-2-BKG-006	LS	5/3/2006	954490-003	E030-03	40085-6	
BOR-2	MW-93-BKG-006	LFD	5/3/2006	954490-005	E030-05	40085-7	
BOR-2	BOR-2-EB-BKG-006	LEB	5/3/2006	954490-004	E030-04		
CA Agriculture Station	CA Agriculture Station-BKG-006	LS	5/1/2006	954352-001	E011-06R	40085-14	
EPNG-2	EPNG-2-BKG-006	LS	5/2/2006	954435-002	E021-06	40085-2	
GSRV-2	GSRV-2-BKG-006	LS	5/4/2006	954545-001	E034-01R	40090-1	
GSRV-2	MW-94-BKG-006	LFD	5/4/2006	954545-002	E034-02R	40090-2	
GSRV-2	GSRV-2-EB-BKG-006	LEB	5/4/2006	954545-004	E034-04		
GSWC-1	GSWC-1-BKG-006	LS	5/1/2006	954351-002	E011-01R	40085-18	
GSWC-2	GSWC-2-BKG-006	LS	6/1/2006	955426-001	F024-01R		
GSWC-4	GSWC-4-BKG-006	LS	5/1/2006	954351-001	E011-02R	40085-17	
#### TABLE 1

#### Summary of Background Study Samples

PG&E Topock Background Metals Study

Location	Lab Sample	Sample	Sample	LAB				
ID	ID	Туре	Date	Truesdail	Emax	Zymax	Severn Trent	
Langmaack	LANGMAACK-BKG-006	LS	5/1/2006	954351-003	E011-03R	40085-19		
Lily Hill	Lily Hill-BKG-006	LS	5/1/2006	954352-002	E011-07R	40085-15		
MW-16	MW-16-BKG-006	LS	5/3/2006	954489-001	E030-08	40086-7		
MW-16	MW-90-BKG-006	LFD	5/3/2006	954489-002	E030-09	40086-8		
MW-17	MW-17-BKG-006	LS	5/9/2006	954711-001	E065-01			
MW-17	MW-91-BKG-006	LFD	5/9/2006	954711-002	E065-02			
MW-18	MW-18-BKG-006	LS	5/1/2006	954352-003	E011-08	40085-16		
Needles MW-10	NEEDLES MW-10-BKG-006	LS	5/2/2006	954423-001	E021-01R	40085-10		
Needles MW-11	NEEDLES MW-11-BKG-006	LS	5/2/2006	954423-002	E021-02R	40085-11		
Needles MW-12	NEEDLES MW-12-BKG-006	LS	5/2/2006	954423-003	E021-03R	40085-12		
New Farm Well	New Farm Well-BKG-006	LS	5/3/2006	954490-002	E030-02	40085-5		
P-2	P-2-BKG-006	LS	5/4/2006	954545-003	E034-03	40090-3		
PGE-09S	PGE-09S-BKG-006	LS	5/3/2006	954490-007	E030-07R	40085-9		
PGE-09S	MW-92-BKG-006	LFD	5/3/2006	954490-006	E030-06R	40085-8		
PMM-Supply	PMM-SUPPLY-BKG-006	LS	5/1/2006	954351-005	E011-05	40085-21		
Sanders	SANDERS-BKG-006	LS	5/2/2006	954435-003	E021-07R	40085-3		
Tayloe	TAYLOE-BKG-006	LS	5/2/2006	954423-004	E021-04	40085-13		
TMLP-2	TMLP-2-BKG-006	LS	5/1/2006	954351-004	E011-04R	40085-20		
USFW-5	USFW-5-BKG-006	LS	5/3/2006	954490-001	E030-01	40085-4		

#### Notes:

primary sample field duplicate LS

LFD

LEB rinse blank

not analyzed by the lab ----

# Attachment 3 Copy of Laboratory Reports and Field Documentation

(Attachment 3 included on CD-ROM and posted on ftp site)

# Attachment 4 Data Quality Evaluation Reports

# Review of Analytical Data for Event One of the PG&E Topock Background Study

Prepared for Pacific Gas and Electric

June, 2006



## Introduction

This Data Quality Evaluation (DQE) report assesses the data quality of analytical results for Event One of the Pacific Gas & Electric Company (PG&E) Topock Background Study, between May 9, 2005 and June 22, 2005. Samples were collected and analyzed as required by the California Regional Water Quality Control Board (RWQCB). The PG&E Quality Assurance Program Plan – Topock Addendum, July 2004, individual method requirements, internal laboratory quality control (QC) criteria, and guidelines from the U.S. Environmental Protection Agency (EPA) Contract Laboratory National Functional Guidelines for Inorganic Data Review, July 2002, were used in this assessment.

# Analytical Data

This DQE report covers 36 normal groundwater samples and five field duplicate (FD) groundwater samples. These samples were reported by the laboratories in 31 sample delivery groups identified in Table 1 below:

TABLE 1           Sample Delivery Groups			
05E065	05E088	05E105	05E116
05E140	05E153	05E175	05E189
05F217	39704	39715	39754
942499	942609	942664	942699
942743	942803	942846	942892
942922	942923	942924	942925
942926	942927	942928	942929
943940	E5E240252	E5F249231	

Truesdail Laboratories, Inc. (TLI) of Tustin, California, Emax Laboratories, Inc. of Torrance, California, Severn Trent Laboratories, Inc. (STL-LA) of Santa Ana, California, and Zymax Forensics of San Luis Obispo, California, performed the required analyses. All laboratories are certified by the California Department of Health Service's Environmental Laboratory Accreditation Program for the analyses included in Table 2 where appropriate. Selected samples were analyzed for the analytes and methods listed in Table 2.

TABLE 2 Analytical Parameters

Parameter	Method	Laboratory
Stable isotopes of deuterium and oxygen	CF-IRMS	Zymax

#### TABLE 2

Analytical Parameters

Parameter	Method	Laboratory
Conductivity	E120.1 ª	Emax
рН	E150.1 ª	Emax
Total Dissolved Solids (TDS)	E160.1 ª	Emax
Total Suspended Solids (TSS)	E160.2ª	Emax
Turbidity	E180.1 ª	Emax
Bromide, Chloride, Fluoride, Nitrate, Sulfate	E300.0 ª	Emax
lodide	E300.0(M) ª	Emax and STL-LA
Alkalinity (Carbonate and Bicarbonate)	E310.1 ª	Emax
Perchlorate	E314.0 <sup>a</sup>	Emax
Ammonia	E350.2 <sup>a</sup>	Emax
Total Kjeldahl Nitrogen	E351.3ª	Emax
Ortho-Phosphate	E365.2 <sup>a</sup>	Emax
Soluble Silica	E370.1 <sup>a</sup>	Emax
Sulfide	E376.2 <sup>ª</sup>	Emax
Total Organic Carbon (TOC)	E415.1 <sup>ª</sup>	Emax
Dissolved Organic Carbon (DOC)	E415.1 <sup>a</sup>	Emax
Tritium	E906.0 <sup>a</sup>	TLI
Cations	SW6020A <sup>b</sup>	Emax
Hexavalent Chromium	SW7199 <sup>b</sup>	TLI
Mercury	SW7470A <sup>b</sup>	Emax

<sup>a</sup> EPA Methods for Chemical Analysis of Water and Wastes, Revised March 1983.

<sup>b</sup> SW-846 Test Methods for Evaluating Solid Waste, 3<sup>rd</sup> Edition, revision 4, 1996.

Field samples were also reviewed to ascertain field compliance and data quality issues. This review includes evaluation of FD and equipment blank (EB) data.

Data flags were assigned as outlined below. These flags, as well as the reason for each flag, are entered into the electronic database and can be found in Table 3 at the end of this report (sorted by validation reason and then analyte). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample effects.

The data flags are listed and defined below:

- J = Analyte is present but the reported value might not be accurate or precise (estimated).
- R = Data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
- U = Analyte was not detected at the specified detection limit.
- UJ = Analyte was not detected and the specified detection limit might not be accurate or precise (estimated).

### Data Assessment

Data assessment includes a review of the activities described in the following sections.

#### **Holding Times**

Holding-time exceedances result in the possible loss of target analytes due to degradation or chemical reactions that usually cause a negative bias to sample results.

One pH (E150.1), two TDS (E160.1), and 35 iodide (E300.0M) samples were analyzed outside the recommended holding time for the respective analyte. Non-detected results were flagged "UJ" and detected results were flagged "J" as estimated concentrations. All other holding times were met.

#### Method Blanks

Method blanks are used to monitor each preparation or analytical batch for contamination throughout the entire analytical process from sources such as glassware, reagents, instrumentation and other potential contaminant sources within the laboratory. If a target analyte is detected in the method blank, similar detections in the samples are possibly artifacts of laboratory contamination.

Method blanks were analyzed at the required frequency. No target analytes were detected at or above the reporting limit (RL), indicating that laboratory contamination was not an issue when the samples were analyzed.

#### **Field Blanks**

EBs are used to assess the effectiveness of sampling equipment decontamination procedures. Target analytes detected in EBs may indicate that field equipment was not thoroughly decontaminated and/or samples could have been cross contaminated.

EB results were greater than the RL for five dissolved nickel and six dissolved zinc (SW6020A). Detected results were qualified as not detected and flagged "U" at the reported concentrations.

All other EB target analytes were not detected at or above the RL.

### Quantitation and Sensitivity

Due to a demonstrated matrix effect for the hexavalent chromium analyses, which is discussed in the "Other" section below, the RLs for method SW7199 for the non-detected sample results were raised by the laboratory in the following samples: PGE-9N-BKG-001 and PGE-9S-BKG-001. No flags were applied, but the "ValAdj" reason was noted.

All other method/analyte combinations, with the exception of nickel and zinc, met the project RL objectives. Nickel and zinc RLs were elevated for the samples associated with the EB nickel and zinc detections.

#### Calibration

Initial calibration and periodic verification are essential to generating defensible analytical data. Initial calibrations that do not meet method requirements result in data that may be either positively or negatively biased. Periodic calibration verification ensures that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The inability to meet initial or continuing calibration analyses may result in qualifying the data as estimated or rejecting the data for project decision-making purposes.

Initial and continuing calibrations were performed as required by the methods. Two samples had results greater than the linear calibration range for nitrate (E300.0) and were qualified as estimated and flagged "J".

All other calibration criteria were met.

#### Matrix Spike Samples

Matrix spike (MS) recoveries are used to evaluate the affect of the sample matrix on the recovery of target analytes. A sample is fortified with a known quantity of a target analyte and is carried through the same preparation and analytical procedures as the unspiked sample. MS recoveries outside the QC limits may indicate that the sample's matrix is affecting the method's ability to accurately quantify the target analyte in the associated sample, or samples from similar locations. A low MS recovery generally indicates a negative bias in the sample data, while a high MS recovery indicates a potential positive bias to the associated sample data. If duplicate MS analyses are performed, a relative percent difference (RPD) greater than QC criteria may further indicate that the sample matrix is affecting the method for the target analyte that did not meet criteria. Therefore, when the MS does not meet criteria, results are usually considered estimated.

One sample had MS and spike duplicate (SD) recoveries that were less than the lower control limit (LCL) for boron, calcium, and sodium (SW6020A). Detected results were qualified as estimated and flagged "J".

All other MS/SD acceptance criteria were met in this sampling event.

### **Field Duplicates**

FDs are collected and analyzed to determine if field collection activities or the sample matrix influences the precision of the analytical measurements obtained at the sample site.

One FD pair had results that exceeded the RPD criteria for the following analytes: TSS (E160.2), turbidity (E180.1), aluminum, arsenic, chromium, copper, iron, manganese, nickel, vanadium, and zinc (SW6020A). A second FD pair had results that exceeded the RPD criteria for zinc and dissolved copper (SW6020A). A third FD pair had results that exceeded the RPD criteria for dissolved nickel (SW6020A). And a fourth FD pair had results that exceeded the RPD criteria for soluble silica (E370.1). Detected and non-detected results were qualified as estimated and flagged "J" and "UJ", respectively.

All other FD acceptance criteria were met in this sampling event.

#### Laboratory Duplicates

Laboratory duplicates measure laboratory precision. RPDs that exceed method criteria indicate imprecision in some aspect of the analytical procedure.

The laboratory analyzed duplicate aliquots of field samples at the required frequency. The QC acceptance criteria were met for all methods.

#### Laboratory Control Samples

A laboratory control sample (LCS) measures laboratory accuracy. Accuracy is the degree of agreement between a measured value and the expected value. The LCS is prepared from laboratory deionized or reagent-grade water and spiked with known amounts of the target analytes of interest. Recovery of analytes outside of QC limits generally indicates a problem with the analytical procedure. A low LCS recovery indicates that the target analyte in associated samples is likely biased low. Likewise, a high LCS recovery indicates that the target analyte in associated samples is likely biased high. Results associated with LCS recovery criteria exceedances are considered estimated.

LCSs were analyzed at the required frequency and were recovered within QC limits with the following exceptions:

Four perchlorate (E314.0) non-detected results were flagged "UJ" as estimated concentrations because the associated LCS recovery was below the acceptance criteria. Seven copper (SW6020A) detected results were flagged "J" as estimated concentrations because the associated LCS recovery was greater than the upper control limit.

#### Miscellaneous

Two perchlorate (E314.0) sample results were reported from undiluted samples when the specific conductance exceeded the maximum concentration threshold (MCT) for the calibration range and one perchlorate sample had an interfering peak at the perchlorate retention time. Samples were not reanalyzed at a dilution. The non-detected results were qualified as estimated and flagged "UJ".

#### Chain of Custody / Sample Receipt

Samples are collected under chain of custody to ensure that sample integrity is documented and known from the time of collection through receipt at the laboratory where custody is relinquished to the laboratory. Each sample was documented in a completed chain of custody and received at the laboratory in good condition. All discrepancies identified in laboratory custody were promptly resolved.

The temperature criterion was exceeded for 41 iodide (E300.0M) samples and the nondetected results were qualified as estimated and flagged "UJ".

#### Other

Matrix interference has been encountered at the Topock site, in selected monitoring wells, that affected the sensitivity for hexavalent chromium by the SW7199 method. CH2M HILL directed the laboratory to perform additional quality assurance (QA)/QC analyses to aid in assessing if there is any effect on method sensitivity for each well location due to the sample matrix.

The laboratory was instructed to analyze an MS of all samples by spiking the samples with 1  $\mu$ g/L of hexavalent chromium to ensure that identification is accurate for detected results. For non-detected results, the MS should verify there are not false negatives that go undetected.

If the MS is not recovered or the peak is outside of the established retention time window for either detected or non-detected results, the laboratory will make a fivefold dilution of two aliquots of the sample. The first aliquot will be analyzed without the spike, and the second will be spiked with  $1 \mu g/L$  of hexavalent chromium, and the recovery and peak retention time evaluated. If this MS recovery is not within laboratory QC limits and/or the peak is not within the laboratory retention time window, the laboratory will dilute two additional aliquots of sample tenfold, spike one of the aliquots, analyze the sample/MS, and perform successively greater dilutions of 25:1, 50:1, or 100:1 until the peak identified in the post spike analysis is within the established retention time window for hexavalent chromium, and the recovery of the spike is within laboratory QC limits.

The detected result that is reported by the laboratory on the final data package is chosen from the dilution where both the peak detected in the unspiked and the spiked sample fall within the appropriate retention time and the MS is recovered with QC control limits. The RLs are raised to the level of the appropriate dilution.

For non-detected results, the dilution selected by the laboratory for reporting is taken from the smallest dilution that yields an MS recovery within QC control limits and within the appropriate retention time window.

### **Overall Review**

The goal of this review is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters (PARCC) are addressed in the QAPP. The following summary highlights the PARCC findings for the above-defined events:

- 1. The completeness objective for the PG&E program is 95 percent for aqueous samples. The completeness objectives were met for all method/analyte combinations collected.
- 2. Samples were collected and analyzed based on approved methods/procedures and the results are reported using industry-standardized units.
- 3. The routinely acceptable performance of field and laboratory QC indicators (FDs, field blanks, laboratory blanks, LCS, MS/MSD and calibrations) show the accuracy and precision of the data meet the project objectives with the following exceptions:
  - Criteria were exceeded for one perchlorate (E314.0) and one copper (SW6020A) LCS. The associated results were qualified as estimated.
  - FD precision criteria were exceeded for four FD pairs and the results were qualified as estimated (methods include: E160.2, E180.1, E370.1, and SW6020A).
  - Two sample results were affected by calibration exceedances for nitrate (E300.0) and the associated results were qualified as estimated.
  - Five sample results were affected by EB contamination for dissolved nickel (SW6020A) and six sample results were affected by EB contamination for dissolved zinc (SW6020A). The sample results were qualified as not detected.
  - Three sample results were affected by laboratory accuracy and precision for perchlorate (E314.0) and the results were qualified as estimated.
  - MS/SD results for boron, calcium, and sodium (SW6020A) in one sample were less than the LCL and the results were qualified as estimated.
- 4. Holding time was exceeded for 35 iodide (E300.0M) samples, one pH (E150.1) sample, and two TDS (E160.1) samples. The results were qualified as estimated.
- 5. The temperature criterion was exceeded for 41 iodide (E300.0M) samples and the results were qualified as estimated.
- 6. Matrix effects were identified in two of the samples for hexavalent chromium (SW7199) analyses and the RLs were raised to the concentrations where the matrix effects were overcome as indicated by acceptable MS analyses.
- 7. Analytical data as qualified meet the data quality objectives and may be used in project decision making.

#### TABLE 3

Data Qualification Summary

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
						-	>ICLinearRa
E300.0	MW-05-BKG-001	05E116	Nitrate-N	mg/L	18.9	J	nge
F200 0		055440	Nitrata NI		00 F		>ICLinearRa
E300.0	MW 08 BKG-001	05E116	Nitrate -IN	mg/L	20.5	J	
SW6020A	MW 00 BKG-001	05E116	Nickel, dissolved	mg/∟ mg/l	0.00549	U	
SW6020A	MW 05 BKG-001	05E116	Nickel, dissolved	mg/L ma/l	0.00040	0	
SW6020A	NIV-05-BKG-001	05E116	Nickel, dissolved	mg/∟ mg/l	0.00646	U	
SW6020A	P-2-DKG-001	05E116	Nickel, dissolved	mg/∟ mg/l	0.00142	0	
SW6020A		05E116		mg/∟	0.00266	0	
SW6020A	MW 00 BKG-001	05E116	Zinc, dissolved	mg/∟	0.0274	U	
SVV6020A	MW 05 BKG-001	05E116	Zinc, dissolved	mg/∟	0.041	U	
SVV6020A	MW-05-BKG-001	05E116		mg/∟	0.0321	0	
SW6020A	MVV-08-BKG-001	05E116	Zinc, dissolved	mg/L	0.0137	U	EB>RL
SW6020A	MW-07-BKG-001	05E116	Zinc, dissolved	mg/∟	0.0161	U	
SW6020A	P-2-BKG-001	05E116	Zinc, dissolved	mg/L	0.0162	0	EB>RL
SW6020A	MW-90-BKG-001	05E116	Aluminum	mg/L	2.61	J	FD>RPD
SW6020A	MW-16-BKG-001	05E116	Aluminum	mg/L	4.31	J	FD>RPD
SW6020A	MW-90-BKG-001	05E116	Arsenic	mg/L	0.0102	J	FD>RPD
SW6020A	MW-16-BKG-001	05E116	Arsenic	mg/L	0.0132	J	FD>RPD
SW6020A	MW-90-BKG-001	05E116	Chromium	mg/L	0.0387	J	FD>RPD
SW6020A	MW-16-BKG-001	05E116	Chromium	mg/L	0.055	J	FD>RPD
SW6020A	MW-90-BKG-001	05E116	Copper	mg/L	0.0143	J	FD>RPD
SW6020A	MW-16-BKG-001	05E116	Copper	mg/L	0.0246	J	FD>RPD
SW6020A	MW-91-BKG-001	05E189	Copper, dissolved	mg/L	0.0072	J	FD>RPD
SW6020A	MW-17-BKG-001	05E189	Copper, dissolved	mg/L	0.0198	J	FD>RPD
SW6020A	MW-16-BKG-001	05E116	Iron	mg/L	6.96	J	FD>RPD
SW6020A	MW-90-BKG-001	05E116	Iron	mg/L	4.65	J	FD>RPD
SW6020A	MW-90-BKG-001	05E116	Manganese	mg/L	0.0853	J	FD>RPD
SW6020A	MW-16-BKG-001	05E116	Manganese	mg/L	0.137	J	FD>RPD
SW6020A	MW-16-BKG-001	05E116	Nickel	mg/L	0.0533	J	FD>RPD
SW6020A	MW-90-BKG-001	05E116	Nickel	mg/L	0.0316	J	FD>RPD
SW6020A	MW-92-BKG-001	05E175	Nickel, dissolved	mg/L	0.001	UJ	FD>RPD
	PMM-Supply-BKG-						
SW6020A	001	05E175	Nickel, dissolved	mg/L	0.00271	J	FD>RPD
F 270 4	TOPOCK-3-BKG-	055452	Salubla Siliaa		25.4		
E370.1		05E153	Soluble Silica	mg/∟ mg/l	20.4	J	
E370.1	MW 40 PKG-001	05E153		mg/∟	31.9	J	
E160.2	MW 00 BKG-001	05E116	155	mg/∟	467	J	
E100.2	MW 16 BKC 001	05E116	100 Turkiditu	mg/∟ NTU	93	J	
E100.1	MW 00 PKC 001	05E116			00.2	J	
E180.1	MVV-90-BKG-001	05E116		NTU 	68.2	J	FD>RPD
SW6020A	MW-90-BKG-001	05E116	vanadium	mg/L	0.0444	J	FD>RPD
SVV6020A	IVIVV-16-BKG-001	USE116		rng/L	0.0567	J	
SW6020A	MW-16-BKG-001	U5E116	∠inc ⊐	mg/L	0.0975	J	FD>RPD
SW6020A	MW-90-BKG-001	U5E116	∠inc ⊐	mg/L	0.0791	J	FD>RPD
SW6020A	INIVV-91-BKG-001	05E189	∠inc	mg/L	0.0784	J	
SW6020A	MW-17-BKG-001	05E189	∠inc	mg/L	0.124	J 	FD>RPD
E300.0M	MW-07-BKG-001	05E116	lodide	ug/L	500	UJ	HI>UCL

ADOT NEW WELL- E300.0M         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-08-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-08-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-04-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-05-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-2-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         E5E240252         Iodide         ug/L         500	Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
E300.0M         BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-08-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-08-BKG-001         05E065         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-04-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-90-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-05-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-2-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E105         Iodide         ug/L         5		ADOT NEW WELL-				Rooun	ilug	Readen
E300.0M         MW-08-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-04-BKG-001         05E065         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-04-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-05-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-2-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L	E300.0M	BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
E300.0M         MW-04-BKG-001         05E065         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-90-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-90-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-2-BKG-001         05E088         lodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E105         lodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         lodide         ug/L	E300.0M	MW-08-BKG-001	05E116	lodide	ug/L	500	UJ	HT>UCL
E300.0M         MW-90-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-05-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-2-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         Lily Hill-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L	E300.0M	MW-04-BKG-001	05E065	lodide	ug/L	500	UJ	HT>UCL
E300.0M         MW-05-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-2-BKG-001         05E088         lodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         Lily Hill-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         05E088         lodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E105         lodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         05E116         lodide         ug/L	E300.0M	MW-90-BKG-001	05E116	lodide	ug/L	500	UJ	HT>UCL
E300.0M         BOR-2-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-4-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         Lily Hill-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L	E300.0M	MW-05-BKG-001	05E116	lodide	ug/L	500	UJ	HT>UCL
E300.0M         GSWC-4-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         Lily Hill-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E1105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L	E300.0M	BOR-2-BKG-001	05E088	lodide	ug/L	500	UJ	HT>UCL
E300.0M         Lily Hill-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         BOR-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         <	E300.0M	GSWC-4-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
E300.0M         BOR-3-BKG-001         05E088         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500	E300.0M	Lily Hill-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
E300.0M         GSWC-3-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         USFW-5-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500	E300.0M	BOR-3-BKG-001	05E088	lodide	ug/L	500	UJ	HT>UCL
E300.0M         USFW-5-BKG-001         05E105         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ </td <td>E300.0M</td> <td>GSWC-3-BKG-001</td> <td>E5E240252</td> <td>lodide</td> <td>ug/L</td> <td>500</td> <td>UJ</td> <td>HT&gt;UCL</td>	E300.0M	GSWC-3-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
E300.0M         MW-11-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         P-2-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         SANDERS-BKG- 001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L <t< td=""><td>E300.0M</td><td>USFW-5-BKG-001</td><td>05E105</td><td>lodide</td><td>ug/L</td><td>500</td><td>UJ</td><td>HT&gt;UCL</td></t<>	E300.0M	USFW-5-BKG-001	05E105	lodide	ug/L	500	UJ	HT>UCL
E300.0M         P-2-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-10-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL	E300.0M	MW-11-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
E300.0M         MW-10-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         MW-06-BKG-001         05E116         lodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         lodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         lodide         ug/L         500         UJ         HT>UCL	E300.0M	P-2-BKG-001	05E116	lodide	ug/L	500	UJ	HT>UCL
E300.0M         MW-06-BKG-001         05E116         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         SANDERS-BKG- 001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL	E300.0M	MW-10-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
SANDERS-BKG- 001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL	E300.0M	MW-06-BKG-001	05E116	lodide	ug/L	500	UJ	HT>UCL
E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           TOPOCK-3-BKG-         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL		SANDERS-BKG-			5			
TOPOCK-3-BKG- 001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L         500         UJ         HT>UCL	E300.0M	001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
E300.0M         001         E5E240252         Iodide         ug/L         500 UJ         HT>UCL           E300.0M         GSWC-1-BKG-001         E5E240252         Iodide         ug/L         500 UJ         HT>UCL		TOPOCK-3-BKG-						
E300.0M GSWC-1-BKG-001 E5E240252 lodide ug/L 500 UJ HT>UCL	E300.0M	001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
	E300.0M	GSWC-1-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
		NEW FARM WELL-						
E300.0M BKG-001 05E105 lodide ug/L 500 UJ H1>UCL	E300.0M	BKG-001	05E105	lodide	ug/L	500	UJ	HI>UCL
E300.0M PGE-9N-BKG-001 05E088 lodide ug/L 500 UJ HT>UCL	E300.0M	PGE-9N-BKG-001	05E088	lodide	ug/L	500	UJ	HT>UCL
E300.0M MW-18-BKG-001 05E105 lodide ug/L 500 UJ HT>UCL	E300.0M	MW-18-BKG-001	05E105	lodide	ug/L	500	UJ	HT>UCL
E300.0M GSWC-2-BKG-001 E5E240252 lodide ug/L 500UJ HT>UCL	E300.0M	GSWC-2-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
E300.0M MW-03-BKG-001 05E065 Iodide ug/L 500UJ HT>UCL	E300.0M	MW-03-BKG-001	05E065	lodide	ug/L	500	UJ	HT>UCL
E300.0M MW-01-BKG-001 05E065 Iodide ug/L 500 UJ HT>UCL	E300.0M	MW-01-BKG-001	05E065	lodide	ug/L	500	UJ	HT>UCL
E300.0M EPNG-2-BKG-001 E5E240252 lodide ug/L 500 UJ HT>UCL	E300.0M	EPNG-2-BKG-001	E5E240252	lodide	ug/L	500	UJ	HT>UCL
CA-AG STATION-	5000 OM	CA-AG STATION-	555040050	le d'ale		500		
E300.0M BKG-001 E5E240252 lodide Ug/L 500/UJ HT>UCL	E300.0M	BKG-001	E5E240252		ug/L	500	UJ	HI>UCL
E300.0M MW-93-BKG-001 E5E240252 IOdide Ug/L 500/UJ H1>UCL	E300.0M	MW-93-BKG-001	E5E240252	logide	ug/L	500	UJ	HI>UCL
LANGMAACK-BKG- E300.0M 001 E5E240252 lodide ug/l 500.000 HT_UC	E300.0M		E5E240252	lodide	ug/l	500		
E300.0M 001 E3E240232 lodide ug/L 30003 ITT>UCL	E300.0M	MW-92-BKG-001	E5E240252	lodide	ug/L	500		
DMM_Supply_BKG_	L300.0M	PMM_Supply_BKG_	LJL2402J2		ug/L	500	05	
E300.0M 001 E5E240252 lodide ua/l 500UJ HT>UCL	E300.0M	001	E5E240252	lodide	ua/l	500	UJ	HT>UCL
E300.0M MW-16-BKG-001 05E116 lodide ug/L 500UJ HT>UCL	E300.0M	MW-16-BKG-001	05E116	lodide	ua/L	500	UJ	HT>UCL
E300.0M PGE-9S-BKG-001 05E088 lodide ug/L 500UJ HT>UCL	E300.0M	PGE-9S-BKG-001	05E088	lodide	ua/L	500	UJ	HT>UCL
E300.0M TMLP-2-BKG-001 05E105 lodide ug/l 500UJ HT>UCL	E300.0M	TMLP-2-BKG-001	05E105	lodide	ua/L	500	UJ	HT>UCL
E300.0M Tayloe-BKG-001 E5E240252 lodide ug/L 500/UJ HT>UCL	E300.0M	Tavloe-BKG-001	E5E240252	lodide	ua/L	500	UJ	HT>UCL
E150.1 MW-18-BKG-001 05E105 PH PH 7.38J HT>UCL	E150.1	MW-18-BKG-001	05E105	PH	∽g, _ PH	7.38	J	HT>UCL
E160.1 MW-18-BKG-001 05E105 TDS mg/l 1010.J HT>UCI	E160 1	MW-18-BKG-001	05E105	TDS	ma/l	1010	.]	HT>UCI
E160.1 MW-05-BKG-001 05E116 TDS mg/L 980.1 HT>UCL	E160.1	MW-05-BKG-001	05E116	TDS	ma/l	980	<del>с</del> .]	HT>UCI
E314.0 PGE-9S-BKG-001 05E088 Perchlorate ug/l 2UJ LabA&P	E314.0	PGE-9S-BKG-001	05E088	Perchlorate	ua/l	2	U.J	LabA&P
E314.0 PGE-9N-BKG-001 05E088 Perchlorate ug/l 211.1 LabA&P	E314.0	PGE-9N-BKG-001	05E088	Perchlorate	ug/L	2	U.I	LabA&P
E314.0 MW-10-BKG-001 05E140 Perchlorate ug/l 200 LabA&P	E314.0	MW-10-BKG-001	05E140	Perchlorate	ua/l	2	U.I	LabA&P
E314.0 MW-17-BKG-001 05E189 Perchlorate ug/l 21UJ 1CS <lci< td=""><td>E314.0</td><td>MW-17-BKG-001</td><td>05E189</td><td>Perchlorate</td><td>ua/L</td><td>2</td><td>UJ</td><td></td></lci<>	E314.0	MW-17-BKG-001	05E189	Perchlorate	ua/L	2	UJ	
E314.0 GSRV-2-BKG-001 05E189 Perchlorate ug/l 2111 1CS-LCL	E314 0	GSRV-2-BKG-001	05E189	Perchlorate	ua/l	2	U.J	
E314.0 MW-91-BKG-001 05E189 Perchlorate ug/l 2100 2000	E314.0	MW-91-BKG-001	05E189	Perchlorate	ua/l	2	UJ	
E314.0 MW-94-BKG-001 05E189 Perchlorate ug/L 2 UJ I CS <i cl<="" td=""><td>E314.0</td><td>MW-94-BKG-001</td><td>05E189</td><td>Perchlorate</td><td>ug/L</td><td>2</td><td>UJ</td><td>LCS<lcl< td=""></lcl<></td></i>	E314.0	MW-94-BKG-001	05E189	Perchlorate	ug/L	2	UJ	LCS <lcl< td=""></lcl<>

Method	NativeID	COC Number	Analyte	Units	Final	Validation	Validation
CIA/COOO A			Connor			гад	Reason
SVV6020A	GSWC-3-BKG-001	05E175	Copper	mg/∟	0.00558	J	
SVV6020A	GSVVC-4-BKG-001	05E175	Copper	mg/L	0.00549	J	LCS>UCL
SW6020A	PMM-Supply-BKG-	05E175	Copper	ma/l	0.00492	J	LCS>UCL
SW6020A	MW-92-BKG-001	05E175	Copper	ma/L	0.005	J	
0.1.002011	ADOT New Well-			<u>g</u> / =	01000	•	
SW6020A	BKG-001	05E175	Copper	mg/L	0.00522	J	LCS>UCL
SW6020A	Sanders-BKG-001	05E175	Copper	mg/L	0.00961	J	LCS>UCL
SW6020A	EPNG-2-BKG-001	05E175	Copper	mg/L	0.00473	J	LCS>UCL
SW6020A	Sanders-BKG-001	05E175	Boron	mg/L	1.16	J	MS <lcl< td=""></lcl<>
SW6020A	Sanders-BKG-001	05E175	Calcium	mg/L	87.2	J	MS <lcl< td=""></lcl<>
SW6020A	Sanders-BKG-001	05E175	Sodium	mg/L	398	J	MS <lcl< td=""></lcl<>
SW6020A	Sanders-BKG-001	05E175	Boron	mg/L	1.16	J	SD <lcl< td=""></lcl<>
SW6020A	Sanders-BKG-001	05E175	Calcium	mg/L	87.2	J	SD <lcl< td=""></lcl<>
SW6020A	Sanders-BKG-001	05E175	Sodium	mg/L	398	J	SD <lcl< td=""></lcl<>
E300.0M	MW-04-BKG-001	05E065	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-16-BKG-001	05E116	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	BOR-3-BKG-001	05E088	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	PGE-9N-BKG-001	05E088	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-91-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	PGE-9S-BKG-001	05E088	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	Tayloe-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
	CA-AG STATION-						
E300.0M	BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E200.0M	NEW FARM WELL-	055105	ladida	ug/l	500		
E300.0101		052105	louide	ug/∟	500	03	
E300.0M	001	E5E240252	lodide	ua/L	500	UJ	TEMP>6C
E300.0M	MW-93-BKG-001	E5E240252	lodide	ua/L	500	UJ	TEMP>6C
E300.0MM	MW-94-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	EPNG-2-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-01-BKG-001	05E065	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	GSWC-1-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-03-BKG-001	05E065	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	TMLP-2-BKG-001	05E105	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	GSWC-2-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-18-BKG-001	05E105	lodide	ug/L	500	UJ	TEMP>6C
	TOPOCK-2-BKG-						
E300.0M	001	E5F240231	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-92-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
	SANDERS-BKG-						
E300.0M	001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E200.0M	ADOT NEW WELL-	E5E240252	ladida	ug/l	500		
E300.0M		C5E240252	lodide	ug/∟	500	00	
E300.0M	MW 05 BKG 001	05E116	lodide	ug/L	500	05	
E300.0M		5E110	lodide	ug/L	500		
E300.0M	MW-07-RKC 001	05E116	lodide	ug/L	500		
E300.0M		E5E240252	Iodide	ug/L	500		
E300.0M		05E116	lodide	ug/L	500	111	
E300.0M	MW_90_RKG_001	05E116	Iodide	ug/L	500		
L000.0W	00-DICO-001	000110	iouluo	ug/L	500	3	

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
E300.0M	MW-17-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
	PMM-Supply-BKG-						
E300.0M	001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	GSWC-3-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	P-2-BKG-001	05E116	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-11-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	BOR-2-BKG-001	05E088	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	LANGMAACK-BKG- 001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	Needles MW-12- BKG-001	E5F240231	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	MW-10-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	USFW-5-BKG-001	05E105	lodide	ug/L	500	UJ	TEMP>6C
E300.0M	GSRV-2-BKG-001	E5E240252	lodide	ug/L	500	UJ	TEMP>6C
SW7199	PGE-9N-BKG-001	942609	Chromium, hexavalent	mg/L	0.001	U	ValAdj
SW7199	PGE-9S-BKG-001	942609	Chromium, hexavalent	mg/L	0.001	U	ValAdj

<sup>1</sup> This is the final qualifier flag for this analyte/method combination. If more than one flag was applied, this is the most conservative.

Validation Reasons:

>ICLinearRange = Result greater than linear calibration range

EB>RL = Equipment blank concentration greater than the RL

FD>RPD = Field duplicate exceeds RPD criteria

HT>UCL = Holding time exceeded

LabA&P = Laboratory accuracy and precision criteria not met

LCS<LCL = LCS recovery less than lower control limit

LCS>UCL = LCS recovery greater than upper control limit

MS<LCL = Matrix spike recovery less than lower limit

SD<LCL = Matrix spike duplicate recovery criteria less than lower limit

Temp>6C = Temperature Blank>6C<8C

ValAdj = Value reported by laboratory adjusted due to matrix issues

# Review of Analytical Data for Event Two of the PG&E Topock Background Study

Prepared for Pacific Gas and Electric

June, 2006

CH2MHILL 2525 Airpark Drive Redding, California 96001

## Introduction

This Data Quality Evaluation (DQE) report assesses the data quality of analytical results for Event Two of the Pacific Gas & Electric Company (PG&E) Topock Background Study, between July 18, 2005 and August 11, 2005. Samples were collected and analyzed as required by the California Regional Water Quality Control Board (RWQCB). The PG&E Quality Assurance Program Plan – Topock Addendum, July 2004, individual method requirements, internal laboratory quality control (QC) criteria, and guidelines from the U.S. Environmental Protection Agency (EPA) Contract Laboratory National Functional Guidelines for Inorganic Data Review, July 2002, were used in this assessment.

# Analytical Data

This DQE report covers 36 normal groundwater samples and five field duplicate (FD) groundwater samples. These samples were reported by the laboratories in 27 sample delivery groups identified in Table 1 below:

TABLE 1 Sample Delivery Groups			
05G126	05G162	05G182	05G190
05G222	05G232	05H122	39795
39796	39801	39802	39803
39804	39846	944787	944914
944956	944993	945040	945101
945709	E5G190345	E5G250237	E5G250238
E5G270146	E5G270364	E5H120316	

Truesdail Laboratories, Inc. (TLI) of Tustin, California, Emax Laboratories, Inc. of Torrance, California, Severn Trent Laboratories, Inc. (STL-LA) of Santa Ana, California, and Zymax Forensics of San Luis Obispo, California, performed the required analyses. All laboratories are certified by the California Department of Health Service's Environmental Laboratory Accreditation Program for the analyses included in Table 2 where appropriate. Selected samples were analyzed for the analytes and methods listed in Table 2.

 TABLE 2

 Analytical Parameters

Parameter	Method	Laboratory
Stable isotopes of deuterium and oxygen	CF-IRMS	Zymax
Total Dissolved Solids (TDS)	E160.1 ª	Emax

#### TABLE 2

Analytical Parameters

Parameter	Method	Laboratory
Total Suspended Solids (TSS)	E160.2ª	Emax
Turbidity	E180.1 ª	Emax
Bromide, Chloride, Fluoride, Nitrate, Sulfate	E300.0 ª	Emax
lodide	E300.0(M) ª	STL-LA
Alkalinity (Carbonate and Bicarbonate)	E310.1 ª	Emax
Perchlorate	E314.0 <sup>ª</sup>	Emax
Ammonia	E350.2 <sup>ª</sup>	Emax
Total Kjeldahl Nitrogen	E351.3ª	Emax
Ortho-Phosphate	E365.2 <sup>ª</sup>	Emax
Soluble Silica	E370.1 <sup>a</sup>	Emax
Sulfide	E376.1 <sup>ª</sup>	Emax
Total Organic Carbon (TOC)	E415.1 <sup>a</sup>	Emax
Dissolved Organic Carbon (DOC)	E415.1 <sup>a</sup>	Emax
Tritium	E906.0 <sup>a</sup>	TLI
Cations	SW6020A <sup>b</sup>	Emax
Hexavalent Chromium	SW7199 <sup> b</sup>	TLI
Mercury	SW7470A <sup>b</sup>	Emax

<sup>a</sup> EPA Methods for Chemical Analysis of Water and Wastes, Revised March 1983.

<sup>b</sup> SW-846 Test Methods for Evaluating Solid Waste, 3<sup>rd</sup> Edition, revision 4, 1996.

Field samples were also reviewed to ascertain field compliance and data quality issues. This review includes evaluation of FD and equipment blank (EB) data.

Data flags were assigned as outlined below. These flags, as well as the reason for each flag, are entered into the electronic database and can be found in Table 3 at the end of this report (sorted by validation reason and then analyte). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample effects.

The data flags are listed and defined below:

- J = Analyte is present but the reported value might not be accurate or precise (estimated).
- R = Data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.

- U = Analyte was not detected at the specified detection limit.
- UJ = Analyte was not detected and the specified detection limit might not be accurate or precise (estimated).

### Data Assessment

Data assessment includes a review of the activities described in the following sections.

#### **Holding Times**

Holding-time exceedances result in the possible loss of target analytes due to degradation or chemical reactions that usually cause a negative bias to sample results.

Twenty-two nitrate (E300.0) and 21 iodide (E300.0M) samples were analyzed outside the recommended holding-time for the respective analyte. The non-detected results were flagged "UJ" and detected results were flagged "J" as estimated concentrations. Two of the non-detected nitrate results were not usable due to gross exceedance of the holding-time criteria and were flagged "R". All other holding-times were met.

#### Method Blanks

Method blanks are used to monitor each preparation or analytical batch for contamination throughout the entire analytical process from sources such as glassware, reagents, instrumentation and other potential contaminant sources within the laboratory. If a target analyte is detected in the method blank, similar detections in the samples are possibly artifacts of laboratory contamination.

Method blanks were analyzed at the required frequency. No target analytes were detected at or above the reporting limit (RL), indicating that laboratory contamination was not an issue when the samples were analyzed.

#### **Field Blanks**

EB are used to assess the effectiveness of sampling equipment decontamination procedures. Target analytes detected in EB may indicate that field equipment was not thoroughly decontaminated and/or samples could have been cross contaminated.

All EB target analytes were not detected at or above the RL.

#### Quantitation and Sensitivity

Due to a demonstrated matrix effect for the hexavalent chromium analyses, which is discussed in the "Other" section below, the RLs for method SW7199 for the non-detected sample results were raised by the laboratory in the following samples: PGE-9N-BKG-002 and PGE-9S-BKG-002. No flags were applied, but the "ValAdj" reason was noted.

All other method/analyte combinations met the project RL objectives.

### Calibration

Initial calibration and periodic verification are essential to generating defensible analytical data. Initial calibrations that do not meet method requirements result in data that may be either positively or negatively biased. Periodic calibration verification ensures that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The inability to meet initial or continuing calibration analyses may result in qualifying the data as estimated or rejecting the data for project decision-making purposes.

Initial and continuing calibrations were performed as required by the methods. One continuing calibration verification standard (CCV) for fluoride (E300.0) had recoveries that were less than the lower control limit (LCL). Six fluoride sample results were qualified as estimated. Detected results were flagged "J" and non-detected results were flagged "UJ".

All other calibration criteria were met.

### Matrix Spike Samples

Matrix spike (MS) recoveries are used to evaluate the affect of the sample matrix on the recovery of target analytes. A sample is fortified with a known quantity of a target analyte and is carried through the same preparation and analytical procedures as the unspiked sample. MS recoveries outside the QC limits may indicate that the sample's matrix is affecting the method's ability to accurately quantify the target analyte in the associated sample, or samples from similar locations. A low MS recovery generally indicates a negative bias in the sample data, while a high MS recovery indicates a potential positive bias to the associated sample data. If duplicate MS analyses are performed, a relative percent difference (RPD) greater than QC criteria may further indicate that the sample matrix is affecting the method for the target analyte that did not meet criteria. Therefore, when the MS does not meet criteria, results are usually considered estimated.

One sample had MS and spike duplicate (SD) recoveries less than the LCL for dissolved mercury (SW7470A). Non-detected results were qualified as estimated and flagged "UJ".

All other MS/SD acceptance criteria were met in this sampling event.

#### **Field Duplicates**

FD are collected and analyzed to determine if field collection activities or the sample matrix influences the precision of the analytical measurements obtained at the sample site.

One FD pair had results that exceeded the RPD criteria for TSS (E160.2). A second FD pair had results that exceeded the RPD criteria for turbidity (E180.1) and dissolved lead (SW6020A). And a third FD pair had results that exceeded the RPD criteria for dissolved copper (SW6020A). Detected and non-detected results were qualified as estimated and flagged "J" and "UJ", respectively.

All other FD acceptance criteria were met in this sampling event.

#### Laboratory Duplicates

Laboratory duplicates measure laboratory precision. RPDs that exceed method criteria indicate imprecision in some aspect of the analytical procedure.

The laboratory analyzed duplicate aliquots of field samples at the required frequency. The QC acceptance criteria were met for all methods.

### Laboratory Control Samples

A laboratory control sample (LCS) measures laboratory accuracy. Accuracy is the degree of agreement between a measured value and the expected value. The LCS is prepared from laboratory deionized or reagent-grade water and spiked with known amounts of the target analytes of interest. Recovery of analytes outside of QC limits generally indicates a problem with the analytical procedure. A low LCS recovery indicates that the target analyte in associated samples is likely biased low. Likewise, a high LCS recovery indicates that the target analyte in associated samples is likely biased high. Results associated with LCS recovery criteria exceedances are considered estimated.

LCSs were analyzed at the required frequency and were recovered within QC limits.

### Chain of Custody / Sample Receipt

Samples are collected under chain of custody to ensure that sample integrity is documented and known from the time of collection through receipt at the laboratory where custody is relinquished to the laboratory.

Each sample was documented in a completed chain of custody and received at the laboratory in good condition. All discrepancies identified in laboratory custody were promptly resolved.

#### Other

Matrix interference has been encountered at the Topock site, in selected monitoring wells, that affected the sensitivity for hexavalent chromium by the SW7199 method. CH2M HILL directed the laboratory to perform additional quality assurance (QA)/QC analyses to aid in assessing if there is any effect on method sensitivity for each well location due to the sample matrix.

The laboratory was instructed to analyze an MS of all samples by spiking the samples with 1  $\mu$ g/L of hexavalent chromium to ensure that identification is accurate for detected results. For non-detected results, the MS should verify there are not false negatives that go undetected.

If the MS is not recovered or the peak is outside of the established retention time window for either detected or non-detected results, the laboratory will make a fivefold dilution of two aliquots of the sample. The first aliquot will be analyzed without the spike, and the second will be spiked with  $1 \mu g/L$  of hexavalent chromium, and the recovery and peak retention time evaluated. If this MS recovery is not within laboratory QC limits and/or the peak is not within the laboratory retention time window, the laboratory will dilute two additional aliquots of sample tenfold, spike one of the aliquots, analyze the sample/MS, and

perform successively greater dilutions of 25:1, 50:1, or 100:1 until the peak identified in the post spike analysis is within the established retention time window for hexavalent chromium, and the recovery of the spike is within laboratory QC limits.

The detected result that is reported by the laboratory on the final data package is chosen from the dilution where both the peak detected in the unspiked and the spiked sample fall within the appropriate retention time and the MS is recovered with QC control limits. The RLs are raised to the level of the appropriate dilution.

For non-detected results, the dilution selected by the laboratory for reporting is taken from the smallest dilution that yields an MS recovery within QC control limits and within the appropriate retention time window.

### **Overall Review**

The goal of this review is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters (PARCC) are addressed in the QAPP. The following summary highlights the PARCC findings for the above-defined events:

- 1. The completeness objective for the PG&E program is 95 percent for aqueous samples. The completeness objectives were met for all method/analyte combinations collected.
- 2. Samples were collected and analyzed based on approved methods/procedures and the results are reported using industry-standardized units.
- 3. The routinely acceptable performance of field and laboratory QC indicators (FDs, field blanks, laboratory blanks, LCS, MS/MSD and calibrations) show the accuracy and precision of the data meet the project objectives with the following exceptions:
  - FD precision criteria were exceeded for three FD pairs and the results were qualified as estimated (methods include: E160.2, E180.1, and SW6020A).
  - MS/SD results for dissolved mercury (SW6020A) in one sample were less than the LCL and the results were qualified as estimated.
  - Six sample results were affected by calibration exceedances for fluoride (E300.0) and the associated results were qualified as estimated.
- 4. Holding time was exceeded for 22 nitrate (E300.0) and 21 iodide (E300.0M) samples and the results were qualified as estimated.
- 5. Matrix effects were identified in two of the samples for hexavalent chromium (SW7199) analyses and the RLs were raised to the concentrations where the matrix effects were overcome as indicated by acceptable MS analyses.
- 6. Two of the non-detected nitrate (E300.0) results were not usable due to a gross exceedance of the holding time criteria and were flagged "R".

7. Analytical data as qualified meet the data quality objectives and may be used in project decision making.

#### TABLE 3

Data Qualification Summary

Method	NativeID	COC	Analyte	Units	Final	Validation	Validation
		Number			Result	Flag	Reason
E300.0	PGE-9N-BKG-002	05G162	Fluoride	mg/L	0.5	UJ	CCV <lcl< td=""></lcl<>
E300.0	PGE-9S-BKG-002	05G162	Fluoride	mg/L	0.5	UJ	CCV <lcl< td=""></lcl<>
E300.0	TMLP-2-BKG-002	05G162	Fluoride	mg/L	1.22	J	CCV <lcl< td=""></lcl<>
F200 0	New Farm Well-BKG-	050400	Flueride		0.5		
E300.0		05G162	Fluoride	mg/∟	0.5	UJ	
E300.0		050102	Fluoride	mg/L	0.5	00	
E300.0		050102	Coppor dissolved	mg/L	0.00171	00	
SW6020A	MW 04 BKG 002	05G190	Copper, dissolved	mg/L	0.00171	J	
SW6020A	MW-94-BKG-002	050190	Lead dissolved	mg/L	0.00449	J 111	
SW6020A		05H122	Lead, dissolved	mg/L	0.001	1	
51160 2	MW-16-BKG-002	056232		mg/L	55.5	5 1	
E160.2	MW-90-BKG-002	056232	T00 T99	mg/L	10	5	
E180.1		050232	Turbidity		10	1	
E180.1	MW-93-BKG-002	05H122	Turbidity	NTU		5	
E300.0M	MW-92-BKG-002	E5G250237	Iodide		500	111	
E300.0M	MW-07-BKG-002	E5G190345	lodide	ug/L	500	1.1	
E300.0M	PGE-9S-BKG-002	E5G250238	lodide	ug/L	500	U.I	
2000.0111	New Farm Well-BKG-	200200200		ug, 1	000	00	
E300.0M	002	E5G250238	lodide	ug/L	500	UJ	HT>UCL
E300.0M	BOR-2-BKG-002	E5G250238	lodide	ug/L	500	UJ	HT>UCL
E300.0M	TMLP-2-BKG-002	E5G250238	lodide	ug/L	500	UJ	HT>UCL
E300.0M	MW-04-BKG-002	E5G190345	lodide	ug/L	500	UJ	HT>UCL
E300.0M	PGE-9N-BKG-002	E5G250238	lodide	ug/L	500	UJ	HT>UCL
E300.0M	MW-05-BKG-002	E5G190345	lodide	ug/L	500	UJ	HT>UCL
	Needles MW-11-BKG-						
E300.0M	002	E5G250237	lodide	ug/L	500	UJ	HT>UCL
E300.0M	BOR-3-BKG-002	E5G250237	lodide	ug/L	500	UJ	HT>UCL
	Needles MW-10-BKG-	EC000007	المطنطم		500		
E300.01VI		E3G230237	louide	ug/L	500	UJ	HISUCL
E300.0M	Needles IVIV-12-BKG-	E5G250237	lodide	ua/l	500	11.1	
E300.0M	Topock-2-BKG-002	E5G250237	lodide	ug/L	500	U.I	HT>UCI
E300.0M	PMM-Supply-BKG-002	E5G250237	lodide	ug/L	500	U.I	HT>UCI
E300.0M	MW-08-BKG-002	E5G190345	lodide	ug/L	500	U.J	HT>UCL
E300.0M	MW-06-BKG-002	E5G190345	lodide	ua/L	500	UJ	HT>UCL
E300.0M	MW-03-BKG-002	E5G190345	lodide	ua/L	500	UJ	HT>UCL
E300.0M	MW-01-BKG-002	E5G190345	lodide	ua/L	500	UJ	HT>UCL
E300.0M	MW-93-BKG-002	E5H120316	lodide	ug/L	500	UJ	HT>UCL
E300.0M	USFW-5-BKG-002	E5G250238	lodide	ug/L	500	UJ	HT>UCL
E300.0	SANDERS-BKG-002	05G222	Nitrate	mg/L	2.75	J	HT>UCL
E300.0	MW-07-BKG-002	05G126	Nitrate	mg/L	7.06	J	HT>UCL
E300.0	MW-01-BKG-002	05G126	Nitrate	mg/L	6.16	J	HT>UCL
E300.0	MW-05-BKG-002	05G126	Nitrate	mg/L	14.8	J	HT>UCL
E300.0	MW-04-BKG-002	05G126	Nitrate	mg/L	5.49	J	HT>UCL
E300.0	MW-08-BKG-002	05G126	Nitrate	mg/L	15	J	HT>UCL
E300.0	EPNG-2-BKG-002	05G222	Nitrate	mg/L	2.01	J	HT>UCL

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
E300.0	TAYLOE-BKG-002	05G222	Nitrate	mg/L	1.79	J	HT>UCL
E300.0	LANGMAACK-BKG- 002 ADOT NEW WELL-	05G222	Nitrate	mg/L	3.24	J	HT>UCL
E300.0	BKG-002	05G222	Nitrate	mg/L	1.99	J	HT>UCL
E300.0	GSWC-4-BKG-002	05G190	Nitrate	mg/L	1.9	J	HT>UCL
E300.0	CA Agriculture Station- BKG-002	05G222	Nitrate	mg/L	1.86	J	HT>UCL
E300.0	LILY HILL-BKG-002	05G222	Nitrate	mg/L	4.7	J	HT>UCL
E300.0	MW-03-BKG-002	05G126	Nitrate	mg/L	9	J	HT>UCL
E300.0	PMM-Supply-BKG-002	05G182	Nitrate	mg/L	3.14	J	HT>UCL
E300.0	Needles MW-12-BKG- 002	05G182	Nitrate	mg/L	0.687	J	HT>UCL
E300.0	002	05G182	Nitrate	mg/L	1.72	J	HT>UCL
E300.0	BOR-3-BKG-002	05G182	Nitrate	mg/L	0.5	R	HT>UCL
E300.0	Topock-2-BKG-002	05G182	Nitrate	mg/L	1.93	J	HT>UCL
E300.0	GSWC-2-BKG-002	05G190	Nitrate	mg/L	1.49	J	HT>UCL
E300.0	MW-92-BKG-002	05G182	Nitrate	mg/L	3.15	J	HT>UCL
E300.0	Needles MW-10-BKG- 002	05G182	Nitrate	mg/L	0.5	R	HT>UCL
SW7470A	MW-08-BKG-002	05G126	Mercury, dissolved	ug/L	0.2	UJ	MS <lcl< td=""></lcl<>
SW7470A	MW-08-BKG-002	05G126	Mercury, dissolved	ug/L	0.2	UJ	SD <lcl< td=""></lcl<>
SW7199	PGE-9S-BKG-002	944914	Chromium, hexavalent	mg/L	0.001	U	ValAdj
SW7199	PGE-9N-BKG-002	944914	Chromium, hexavalent	mg/L	0.001	U	ValAdj

<sup>1</sup> This is the final qualifier flag for this analyte/method combination. If more than one flag was applied, this is the most conservative.

Validation Reasons:

CCV<LCL = Continuing calibration recovery less than lower control limit

FD>RPD = Field duplicate exceeds RPD criteria

HT>UCL = Holding time exceeded

MS<LCL = Matrix spike recovery less than lower limit

SD<LCL = Matrix spike duplicate recovery criteria less than lower limit

ValAdj = Value reported by laboratory adjusted due to matrix issues

# Review of Analytical Data for Event Three of the PG&E Topock Background Study

Prepared for Pacific Gas and Electric

June, 2006

CH2MHILL 2525 Airpark Drive Redding, California 96001

## Introduction

This Data Quality Evaluation (DQE) report assesses the data quality of analytical results for Event Three of the Pacific Gas & Electric Company (PG&E) Topock Background Study, between October 31, 2005 and November 30, 2005. Samples were collected and analyzed as required by the California Regional Water Quality Control Board (RWQCB). The PG&E Quality Assurance Program Plan – Topock Addendum, July 2004, individual method requirements, internal laboratory quality control (QC) criteria, and guidelines from the U.S. Environmental Protection Agency (EPA) Contract Laboratory National Functional Guidelines for Inorganic Data Review, July 2002, were used in this assessment.

# Analytical Data

This DQE report covers 25 normal groundwater samples and five field duplicate (FD) groundwater samples. These samples were reported by the laboratories in 13 sample delivery groups identified in Table 1 below:

TABLE 1 Sample Delivery Groups			
05K011	05K026	05K032	05K033
05K047	05L008	39924	39956
948365	948423	948461	948506
949384			

Truesdail Laboratories, Inc. (TLI) of Tustin, California, Emax Laboratories, Inc. of Torrance, California, and Zymax Forensics of San Luis Obispo, California, performed the required analyses. All laboratories are certified by the California Department of Health Service's Environmental Laboratory Accreditation Program for the analyses included in Table 2 where appropriate. Selected samples were analyzed for the analytes and methods listed in Table 2.

#### TABLE 2 Analytical Parameters

Parameter	Method	Laboratory
Stable isotopes of deuterium and oxygen	CF-IRMS	Zymax
Total Dissolved Solids (TDS)	E160.1 ª	Emax
Total Suspended Solids (TSS)	E160.2ª	Emax
Turbidity	E180.1 ª	Emax
Chloride, Fluoride, Nitrate, Sulfate	E300.0 ª	Emax

#### TABLE 2 Analytical Parameters

Parameter	Method	Laboratory
Alkalinity (Carbonate and Bicarbonate)	E310.1 ª	Emax
Ammonia	E350.2 <sup>a</sup>	Emax
Total Kjeldahl Nitrogen	E351.3 <sup>ª</sup>	Emax
Soluble Silica	E370.1 <sup>a</sup>	Emax
Total Organic Carbon (TOC)	E415.1 <sup>a</sup>	Emax
Dissolved Organic Carbon (DOC)	E415.1 <sup>a</sup>	Emax
Cations	SW6020A <sup>b</sup>	Emax
Hexavalent Chromium	SW7199 <sup>b</sup>	TLI
Mercury	SW7470A <sup>b</sup>	Emax

<sup>a</sup> EPA Methods for Chemical Analysis of Water and Wastes, Revised March 1983.

<sup>b</sup> SW-846 Test Methods for Evaluating Solid Waste, 3<sup>rd</sup> Edition, revision 4, 1996.

Field samples were also reviewed to ascertain field compliance and data quality issues. This review includes evaluation of FD and equipment blank (EB) data.

Data flags were assigned as outlined below. These flags, as well as the reason for each flag, are entered into the electronic database and can be found in Table 3 at the end of this report (sorted by validation reason and then analyte). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample effects.

The data flags are listed and defined below:

- J = Analyte is present but the reported value might not be accurate or precise (estimated).
- R = Data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
- U = Analyte was not detected at the specified detection limit.
- UJ = Analyte was not detected and the specified detection limit might not be accurate or precise (estimated).

### Data Assessment

Data assessment includes a review of the activities described in the following sections.

### **Holding Times**

Holding-time exceedances result in the possible loss of target analytes due to degradation or chemical reactions that usually cause a negative bias to sample results.

One hexavalent chromium (SW7199) sample was analyzed outside the recommended holding-time. The non-detected result was flagged "UJ" as an estimated concentration. All other holding-times were met.

#### Method Blanks

Method blanks are used to monitor each preparation or analytical batch for contamination throughout the entire analytical process from sources such as glassware, reagents, instrumentation and other potential contaminant sources within the laboratory. If a target analyte is detected in the method blank, similar detections in the samples are possibly artifacts of laboratory contamination.

Method blanks were analyzed at the required frequency. No target analytes were detected at or above the reporting limit (RL), indicating that laboratory contamination was not an issue when the samples were analyzed.

#### Field Blanks

EBs are used to assess the effectiveness of sampling equipment decontamination procedures. Target analytes detected in EBs may indicate that field equipment was not thoroughly decontaminated and/or samples could have been cross contaminated.

EB results were detected greater than the RL for two dissolved copper and two dissolved vanadium (SW6020A). Detected results were qualified as not detected and flagged "U" at the reported concentrations.

All other EB target analytes were not detected at or above the RL.

#### Quantitation and Sensitivity

Due to a demonstrated matrix effect for the hexavalent chromium analyses, which is discussed in the "Other" section below, the RLs for method SW7199 for the non-detected sample results were raised by the laboratory in the following samples: MW-92-BKG-003, Needles MW-12-BKG-003, PGE-9S-BKG-003, and Sanders-BKG-003. No flags were applied, but the "ValAdj" reason was noted.

All other method/analyte combinations, with the exception of copper and vanadium, met the project RL objectives. Copper and vanadium RLs were elevated for the samples associated with the EB copper and vanadium detected results.

### Calibration

Initial calibration and periodic verification are essential to generating defensible analytical data. Initial calibrations that do not meet method requirements result in data that may be either positively or negatively biased. Periodic calibration verification ensures that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The

inability to meet initial or continuing calibration analyses may result in qualifying the data as estimated or rejecting the data for project decision-making purposes.

Initial and continuing calibrations were performed as required by the methods. All calibration criteria were met.

### Matrix Spike Samples

Matrix spike (MS) recoveries are used to evaluate the affect of the sample matrix on the recovery of target analytes. A sample is fortified with a known quantity of a target analyte and is carried through the same preparation and analytical procedures as the unspiked sample. MS recoveries outside the QC limits may indicate that the sample's matrix is affecting the method's ability to accurately quantify the target analyte in the associated sample, or samples from similar locations. A low MS recovery generally indicates a negative bias in the sample data, while a high MS recovery indicates a potential positive bias to the associated sample data. If duplicate MS analyses are performed, a relative percent difference (RPD) greater than QC criteria may further indicate that the sample matrix is affecting the method for the target analyte that did not meet criteria. Therefore, when the MS does not meet criteria, results are usually considered estimated.

One MS sample had a recovery less than the lower control limit (LCL) and one MS sample had a recovery greater than the upper control limit (UCL) for hexavalent chromium (SW7199). Detected results were qualified as estimated and flagged "J".

All other MS/SD acceptance criteria were met in this sampling event.

#### **Field Duplicates**

FDs are collected and analyzed to determine if field collection activities or the sample matrix influences the precision of the analytical measurements obtained at the sample site.

One FD pair had results that exceeded the RPD criteria for the following analytes: turbidity (E180.1), dissolved - chromium, lead, and zinc (SW6020A). A second FD pair had results that exceeded the RPD criteria for the following analytes: dissolved - chromium, copper, lead, vanadium, and zinc (SW6020A). A third FD pair had results that exceeded the RPD criteria for the following analytes: DOC (E415.1), dissolved manganese, and dissolved silver (SW6020A). A fourth FD pair had results that exceeded the RPD criteria for turbidity (E180.1). And a fifth FD pair had results that exceeded the RPD criteria for dissolved nickel (SW6020A). Detected and non-detected results were qualified as estimated and flagged "J" and "UJ", respectively.

All other FD acceptance criteria were met in this sampling event.

#### Laboratory Duplicates

Laboratory duplicates measure laboratory precision. RPDs that exceed method criteria indicate imprecision in some aspect of the analytical procedure.

The laboratory analyzed duplicate aliquots of field samples at the required frequency. The QC acceptance criteria were met for all methods.

### Laboratory Control Samples

A laboratory control sample (LCS) measures laboratory accuracy. Accuracy is the degree of agreement between a measured value and the expected value. The LCS is prepared from laboratory deionized or reagent-grade water and spiked with known amounts of the target analytes of interest. Recovery of analytes outside of QC limits generally indicates a problem with the analytical procedure. A low LCS recovery indicates that the target analyte in associated samples is likely biased low. Likewise, a high LCS recovery indicates that the target analyte in associated samples is likely biased high. Results associated with LCS recovery criteria exceedances are considered estimated.

LCSs were analyzed at the required frequency and were recovered within QC limits.

#### Miscellaneous

One DOC (E415.1) detected result was significantly greater than the associated TOC result and was unusable and flagged "R".

The serial dilution criteria were exceeded for three dissolved zinc (SW6020A). The detected results were qualified as estimated and flagged "J".

#### Chain of Custody / Sample Receipt

Samples are collected under chain of custody to ensure that sample integrity is documented and known from the time of collection through receipt at the laboratory where custody is relinquished to the laboratory.

Each sample was documented in a completed chain of custody and received at the laboratory in good condition. All discrepancies identified in laboratory custody were promptly resolved.

#### Other

Matrix interference has been encountered at the Topock site, in selected monitoring wells, that affected the sensitivity for hexavalent chromium by the SW7199 method. CH2M HILL directed the laboratory to perform additional quality assurance (QA)/QC analyses to aid in assessing if there is any effect on method sensitivity for each well location due to the sample matrix.

The laboratory was instructed to analyze an MS of all samples by spiking the samples with 1  $\mu$ g/L of hexavalent chromium to ensure that identification is accurate for detected results. For non-detected results, the MS should verify there are not false negatives that go undetected.

If the MS is not recovered or the peak is outside of the established retention time window for either detected or non-detected results, the laboratory will make a fivefold dilution of two aliquots of the sample. The first aliquot will be analyzed without the spike, and the second will be spiked with  $1 \mu g/L$  of hexavalent chromium, and the recovery and peak retention time evaluated. If this MS recovery is not within laboratory QC limits and/or the peak is not within the laboratory retention time window, the laboratory will dilute two additional aliquots of sample tenfold, spike one of the aliquots, analyze the sample/MS, and

perform successively greater dilutions of 25:1, 50:1, or 100:1 until the peak identified in the post spike analysis is within the established retention time window for hexavalent chromium, and the recovery of the spike is within laboratory QC limits.

The detected result that is reported by the laboratory on the final data package is chosen from the dilution where both the peak detected in the unspiked and the spiked sample fall within the appropriate retention time and the MS is recovered with QC control limits. The RLs are raised to the level of the appropriate dilution.

For non-detected results, the dilution selected by the laboratory for reporting is taken from the smallest dilution that yields an MS recovery within QC control limits and within the appropriate retention time window.

### **Overall Review**

The goal of this review is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters (PARCC) are addressed in the QAPP. The following summary highlights the PARCC findings for the above-defined events:

- 1. The completeness objective for the PG&E program is 95 percent for aqueous samples. The completeness objectives were met for all method/analyte combinations collected.
- 2. Samples were collected and analyzed based on approved methods/procedures and the results are reported using industry-standardized units.
- 3. The routinely acceptable performance of field and laboratory QC indicators (FDs, field blanks, laboratory blanks, LCS, MS/MSD and calibrations) show the accuracy and precision of the data meet the project objectives with the following exceptions:
  - FD precision criteria were exceeded for five FD pairs and the results were qualified as estimated (methods include: E180.1, E415.1, and SW6020A).
  - Two sample results were affected by EB contamination for dissolved copper and dissolved vanadium (SW6020A). The sample results were qualified as not detected.
  - One MS sample with a recovery less than the LCL and another MS sample with a recovery greater than the UCL for hexavalent chromium (SW7199) resulted in data qualified as estimated.
  - Three sample results were affected by serial dilution exceedances for dissolved zinc (SW6020A) and the results were qualified as estimated.
- 4. Holding time was exceeded for one hexavalent chromium (SW7199) sample and the result was qualified as estimated.

- 5. Matrix effects were identified in four of the samples for hexavalent chromium (SW7199) analyses and the RLs were raised to the concentrations where the matrix effects were overcome as indicated by acceptable MS analyses.
- 6. Analytical data as qualified meets the data quality objectives and may be used in project decision making.

#### TABLE 3

Data Qualification Summary

SW6020A         GSRV-2-BKG-003         05K033         Copper, dissolved         mg/L         0.00183         U         EB>RL           SW6020A         MW-94-BKG-003         05K033         Copper, dissolved         mg/L         0.00356         U         EB>RL           SW6020A         MW-94-BKG-003         05K033         Copper, dissolved         mg/L         0.00356         U         EB>RL           SW6020A         MW-94-BKG-003         05K033         Vanadium, dissolved         mg/L         0.0193         U         EB>RL	
SW6020A         MW-94-BKG-003         05K033         Copper, dissolved         mg/L         0.00356         U         EB>RL           SW6020A         MW-94-BKG-003         05K033         Vanadium, dissolved         mg/L         0.0193         U         EB>RL	
SW6020A MW-94-BKG-003 05K033 Vanadium, dissolved mg/L 0.0193 U EB>RL	
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SW6020A  GSRV-2-BKG-003  05K033  Vanadium, dissolved  mg/L   0.0193 U  EB>RL	
SW6020A MW-93-BKG-003 05K033 Chromium, dissolved mg/L 0.0106 J FD>RP	)
SW6020A MW-91-BKG-003 05K033 Chromium, dissolved ma/L 0.0172 J FD>RP	)
TOPOCK-2-BKG-	
SW6020A 003 05K033 Chromium, dissolved mg/L 0.0169 J FD>RP	)
SW6020A MW-17-BKG-003 05K033 Chromium, dissolved mg/L 0.0233 J FD>RP	)
SW6020A MW-91-BKG-003 05K033 Copper, dissolved mg/L 0.00574 J FD>RP	)
SW6020A MW-17-BKG-003 05K033 Copper, dissolved mg/L 0.00721 J FD>RP	)
E415.1 GSRV-2-BKG-003 05K033 DOC mg/L 8.72 R FD>RP	)
E415.1 MW-94-BKG-003 05K033 DOC mg/L 1UJ FD>RP	)
SW6020A MW-17-BKG-003 05K033 Lead, dissolved mg/L 0.0564 J FD>RP	)
SW6020A MW-93-BKG-003 05K033 Lead, dissolved mg/L 0.00246 J FD>RP	)
SW6020A MW-91-BKG-003 05K033 Lead. dissolved mg/L 0.00866J FD>RP	· ا
TOPOCK-2-BKG-	
SW6020A 003 05K033 Lead, dissolved mg/L 0.0555 J FD>RP	)
SW6020A GSRV-2-BKG-003 05K033 Manganese, dissolved mg/L 0.0118 J FD>RP	)
SW6020A MW-94-BKG-003 05K033 Manganese, dissolved mg/L 0.001 UJ FD>RP	)
SW6020A MW-16-BKG-003 05K047 Nickel, dissolved mg/L 0.0124 J FD>RP	)
SW6020A MW-90-BKG-003 05K047 Nickel, dissolved mg/L 0.00881 J FD>RP	)
SW6020A GSRV-2-BKG-003 05K033 Silver, dissolved mg/L 0.0103 J FD>RP	)
SW6020A MW-94-BKG-003 05K033 Silver, dissolved mg/L 0.00568 J FD>RP	)
TOPOCK-2-BKG-	
E180.1 003 05K033 Turbidity NTU 7.52 J FD>RP	)
E180.1 PGE-9S-BKG-003 05K011 Turbidity NTU 54.8 J FD>RP	)
E180.1 MW-92-BKG-003 05K011 Turbidity NTU 38.3 J FD>RP	)
E180.1 MW-93-BKG-003 05K033 Turbidity NTU 4.5 J FD>RP	)
SW6020A MW-17-BKG-003 05K033 Vanadium, dissolved mg/L 0.00719 J FD>RP	)
SW6020A MW-91-BKG-003 05K033 Vanadium, dissolved mg/L 0.00458 J FD>RP	)
SW6020A MW-93-BKG-003 05K033 Zinc, dissolved mg/L 0.113 J FD>RP	)
SW6020A MW-17-BKG-003 05K033 Zinc, dissolved mg/L 0.0747 J FD>RP	)
SW6020A MW-91-BKG-003 05K033 Zinc, dissolved mg/L 0.061 J FD>RP	)
TOPOCK-2-BKG-	
SW6020A         003         05K033         Zinc, dissolved         mg/L         0.0444         J         FD>RPI	)
Needles MW-12- SW7199 BKG-003 948506 Chromium bexavalent mg/l 0.001UU HT>UC	
CA Agriculture	-
SW7199 Station-BKG-003 948506 Chromium, hexavalent mg/L 0.001 J MS <lc< td=""><td>-</td></lc<>	-
Langmaack-BKG- SW7199 003 948461 Chromium bexavalent mg/l 0.021.l MS>UC	
E415.1 GSRV-2-BKG-003 05K033 DOC mg/l 872R Reject	-
ADOT New Wel I -	
SW6020A BKG-003 05K047 Zinc, dissolved mg/L 0.0336 J SerDil	
SW6020A MW-94-BKG-003 05K033 Zinc, dissolved mg/L 0.0248 J SerDil	
SW6020A GSRV-2-BKG-003 05K033 Zinc, dissolved ma/L 0.0149J SerDil	
SW7199 Needles MW-12- 948506 Chromium, hexavalent mg/L 0.001 UJ ValAdj	

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
	BKG-003						
SW7199	MW-92-BKG-003	948365	Chromium, hexavalent	mg/L	0.001	U	ValAdj
SW7199	PGE-9S-BKG-003	948365	Chromium, hexavalent	mg/L	0.001	U	ValAdj
SW7199	Sanders-BKG-003	948506	Chromium, hexavalent	mg/L	0.001	U	ValAdj
<sup>1</sup> This is the fin	al qualifier flag for this a	nalyte/method o	combination. If more than o	ne flag was	applied, thi	s is the most co	nservative.
Validation Rea	sons:						
EB>RL = Equipment blank concentration greater than the RL							
FD>RPD = Field duplicate exceeds RPD criteria							
HT>UCL = Holding time exceeded							
MS <lcl =="" less="" limit<="" lower="" matrix="" recovery="" spike="" td="" than=""></lcl>							
MS>UCL = Matrix spike recovery greater than upper limit							
Reject = Value does not match associated analysis result/does not match historic data							
SerDil = Serial dilution %D>UCL							
ValAdj = Value reported by laboratory adjusted due to matrix issues							

# Review of Analytical Data for Event Four of the PG&E Topock Background Study

Prepared for Pacific Gas and Electric

June, 2006

CH2MHILL 2525 Airpark Drive Redding, California 96001
# Introduction

This Data Quality Evaluation (DQE) report assesses the data quality of analytical results for Event Four of the Pacific Gas & Electric Company (PG&E) Topock Background Study, between December 19, 2005 and February 9, 2006. Samples were collected and analyzed as required by the California Regional Water Quality Control Board (RWQCB). The PG&E Quality Assurance Program Plan – Topock Addendum, July 2004, individual method requirements, internal laboratory quality control (QC) criteria, and guidelines from the U.S. Environmental Protection Agency (EPA) Contract Laboratory National Functional Guidelines for Inorganic Data Review, July 2002, were used in this assessment.

# Analytical Data

This DQE report covers 25 normal groundwater samples and five field duplicate (FD) groundwater samples. These samples were reported by the laboratories in 13 sample delivery groups identified in Table 1 below:

TABLE 1 Sample Delivery Groups			
05L158	05L172	05L182	05L187
06B080	39969	39977	39999
950009	950084	950115	950147
951652			

Truesdail Laboratories, Inc. (TLI) of Tustin, California, Emax Laboratories, Inc. of Torrance, California, and Zymax Forensics of San Luis Obispo, California, performed the required analyses. All laboratories are certified by the California Department of Health Service's Environmental Laboratory Accreditation Program for the analyses included in Table 2 where appropriate. Selected samples were analyzed for the analytes and methods listed in Table 2.

# TABLE 2Analytical Parameters

Parameter	Method	Laboratory
Stable isotopes of deuterium and oxygen	CF-IRMS	Zymax
Total Dissolved Solids (TDS)	E160.1 ª	Emax
Total Suspended Solids (TSS)	E160.2ª	Emax
Turbidity	E180.1 ª	Emax
Bromide, Chloride, Fluoride, Nitrate, Sulfate	E300.0 ª	Emax

#### TABLE 2 Analytical Parameters

Parameter	Method	Laboratory
Alkalinity (Carbonate and Bicarbonate)	E310.1 ª	Emax
Ammonia	E350.2 <sup>ª</sup>	Emax
Total Kjeldahl Nitrogen	E351.3ª	Emax
Soluble Silica	E370.1 <sup>a</sup>	Emax
Total Organic Carbon (TOC)	E415.1 <sup>a</sup>	Emax
Dissolved Organic Carbon (DOC)	E415.1 <sup>a</sup>	Emax
Cations	SW6020A <sup>b</sup>	Emax
Hexavalent Chromium	SW7199 <sup>b</sup>	TLI
Mercury	SW7470A <sup>b</sup>	Emax

<sup>a</sup> EPA Methods for Chemical Analysis of Water and Wastes, Revised March 1983.

SW-846 Test Methods for Evaluating Solid Waste, 3<sup>rd</sup> Edition, revision 4, 1996.

Field samples were also reviewed to ascertain field compliance and data quality issues. This review includes evaluation of FD and equipment blank (EB) data.

Data flags were assigned as outlined below. These flags, as well as the reason for each flag, are entered into the electronic database and can be found in Table 3 at the end of this report (sorted by validation reason and then analyte). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample effects.

The data flags are listed and defined below:

- J = Analyte is present but the reported value might not be accurate or precise (estimated).
- R = Data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
- U = Analyte was not detected at the specified detection limit.
- UJ = Analyte was not detected and the specified detection limit might not be accurate or precise (estimated).

# Data Assessment

Data assessment includes a review of the activities described in the following sections.

#### **Holding Times**

Holding-time exceedances result in the possible loss of target analytes due to degradation or chemical reactions that usually cause a negative bias to sample results.

All holding times were met.

#### Method Blanks

Method blanks (MB) are used to monitor each preparation or analytical batch for contamination throughout the entire analytical process from sources such as glassware, reagents, instrumentation and other potential contaminant sources within the laboratory. If a target analyte is detected in the method blank, similar detections in the samples are possibly artifacts of laboratory contamination.

MBs were analyzed at the required frequency. One MB for dissolved aluminum (SW6020A) had a value greater than the reporting limit (RL). Five associated dissolved aluminum detected results were qualified as not detected and flagged "U" at the reported concentrations.

All other MB target analytes were not detected at or above the reporting limit (RL).

#### Field Blanks

EBs are used to assess the effectiveness of sampling equipment decontamination procedures. Target analytes detected in EBs may indicate that field equipment was not thoroughly decontaminated and/or samples could have been cross contaminated.

The EB results were greater than the RL for one dissolved aluminum, three dissolved copper, one dissolved molybdenum, and two dissolved nickel (SW6020A). Detected results were qualified as not detected and flagged "U" at the reported concentrations.

All other EB target analytes were not detected at or above the RL.

#### **Quantitation and Sensitivity**

Due to a demonstrated matrix effect for the hexavalent chromium analyses, which is discussed in the "Other" section below, the RLs for method SW7199 for the non-detected sample results were raised by the laboratory in the following samples: MW-92-BKG-004 and PGE-09S-BKG-004. No flags were applied, but the "ValAdj" reason was noted.

All other method/analyte combinations, with the exception of aluminum, copper, molybdenum and nickel, met the project RL objectives. Aluminum, copper, molybdenum and nickel RLs were elevated for the samples associated with the MB/EB aluminum, copper, molybdenum and nickel detected results.

#### Calibration

Initial calibration and periodic verification are essential to generating defensible analytical data. Initial calibrations that do not meet method requirements result in data that may be either positively or negatively biased. Periodic calibration verification ensures that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The

inability to meet initial or continuing calibration analyses may result in qualifying the data as estimated or rejecting the data for project decision-making purposes.

Initial and continuing calibrations were performed as required by the methods. One continuing calibration verification standard (CCV) for nitrate (E300.0) was less than the lower control limit (LCL). One detected and three non-detected nitrate results were qualified as estimated and flagged "J" and "UJ", respectively.

All other calibration criteria were met.

#### Matrix Spike Samples

Matrix spike (MS) recoveries are used to evaluate the affect of the sample matrix on the recovery of target analytes. A sample is fortified with a known quantity of a target analyte and is carried through the same preparation and analytical procedures as the unspiked sample. MS recoveries outside the QC limits may indicate that the sample's matrix is affecting the method's ability to accurately quantify the target analyte in the associated sample, or samples from similar locations. A low MS recovery generally indicates a negative bias in the sample data, while a high MS recovery indicates a potential positive bias to the associated sample data. If duplicate MS analyses are performed, a relative percent difference (RPD) greater than QC criteria may further indicate that the sample matrix is affecting the method for the target analyte that did not meet criteria. Therefore, when the MS does not meet criteria, results are usually considered estimated.

Two MS samples had recoveries less than the LCL for hexavalent chromium (SW7199). Detected results were qualified as estimated and flagged "J".

All other MS/spike duplicate (SD) acceptance criteria were met in this sampling event.

#### **Field Duplicates**

FDs are collected and analyzed to determine if field collection activities or the sample matrix influences the precision of the analytical measurements obtained at the sample site.

One FD pair had results that exceeded the RPD criteria for the following analytes: alkalinity/bicarbonate (E310.1), dissolved - chromium, copper, manganese, nickel, and zinc (SW6020A). A second FD pair had results that exceeded the RPD criteria for TSS (E160.2) and dissolved copper (SW6020A). The third and fourth FD pairs had results that exceeded the RPD criteria for dissolved copper and dissolved nickel (SW6020A). And a fifth FD pair had results that exceeded the RPD criteria for dissolved copper and dissolved nickel (SW6020A). And a fifth FD pair had results that exceeded the RPD criteria for dissolved manganese (SW6020A). Detected and non-detected results were qualified as estimated and flagged "J" and "UJ", respectively.

All other FD acceptance criteria were met in this sampling event.

#### Laboratory Duplicates

Laboratory duplicates measure laboratory precision. RPDs that exceed method criteria indicate imprecision in some aspect of the analytical procedure.

The laboratory analyzed duplicate aliquots of field samples at the required frequency. One laboratory duplicate exceeded the RPD criteria for TDS and another laboratory duplicate

exceeded the RPD criteria for TSS. Detected results were qualified as estimated and flagged "J".

The laboratory duplicate QC acceptance criteria were met for all other methods.

## Laboratory Control Samples

A laboratory control sample (LCS) measures laboratory accuracy. Accuracy is the degree of agreement between a measured value and the expected value. The LCS is prepared from laboratory deionized or reagent-grade water and spiked with known amounts of the target analytes of interest. Recovery of analytes outside of QC limits generally indicates a problem with the analytical procedure. A low LCS recovery indicates that the target analyte in associated samples is likely biased low. Likewise, a high LCS recovery indicates that the target analyte in associated samples is likely biased high. Results associated with LCS recovery criteria exceedances are considered estimated.

LCSs were analyzed at the required frequency and were recovered within QC limits.

## Chain of Custody / Sample Receipt

Samples are collected under chain of custody to ensure that sample integrity is documented and known from the time of collection through receipt at the laboratory where custody is relinquished to the laboratory.

Each sample was documented in a completed chain of custody and received at the laboratory in good condition. All discrepancies identified in laboratory custody were promptly resolved.

#### Other

Matrix interference has been encountered at the Topock site, in selected monitoring wells, that affected the sensitivity for hexavalent chromium by the SW7199 method. CH2M HILL directed the laboratory to perform additional quality assurance (QA)/QC analyses to aid in assessing if there is any effect on method sensitivity for each well location due to the sample matrix.

The laboratory was instructed to analyze an MS of all samples by spiking the samples with 1  $\mu$ g/L of hexavalent chromium to ensure that identification is accurate for detected results. For non-detected results, the MS should verify there are not false negatives that go undetected.

If the MS is not recovered or the peak is outside of the established retention time window for either detected or non-detected results, the laboratory will make a fivefold dilution of two aliquots of the sample. The first aliquot will be analyzed without the spike, and the second will be spiked with  $1 \mu g/L$  of hexavalent chromium, and the recovery and peak retention time evaluated. If this MS recovery is not within laboratory QC limits and/or the peak is not within the laboratory retention time window, the laboratory will dilute two additional aliquots of sample tenfold, spike one of the aliquots, analyze the sample/MS, and perform successively greater dilutions of 25:1, 50:1, or 100:1 until the peak identified in the post spike analysis is within the established retention time window for hexavalent chromium, and the recovery of the spike is within laboratory QC limits.

The detected result that is reported by the laboratory on the final data package is chosen from the dilution where both the peak detected in the unspiked and the spiked sample fall within the appropriate retention time and the MS is recovered with QC control limits. The RLs are raised to the level of the appropriate dilution.

For non-detected results, the dilution selected by the laboratory for reporting is taken from the smallest dilution that yields an MS recovery within QC control limits and within the appropriate retention time window.

# **Overall Review**

The goal of this review is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters (PARCC) are addressed in the QAPP. The following summary highlights the PARCC findings for the above-defined events:

- 1. The completeness objective for the PG&E program is 95 percent for aqueous samples. The completeness objectives were met for all method/analyte combinations collected.
- 2. Samples were collected and analyzed based on approved methods/procedures and the results are reported using industry-standardized units.
- 3. The routinely acceptable performance of field and laboratory QC indicators (FDs, field blanks, laboratory blanks, LCS, MS/MSD and calibrations) show the accuracy and precision of the data meet the project objectives with the following exceptions:
  - FD precision criteria were exceeded for five FD pairs and the results were qualified as estimated (methods include: E160.2, E310.1, and SW6020A).
  - Four sample results were affected by calibration exceedances for nitrate (E300.0) and the associated results were qualified as estimated.
  - One dissolved aluminum, three dissolved copper, one dissolved molybdenum and two dissolved nickel (SW6020A) sample results were affected by EB contamination. The results were qualified as not detected.
  - Five dissolved aluminum (SW6020A) results affected by MB contamination were qualified as not detected.
  - One laboratory duplicate exceeded the RPD criteria for TDS and another laboratory duplicate exceeded the RPD criteria for TSS. Detected results were qualified as estimated and flagged "J".
  - Two MS sample results for hexavalent chromium (SW7199) were less than the LCL and the results were qualified as estimated.
- 4. Matrix effects were identified in two of the samples for hexavalent chromium (SW7199) analyses and the RLs were raised to the concentrations where the matrix effects were overcome as indicated by acceptable MS analyses.

5. Analytical data as qualified meets the data quality objectives and may be used in project decision making.

#### TABLE 3

Data Qualification Summary

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation	Validation Reason
E300.0	New Form Well-BKG-004		Nitrato-N	ma/l	nesun 0.5	1 lag	
E300.0		051 192	Nitrate-N	mg/L	2.64	00	
E300.0		051 192	Nitrate -N	mg/L	2.04	J 111	
E300.0		051 102	Nitrate -N	mg/∟	0.5	00	
E300.0		051102	Nillale -N	mg/∟ ∽a/l	0.0	00	
SW6020A	GSRV-2-BKG-004	05L187	Aluminum, dissolved	mg/∟	0.101	U	EB>RL
SW6020A	MW-94-BKG-004	05L187	Copper, dissolved	mg/∟	0.003	U	EB>RL
SW6020A	BOR-2-BKG-004	05L182	Copper, dissolved	mg/∟	0.00325	U	EB>RL
SW6020A	GSRV-2-BKG-004	05L187	Copper, dissolved	mg/L	0.00129	U	EB>RL
SW6020A	BOR-2-BKG-004	05L182	Molybdenum, dissolved	mg/L	0.00758	U	EB>RL
SW6020A	GSRV-2-BKG-004	05L187	NICKEI, dissolved	mg/L	0.00208	0	EB>RL
SW6020A	BOR-2-BKG-004	05L182	Nickel, dissolved	mg/L	0.00628	U	EB>RL
E310.1	MW-91-BKG-004	05L187	Alkalinity	mg/L	53.5	J	FD>RPD
E310.1	MW-17-BKG-004	05L187	Alkalinity	mg/L	153	J	FD>RPD
E310.1	MW-91-BKG-004	05L187	Bicarbonate Alkalinity	mg/L	53.5	J	FD>RPD
E310.1	MW-17-BKG-004	05L187	Bicarbonate Alkalinity	mg/L	153	J	FD>RPD
SW6020A	MW-91-BKG-004	05L187	Chromium, dissolved	mg/L	0.0148	J	FD>RPD
SW6020A	MW-17-BKG-004	05L187	Chromium, dissolved	mg/L	0.00659	J	FD>RPD
SW6020A	MW-91-BKG-004	05L187	Copper, dissolved	mg/L	0.00467	J	FD>RPD
SW6020A	MW-93-BKG-004	05L158	Copper, dissolved	mg/L	0.00503	J	FD>RPD
SW6020A	PGE-09S-BKG-004	05L172	Copper, dissolved	mg/L	0.00738	J	FD>RPD
SW6020A	TOPOCK-2-BKG-004	05L158	Copper, dissolved	mg/L	0.00175	J	FD>RPD
SW6020A	MW-16-BKG-004	05L187	Copper, dissolved	mg/L	0.00408	J	FD>RPD
SW6020A	MW-90-BKG-004	05L187	Copper, dissolved	mg/L	0.00101	J	FD>RPD
SW6020A	MW-92-BKG-004	05L172	Copper, dissolved	mg/L	0.00503	J	FD>RPD
SW6020A	MW-17-BKG-004	05L187	Copper, dissolved	mg/L	0.0109	J	FD>RPD
SW6020A	MW-94-BKG-004	05L187	Manganese, dissolved	mg/L	0.001	UJ	FD>RPD
SW6020A	GSRV-2-BKG-004	05L187	Manganese, dissolved	mg/L	0.00278	J	FD>RPD
SW6020A	MW-17-BKG-004	05L187	Manganese, dissolved	mg/L	0.00437	J	FD>RPD
SW6020A	MW-91-BKG-004	05L187	Manganese, dissolved	mg/L	0.00232	J	FD>RPD
SW6020A	MW-93-BKG-004	05L158	Nickel, dissolved	mg/L	0.001	UJ	FD>RPD
SW6020A	MW-90-BKG-004	05L187	Nickel, dissolved	mg/L	0.00679	J	FD>RPD
SW6020A	TOPOCK-2-BKG-004	05L158	Nickel, dissolved	mg/L	0.00217	J	FD>RPD
SW6020A	MW-16-BKG-004	05L187	Nickel, dissolved	mg/L	0.00979	J	FD>RPD
SW6020A	MW-17-BKG-004	05L187	Nickel, dissolved	mg/L	0.00924	J	FD>RPD
SW6020A	MW-91-BKG-004	05L187	Nickel, dissolved	mg/L	0.0017	J	FD>RPD
E160.2	PGE-09S-BKG-004	05L172	TSS	mg/L	10	UJ	FD>RPD
E160.2	MW-92-BKG-004	05L172	TSS	mg/L	21.5	J	FD>RPD
SW6020A	MW-17-BKG-004	05L187	Zinc, dissolved	mg/L	0.0703	J	FD>RPD
SW6020A	MW-91-BKG-004	05L187	Zinc, dissolved	mg/L	0.0534	J	FD>RPD
	CA Agriculture Station-						Lab Dup
E160.1	BKG-004	05L158	TDS	mg/L	910	J	RPD
E160.2	BOR-2-BKG-004	05  182	TSS	ma/l	102	.1	Lab Dup RPD
SW6020A	MW-92-BKG-004	05L172	Aluminum, dissolved	ma/l	0.0833	- U	LB>RL
SW6020A	TAYLOE-BKG-004	05L172	Aluminum, dissolved	ma/l	0.0665	- U	LB>RI
SW6020A	MW-90-BKG-004	05L187	Aluminum, dissolved	ma/l	0.0732	- U	LB>RL
SW6020A	MW-16-BKG-004	05L187	Aluminum, dissolved	ma/L	0.0923	U	LB>RL
				3-			

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
SW6020A	GSRV-2-BKG-004	05L187	Aluminum, dissolved	mg/L	0.101	U	LB>RL
SW7199	Langmaack-BKG-004	950009	Chromium, hexavalent	mg/L	0.0194	J	MS <lcl< td=""></lcl<>
SW7199	Topock-2-BKG-004	950009	Chromium, hexavalent	mg/L	0.0067	J	MS <lcl< td=""></lcl<>
SW7199	PGE-09S-BKG-004	950084	Chromium, hexavalent	mg/L	0.001	U	ValAdj
SW7199	MW-92-BKG-004	950084	Chromium, hexavalent	mg/L	0.001	U	ValAdj

<sup>1</sup> This is the final qualifier flag for this analyte/method combination. If more than one flag was applied, this is the most conservative.

Validation Reasons:

CCV<LCL = Continuing calibration recovery less than lower control limit

EB>RL = Equipment blank concentration greater than the RL

FD>RPD = Field duplicate exceeds RPD criteria

HT>UCL = Holding time exceeded

Lab Dup RPD = Lab duplicate exceeds RPD criteria

LB>RL = Laboratory blank contamination greater than the RL

MS<LCL = Matrix spike recovery less than lower limit

ValAdj = Value reported by laboratory adjusted due to matrix issues

# Review of Analytical Data for Event Five of the PG&E Topock Background Study

Prepared for Pacific Gas and Electric

June, 2006

CH2MHILL 2525 Airpark Drive Redding, California 96001

# Introduction

This Data Quality Evaluation (DQE) report assesses the data quality of analytical results for Event Five of the Pacific Gas & Electric Company (PG&E) Topock Background Study, between February 20, 2006 and March 21, 2006. Samples were collected and analyzed as required by the California Regional Water Quality Control Board (RWQCB). The PG&E Quality Assurance Program Plan – Topock Addendum, July 2004, individual method requirements, internal laboratory quality control (QC) criteria, and guidelines from the U.S. Environmental Protection Agency (EPA) Contract Laboratory National Functional Guidelines for Inorganic Data Review, July 2002, were used in this assessment.

# Analytical Data

This DQE report covers 25 normal groundwater samples and five field duplicate (FD) groundwater samples. These samples were reported by the laboratories in 17 sample delivery groups identified in Table 1 below:

TABLE 1   Sample Delivery Groups			
06B156	06B173	06B183	06B194
06C035	06C198	06C217	40010
40026	40051	951934	951993
952059	952092	952323	952979
953046			

Truesdail Laboratories, Inc. (TLI) of Tustin, California, Emax Laboratories, Inc. of Torrance, California, and Zymax Forensics of San Luis Obispo, California, performed the required analyses. All laboratories are certified by the California Department of Health Service's Environmental Laboratory Accreditation Program for the analyses included in Table 2 where appropriate. Selected samples were analyzed for the analytes and methods listed in Table 2.

#### TABLE 2 Analytical Parameters

Parameter	Method	Laboratory
Stable isotopes of deuterium and oxygen	CF-IRMS	Zymax
Total Dissolved Solids (TDS)	E160.1 ª	Emax
Total Suspended Solids (TSS)	E160.2ª	Emax
Turbidity	E180.1 ª	Emax

TAE	ßL	E	2		
				_	

Analytical Parameters

Parameter	Method	Laboratory
Bromide, Chloride, Fluoride, Nitrate, Sulfate	E300.0 ª	Emax
Alkalinity (Carbonate and Bicarbonate)	E310.1 ª	Emax
Ammonia	E350.2 <sup>a</sup>	Emax
Total Kjeldahl Nitrogen	E351.3 <sup>ª</sup>	Emax
Soluble Silica	E370.1 <sup>a</sup>	Emax
Total Organic Carbon (TOC)	E415.1 <sup>a</sup>	Emax
Dissolved Organic Carbon (DOC)	E415.1 <sup>a</sup>	Emax
Cations	SW6020A <sup>b</sup>	Emax
Hexavalent Chromium	SW7199 <sup>b</sup>	TLI
Mercury	SW7470A <sup>b</sup>	Emax

<sup>a</sup> EPA Methods for Chemical Analysis of Water and Wastes, Revised March 1983.

SW-846 Test Methods for Evaluating Solid Waste, 3<sup>rd</sup> Edition, revision 4, 1996.

Field samples were also reviewed to ascertain field compliance and data quality issues. This review includes evaluation of FD and equipment blank (EB) data.

Data flags were assigned as outlined below. These flags, as well as the reason for each flag, are entered into the electronic database and can be found in Table 3 at the end of this report (sorted by validation reason and then analyte). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample effects.

The data flags are listed and defined below:

- J = Analyte is present but the reported value might not be accurate or precise (estimated).
- R = Data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
- U = Analyte was not detected at the specified detection limit.
- UJ = Analyte was not detected and the specified detection limit might not be accurate or precise (estimated).

## Data Assessment

Data assessment includes a review of the activities described in the following sections.

#### Holding Times

Holding-time exceedances result in the possible loss of target analytes due to degradation or chemical reactions that usually cause a negative bias to sample results.

All holding times were met.

#### **Method Blanks**

Method blanks (MB) are used to monitor each preparation or analytical batch for contamination throughout the entire analytical process from sources such as glassware, reagents, instrumentation and other potential contaminant sources within the laboratory. If a target analyte is detected in the MB, similar detections in the samples are possibly artifacts of laboratory contamination.

MBs were analyzed at the required frequency. All MB QC criteria were met with the following exception:

One MB for dissolved mercury (SW7470A) had a negative result with an absolute value greater than the reporting limit (RL). Six associated non-detected sample results were qualified as estimated and flagged "UJ".

#### Field Blanks

EBs are used to assess the effectiveness of sampling equipment decontamination procedures. Target analytes detected in EBs may indicate that field equipment was not thoroughly decontaminated and/or samples could have been cross contaminated.

The EB results were greater than the RL for one dissolved copper, one dissolved iron, one dissolved vanadium and one dissolved zinc (SW6020A). Detected results were qualified as not detected and flagged "U" at the reported concentrations.

All other EB target analytes were not detected at or above the RL.

#### Quantitation and Sensitivity

Due to a demonstrated matrix effect for the hexavalent chromium analyses, which is discussed in the "Other" section below, the RLs for method SW7199 for the non-detected sample results were raised by the laboratory in the following samples: MW-92-BKG-005 and PGE-9S-BKG-005. No flags were applied, but the "ValAdj" reason was noted.

All other method/analyte combinations with the exception of copper, iron, vanadium, and zinc, met the project RL objectives. Copper, iron, vanadium, and zinc RLs were elevated for the samples associated with the EB copper, iron, vanadium, and zinc detected results.

#### Calibration

Initial calibration and periodic verification are essential to generating defensible analytical data. Initial calibrations that do not meet method requirements result in data that may be either positively or negatively biased. Periodic calibration verification ensures that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The

inability to meet initial or continuing calibration analyses may result in qualifying the data as estimated or rejecting the data for project decision-making purposes.

Initial and continuing calibrations were performed as required by the methods. One calibration verification ending standard (CVES) for boron (SW6020A) had recoveries that exceeded the percent difference criteria. Three boron detected results were qualified as estimated and flagged "J".

All other calibration criteria were met.

## Matrix Spike Samples

Matrix spike (MS) recoveries are used to evaluate the affect of the sample matrix on the recovery of target analytes. A sample is fortified with a known quantity of a target analyte and is carried through the same preparation and analytical procedures as the unspiked sample. MS recoveries outside the QC limits may indicate that the sample's matrix is affecting the method's ability to accurately quantify the target analyte in the associated sample, or samples from similar locations. A low MS recovery generally indicates a negative bias in the sample data, while a high MS recovery indicates a potential positive bias to the associated sample data. If duplicate MS analyses are performed, a relative percent difference (RPD) greater than QC criteria may further indicate that the sample matrix is affecting the method for the target analyte that did not meet criteria. Therefore, when the MS does not meet criteria, results are usually considered estimated.

All MS/spike duplicate (SD) acceptance criteria were met in this sampling event.

### **Field Duplicates**

FDs are collected and analyzed to determine if field collection activities or the sample matrix influences the precision of the analytical measurements obtained at the sample site.

One FD pair had results that exceeded the RPD criteria for the following analytes: ammonia (E350.2), TKN (E351.3), dissolved copper and dissolved lead (SW6020A). A second FD pair had results that exceeded the RPD criteria for soluble silica (E370.1). Detected results were qualified as estimated and flagged "J".

All other FD acceptance criteria were met in this sampling event.

### Laboratory Duplicates

Laboratory duplicates measure laboratory precision. RPDs that exceed method criteria indicate imprecision in some aspect of the analytical procedure.

The laboratory analyzed duplicate aliquots of field samples at the required frequency. The QC acceptance criteria were met for all methods.

### Laboratory Control Samples

A laboratory control sample (LCS) measures laboratory accuracy. Accuracy is the degree of agreement between a measured value and the expected value. The LCS is prepared from laboratory deionized or reagent-grade water and spiked with known amounts of the target analytes of interest. Recovery of analytes outside of QC limits generally indicates a problem

with the analytical procedure. A low LCS recovery indicates that the target analyte in associated samples is likely biased low. Likewise, a high LCS recovery indicates that the target analyte in associated samples is likely biased high. Results associated with LCS recovery criteria exceedances are considered estimated.

LCSs were analyzed at the required frequency and were recovered within QC limits with the following exceptions:

Three boron (SW6020A) detected results were flagged "J" as estimated concentrations because the associated LCS recovery was less than the lower control limit.

#### Chain of Custody / Sample Receipt

Samples are collected under chain of custody to ensure that sample integrity is documented and known from the time of collection through receipt at the laboratory where custody is relinquished to the laboratory.

Each sample was documented in a completed chain of custody and received at the laboratory in good condition. All discrepancies identified in laboratory custody were promptly resolved.

#### Other

Matrix interference has been encountered at the Topock site, in selected monitoring wells, that affected the sensitivity for hexavalent chromium by the SW7199 method. CH2M HILL directed the laboratory to perform additional quality assurance (QA)/QC analyses to aid in assessing if there is any effect on method sensitivity for each well location due to the sample matrix.

The laboratory was instructed to analyze an MS of all samples by spiking the samples with 1  $\mu$ g/L of hexavalent chromium to ensure that identification is accurate for detects. For non-detect results, the MS should verify there are not false negatives that go undetected.

If the MS is not recovered or the peak is outside of the established retention time window for either detected or non-detected results, the laboratory will make a fivefold dilution of two aliquots of the sample. The first aliquot will be analyzed without the spike, and the second will be spiked with 1  $\mu$ g/L of hexavalent chromium, and the recovery and peak retention time evaluated. If this MS recovery is not within laboratory QC limits and/or the peak is not within the laboratory retention time window, the laboratory will dilute two additional aliquots of sample tenfold, spike one of the aliquots, analyze the sample/MS, and perform successively greater dilutions of 25:1, 50:1, or 100:1 until the peak identified in the post spike analysis is within the established retention time window for hexavalent chromium, and the recovery of the spike is within laboratory QC limits.

The detected result that is reported by the laboratory on the final data package is chosen from the dilution where both the peak detected in the unspiked and the spiked sample fall within the appropriate retention time and the MS is recovered with QC control limits. The RLs are raised to the level of the appropriate dilution.

For non-detected results, the dilution selected by the laboratory for reporting is taken from the smallest dilution that yields an MS recovery within QC control limits and within the appropriate retention time window.

# **Overall Review**

The goal of this review is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters (PARCC) are addressed in the QAPP. The following summary highlights the PARCC findings for the above-defined events:

- 1. The completeness objective for the PG&E program is 95 percent for aqueous samples. The completeness objectives were met for all method/analyte combinations collected.
- 2. Samples were collected and analyzed based on approved methods/procedures and the results are reported using industry-standardized units.
- 3. The routinely acceptable performance of field and laboratory QC indicators (FDs, field blanks, laboratory blanks, LCS, MS/MSD and calibrations) show the accuracy and precision of the data meet the project objectives with the following exceptions:
  - A criterion was exceeded for one boron (SW6020A) LCS. The associated results were qualified as estimated.
  - FD precision criteria were exceeded for two FD pairs and the results were qualified as estimated (methods include: E350.2, E351.3, E370.1, and SW6020A).
  - Three sample results were affected by calibration exceedances for boron (SW6020A) and the associated results were qualified as estimated.
  - Dissolved copper, iron, vanadium and zinc (SW6020A) were affected by EB contamination and qualified as not detected. Six sample results were affected by a negative MB result for dissolved mercury (SW7470A). The results were qualified as estimated.
- 4. Matrix effects were identified in two of the samples for hexavalent chromium (SW7199) analyses and the RLs were raised to the concentrations where the matrix effects were overcome as indicated by acceptable MS analyses.
- 5. Analytical data as qualified meets the data quality objectives and may be used in project decision making.

#### TABLE 3

Data Qualification Summary

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
SW6020A	GSRV-2-BKG-005	06C198	Boron, dissolved	mg/L	0.128	J	CVES
SW6020A	MW-94-BKG-005	06C198	Boron, dissolved	mg/L	0.126	J	CVES
SW6020A	P-2-BKG-005	06C198	Boron, dissolved	mg/L	0.474	J	CVES
SW6020A	BOR-2-BKG-005	06B173	Copper, dissolved	mg/L	0.00187	U	EB>RL
SW6020A	BOR-2-BKG-005	06B173	Iron, dissolved	mg/L	0.673	U	EB>RL
SW6020A	BOR-2-BKG-005	06B173	Vanadium, dissolved	mg/L	0.00153	U	EB>RL
SW6020A	BOR-2-BKG-005	06B173	Zinc, dissolved	mg/L	0.0121	U	EB>RL
E350.2	MW-92-BKG-005	06B173	Ammonia (NH3-N)	mg/L	1.94	J	FD>RPD
E350.2	PGE-09S-BKG-005	06B173	Ammonia (NH3-N)	mg/L	0.712	J	FD>RPD
SW6020A	MW-92-BKG-005	06B173	Copper, dissolved	mg/L	0.0076	J	FD>RPD
SW6020A	PGE-09S-BKG-005	06B173	Copper, dissolved	mg/L	0.0144	J	FD>RPD
SW6020A	PGE-09S-BKG-005	06B173	Lead, dissolved	mg/L	0.00355	J	FD>RPD
SW6020A	MW-92-BKG-005	06B173	Lead, dissolved	mg/L	0.00142	J	FD>RPD
E370.1	MW-94-BKG-005	06C198	Silica	mg/L	34.2	J	FD>RPD
E370.1	GSRV-2-BKG-005	06C198	Silica	mg/L	24.8	J	FD>RPD
E351.3	PGE-09S-BKG-005	06B173	TKN	mg/L	0.778	J	FD>RPD
E351.3	MW-92-BKG-005	06B173	TKN	mg/L	2	J	FD>RPD
SW6020A	P-2-BKG-005	06C198	Boron, dissolved	mg/L	0.474	J	LCS <lcl< td=""></lcl<>
SW6020A	MW-94-BKG-005	06C198	Boron, dissolved	mg/L	0.126	J	LCS <lcl< td=""></lcl<>
SW6020A	GSRV-2-BKG-005	06C198	Boron, dissolved	mg/L	0.128	J	LCS <lcl< td=""></lcl<>
SW7470A	MW-92-BKG-005	06B173	Mercury, dissolved	UG/L	0.2	UJ	Negative blank
SW7470A	LANGMAACK-BKG-005	06B173	Mercury, dissolved	UG/L	0.2	UJ	Negative blank
SW7470A	PGE-09S-BKG-005	06B173	Mercury, dissolved	UG/L	0.2	UJ	Negative blank
SW7470A	USFW-5-BKG-005	06B173	Mercury, dissolved	UG/L	0.2	UJ	Negative blank
SW7470A	New Farm Well-BKG-005	06B173	Mercury, dissolved	UG/L	0.2	UJ	Negative blank
							Negative
SW7470A	BOR-2-BKG-005	06B173	Mercury, dissolved	UG/L	0.2	UJ	blank
SW7199	MW-92-BKG-005	951993	Chromium, hexavalent	mg/L	0.001	U	ValAdj
SW7199	PGE-09S-BKG-005	951993	Chromium, hexavalent	mg/L	0.001	U	ValAdj

<sup>1</sup> This is the final qualifier flag for this analyte/method combination. If more than one flag was applied, this is the most conservative.

Validation Reasons:

CVES = Calibration verification ending standard exceeded %D criteria

EB>RL = Equipment blank concentration greater than the RL

FD>RPD = Field duplicate exceeds RPD criteria

LCS<LCL = LCS recovery less than lower control limit

Negative blank = Blank absolute value > RL

ValAdj = Value reported by laboratory adjusted due to matrix issues

# Review of Analytical Data for Event Six of the PG&E Topock Background Study

Prepared for Pacific Gas and Electric

July, 2006

CH2MHILL 2525 Airpark Drive Redding, California 96001

# Introduction

This Data Quality Evaluation (DQE) report assesses the data quality of analytical results for Event Six of the Pacific Gas & Electric Company (PG&E) Topock Background Study, between May 1, 2006 and June 30, 2006. Samples were collected and analyzed as required by the California Regional Water Quality Control Board (RWQCB). The PG&E Quality Assurance Program Plan – Topock Addendum, July 2004, individual method requirements, internal laboratory quality control (QC) criteria, and guidelines from the U.S. Environmental Protection Agency (EPA) Contract Laboratory National Functional Guidelines for Inorganic Data Review, July 2002, were used in this assessment.

# Analytical Data

This DQE report covers 25 normal groundwater samples and five field duplicate (FD) groundwater samples. These samples were reported by the laboratories in 23 sample delivery groups identified in Table 1 below:

TABLE 1 Sample Delivery Groups			
06E011	06E021	06E030	06E034
06E065	06F024	0G007	40085
40086	40090	40111	40120
40152	954351	954352	954423
954435	954489	954490	954545
954711	955426	956347	

Truesdail Laboratories, Inc. (TLI) of Tustin, California, Emax Laboratories, Inc. of Torrance, California, and Zymax Forensics of San Luis Obispo, California, performed the required analyses. All laboratories are certified by the California Department of Health Service's Environmental Laboratory Accreditation Program for the analyses included in Table 2 where appropriate. Selected samples were analyzed for the analytes and methods listed in Table 2.

#### TABLE 2 Analytical Parameters

Parameter	Method	Laboratory
Stable isotopes of deuterium and oxygen	CF-IRMS	Zymax
Total Dissolved Solids (TDS)	E160.1 ª	Emax
Total Suspended Solids (TSS)	E160.2 <sup>a</sup>	Emax

TABLE 2	
Analytical	Parameters

Parameter	Method	Laboratory
Turbidity	E180.1 ª	Emax
Chloride, Fluoride, Nitrate, Sulfate	E300.0 ª	Emax
Alkalinity (Carbonate and Bicarbonate)	E310.1 ª	Emax
Ammonia	E350.2 <sup>a</sup>	Emax
Total Kjeldahl Nitrogen	E351.3 <sup>ª</sup>	Emax
Soluble Silica	E370.1 <sup>a</sup>	Emax
Total Organic Carbon (TOC)	E415.1 <sup>a</sup>	Emax
Dissolved Organic Carbon (DOC)	E415.1 <sup>a</sup>	Emax
Cations	SW6020A <sup>b</sup>	Emax
Hexavalent Chromium	SW7199 <sup>b</sup>	TLI
Mercury	SW7470A <sup>b</sup>	Emax

<sup>®</sup>EPA Methods for Chemical Analysis of Water and Wastes, Revised March 1983.

<sup>b</sup>SW-846 Test Methods for Evaluating Solid Waste, 3<sup>rd</sup> Edition, revision 4, 1996.

Field samples were also reviewed to ascertain field compliance and data quality issues. This review includes evaluation of FD and equipment blank (EB) data.

Data flags were assigned as outlined below. These flags, as well as the reason for each flag, are entered into the electronic database and can be found in Table 3 at the end of this report (sorted by validation reason and then analyte). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample effects.

The data flags are listed and defined below:

- J = Analyte is present but the reported value might not be accurate or precise (estimated).
- R = Data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
- U = Analyte was not detected at the specified detection limit.
- UJ = Analyte was not detected and the specified detection limit might not be accurate or precise (estimated).

## Data Assessment

Data assessment includes a review of the activities described in the following sections.

#### **Holding Times**

Holding-time exceedances result in the possible loss of target analytes due to degradation or chemical reactions that usually cause a negative bias to sample results.

Five turbidity (E180.1) samples were analyzed outside the recommended holding-time. The non-detected and detected sample results were qualified as estimated and flagged "UJ" and "J", respectively. One of the non-detected turbidity results was not usable due to gross exceedance of the holding-time criteria and was flagged "R". Two TSS (E160.2) samples were analyzed outside the recommended holding-time. The non-detected and detected sample results were qualified as estimated and flagged "UJ" and "J", respectively. All other holding-times were met.

#### Method Blanks

Method blanks (MB) are used to monitor each preparation or analytical batch for contamination throughout the entire analytical process from sources such as glassware, reagents, instrumentation and other potential contaminant sources within the laboratory. If a target analyte is detected in the MB, similar detections in the samples are possibly artifacts of laboratory contamination.

MBs were analyzed at the required frequency. One continuing calibration blank (CCB) was greater than the reporting limit (RL) for dissolved iron (SW6020A). Two dissolved iron detected results were qualified as not detected and flagged "U" at the reported concentrations.

All other MB target analytes were not detected at or above the RL.

#### **Field Blanks**

EBs are used to assess the effectiveness of sampling equipment decontamination procedures. Target analytes detected in EBs may indicate that field equipment was not thoroughly decontaminated and/or samples could have been cross contaminated.

One EB was greater than the RL for dissolved zinc (SW6020A). One dissolved zinc detected result was qualified as not detected and flagged "U" at the reported concentration.

All other EB target analytes were not detected at or above the RL.

#### Quantitation and Sensitivity

Due to a demonstrated matrix effect for the hexavalent chromium analyses, which is discussed in the "Other" section below, the RLs for method SW7199 for the non-detected sample results were raised by the laboratory in the following samples: MW-92-BKG-006 and PGE-09S-BKG-006. No flags were applied, but the "ValAdj" reason was noted.

All other method/analyte combinations, with the exception of iron and zinc, met the project RL objectives. Iron and zinc RLs were elevated for the samples associated with the EB/MB iron and zinc detected results.

#### Calibration

Initial calibration and periodic verification are essential to generating defensible analytical data. Initial calibrations that do not meet method requirements result in data that may be either positively or negatively biased. Periodic calibration verification ensures that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The inability to meet initial or continuing calibration analyses may result in qualifying the data as estimated or rejecting the data for project decision-making purposes.

All calibration criteria were met.

#### Matrix Spike Samples

Matrix spike (MS) recoveries are used to evaluate the affect of the sample matrix on the recovery of target analytes. A sample is fortified with a known quantity of a target analyte and is carried through the same preparation and analytical procedures as the unspiked sample. MS recoveries outside the QC limits may indicate that the sample's matrix is affecting the method's ability to accurately quantify the target analyte in the associated sample, or samples from similar locations. A low MS recovery generally indicates a negative bias in the sample data, while a high MS recovery indicates a potential positive bias to the associated sample data. If duplicate MS analyses are performed, a relative percent difference (RPD) greater than QC criteria may further indicate that the sample matrix is affecting the MS does not meet criteria, results are usually considered estimated.

All MS/spike duplicate (SD) acceptance criteria were met in this sampling event.

#### **Field Duplicates**

FDs are collected and analyzed to determine if field collection activities or the sample matrix influences the precision of the analytical measurements obtained at the sample site.

One FD pair had results that exceeded the RPD criteria for the following analytes: TSS (E160.2), turbidity (E180.1), dissolved - aluminum, arsenic, barium, chromium, copper, iron, lead, nickel, vanadium, and zinc (SW6020A). A second FD pair had results that exceeded the RPD criteria for TDS (E160.1) and a third FD pair had results that exceeded the RPD criteria for DOC (E415.1). The non-detected and detected sample results were qualified as estimated and flagged "UJ" and "J", respectively.

All other FD acceptance criteria were met in this sampling event.

#### Laboratory Duplicates

Laboratory duplicates measure laboratory precision. RPDs that exceed method criteria indicate imprecision in some aspect of the analytical procedure.

The laboratory analyzed duplicate aliquots of field samples at the required frequency. The QC acceptance criteria were met for all methods.

#### Laboratory Control Samples

A laboratory control sample (LCS) measures laboratory accuracy. Accuracy is the degree of agreement between a measured value and the expected value. The LCS is prepared from laboratory deionized or reagent-grade water and spiked with known amounts of the target analytes of interest. Recovery of analytes outside of QC limits generally indicates a problem with the analytical procedure. A low LCS recovery indicates that the target analyte in associated samples is likely biased low. Likewise, a high LCS recovery indicates that the target analyte in associated samples is likely biased low. Results associated with LCS recovery criteria exceedances are considered estimated.

LCSs were analyzed at the required frequency and were recovered within QC limits with the following exceptions:

Two dissolved chromium, two dissolved nickel, and one dissolved zinc (SW6020A) detected results were flagged "J" as estimated concentrations because the associated LCS recoveries were greater than the upper control limit.

#### Chain of Custody / Sample Receipt

Samples are collected under chain of custody to ensure that sample integrity is documented and known from the time of collection through receipt at the laboratory where custody is relinquished to the laboratory.

Each sample was documented in a completed chain of custody and received at the laboratory in good condition. All discrepancies identified in laboratory custody were promptly resolved.

#### Other

Matrix interference has been encountered at the Topock site, in selected monitoring wells, that affected the sensitivity for hexavalent chromium by the SW7199 method. CH2M HILL directed the laboratory to perform additional quality assurance (QA)/QC analyses to aid in assessing if there is any effect on method sensitivity for each well location due to the sample matrix.

The laboratory was instructed to analyze an MS of all samples by spiking the samples with 1  $\mu$ g/L of hexavalent chromium to ensure that identification is accurate for detected results. For non-detected results, the MS should verify there are not false negatives that go undetected.

If the MS is not recovered or the peak is outside of the established retention time window for either detected or non-detected results, the laboratory will make a fivefold dilution of two aliquots of the sample. The first aliquot will be analyzed without the spike, and the second will be spiked with  $1 \mu g/L$  of hexavalent chromium, and the recovery and peak retention time evaluated. If this MS recovery is not within laboratory QC limits and/or the peak is not within the laboratory retention time window, the laboratory will dilute two additional aliquots of sample tenfold, spike one of the aliquots, analyze the sample/MS, and perform successively greater dilutions of 25:1, 50:1, or 100:1 until the peak identified in the post spike analysis is within the established retention time window for hexavalent chromium, and the recovery of the spike is within laboratory QC limits.

The detected result that is reported by the laboratory on the final data package is chosen from the dilution where both the peak detected in the unspiked and the spiked sample fall within the appropriate retention time and the MS is recovered with QC control limits. The RLs are raised to the level of the appropriate dilution.

For non-detected results, the dilution selected by the laboratory for reporting is taken from the smallest dilution that yields an MS recovery within QC control limits and within the appropriate retention time window.

# **Overall Review**

The goal of this review is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters (PARCC) are addressed in the QAPP. The following summary highlights the PARCC findings for the above-defined events:

- 1. The completeness objective for the PG&E program is 95 percent for aqueous samples. The completeness objectives were met for all method/analyte combinations collected.
- 2. Samples were collected and analyzed based on approved methods/procedures and the results are reported using industry-standardized units.
- 3. The routinely acceptable performance of field and laboratory QC indicators (FDs, field blanks, laboratory blanks, LCS, MS/MSD and calibrations) show the accuracy and precision of the data meet the project objectives with the following exceptions:
  - Criteria were exceeded in one chromium, one nickel, and one zinc (SW6020A) LCS. The associated results were qualified as estimated.
  - FD precision criteria were exceeded for three FD pairs and the results were qualified as estimated (methods include: E160.1, E160.2, E180.1, E415.1, and SW6020A)).
  - One sample result was affected by EB contamination for dissolved zinc (SW6020A).
  - Two sample results were affected by CCB contamination for dissolved iron (SW6020A). The results were qualified as not detected.
- 4. Matrix effects were identified in two of the samples for hexavalent chromium (SW7199) analyses and the RLs were raised to the concentrations where the matrix effects were overcome as indicated by acceptable MS analyses.
- 5. Holding time was exceeded for five turbidity (E180.1) samples and two TSS (EE160.1) samples. Four of the turbidity results were qualified as estimated and one was rejected due to gross exceedance of the holding time criteria.
- 6. Analytical data as qualified met the data quality objectives and may be used in project decision making.

#### TABLE 3

Data Qualification Summary

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
SW6020A	USFW-5-BKG-006	06E030	IRON, dissolved	MG/L	0.48	U	CCB>RL
	New Farm Well-BKG-						
SW6020A	006	06E030	IRON, dissolved	MG/L	0.413	U	CCB>RL
SW6020A	MW-94-BKG-006	06E034	ZINC, dissolved	MG/L	0.0114	U	EB>RL
			ALUMINUM,				
SW6020A	TOPOCK-2-BKG-006	06G007	dissolved	MG/L	0.308	J	FD>RPD
			ALUMINUM,				
SW6020A	MW-95-BKG-006	06G007	dissolved	MG/L	0.05	UJ	FD>RPD
SW6020A	MW-95-BKG-006	06G007	ARSENIC, dissolved	MG/L	0.0114	J	FD>RPD
SW6020A	TOPOCK-2-BKG-006	06G007	ARSENIC, dissolved	MG/L	0.0315	J	FD>RPD
SW6020A	TOPOCK-2-BKG-006	06G007	BARIUM, dissolved	MG/L	0.114	J	FD>RPD
SW6020A	MW-95-BKG-006	06G007	BARIUM, dissolved	MG/L	0.0754	J	FD>RPD
			CHROMIUM,				
SW6020A	MW-95-BKG-006	06G007	dissolved	MG/L	0.0113	J	FD>RPD
0.1/00.001			CHROMIUM,				
SW6020A	TOPOCK-2-BKG-006	06G007	dissolved	MG/L	0.0796	J	FD>RPD
SW6020A	MW-95-BKG-006	06G007	COPPER, dissolved	MG/L	0.00462	J	FD>RPD
SW6020A	TOPOCK-2-BKG-006	06G007	COPPER, dissolved	MG/L	0.208	J	FD>RPD
E415.1	MW-94-BKG-006	06E034	DOC	MG/L	1	UJ	FD>RPD
E415.1	GSRV-2-BKG-006	06E034	DOC	MG/L	9.71	J	FD>RPD
SW6020A	MW-95-BKG-006	06G007	IRON, dissolved	MG/L	0.198	J	FD>RPD
SW6020A	TOPOCK-2-BKG-006	06G007	IRON, dissolved	MG/L	11.2	J	FD>RPD
SW6020A	MW-95-BKG-006	06G007	LEAD, dissolved	MG/L	0.00236	J	FD>RPD
SW6020A	TOPOCK-2-BKG-006	06G007	LEAD, dissolved	MG/L	0.0142	J	FD>RPD
SW6020A	TOPOCK-2-BKG-006	06G007	NICKEL, dissolved	MG/L	0.00422	J	FD>RPD
SW6020A	MW-95-BKG-006	06G007	NICKEL, dissolved	MG/L	0.001	UJ	FD>RPD
E160.1	MW-93-BKG-006	06E030	TDS	MG/L	650	J	FD>RPD
E160.1	BOR-2-BKG-006	06E030	TDS	MG/L	855	J	FD>RPD
E160.2	TOPOCK-2-BKG-006	06G007	TSS	MG/L	29	J	FD>RPD
E160.2	MW-95-BKG-006	06G007	TSS	MG/L	10	UJ	FD>RPD
E180.1	MW-95-BKG-006	06G007	TURBIDITY	NTU	1	R	FD>RPD
E180.1	TOPOCK-2-BKG-006	06G007	TURBIDITY	NTU	25.9	J	FD>RPD
			VANADIUM,				
SW6020A	TOPOCK-2-BKG-006	06G007	dissolved	MG/L	0.0379	J	FD>RPD
			VANADIUM,				
SW6020A	MW-95-BKG-006	06G007	dissolved	MG/L	0.0177	J	FD>RPD
SW6020A	MW-95-BKG-006	06G007	ZINC, dissolved	MG/L	0.01	UJ	FD>RPD
SW6020A	TOPOCK-2-BKG-006	06G007	ZINC, dissolved	MG/L	0.0513	J	FD>RPD
E160.2	MW-95-BKG-006	06G007	TSS	MG/L	10	UJ	HT>UCL
E160.2	TOPOCK-2-BKG-006	06G007	TSS	MG/L	29	J	HT>UCL
E180.1	MW-93-BKG-006	06E030	TURBIDITY	NTU	20.8	J	HT>UCL
E180.1	BOR-2-BKG-006	06E030	TURBIDITY	NTU	24.7	J	HT>UCL
	NEEDLES MW-12-						
E180.1	BKG-006	06E021	TURBIDITY	NTU	1	UJ	HT>UCL

Method	NativeID	COC Number	Analyte	Units	Final Result	Validation Flag <sup>1</sup>	Validation Reason
E180.1	MW-95-BKG-006	06G007	TURBIDITY	NTU	1	R	HT>UCL
E180.1	TOPOCK-2-BKG-006	06G007	TURBIDITY	NTU	25.9	J	HT>UCL
SW6020A	MW-91-BKG-006	06E065	CHROMIUM, dissolved	MG/L	0.0163	J	LCS>UCL
SW6020A	MW-17-BKG-006	06E065	CHROMIUM, dissolved	MG/L	0.0158	J	LCS>UCL
SW6020A	MW-17-BKG-006	06E065	NICKEL, dissolved	MG/L	0.00223	J	LCS>UCL
SW6020A	MW-91-BKG-006	06E065	NICKEL, dissolved	MG/L	0.00208	J	LCS>UCL
SW6020A	TOPOCK-2-BKG-006	06G007	ZINC, dissolved	MG/L	0.0513	J	LCS>UCL
SW7199	PGE-09S-BKG-006	954490	Chromium, hexavalent	mg/L	0.001	U	ValAdj
SW7199	MW-92-BKG-006	954490	Chromium, hexavalent	mg/L	0.001	U	ValAdj

<sup>1</sup> This is the final qualifier flag for this analyte/method combination. If more than one flag was applied, this is the most conservative.

Validation Reasons:

CCB>RL = Continuing calibration blank concentration exceeds the RL

EB>RL = Equipment blank concentration greater than the RL

FD>RPD = Field duplicate exceeds RPD criteria

HT>UCL = Holding time exceeded

LCS>UCL = LCS recovery greater than upper control limit

ValAdj = Value reported by laboratory adjusted due to matrix issues