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RESPONSE TO COMMENTS ON THE WORK PLAN AND ADDENDUM FOR HYDRAULIC TESTING IN BEDROCK WELLS, PACIFIC GAS AND ELECTRIC COMPANY (PG&E), TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

The Department of Toxic Substances Control (DTSC) has received your comments, dated December 21, 2006, regarding the November 10, 2006 Work Plan for Hydraulic Testing in Bedrock Wells and the December 19, 2006 Technical Addendum to the Work Plan. As a result of DTSC's review, we offer the following responses to you comments. DTSC reprinted each of your comments below in italics. Our response is provided immediately following the comment. In addition, we have numbered each of the specific comments for ease of reference. DTSC received comments from PG&E, dated February 23, 2007, responding to your comments as well. The PGE responses (also in italics) have been included following each DTSC response.

USGS Comment 1*: The U.S. Geological Survey (USGS) reviewed the work plan and addendum to work plan for hydraulic testing of bedrock wells at the Topock Compressor Station, Needles, California. It is unfortunate that the packer in PGE-8 will prevent well-bore videoing, geophysical logging, and well development. Inspection of the density and electric logs suggests that there are major fracture zones in the bedrock. Velocity logging and down-hole sampling would have been useful tools to delineate the fracture zones. The USGS has developed a combined well-bore flow and depth-dependent sample collection tool that might be able to be collect data through the packer (Izbicki and others, 1999 and Izbicki, 2004). The tool is suitable for wells having limited access and clearances as small as 1 inch.*

DTSC Response to Comment 1: DTSC is requiring that a smaller video camera be used to establish the condition of the well below 360 feet bgs. This may be completed after aquifer testing of PGE-8 to allay any concerns regarding the camera lodging and blocking the packer pipe. After the video is conducted and the condition of the screened interval is determined, the potential for flow logging and depth sampling will be evaluated again. At that time, DTSC will determine if PG&E should conduct surveys within well PGE-8 to evaluate vertical hydraulic gradients and conductive zones within the bedrock unit. DTSC encourages USGS input regarding sampling and logging of well PGE-8 once the video is completed.

PG&E Response to Comment 1: *The screened interval of PGE-8 is made up of alternating sections of screen and blank casing that were hung in the open borehole. There are no reliable records of the depth of the screened sections. Without a video log to confirm where the screens are, there is significant uncertainty about where to attempt flow logging. Unless the borehole has caved in behind the screen, water can flow freely in the open annular space between the screen and the borehole walls. Therefore, the location where water enters the borehole during pumping could be remote from the location of the conductive fractures, particularly if the screen is partially obstructed. Due to the unusual construction of this well, flow-logging results would be inconclusive at best for locating discrete zones of higher yielding fractures. Without a video log to evaluate the location and condition of the screened intervals, flow logging would likely not provide useful information.*

The geophysical contractor (Welenco), who provided the video log of the upper section of the well, attempted to access the 3" injection tubing that extends through the packer. However, the camera could not be manipulated to enter the tubing, which is not centered in the well bore. There would be similar problems trying to get the flow logging tool to thread through the injection tubing and a possible risk of damage to the tool when pulling it back if there are any sharp or jagged edges on bottom section of the injection tubing.

In summary, the presence of the packer and injection tubing in the well presents a significant obstacle to the installation and use of the flow logging tool. The construction of the well is likely to make the results of flow logging difficult to interpret. The USGS aquifer test analysis suggests that even at a conservative pumping rate of 10 gpm from PGE-8, water level response might be observed in nearby alluvial wells. Even if it were possible to obtain a reliable log of flow in the well, understanding the in-well flow patterns in PGE-8 would not be useful in interpreting the results of the aquifer test if drawdown is observed in alluvial wells. We are therefore not recommending the flow logging / depth-specific sampling option be incorporated into the currently planned scope of work at PGE-8.

USGS Comment 2*: The following comments are in response to the proposed hydraulic testing activities presented in Section 4:*

The permeability of potential fault zones should be tested with site-specific numerical models if production exceeds 5 gallons per minute (gpm) while pumping PGE-7 or PGE-8. The radius of investigation should exceed a few hundred feet. Aquifer-test results could be analyzed with permeable fault zones included in the analysis to test the likelihood and potential extent of these features (fig. 1).

DTSC Response to Comment 2: DTSC agrees that this could be a possible direction if production exceeds 5 gallons per minute at PGE-7 or PGE-8. DTSC's conditional approval of the workplan will require PG&E to consider this proposal and to provide a response to this comment. After DTSC receives PG&E's response, it will be forwarded to the USGS and relevant stakeholders. DTSC will determine, in consultation with the USGS, how to direct the aquifer analysis if this situation arises.

PG&E Response to Comment 2: No response was contained in PG&E's February 23, 2007 letter.

USGS Comment 3: *Nearby alluvial wells should be monitored in addition to bedrock wells during the PGE-7 and PGE-8 pumping tests. The leaky boundary response to pumping PGE-8 at 26 gpm during the 1969 aquifer test suggests that the alluvial aquifer is a permeable source of water relative to the bedrock. Lateral and vertical hydraulic conductivity of the bedrock can be quantified if water levels in the alluvial wells respond to pumping from the bedrock. Wells MW-38D, MW-38S, MW-24A, and MW-24B in addition to well MW-24BR should be monitored while pumping PGE-7. Wells MW-24B, MW-24BR, PGE-7, MW-38D, MW-38S, MW-09, and MW-10 should be monitored while pumping PGE-8.*

DTSC Response to Comment 3: The workplan lists several alluvial wells for monitoring the PGE-8 test including those recommend by the USGS. However, the workplan is less clear regarding observation wells for the PGE-7 test and DTSC has required that PG&E clarify which wells will be included. DTSC has required that well MW-24A be included as an observation well as requested by the USGS and PG&E's February 23, 2007 letter confirms that it will be added. DTSC has also requested that some or all of the shallow and mid-depth wells at wells PT-7, PT-8, and PT-9 (all yet to be installed as part of the Upland In situ Pilot Test) be utilized as observation wells.

PG&E Response to Comment 3: PG&E already had plans to monitor all of the above wells except MW-24A. MW-24A will be added to the list of monitoring wells equipped with pressure transducers for aquifer testing at PGE-7.

USGS Comment 4: Lateral and vertical hydraulic conductivity of the bedrock was estimated as 0.5 and 0.1 ft/d, respectively, by reinterpreting the 26-hour, Dames and Moore test of PGE-8 as a leaky aquifer response (fig. 2). Bedrock transmissivity of 100 ft^2/d was estimated. A range of specific storages between 0.3E-6 and 3E-6 1/ft were

assigned to multiple solutions which affected transmissivity estimates by less than 50 percent.

Potential drawdowns in wells MW-24B, MW-24BR, PGE-7, MW-38D, MW-38S, MW-09, and MW-10 during a three-day test of PGE-8 at 10 gpm (the minimum estimated pumping rate) were simulated with a radial, numerical model to determine if the estimated pumping rate and pumping period would sufficiently stress the aquifer system. Saturated alluvial and bedrock thicknesses of 110 and 310, respectively, were assigned. Alluvial aquifer and bedrock transmissivities of 1,000 and 100 ft²/d, respectively, were conserved by assigning lateral hydraulic conductivities of 10 and 0.3 ft/d. A vertical-to-horizontal anisotropy of 0.3 and a specific storage of 1.5E-6 1/ft were assigned to both aquifers. A specific yield of 0.1 was assigned to the alluvial aquifer. Results of this analysis suggest that the estimated pumping rate of 10 gpm for the three day pumping period will stress the aquifer enough that the response will be detected at wells MW24BR, PGE-07, MW-9, and MW-10; however, the response to pumping PGE-8 likely will not be detected in wells MW-38D, MW-38S, MW-24A, and MW24-B (fig. 3). Note, that pumping PGE-8 at a higher pumping rate will increase the response at the target wells. Pumping PGE-8 at the highest pumping rate possible would produce the best results.

DTSC Response to Comment 4: The comment is noted and DTSC understands that the highest possible pumping rate is desired. Also see PG&E's response below.

PG&E Response to Comment 4: *The remainder of the USGS comment letter presented modeling results and recommended pumping well PGE-8 at the greatest sustainable rate, consistent with the recommendations included in the workplan.*

DTSC hopes that you will find the responses to your comments valuable in your understanding of the proposed activities. If you have any questions or comments regarding this letter, please feel free to contact me at (714) 484-5439.

Sincerely,

Aaron Yue
Project Manager
Geology, Permitting and Corrective Action Branch

aky: 030706A

cc: PG&E CWG Members (via email)
Native American Indian Tribal Contacts – PG&E Topock Project