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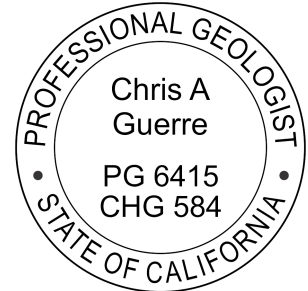
MEMORANDUM

TO: Aaron Yue
Senior Hazardous Substances Engineer
Project Manager
Geological Services Branch

FROM: Chris Guerre, PG, CHG
Senior Engineering Geologist
Geological Services Unit (GSU)

DATE: November 1, 2017

SUBJECT: RESPONSE TO PACIFIC GAS AND ELECTRIC COMPANY (PG&E)
COMMENTS ON WELL SALINITY STRATIFICATION
TECHNICAL MEMORANDUM DATED JULY 27, 2017
TOPOCK COMPRESSOR STATION SITE, NEEDLES, CALIFORNIA
(EPA ID NO. CAT080011729)



PCA 22120 SITE CODE 540015 WP 48

BACKGROUND

The GSU has reviewed PG&E's July 27, 2017 document titled "*Responses to California Department of Toxic Substance Control's March 13, 2017 Memorandum*" (RTC). The March 13, 2017 GSU comments identified concerns with groundwater salinity stratification occurring inside individual groundwater well casings and indicated that the GSU was uncertain why this water column stratification exists. Additionally, the GSU documented concern that the dissimilar water types contained within a well could potentially affect the representativeness of the sample obtained during routine sampling events.

The RTC discusses specific conductivity (SC) profile data for six floodplain wells and three upland wells and concluded that the stratification results from density-driven separation of lighter, lower conductivity water into the upper section of the well and heavier, higher conductivity water into the lower section of the well. The only other interpretation of the SC contrast in individual wells comes from PG&E's June 23, 2005 Technical Memorandum titled, "*Groundwater Elevation and Hydraulic Gradient Error Analysis, Interim Measures No. 2 Pacific Gas and Electric Company, Topock Project*" (2005 Tech Memo) which also illustrates distinct conductivity contrasts between the shallow and deeper portion of the water column inside individual well casings at the site. The 2005 Tech Memo stated that the

lower portion of the water column near the well screen was representative of the aquifer, while the upper portion of the well represented stagnant water that was not otherwise circulated during three volume (3V) purging and sampling events.

To complicate matters, a mixing protocol as described in the 2005 Tech Memo was established by PG&E for an undocumented amount of time in the past. This intentional mixing was done to homogenize the stratified water column within a well to assist in making salinity corrections to water level measurements.

GENERAL COMMENTS

- 1) Conclusions within the RTC regarding SC profiles are based on a small sample dataset that is currently insufficient in size to make a site wide assessment with great certainty. The RTC looked at data from a total of nine wells and made assumptions and recommendations based on data associated with those wells. As recommended in the RTC, more SC profile data should be collected. This should include a one-time assessment of all site wells, including all shallow wells. This should assist in testing and confirming the conceptual model currently developed from the assessment of the nine wells. A schedule for conducting this assessment should be prepared by PG&E. Additional testing will likely be requested or proposed after the one-time event depending on the results of that assessment. It is requested that the timing of the one-time event be scheduled so that the SC profiling: 1) is only conducted prior to any planned well activity (e.g., sampling, in-well maintenance, transducer replacement/maintenance) to ensure that the water column is minimally disturbed; and 2) allows for a sufficient time to elapse since the last intrusive event (e.g., at least one or two weeks after scheduled sampling with even longer times for tighter formations). Ideally, the SC profiling would be conducted just prior to well sampling activities so the SC data will be closely associated with the sampling event.
- 2) Existing SC profiles indicate that three to four zones of different SC waters can exist in the water column within one well. PG&E should assess if distinct SC zones are associated with site contamination. PG&E should prepare a brief, succinct work plan to sample discrete SC zones and have them tested for SC and the contaminants of concern (e.g., typically chromium, but also possibly nitrate, molybdenum or selenium). The work plan should be applied to those wells exhibiting significant SC stratification and documented contamination (e.g., well MW-34-100). For well MW-34-100, the GSU requests that the high conductivity sump (~ 110' bgs) and lower conductivity upper blank casing (~ 40' bgs) be sampled to assess any association between conductivity and contamination. To sequence this work, the GSU requests that the SC profile, with readings taken while the conductivity probe is being both lowered and raised, first be conducted before obtaining a discrete sample using a Snap Sampler, HydraSleeve, or similar device. A SC profile should be run immediately before deploying and after retrieving the discrete sampler to assess water column disturbance due to sampler movement (this step can be dropped if initial results show minimal disturbance). Then, the 3V and/or micropurge/minimal drawdown (MD) purge and sampling method would be used to collect the conventional regularly scheduled sample. The following wells should also be considered for sampling at this time: Well MW-31-135 at ~130' bgs and ~80' bgs;

MW-45-095a at ~93' bgs and ~50' bgs. More wells should be proposed for discrete sampling as SC data are collected site-wide.

- 3) For a handful of wells, a SC profiling study should be prepared and undertaken to study and confirm conductivity re-stratification/effects that apparently occur after well sampling. This should be done at several wells including those that use different sampling methods (3V and MD). SC profiling should be conducted immediately after sampling and then shortly after sampling (e.g., 1 to 2 days and/or 1 week after testing). This study should build upon tests conducted in Items 1 and 2 above. The study should evaluate if purging affects SC stratification. If conductivity stratification remains after 3V or MD sampling, then extra purging efforts should be conducted to see if the stratification can be removed from the well column. If needed, borehole flow testing could be utilized to confirm flow within the water column during purging to assess if stagnant conditions exist in the well due to buoyancy. Based on the existing SC profile data set, MW-34-100 is suggested for this study. Other wells should be added to the study as more SC profiles are obtained in the future. These wells should exhibit well developed conductivity stratification, be located at different areas across the site, and assess different site conditions.
- 4) Groundwater Sampling/Purge Logs were not available for review in connection with evaluation of the RTC. On a separate note, Sampling/Purge logs must be included in all future groundwater sampling reports.

PG&E should determine if Sampling/Purge logs indicate if SC varied in a manner during the purging process that would coincide with evacuation of stratified SC horizons from a particular well. This should be more closely evaluated for those wells exhibiting significant SC stratification. Finally, in the future, more attention should be placed in the field on evaluating purge stabilization parameters for those wells with significant SC stratification.

- 5) Based on the above studies to be conducted in the future, PG&E should update conclusions regarding effects/potential effects of salinity stratification on the representativeness of groundwater samples. The potential for stagnant water to collect in blank casing should be evaluated, especially as wells are converted from 3V to MD sampling methods. Perhaps the lighter, lower conductivity water remains buoyant and is never evacuated from a well during MD or even 3V purging. Potential for blank casing to leak and allow lower conductivity shallow aquifer water to enter the well water column should also be considered and ruled out.

SPECIFIC COMMENTS

- a) The years that the mixing protocol, as described in the 2005 Tech Memo, was implemented should be documented since the mixing protocol effects SC profiles and could alter interpretation of older data.
- b) Data presented in the 2005 Tech Memo was not cited or discussed in PG&E's RTC. The GSU previously requested that any documents related to this SC issue be provided to the GSU for review as well as any unpublished data and assessments.

PG&E was to indicate which wells have been profiled for SC in the past and which are known to have exhibited conductivity stratification. The RTC did not mention all wells with SC profile data (e.g., data for wells MW-34-80 and MW-42-65 documented in the 2005 Tech Memo) and, therefore, did not evaluate and comment on all available data. DTSC is again requesting PG&E to submit a list of all wells with any SC profile data pursuant to the 1996 Corrective Action Consent Agreement.

c) Comments on Attachment 1 SC Profiles

- i. MW-20-130: A SC deflection is absent at 130' for both 2006 profiles even though SC from sampling events indicate higher (13K) SC. Could this be due to the old mixing protocol or is it due to another issue? PG&E should also comment on similar effects noted with older data in MW-33-150 and MW-34-100.
- ii. CW-1D is screened in similar geology as OW-5D. PG&E should discuss why a SC deflection is not observed in CW-1D data.
- iii. The 2009 SC profile data does not match well with laboratory data on several wells (e.g., MW-34-100, OW-5M, OW-5D, CW-1D). PG&E should comment on this data discrepancy.

PG&E should address the requests noted in this memorandum.

The GSU notes that the comments and recommendations presented in this memorandum are facility specific and should not be applied to other projects without consultation with the Project Geologist. If you have any questions or comments please telephone me at (714) 484-5422, or e-mail me at christopher.guerre@dtsc.ca.gov.

Peer reviewed by: Jose Marcos, P.G.

cc: Alfredo Zanoria, C.E.G., CH.G

REFERENCES

CH2MHill, June 23, 2005. *Groundwater Elevation and Hydraulic Gradient Error Analysis, Interim Measures No. 2 PG&E Topock Compressor Station.*