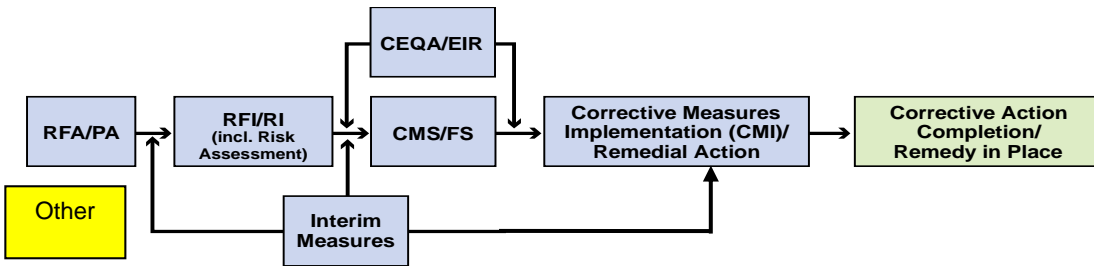


# Topock Project Executive Abstract

<p>Document Title: <i>Decommissioning Report for Topock Compressor Station Well Number 4 (TCS-4)</i></p> <p>Submitting Agency: DTSC, DOI</p> <p>Final Document? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>	<p>Date of Document: June 7, 2016</p> <p>Who Created this Document?: (i.e. PG&amp;E, DTSC, DOI, Other)</p> <p>PG&amp;E</p>
<p>Priority Status: <input checked="" type="checkbox"/> <b>HIGH</b> <input type="checkbox"/> <b>MED</b> <input type="checkbox"/> <b>LOW</b></p> <p>Is this time critical? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>	<p>Action Required:</p> <p><input checked="" type="checkbox"/> Information Only <input type="checkbox"/> Review &amp; Input</p>
<p>Type of Document:</p> <p><input type="checkbox"/> Draft <input type="checkbox"/> Report <input type="checkbox"/> Letter <input checked="" type="checkbox"/> Memo</p> <p><input type="checkbox"/> Other / Explain:</p>	<p><input type="checkbox"/> Other / Explain:</p>
<p>What does this information pertain to?</p> <p><input type="checkbox"/> Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)/Preliminary Assessment (PA)</p> <p><input type="checkbox"/> RCRA Facility Investigation (RFI)/Remedial Investigation (RI) (including Risk Assessment)</p> <p><input type="checkbox"/> Corrective Measures Study (CMS)/Feasibility Study (FS)</p> <p><input type="checkbox"/> Corrective Measures Implementation (CMI)/Remedial Action (RA)</p> <p><input type="checkbox"/> California Environmental Quality Act (CEQA)/Environmental Impact Report (EIR)</p> <p><input type="checkbox"/> Interim Measures</p> <p><input checked="" type="checkbox"/> Other / Explain: Well Decommissioning</p>	<p>Is this a Regulatory Requirement?</p> <p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If no, why is the document needed?</p>
<p>What is the consequence of NOT doing this item? What is the consequence of DOING this item?</p> <p>This technical memorandum is required to document well network maintenance activities that were conducted. Specifically, this work is associated with the decommissioning of an old well and to comply with California Well Standards.</p>	<p>Other Justification/s:</p> <p><input type="checkbox"/> Permit <input type="checkbox"/> Other / Explain:</p>
<p>Brief Summary of attached document:</p> <p>This technical memorandum (TM) documents well maintenance activities conducted for the well network associated with the Pacific Gas and Electric Company (PG&amp;E) Topock Compressor Station (TCS). Specifically, this report documents the decommissioning of an old water supply/waste injection well located west of the TCS, referred to as "Well Number 4" in previous PG&amp;E documentation and as "TCS-4" in this report (see Figure 1; figures are presented at the end of this TM). The activities documented in this report were conducted in accordance with the Decommissioning Plan for Topock Compressor Station Well Number 4 (TCS-4) (CH2M HILL Engineers [CH2M], 2015) (Work Plan). The Work Plan was prepared in accordance with the Standard Operating Procedure for Well and Borehole Decommissioning (Well-SOP-01), which was developed as part of the PG&amp;E Topock Remediation Project, Needles, California (Site) and was most recently submitted as part of the Basis of Design Report/Final (100%) Design Submittal for the Final Groundwater Remedy (CH2M HILL, 2014b). Well-SOP-01 is included as Attachment 1 to this report.</p> <p>Written by: Pacific Gas and Electric Company</p>	
<p>Recommendations:</p> <p>None.</p>	
<p>How is this information related to the Final Remedy or Regulatory Requirements:</p> <p>This technical memorandum is submitted for agency review in compliance with the Work Plan. The activities documented in this technical memorandum are associated with well decommissioning in compliance with the California Well Standards.</p>	
<p>Other requirements of this information?</p> <p>None.</p>	

Related Reports and Documents:

Click any boxes in the Regulatory Road Map (below) to be linked to the Documents Library on the DTSC Topock Web Site ([www.dtsc-topock.com](http://www.dtsc-topock.com)).



Legend

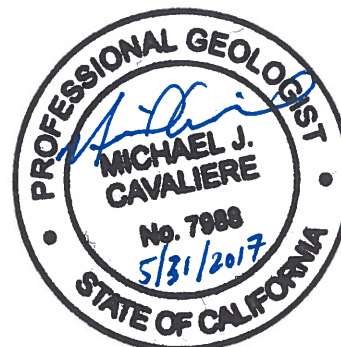
RFA/PA – RCRA Facility Assessment/Preliminary Assessment

RFI/RI – RCRA Facility Investigation/CERCLA Remedial Investigation (including Risk Assessment)

CMS/FS – RCRA Corrective Measure Study/CERCLA Feasibility Study

# Decommissioning Report for Topock Compressor Station Well Number 4 (TCS-4)

DOCUMENT ID: PGE20160607A  
PREPARED FOR: Pacific Gas and Electric Company  
COPY TO: Project File  
PREPARED BY: Mike Cavaliere, P.G.  
DATE: June 7, 2016



This technical memorandum (TM) documents well maintenance activities conducted for the well network associated with the Pacific Gas and Electric Company (PG&E) Topock Compressor Station (TCS). Specifically, this report documents the decommissioning of an old water supply/waste injection well located west of the TCS, referred to as "Well Number 4" in previous PG&E documentation and as "TCS-4" in this report (see Figure 1; figures are presented at the end of this TM). The activities documented in this report were conducted in accordance with the *Decommissioning Plan for Topock Compressor Station Well Number 4 (TCS-4)* (CH2M HILL Engineers [CH2M], 2015) (Work Plan). The Work Plan was prepared in accordance with the *Standard Operating Procedure for Well and Borehole Decommissioning* (Well-SOP-01), which was developed as part of the PG&E Topock Remediation Project, Needles, California (Site) and was most recently submitted as part of the *Basis of Design Report/Final (100%) Design Submittal for the Final Groundwater Remedy* (CH2M HILL, 2014b). Well-SOP-01 is included as Attachment 1 to this report.

As defined in the Work Plan and the SOP, a project-specific well decommissioning report will be submitted to the lead agencies no later than 90 days after completion of well decommissioning activities. TCS-4 decommissioning activities were initiated on February 24, 2016 and were completed on March 9, 2016. This report is organized into the following sections:

- 1.0 Work Approval Process: Summary of the work approval process completed prior to well decommissioning.
- 2.0 Well Commissioning Decision Protocol: Application of the Well Decommissioning Decision Protocol.
- 3.0 Work Performed: Summary of the details of the work performed and documentation of compliance with applicable permitting requirements.
- 4.0 Reporting: Summary of the reporting tasks associated with this work.
- 5.0 References: A list of the works cited in this report.

## 1.0 Work Approval Process

The Work Plan was initially submitted to the California Department of Toxic Substances Control (DTSC) and the United States Department of the Interior (DOI), which are the lead agencies, for review in July 2014. The United States Bureau of Land Management (BLM) provided the Work Plan to the Tribes for consultation in July 2014 and comments were received between September and November 2014. Resolutions to comments received from the agencies and Tribes were documented in the Response to Comments (RTCs) table attached to the Work Plan, which was discussed at the September 15, 2015

Technical Work Group (TWG) meeting. The final Work Plan, which was revised based on the RTCs and discussions held at the TWG meeting, was submitted to the lead agencies on December 4, 2015. DOI approval of, and DTSC concurrence with, the Work Plan was received by PG&E via email on December 15, 2015.

## 2.0 Well Decommissioning Decision Protocol

The well decommissioning decision making protocol is outlined in Well-SOP-01 (see Attachment 1) and was followed during the development and implementation of the Work Plan. The decision making process detailed in the Work Plan and associated field activities is summarized below and organized by “item,” which refers to the specific elements of the protocol flow chart (see Figure 1 in Well-SOP-01 [Attachment 1]). A detailed summary of the well decommissioning tasks conducted in the field (items 12 through 14) are presented in Section 3 of this TM.

- Item 3 – Well TCS-4 was located in the field through the implementation of a surface geophysical survey and associated potholing. This work was performed as part of the *Implementation Plan for Repair of Monitoring Wells MW-38S and MW-38D and Old Well/Pipe Reconnaissance* (CH2M HILL, 2011), which was approved by DTSC and DOI on February 24 and 25, 2011, respectively. As documented in Volume 1 of the *Addendum to the Final RCRA Facility Investigation/Remedial Investigation Report* (CH2M HILL, 2014a), the well was found to be buried below the existing ground surface, in poor condition, and not of use for groundwater remedy or monitoring (see Item 7).
- Item 4 – Approval to proceed with well decommissioning activities in accordance with the Work Plan was received from DOI on December 15, 2015.
- Item 5 – In preparation for well decommissioning activities, the following were reviewed: available well records including the PG&E document archives and the California Department of Water Resources (DWR) well database of well completion reports, California DWR established California Well Standards, and Well-SOP-01.
- Item 6 – Review of the materials listed above in Item 5 indicated that additional well condition data were required to determine the appropriate decommissioning method. Well construction details were not available in the PG&E document archives or the California DWR well database of well completion reports. In the absence of well construction details, it was determined that additional field work would need to be conducted to evaluate the construction and current condition of the well. This work was performed as part of *Implementation Plan for Repair of Monitoring Wells MW-38S and MW-38D and Old Well/Pipe Reconnaissance* (CH2M HILL, 2011), which was approved by DTSC and DOI on February 24 and 25, 2011, respectively.
- Item 7 – Additional well condition information was collected and key findings included the following:
  - An initial video survey of the well confirmed that the well was in-filled below a depth of 59 feet below ground surface (ft bgs), a depth shallower than the water table.
  - The well was opened to a total depth of 158 ft bgs using a rotosonic drill rig.
  - A second well video survey was performed, with the following key observations, also shown on Figure 2:
    - 5.5 ft bgs – 3-inch diameter steel wastewater pipeline was observed connecting to the side of the well casing
    - 49.5 ft bgs – hole in the casing
    - 69 ft bgs – water level, heavy corrosion observed in saturated portion of the casing
    - 76 to 127.5 ft bgs – Mills Knife perforations observed (assumed to continue to the total depth of the casing)

- 122.6 ft bgs – casing damaged (assumed from heavy corrosion)
- 127.5 ft bgs – obstruction or in-filling
- Soil and groundwater samples were collected from within the well and soil samples were collected from the excavation adjacent to the well head.
- Item 8 – Given the observed poor condition of the well and absence of documentation regarding the required annular seal around the well casing, it was determined that TCS-4 could not be decommissioned in place (without modification).
- Item 9 – Based on the level of disturbance that would be required to over-drill and remove the 10-inch diameter well casing, it was determined that TCS-4 should not be decommissioned by removing the well materials.
- Item 11 – Given the condition and size of TCS-4, it was determined that the well should be decommissioned in place with modification. The lead agencies stated that it was acceptable to decommission the well in place as long as the well casing was perforated at 75, 50, and 25 feet bgs to allow grout sealing material into the annular space around the casing at multiple depths, thereby ensuring that the well bore would not provide a conduit for infiltrating fluids from the ground surface to the aquifer.
- Items 12 through 14 cover the implementation of the decommissioning procedures in the field, which is detailed in Section 3.
- Item 15 – This report documents all activities associated with the decommissioning of TCS-4.

### 3.0 Work Performed

The work performed to decommission TCS-4 included well head modification (including the collection of opportunistic soil samples), perforation of the casing, and the placement of grout sealing material. Pre-construction biological and cultural resource surveys were conducted in accordance with the Work Plan. Two separate project initiation meetings were held at the site. The first was held on February 25, 2016 prior to the implementation of well head modification tasks, and the second on March 1, 2016 at the time of drill rig mobilization for in-well decommissioning tasks. Qualified field monitors for biological and cultural resources were on site during all site activities, and Tribal monitors were also on site to observe the work.

Photographs of key stages of Work Plan implementation are provided in Attachment 2 and referenced in the subsections below.

#### 3.1 Well Modification

External modifications to the well head and internal modifications to the well casing were performed to facilitate well decommissioning. Prior to implementing these modifications, the above-ground rock gabions that were placed to protect the well head from surface flow in Bat Cave Wash were removed (see Photos 1 and 2).

Excavation around the TCS-4 well was conducted to modify the well head for decommissioning. The dimensions of the initial excavation, which were determined to allow for proper sloping of the excavation side walls to permit entrance by workers, were approximately 12 feet long (north-south) by 20 feet wide (east-west) and up to 7 feet deep. Once the well head was exposed the following external modifications were made to facilitate well decommissioning and ensure that fluids did not exit the well casing during the process:

- The temporary PVC well casing extension, which brought the well casing up to the existing ground surface, was removed and replaced with a steel extension (see Photos 2, 3A, and 3B).

- A 5-foot-long section of the 3-inch diameter steel injection pipe, which connected into the side of the TCS-4 well casing, was removed such that a 0.5-foot stub remained attached to the well casing. Both ends of the injection pipe where the section was removed were then capped by welding steel end plates in place (see Photos 3A and 3B).

At the direction of DTSC in the field, six opportunistic soil samples were collected from the excavation at the following locations:

- 5 feet N20°W of the TCS-4 well head at depths of 5 and 6 ft bgs – TCS4-N-05, TCS4-N-06
- 7 feet due south of the TCS-4 well head at depths of 5 and 6 ft bgs – TCS4-S-05, TCS4-S-06
- 14 feet N80°E of the TCS-4 well head at depths of 5 and 6 ft bgs – TCS4-E-05, TCS4-E-06

These samples were analyzed for the full AOC-1/SWMU-1 analytical suite, which includes the following chemicals of potential concern (COPCs): hexavalent chromium, Title 22 metals, PAHs, PCBs, pesticides, and dioxins/furans. In addition, due to the potential for the pipe wrap material on the injection pipe to contain asbestos, these samples were also analyzed for asbestos. The results of laboratory analysis of these samples will be evaluated as part of the ongoing Topock Soil RFI/RI project.

Following external well head modifications and opportunistic soil sample collection, the excavation was backfilled using the same material that was excavated so the drill rig could set up on the well. With the drill rig in place, internal modification of the well was conducted by perforating the casing with a Mills Knife at three depths: 15 to 20 ft bgs, 35 to 40 ft bgs, and 51 to 54 ft bgs. The Work Plan indicated that the perforations would be installed at 25, 50, and 75 feet bgs; however, the actual depths were selected based on the driller's assessment of the condition of the well casing from the video surveys. These alternate depths were chosen to avoid potential complications with perforating already compromised sections of the casing. The modified depths were approved by DTSC in the field prior to implementation.

Subsequent to perforation, the accessible total depth of the well was confirmed at approximately 130 ft bgs, which is consistent with previous measurements. The core barrel of the roto sonic drill rig was then used to remove the blockage, which was determined to be a bridge of material within the well casing and not infill from the bottom of the well. The well was then opened to total depth of 158 ft bgs. The volume of infill material removed from the well casing was approximately 20-30 gallons, and was all fine-grained (largely saturated silt and sand with no gravel recovered).

### 3.2 Placement of Sealing Material

With the roto sonic drill casing placed approximately 1 foot from the bottom of the well (approximately 157 ft bgs), the sealing material was placed within the well casing. The sealing material was chosen, as described in the Work Plan, to be neat cement composed of Type II/V Portland cement with up to 6 percent bentonite powder. The sealing material was placed through the drill casing as a tremie pipe. As lifts of sealing material were added, the depth of the drill casing was raised until the material level was above the water table. Once the level of the sealing material was above the water table, additional material was added from the surface. Based on a calculation of the estimated volume of the primary well casing, the minimum volume of sealing material that was required to fill the well casing alone was calculated to be approximately 700 gallons.<sup>1</sup> A total of 800 gallons of sealing material was used. The 14 percent overage in required volume was due to seepage of sealing material out of the well casing through existing holes and perforations that were installed in the casing. Groundwater that was displaced by the placement of the sealing material seeped out of the vadose zone well casing perforations and no water was displaced out of the top of the well during seal placement.

<sup>1</sup> It should be noted that the calculated estimated minimum volume of sealing material included in the Work Plan (2,500 gallons) was incorrect. The calculation used in development of the Work Plan was reviewed and it was determined that the error was associated with the unit of length used for the well casing diameter (inches were used instead of feet).

### 3.3 Decommissioning of the Well Head

The well head was decommissioned in accordance with regulatory and project-specific guidance such that the resulting surface condition does not present a physical hazard to humans or animals. After the sealing material was placed, the well head was decommissioned by re-excavating around the well to a depth of approximately 7 ft bgs to expose the 3-inch diameter steel pipe stub. The well casing was cut at approximately 5 ft bgs. The remnants of the concrete pad were removed. A 24-inch diameter cardboard form was used to place the “mushroom cap” (see Photo 4). The mushroom cap is composed of neat cement grout that extends beyond the diameter of the conductor casing and 3-inch pipe stub so that fluids drain away from the well. Once the mushroom cap cured, the excavation was backfilled using the same material that was excavated and the work area was restored using rakes and the application of water to minimize visual evidence of the work area (see Photo 5). A diagram containing details of the well as decommissioned is provided in Figure 1.

Following all decommissioning tasks, the equipment decontamination was conducted on the existing decontamination pad at the Transwestern Bench. Incidental trash was collected in the work area and disposed of in the existing dumpster at the Transwestern Bench for appropriate disposal.

### 3.4 Waste Management

Investigation-derived wastes (IDW) were primarily liquids associated with decontamination of the drilling and sampling equipment. As mentioned above, a minimal volume of soil material was removed from the well and no fluids were displaced out of the well during the decommissioning process. All IDW was containerized in the work area and stored at the existing decontamination pad located at the Transwestern Bench for characterization.

The minimal amount of soil that was generated was added to a bin that contained visually impacted soils and debris generated during the Topock soil investigation, which was being conducted in parallel with this work. This bin was characterized for the full list of AOC-1/SWMU-1 COPCs (hexavalent chromium, Title 22 metals, PAHs, PCBs, pesticides, and dioxins/furans) plus total petroleum hydrocarbons, and based on the analytical results, was disposed of as hazardous waste at US Ecology Landfill in Beatty, Nevada. IDW liquids (approximately 50 gallons of water generated during drill casing decontamination) were processed at the IM-3 treatment plant.

## 4.0 Reporting

This technical memorandum provides complete documentation of the implementation of the Work Plan, and is being provided to the lead agencies within 90 days of the completion of field work in compliance with Well-SOP-01. In addition, the following steps have been taken to document this work:

- The Topock Well Inventory has been updated to reflect the decommissioning status of this well. This inventory is located on the DTSC project website ([www.dtsc-topock.com](http://www.dtsc-topock.com)), by clicking on the “Documents” tab and selecting the “Borehole Logs and Well Construction Documents” link.
- A record of well decommissioning has been filed with the California Department of Water Resources, San Bernardino County, and the U.S. Environmental Protection Agency Region 9 Underground Injection Control (UIC) Program. Forms associated with these filings are included in Attachment 3.

## 5.0 References

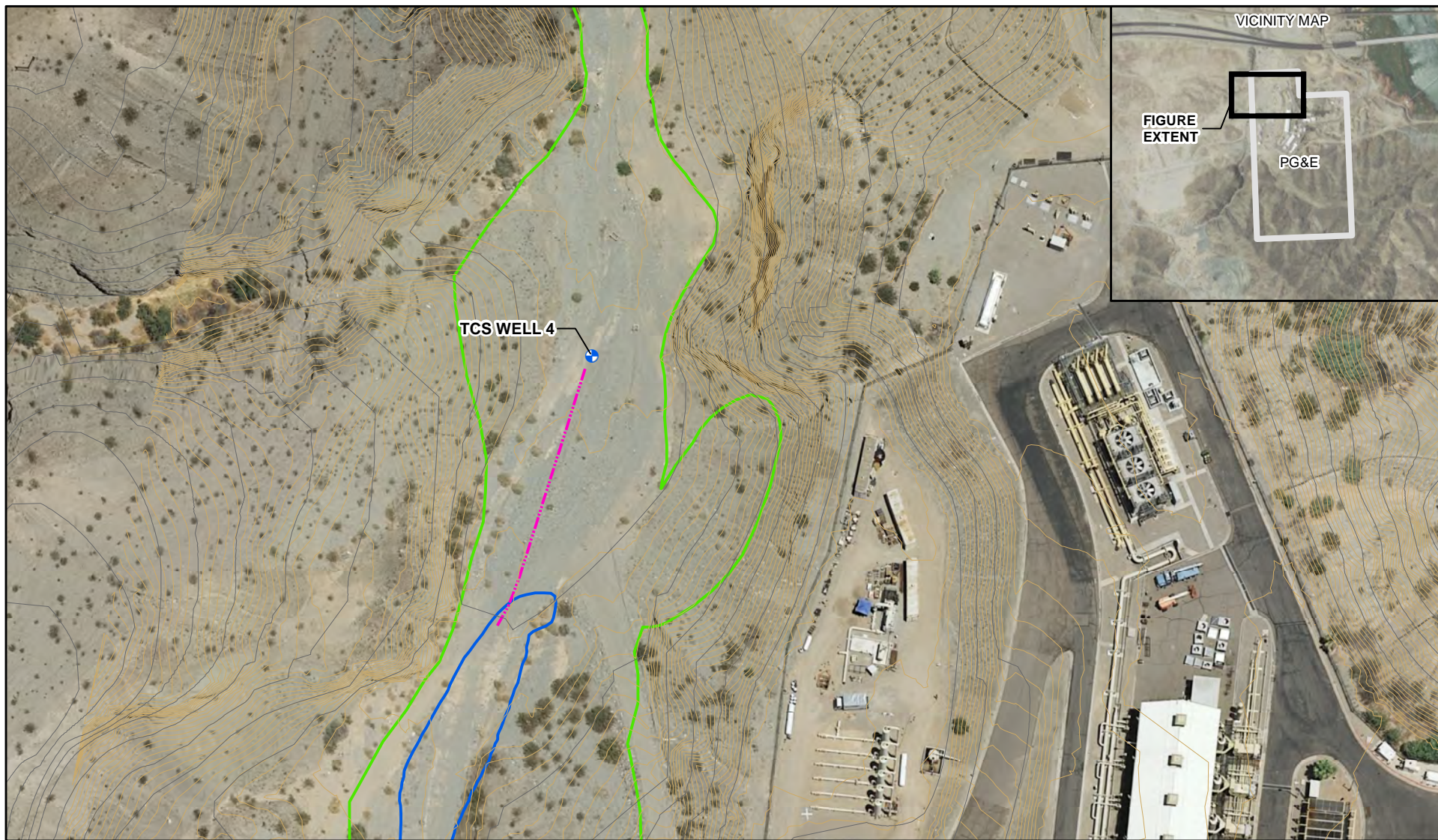
CH2M HILL Engineers. (CH2M). 2011. *Implementation Plan for Repair of Monitoring Wells MW-38S and MW-38D and Old Well/Pipe Reconnaissance*.

CH2M HILL Engineers. (CH2M). 2014a. *Addendum to the Final RCRA Facility Investigation/Remedial Investigation Report, Volume 1, Topock Compressor Station, Needles, California*. May 30.







CH2M HILL Engineers. (CH2M). 2014b. *Basis of Design Report/Final (100%) Design Submittal for the Final Groundwater Remedy*. November 18.

CH2M HILL Engineers (CH2M). 2015. *Decommissioning Plan for Topock Compressor Station Well Number 4 (TCS-4)*. December 4.



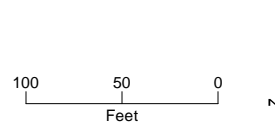


#### LEGEND

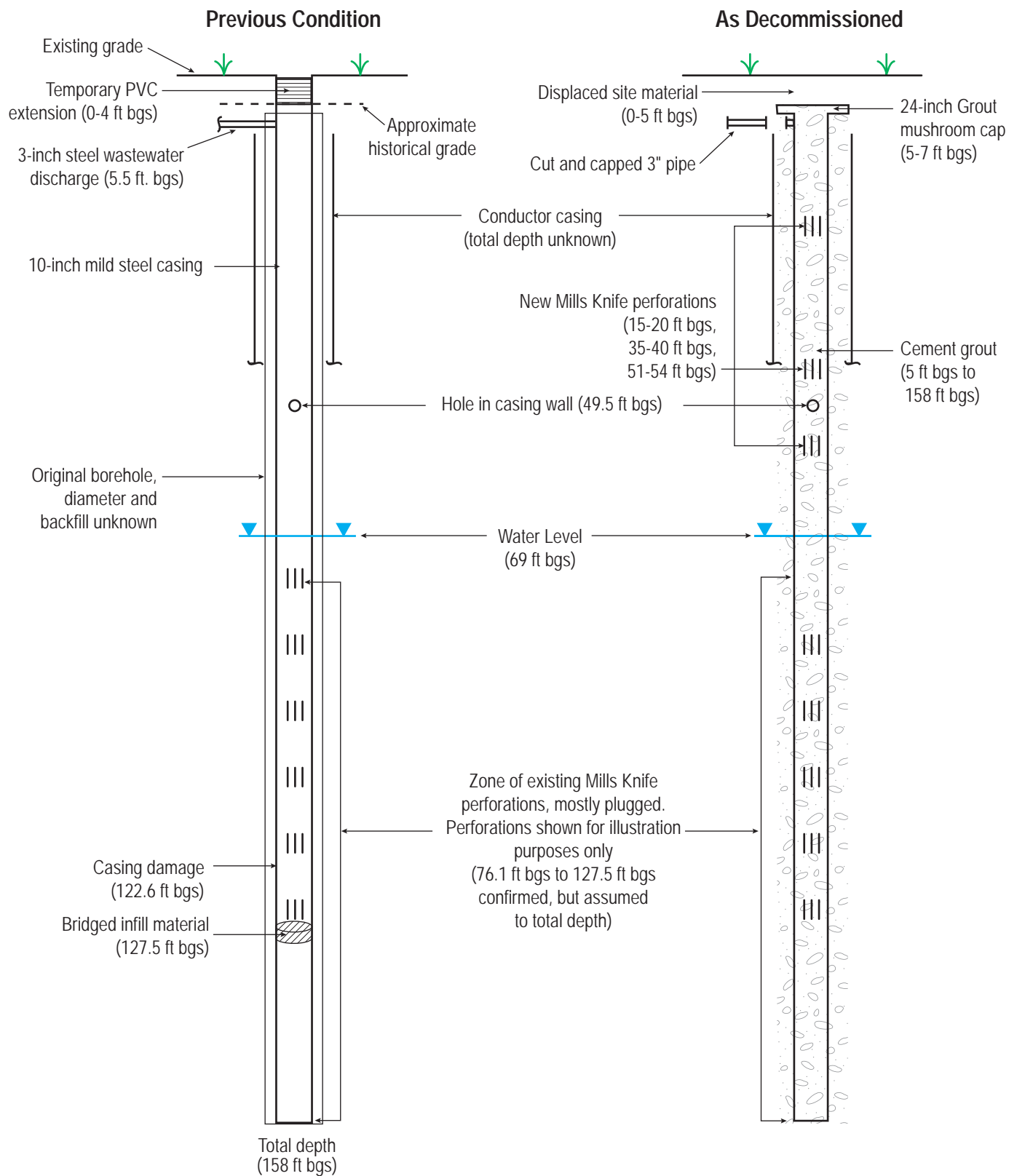
-  DECOMMISSIONED WELL LOCATION
-  ESTIMATED PIPELINE LOCATION<sup>1</sup>
-  TOPOGRAPHIC CONTOUR (10-FOOT INTERVAL)
-  TOPOGRAPHIC CONTOUR (2-FOOT INTERVAL)
-  AOC 1 BOUNDARY
-  SWMU 1 BOUNDARY

#### NOTES:

- <sup>1</sup>ESTIMATE LOCATION OF BURIED 3-INCH DIAMETER STEEL PIPE
- ESTIMATED VIA GEOPHYSICAL SURVEY PERFORMED ON APRIL 2, 3, AND 4, 2013



**FIGURE 1**  
**DECOMMISSIONED WELL**  
**TCS-4 LOCATION MAP**  
 DECOMMISSIONING REPORT FOR  
 TCS WELL NUMBER 4 (TCS-4)  
 PG&E TOPOCK COMPRESSOR STATION  
 NEEDLES, CALIFORNIA



#### Notes

ft bgs = foot below ground surface

All depths relative to existing ground surface.

Drawings are not to scale.

**FIGURE 2**  
**TCS-4 WELL SCHEMATIC**  
 DECOMMISSIONING REPORT FOR  
 TCS WELL NUMBER 4 (TCS-4)  
 PG&E TOPOCK COMPRESSOR STATION  
 NEEDLES, CALIFORNIA

Attachment 1  
Standard Operating Procedure  
Well-SOP-01



## Well-SOP-01 Rev. 0

# Standard Operating Procedure for Well and Borehole Permanent Decommissioning

PREPARED FOR: Topock Groundwater Remediation Project  
COPY TO: Project File  
PREPARED BY: Pacific Gas & Electric Company  
DATE: August 27, 2014

This document defines the standard operating procedures (SOP) for decommissioning groundwater wells and boreholes associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project, Needles, California (Site). This document was developed, in part, as a direct result of Tribal concerns that included dialog regarding future decommissioning activities at the site between PG&E, agencies, and Native American Indian Tribes (Tribes). PG&E acknowledges that the Topock Remediation Project is an area that is culturally important to the Tribes and that the activities, materials, and procedures used in this process are of specific interest. Tribes have raised concerns with drilling intrusions, well and borehole decommissioning, emplacement of foreign materials into the earth, and retention of soils displaced as a result of drilling. Based on Tribal input, the potential for use of displaced site material in the decommissioning process, which may require a variance with the applicable permitting agency, is included in this document (Section 2.2.3).

An initial draft of this SOP was submitted for review and comment by the agencies and Tribes. The comments received, PG&E responses to these comments, as well as the conclusions of discussion during a June 6, 2014 conference call regarding the PG&E responses to comments are documented in Attachment A.

This SOP will be used as a reference to guide the development of future work plans required for agency, Tribal, and stakeholder review prior to conducting all well and borehole decommissioning tasks associated with the groundwater remedy. For the purpose of this SOP, an exploratory borehole (borehole) is defined as a drilled borehole in which no casings have been installed, regardless of whether or not the borehole was drilled to the water table. However, California boreholes drilled to the water table must be decommissioned per water well standards. The technical procedures included in this SOP are based on applicable regulatory and project-specific guidance information; however, specific work plans for well decommissioning tasks are necessary to evaluate task-specific details and ensure overall compliance. The structure of the SOP has been developed to provide adequate flexibility such that it can be applied to different well types and sizes in a variety of environmental settings. Specifically, this SOP provides a summary of the following key criteria that must be considered when developing a scope of work to decommission a well or exploratory borehole:

- Regulatory information and project-specific resources
- General technical specifications and procedures used for well or borehole decommissioning
- Evaluation of the well or borehole decommissioning scenarios

## 1.0 Summary of Guidance Information

Multiple sources of guidance information must be considered prior to conducting well or borehole decommissioning activities. Groundwater wells at the Site are located in the states of California and Arizona. Both states regulate the minimum specifications and procedures for the decommissioning of groundwater monitoring and supply wells to protect the quality of groundwater. Further, project-specific documents provide additional guidance related to sensitive cultural and biological resources. A summary of key regulatory information (project-specific applicable or relevant and appropriate [ARAR] numbers are provided) and project-specific resource documents associated with conducting groundwater well or borehole decommissioning activities is provided in the following subsections.

## 1.1 Regulatory Information – California (ARAR #98)

Statewide minimum standards for decommissioning a groundwater well in the State of California were established by the California Department of Water Resources (DWR) in the California Well Standards. The California Well Standards were originally established in Bulletin 74 (February 1968), later re-written as Bulletin 74-81 (December 1981), and later supplemented by Bulletin 74-90 (June 1991). The DWR states that the California Well Standards may not be sufficient for local conditions and local permitting agencies may need to adopt more stringent standards to ensure groundwater quality protection. However, The County of San Bernardino is the local permitting agency for Site wells located in California and have adopted the DWR standards.

The California Well Standards identify well destruction (or decommissioning for this SOP) requirements for both water supply wells (Part III of Bulletin 74-81), and monitoring wells and exploratory boreholes<sup>1</sup> (Part III of Bulletin 74-90). Although San Bernardino County does not require permits for the decommissioning of boreholes that do not reach the water table, DTSC has stated that they may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances. For example, a borehole that terminates within 10 to 20 feet the water table and is located in an area where the potential for infiltration (e.g., wash channels) or future spills (e.g., an area of active industrial operations) is greater. The general requirements for both well types are similar; however, special considerations for monitoring wells and exploratory boreholes address the potential for these well types to be in areas of known or potential pollution or contamination.

## 1.2 Regulatory Information – Arizona (ARARs #48 and #49)

Development of rules for adopting standards for the construction and abandonment (or decommissioning for this SOP) of a groundwater well in the State of Arizona are required under Arizona Revised Statute 45-594(A). In response to the statute, the Arizona Department of Water Resources (ADWR), adopted the Well Abandonment Rule. The Well Abandonment Rule as Arizona Administrative Code (A.A.C) R12-15-816 was originally established on March 5, 1984. An amendment to the rule was effected on June 18, 1990. The Well Abandonment Rule requires that the abandonment (decommissioning) of a well be accomplished through filling or sealing the well so as to prevent the well from allowing the vertical movement of water. The rule contained general guidance for the decommissioning process, but lacked specific information regarding applicable aquifer conditions, and for the depths, types of materials and methods for the well decommissioning. ADWR provided additional written guidance for well abandonment to comply with A.A.C. R12-15-816(G) in the Well Abandonment Handbook on October 3, 2008.

The Well Abandonment Handbook (WAH) provides a standard well decommissioning method to be used for the post-installation of any well or borehole, regardless of the aquifer or vadose zone conditions applicable to the well (Section IV A). In addition, the WAH details five alternative abandonment methods. The five alternatives are for specific vadose zone and aquifer conditions which may include contamination, single or multiple aquifers, or dry wells (Section IV B). For example, Alternative 4, which applies to wells that only penetrate a single aquifer without vertical flow components and no water quality contamination issues, might be applicable to wells in the Topock area that are 8-inches or greater in diameter. A variance option to Alternative 4 permits the use of clean fine sand to fill the well being decommissioned.

Legal authorization from the ADWR is required to decommission most types of wells in the State of Arizona. ADWR requires a statewide decommissioning form to be filed and reviewed prior to decommissioning. The notice of intention to abandon a well (NOIA) can be obtained from the ADWR Groundwater Management Support Section in Phoenix or other local offices. In addition, all forms are available online at <http://www.azwater.gov/azdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm>. The permit must be signed and filed by the well owner. The information on the NOIA must include a well construction diagram with proposed decommissioning specifications; casing type, description of the proposed method of decommissioning (over-drilling, jacking, perforation, etc.); a description of the method of emplacing sealing or fill materials; and the specific type and estimated amount of grout material to be used (water-cement ratio, water-

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<sup>1</sup> San Bernardino County does not require permits for the installation or decommissioning of boreholes that do not reach the water table.

bentonite ratio and/or other materials or additives used). ADWR performs a completeness and substantive review of the NOIA to determine whether the proposed abandonment methods and materials meet the requirements of the ADWR abandonment rule in R12-15-816(G). If an alternative method of decommissioning is proposed in lieu of the standard method, further substantive review is performed by ADWR to verify that the proposed methods apply, and whether appropriate fill materials were chosen. A proposal to use an alternative decommissioning method requires an application to ADWR for a variance from the well decommissioning rule (a deviation from the standard decommissioning method). Following ADWR confirmation that the proposed well decommissioning methods and materials meet the requirements of the rule, a well decommissioning authorization card is mailed to the designated well drilling contractor and well decommissioning operations may begin.

### 1.3 Project-specific Resources

In addition to regulatory guidance, project specific requirements or information must be considered prior to initiating well decommissioning activities. The following is a list of documents that may be applicable:

- **Topock Well Inventory Data Package** – Inventory of wells related to the Topock Remediation Project for reference when developing specific plans for well decommissioning. This data package includes a technical memorandum, well location map, and a searchable spreadsheet of well details. As requested by DTSC, the well inventory spreadsheet (electronic file) and available well logs associated with the Topock Project will be archived on the DTSC website. This archive will be updated periodically as additional wells and boreholes are installed.
- **Environmental Impact Report (EIR) Mitigation Measures Reporting Program (MMRP)** – This document details specific compliance criteria that must be considered before, during, and after implementation of well decommissioning activities.
- **Management Protocol for Handling and Disposition of Displaced Site Material** – This document identifies the general approach and management protocols required for the handling and disposition of soil and/or rock that is displaced as a result of activities associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project. The use of displaced site material for use in the well decommissioning process is discussed in Section 2.2.3.
- **Special Handling for Clay Material Encountered During Drilling** – As requested by the Hualapai Department of Cultural Resources, special handling procedures for drill cuttings generated from clay beds will be used in the field (this does not include clay-containing sediment mixtures, only clay beds). If clay bed(s) are encountered during drilling, then the cutting from those interval(s) will be set aside on 100% cotton muslin (dye free) for future disposition, following discussions with the Tribes. PG&E will notify the agencies and Tribes in the event clay material is encountered and separated for storage.
- **Previous Well Decommissioning Work Plans** –
  - Well PGE-6 Revised Decommissioning Work Plan (November 10, 2006).
  - Final Revised Implementation Plan for Repair of Monitoring Wells MW-38S and MW-38D and Old Well/Pipe Reconnaissance (February 11, 2011).
- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Permit Exemption** – Per the November 16, 2007 Memorandum from the United States Department of the Interior, remedial actions including well decommissioning are exempt from the federal, state, and local permitting process. Since the issuance of this memorandum, the applicability of this exemption has been confirmed with the County of San Bernardino, California in February 2008 and January 2011. However, the County of San Bernardino will need to be consulted in the event a variance to the California Well Standards is required. The applicability of this exemption has not been confirmed with the State of Arizona. Regardless of the permit exemption, all work plans for decommissioning activities will be reviewed and approved by the appropriate state and federal agencies prior to implementation.

## 1.4 General Technical Resources

In addition to regulatory guidance and project specific information various technical resources should be considered during the development of a work plan for well or borehole decommissioning. The following is a list of documents that may be useful:

- Monitoring Well Design and Construction for Hydrogeologic Characterization. Guidance Manual for Ground Water Investigations. July 1995. State of California, Environmental Protection Agency.
- ASTM Standard D5299-99 (2005), "Standard Guidance for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities", ASTM International, West Conshohocken, PA, 2005, [www.astm.org](http://www.astm.org).
- ASTM Standard C150/C150M-12, "Standard Specification for Portland Cement", ASTM International, West Conshohocken, PA, 2012, [www.astm.org](http://www.astm.org).
- ASTM Standard D4380-84 (2006), "Standard Test Method for Density of Bentonitic Slurries", ASTM International, West Conshohocken, PA, 2012, [www.astm.org](http://www.astm.org).

## 2.0 General Technical Specifications and Procedures for Decommissioning Wells and Exploratory Boreholes

Monitoring wells or exploratory boreholes that are no longer useful must be properly decommissioned to ensure the quality of groundwater is protected and eliminate a possible physical hazard to humans and animals. Notification or permitting requirements should be evaluated prior to the initiation of well decommissioning activities in the field. Involved oversight agencies will be notified in advance of any decommissioning activities to ensure concurrence with decommissioning of a particular well(s). The general process for decommissioning a well at the Topock site is presented on Figure 1, Well Decommissioning Decision Protocol. The information provided in this section is intended to be applicable for wells or boreholes located in either California or Arizona; however, it is assumed that the details included in the specific work plan(s) will be designed in compliance with the appropriate state regulations, and reviewed by the appropriate permitting agency. In addition, depending on the condition of the aquifer and well(s) subject to decommissioning, potentially applicable variance options that include the minimization of the placement of sealing material should be evaluated with the lead agencies during well decommission work plan development (e.g., Arizona Alternative 4 – variance option). A discussion of the primary steps identified in this protocol, including the potential materials and methods required for each, is presented in the following subsections.

### 2.1 Evaluation of Well or Borehole

Key well or borehole information should be assembled and reviewed prior to initiating decommissioning activities to determine lithologic and well construction details, the current condition of the well or borehole, soil and water quality information, applicable regulatory criteria, and identification of the procedures and materials that should be used. The majority of this information will be available through review of drilling and well installation information, the Topock Well Inventory, groundwater sample collection logs, or other related documents. The Topock Well Inventory can be found online at: [http://dtsc-topock.com/sites/default/files/Topock-Well-Inventory\\_Tech-Memo.pdf](http://dtsc-topock.com/sites/default/files/Topock-Well-Inventory_Tech-Memo.pdf). However, it is possible that additional survey of the given well or borehole will be required to obtain all key information. The following is a list of survey techniques that may be utilized to evaluate the condition of well or borehole (list is not intended to be all-inclusive):

- Well measurement – Evaluation of the depth to the bottom of, or the depth to water within, a well or borehole. This is typically accomplished using a graduated measuring tape with a water sensor or blunt weight at the end.
- Video survey – An in-well video camera can be used to evaluate the condition of the well casing and screen, and identify obstructions. In-well cameras are typically calibrated for depth and orientation (i.e. north, south, east and west), and deployed on a cable using a winch.

- Geophysical survey – Depending on the well casing type, depth to water, potential presence of metallic centralizers or other well construction components, and other variables, select geophysical survey tools may be useful. Similar to an in-well camera, in-well geophysical tools are deployed on a cable using a winch. While not a complete list, examples of geophysical tools that may be useful include:
  - Acoustic (Cement Bond Log) – Used to determine the quality of cement bonding in cased or sealed wells.
  - Gamma – Used to determine intervals of bentonite seals and gravel pack.
  - Caliper – Used to verify diameter of the well or borehole, which is used to calculate borehole and well casing volumes, and identifies obstructions or areas of borehole washout or constriction.
  - Casing Inspection Thickness Measurement (CITM) – An in well survey that uses electromagnetic waves to measure well casing wall thickness in carbon based steels. Survey can be used to understand or measure the integrity of the well casing.

## 2.2 Identification of Materials and Placement Requirements

Different types of materials are required for different well or borehole decommissioning scenarios depending on above-ground, and subsurface environment. Sealing materials are required when the potential for flow of water through the material must be kept to an absolute minimum such that the volume of water and possible pollutants and contaminants passing through them will be of minimal consequence (no material is completely impervious). Filler material is permitted for use under some circumstances when the flow of water through the material is not of critical concern. Potential materials suitable for use during well and borehole decommissioning at the Topock site and associated placement requirements are listed in the following subsections.

### 2.2.1 Sealing Material

Conventional sealing activities are performed with the objective of completely filling the borehole or well casing, voids in the formation in the vicinity of the borehole, and if not over-drilled, the gravel pack and annular spaces. Sealing materials are required for use when decommissioning wells and boreholes regardless of whether they are located in an area of known or potential pollution or contamination. In uncontaminated areas where the well is wholly situated in unconsolidated material in an unconfined groundwater zone, the sealing material is focused in the upper 20 feet of the well or borehole to prevent the infiltration of potential surface contamination. In areas of known or potential soil or groundwater contamination, sealing material is required throughout the entirety of the well or borehole. The following is a list of sealing materials that may be used at the Topock site:

- Neat cement – Composed entirely of Type II/V Portland cement grout with up to 6% bentonite powder.
- Sand-cement grout – Composed of Portland cement with no more than two parts sand to one part cement by weight of sand.
- Concrete – Composed of Portland cement and aggregated mixed at a ratio of at least 564 lbs. of cement per cubic yard of aggregate. Aggregate used must be smaller than 1/5 of the radial thickness of the annular seal and is typically reserved for large volume/diameter borehole or well decommissioning.
- Bentonite clay – Composed of commercially prepared, powdered, granulated, pelletized, or chipped/crushed sodium montmorillonite clay with the largest dimension of pellet or chip being less than 1/5 the radial thickness of the annular seal. Bentonite cannot be used as a sealing material opposite zones of fractured rock, unless otherwise approved by lead agencies. As bentonite seals may have a tendency to dry, shrink and crack in arid and semi-arid areas where subsurface moisture levels can be low, they are not recommended for sealing the vadose zone at the Topock site. In addition, bentonite is not recommended for application in high TDS environments (e.g., >5,000 parts per million) due to the adverse effects on its ability to properly swell and seal in these conditions.

According to Arizona and California Well Standards, drilling mud or cuttings are not acceptable sealing materials.

Water used for the preparation of sealing materials should be potable, compatible with the type of sealing material used and free of contaminants and suspended matter. All manufacturers' specifications for mixture



volumes and curing times must be strictly followed (typically, ASTM C150, Standard Specification for Portland cement). Further, the use of any additives must comply with the requirements of ASTM C494 (Standard Specification for Chemical Admixtures for Concrete).

Sealing material must be placed into a well or borehole at the required interval(s) in one continuous decommissioning operation, which may include multiple lifts of sealant, using methods that prevent the free-fall, dilution, and/or separation of aggregates from the cementing materials. Typically, fluid sealing material is placed using a tremie pipe with positive displacement pumping (pumped under pressure), beginning at the bottom of the sealed interval with the end of the tremie pipe submerged two feet or more below the surface of the grout during placement. When using a tremie pipe, if sealing material is placed throughout the well or borehole, static water is either displaced out of the top by the injected column of sealing material, or into the formation (applicable SOPs for waste management/spill containment will followed). Alternatively, fluid sealing material may need to be pumped into the well under pressure, using the well casing as the conduit. In this case the static water and the sealing material are forced into the voids of the well/borehole and formation. When fluid sealing material is placed under pressure, the pressure must be maintained long enough for the sealing material to cure, as applicable. Dry sealing material, such as bentonite chips or pellets, are typically placed by using a tremie pipe or the well casing as a conduit. Dry sealing materials require water for hydration and proper sealing. Regardless of sealing material type or placement method, verification shall be made that the volume of the material placed in the well or borehole is at least equal to the calculated volume of void space to be sealed.

### **2.2.2 Filler Material**

Filler materials are permitted for use in select portions of the decommissioned well or borehole when located in uncontaminated areas. Suitable filler materials include clay, silt, sand, gravel, crushed stone, native soils, mixtures of the aforementioned types, as well as sealing materials defined above. However, materials containing organic matter are not acceptable.

Filler material must be placed into the well or borehole from the bottom up, such that bridging does not occur and the entire void space is filled. To assure that bridging has not occurred during placement, verification shall be made that the volume of the material placed in the well or borehole (with appropriate porosity assumptions) is at least equal to the calculated volume of void space to be filled (i.e., empty hole).

### **2.2.3 Displaced Site Material**

As discussed in Section 1.3 (Management Protocol for Handling and Disposition of Displaced Site Material), soil and rock that are displaced as a result of the Topock Remediation Project may be retained on site for future use. One of the potential reuses for this material identified in the management protocol is replacement into borings. If the material was generated as drill cuttings, then lead agencies must agree that the material can be used as a component of either sealing or filler material for the purpose of well or borehole decommissioning (a variance may be required).

The requirements for placement of displaced site material, should it be deemed appropriate for use based on physical and chemical composition, are the same as that for filler material. Additional processing of the displaced material may be required to ensure that grain size requirements are met, that the material is free of organic matter, and that the material can be practicably placed into the well or borehole (i.e., prevent bridging). This processing may require the use of heavy equipment for grading or crushing the material so that it is suitable for use in the decommissioning process. An appropriate onsite location would need to be identified if such processing were required.

## **2.3 Well or Borehole Decommissioning Scenarios**

Following evaluation of the well or borehole and in coordination with lead agencies, it must be determined if the well can be decommissioned in place (with or without modification) or if the well materials must be removed. The following subsections define the decommissioning scenarios that may apply pending completion of the well evaluation and coordination with lead agencies, responsible agencies (San Bernardino County or Arizona

Department of Water Resources], affected land owner, Tribes, and other stakeholders. Artesian groundwater conditions have not been observed at the Topock site, and therefore, are not considered in this SOP.

All wells associated with the Topock Remediation Project are considered to be in non-urban areas. When developing work plans that include well or borehole decommissioning, lead and responsible agencies (San Bernardino County) in California will be consulted to confirm this assumption. For the purpose of this SOP, well or borehole decommissioning scenarios are presented for two types of well site environments. These environments, Type 1 and Type 2, are defined as:

- Type 1 Well Environment – A well classified as Type 1 is located outside the area of known or potential soil or groundwater contamination (e.g., as determined by the soil and/or groundwater quality data available for the location or the likelihood of a future release in the area) and is not located in an area that is subject to increased surface water infiltration relative to nearby upland areas (e.g., channel of Bat Cave Wash).
- Type 2 Well Environment – A well classified as Type 2 is located in an area of known or potential soil or groundwater contamination (e.g., as determined by the soil and/or groundwater quality data available for the location or the likelihood of a future release in the area) and/or in an area that is subject to increased surface water infiltration relative to nearby upland areas (e.g., channel of Bat Cave Wash). Any wells located on the Topock Compressor Station, within wash channels, within areas of concern (AOCs), or within/adjacent to roads are in a Type 2 environment.

Three approaches to well and borehole decommissioning, including one approach that would require the approval of a variance to the California Well Standards, were presented by DTSC as draft concepts for discussion during the January 19, 2012 TWG Meeting. This information is provided as Attachment B to this SOP for consideration when developing future work plans that involve borehole or well decommissioning. The overriding consideration for the variance scenario presented in Attachment B was that the decommissioning method would provide seals that had a net permeability equal to or less than the naturally occurring geologic materials encountered along the borehole.

### **2.3.1 Exploratory Borehole**

Typically, exploratory boreholes at the Topock site are installed as part of a data collection effort (i.e., lithologic, soil or groundwater sample collection) and are immediately decommissioned once the data collection objectives for that borehole have been achieved. Therefore, the borehole is typically decommissioned while the drilling tools or casing is still in place, prior to demobilization from that borehole. The following general procedure should be followed for decommissioning an exploratory borehole:

1. Evaluate the borehole for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the borehole, attempts must be made to remove it prior to placement of the sealing material.
2. Place sealing material from total depth to ground surface. Typically, sealing material will be placed using a tremie pipe with positive displacement pumping. Industry practice is to place sealing material from total depth to the ground surface. However, if the boring is not within an area of known or potential pollution or contamination as determined by the soil and/or groundwater quality data available for the borehole, evaluate using displaced site material, or filler material if displaced site material is not available or appropriate, in lieu of sealing material in the upper 5 to 10 feet of the borehole. The use of displaced site material or filler material may require a permit variance if the borehole reached the water table.
3. Verify that the resulting condition of the borehole opening at the surface does not present a physical hazard to humans or animals. If voids are present fill voids created with displaced site material, or filler material if displaced site material is not available or appropriate.

### 2.3.2 Decommissioning a Well in Place

Wells determined to have been constructed in conformance with applicable standards without indication of compromise since the time of installation may be decommissioned in place. This decommissioning option should be utilized whenever acceptable to the regulatory agencies as it represents the field procedures that are least intrusive and create the least amount of disturbance. Further, this decommissioning method is appropriate if the well is in good repair but cannot be removed (e.g., wells constructed with large diameter steel casing), or if removal would negatively influence sealing of the well (e.g., a collapse during removal). In this case the monitoring well casing and any other significant voids (i.e., pore spaces in the gravel pack), at a minimum, should be completely filled with sealing material. The following general procedure should be followed for decommissioning a well in place:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned in place, and whether it is in a location considered to be Type 2.
2. Evaluate well for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the well, attempts must be made to remove it prior to placement of the sealing and/or filler material.
3. Place sealing material. Typically, if fluid sealing material is used, this will be conducted using a tremie pipe with positive displacement pumping.
  - a. Type 1 Well – Evaluate using filler material in lieu of sealing material in portions of the well casing. Place sealing material from total depth to near ground surface.
  - b. Type 2 Well – Place sealing material from total depth to within 5 feet of the ground surface (bgs).
4. Decommission well head.
  - a. Type 1 Well – Remove all well head protection and excavate around the well casing to a depth of approximately 1 to 5 feet bgs, or as practicable. Remove all well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.
  - b. Type 2 Well – Remove all well head protection and excavate around the well casing to a depth of 5 feet bgs. Remove all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.

Note that the Type 1 and Type 2 well scenarios are subtly different. While the Type 2 scenario requires the removal of all well materials to a depth of 5 feet bgs (per CA well standards), Type 1 wells do not require the removal of any well materials. The removal of well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, is not required by CA well standards, but included per stakeholder comments.

### 2.3.3 Decommissioning a Well in Place with Modification

It may be determined that a well should be decommissioned in place, but requires modification prior to sealing. This method may be appropriate in the event well materials or an obstruction cannot be removed, clogged screen cannot be removed, or if removal would negatively influence sealing of the well. In this scenario it may be required to remove a portion of the well casing, perforate sections of the well screen or casing, or conduct other well modifications to facilitate proper sealing. The following general procedure should be followed for decommissioning a well in place when a modification is required:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned in place, what modification work is required, and whether it is considered to be Type 2.
2. Implement required well modification.
3. Place sealing material. The condition that warrants well modification must be evaluated to determine the method use to place the sealing material. For example, if casing perforations above the water table are required, sealing under pressure may be appropriate.
  - a. Type 1 Well – Evaluate using filler material in lieu of sealing material in portions of the borehole. Place sealing material from total depth to near ground surface, or in the event casing is removed, the new top of casing depth. If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders.
  - b. Type 2 Well – Place sealing material from total depth to within 5 feet of the ground surface (bgs). If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders.
5. Decommission well head.
  - a. Type 1 Well – Remove all well head protection and excavate around the well casing to a depth of approximately 1 to 5 bgs, or as practicable. Removal all well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.
  - b. Type 2 Well – Remove all well head protection and excavate around the well casing to a depth of 5 bgs. Removal all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.

### **2.3.4 Decommissioning a Well by Removing Well Materials**

In some cases a well may be decommissioned by complete removal of the well materials. This method may be appropriate in the event a well was not constructed in accordance with applicable standards and the deficiencies may prevent the proper sealing of the well, even with modification. Further, when removal is practicable, lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, or other stakeholders may determine this method preferable to others. Removal is typically conducted by over-drilling the existing well materials with larger diameter drilling tools. Typically, this method is only applied to wells constructed with polyvinyl chloride (PVC) casing or limited lengths of smaller diameter steel casing. Other methods of casing removal (e.g., hydraulic casing jacks) may be useful to remove limited lengths of larger diameter steel casing. The following general procedure should be followed for decommissioning a well by removing the well materials:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned by removal.
2. Remove well materials. Typically, this is conducted by over-drilling or in some cases by combination of the use of hydraulic casing jacks combined with over-drilling.

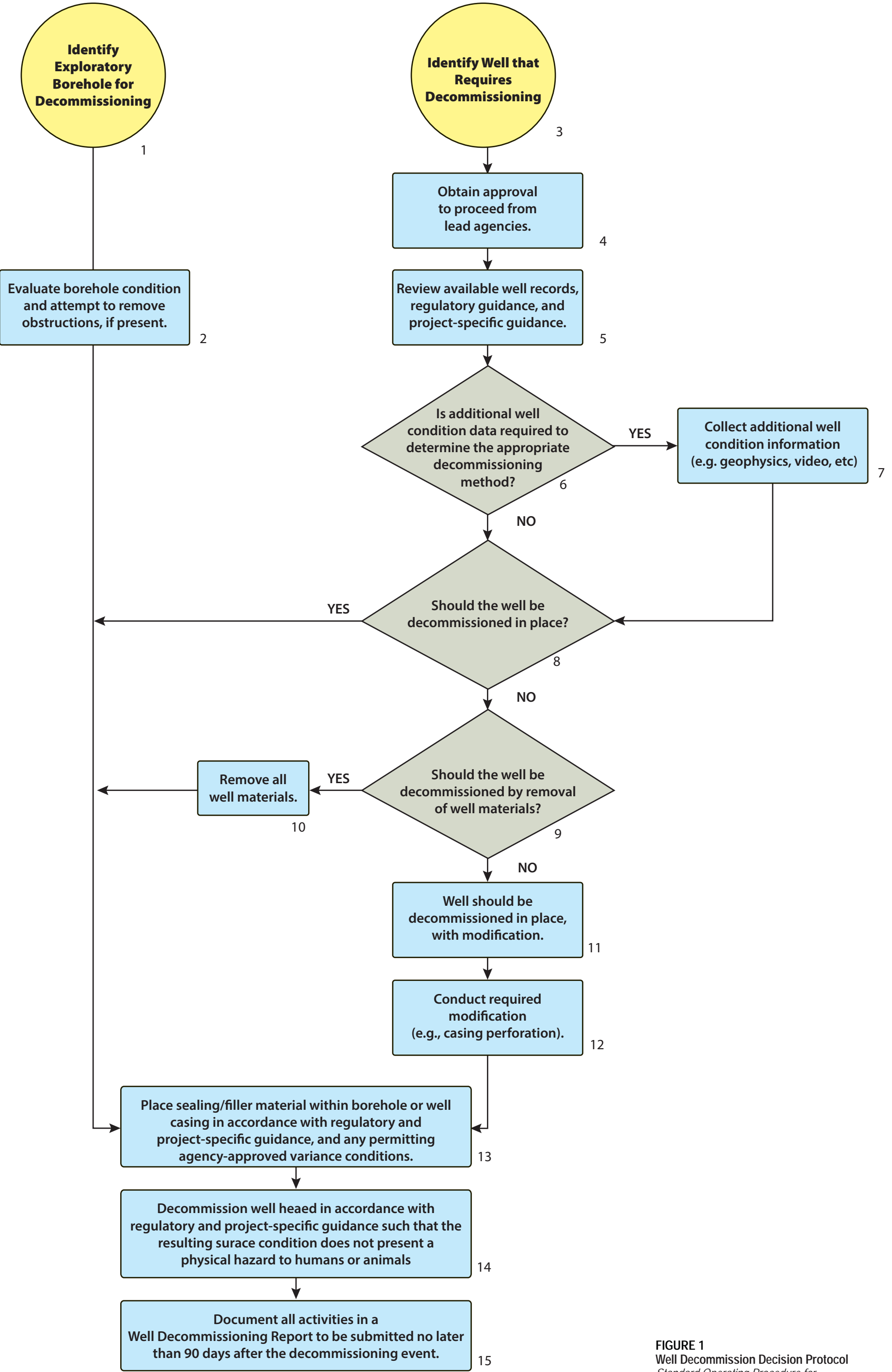
3. Evaluate borehole for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the borehole, it must be removed prior to placement of the sealing material.
4. Place sealing/filler material from total depth to ground surface. Typically, this will be conducted using a tremie pipe with positive displacement pumping. Industry practice is to place sealing material from total depth to the ground surface. However, if the boring is not within an area of known or potential pollution or contamination, evaluate using filler material in lieu of sealing material in portions of the borehole.
5. Decommission remaining elements of the well head protection and fill voids created with displaced site material, or filler material if displaced site material is not available or appropriate.

Other methods may be employed for removal of the well, particularly for steel well materials and steel conductor casings used to seal off upper lithologic zones. Specifically, the well string (or conductor casing) may be pulled by jacking with external equipment, or with the drill rig. Once the well string is removed from the borehole, the remaining materials in the original borehole should be over-drilled to remove them from the formation.

## **2.4 Well Decommissioning Reporting**

Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements. In addition, project-specific reporting must be completed (as required) and the Topock Well Inventory must be updated to reflect the results of decommissioning activities. The timeline for reporting requirements will be specified in the project-specific work plan. The Well Decommissioning Report will be submitted to lead agencies no later than 90 days after completion of well decommissioning activities and will include, at a minimum:

- A summary of the approval process completed prior to well decommissioning, including reference to submitted work plans, subsequent communication and modifications (as applicable) and documentation of approval to proceed;
- Discussion regarding application of the Well Decommissioning Decision Protocol;
- Details of the work performed, including explanation of the applicable well decommissioning scenario and materials utilized;
- Documentation of compliance with applicable permitting requirements, and;
- Signature and seal of an appropriately licensed professional geologist or engineer.



**FIGURE 1**  
Well Decommission Decision Protocol  
Standard Operating Procedure for  
Well and Borehole Decommissioning  
PG&E Topock Compressor Station  
Needles, California

**Attachment A**  
**Responses to Comments on Draft *Standard Operating***  
***Procedure for Well and Borehole Decommissioning***

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**Responses to Comments on *Standard Operating Procedure for Well and Borehole Decommissioning*,  
Pacific Gas and Electric Company, Topock Compressor Station, Needles, California**

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
1	Arizona Department of Water Resources (ADWR) February 28, 2013 Letter ADWR-1			The text in the Standard Operation Procedure (SOP), section 1.2 states that all required forms can be obtained from the Phoenix ADWR offices. All forms are available online at: <a href="http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm">http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm</a>	The text in <b>bold</b> will be added to the following statement. The notice of intention to abandon a well (NOIA) can be obtained from the ADWR Groundwater Management Support Section in Phoenix or other local offices. <b>In addition, all forms are available online at:</b> <a href="http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm">http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm</a>	No additional comments.
2	ADWR-2			The SOP document describes requirements for abandoning (decommissioning) wells in Arizona and California and technical specifications and procedures for abandoning wells at the Topock Compressor Station remediation site. The proposed methods are thorough, protective of the aquifer, and consistent with minimum well construction and abandonment requirements in Arizona Administrative Code (A.A.C.) R12-15-816 and substantive policy described in the ADWR "Well Abandonment Handbook" (2008).	PG&E appreciates the review and input from ADEQ and ADWR on this SOP.	No additional comments.
3	ADWR-3			The proposed methods suggested for abandoning exploratory boreholes in Arizona utilizing "granulated material" are satisfactory. The methods are consistent with the variance option of Alternative 4 in the "Well Abandonment Handbook". Notices of Intent to Abandon a Well must be accompanied with a written request for a variance from the provisions of the minimum well construction and abandonment standards and in accordance with A.A.C. R12-15-820.	This comment is specific to the <i>Revised Implementation Plan for Evaluation of Alternative Freshwater Sources in the Topock Remediation Project Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California</i> (January 28, 2013). However, as noted by the Fort Mojave Indian Tribe in comment FMIT-6, this represents an example of successful application of a variance to the standard well decommissioning procedure in Arizona. This variance was approved by ADWR based on project-specific information about the condition of the aquifer and planned boreholes (not a well in this example). PG&E anticipates similar discourse with the regulatory agencies based on future project-specific information in the development of future well decommissioning work plans.	No additional comments.
4	Department of Toxics Substances Control (DTSC) Document edits in redline strikeout DTSC-1	2 <sup>nd</sup> paragraph	<u>However, California boreholes drilled to the water table must be decommissioned per water well standards.</u>	[DTSC Comment CG1]: Revise text. Clarify that an exploratory borehole drilled to the water table in California must comply with well decommissioning standards.  Underlined text indicates new text inserted into document.	The text in <b>bold</b> will be added to the following statement.  For the purpose of this SOP, an exploratory borehole (borehole) is defined as a drilled borehole in which no casings have been installed, regardless of whether or not the borehole was drilled to the water table. <b>However, California boreholes drilled to the water table must be decommissioned per water well standards.</b>	No additional comments.
5	DTSC-2	1.1	<sup>1</sup> San Bernardino County does not require permits for the installation or decommissioning of boreholes that do not reach the water table.	[DTSC Comment CG2]: Please note that DTSC may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances (e.g., deep boreholes that almost reach the water table). Please incorporate this concept into the SOP.	The text in <b>bold</b> will be added to the following statement.  The California Well Standards identify well destruction (or decommissioning for this SOP) requirements for both water supply wells (Part III of Bulletin 74-81), and monitoring wells and exploratory boreholes <sup>1</sup> . <b>Although San Bernardino County does not require permits for the decommissioning of boreholes that do not reach the water table, DTSC has stated that they may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances. For example, a borehole that terminates within 10 to 20 feet the water table and is located in an area where the potential for infiltration (e.g., wash channels) or future spills (e.g., an area of active industrial operations) is greater.</b>	No additional comments.



Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
6	DTSC-3	1.3	However, the County of San Bernardino will need to be consulted in the event a variance to the California Well Standards is required.	[DTSC Comment CG3]: As the SOP is now sufficiently developed, it is important to have San Bernardino review the next version and provide input as they are a key decision maker regarding well decommissioning.	After PG&E response to comments from ADWR, DTSC, Fort Mojave Indian Tribe and the Hualapai Dept of Cultural Resources included in this table have been addressed and discussed by the Well Decommissioning Subgroup, a draft of this SOP will be submitted to the County San Bernardino for their review and input.	No additional comments.
7	DTSC-4	2.0	Involved oversight agencies will be notified in advance of any decommissioning activities <u>to ensure concurrence with decommissioning of a particular well(s).</u>	Underlined text indicates new text inserted into document.	The proposed text has been added to the document.	No additional comments.
8	DTSC-5	2.1	drilling and well installation information	[DTSC Comment YA4]: A repository of drilling logs and installation notes should be put into a central archive for access by involved stakeholders.	Drilling logs and installation notes, where available, have been included in various documents submitted to the agencies following field work. As specific well decommissioning work plans are developed, this information will be included in those plans. <b>Further, as requested by DTSC, the well inventory spreadsheet (electronic file) and available well logs associated with the Topock Project will be archived on the DTSC website. This archive will be updated periodically as additional wells and boreholes are installed.</b>  The text above in <b>bold</b> will be added to Section 1.3, first bullet (Topock Well Inventory Data Package).	No additional comments.
9	DTSC-6	2.1	Topock Well Inventory	[DTSC Comment CG5]; Include the current Topock Well Inventory as an electronic attachment to this SOP.	The text in <b>bold</b> will be added to the following statement.  The majority of this information will be available through review of drilling and well installation information, the Topock Well Inventory, groundwater sample collection logs, or other related documents. <b>An electronic copy of the Topock Well Inventory has been included in this SOP under Attachment A.</b>	No additional comments.
10	DTSC-7	2.1	Geophysical survey – Depending on the well casing type, depth to water, <u>presence or absence of centralizers</u> , and other variables, select geophysical survey tools may be useful.	Underlined text indicates new text inserted into document.	The modified text in <b>bold</b> will be added to the statement.  Geophysical survey – Depending on the well casing type, depth to water, <b>potential presence of metallic centralizers or other well construction components</b> , and other variables, select geophysical survey tools may be useful.	No additional comments.
11	DTSC-8	2.2.1	Bentonite cannot be used as a sealing material opposite zones of fractured rock, unless otherwise approved by <u>lead agencies (DTSC/DOI).</u>	Underlined text indicates new text inserted into document. Deleted text includes “the permitting” agency.  Subsequent comment from DTSC regarding when bentonite is appropriate as a sealing material...	The proposed edit has been incorporated into the document.  In addition, based on subsequent discussion with DTSC, the following text in <b>bold</b> has been added to Section 2.2.1, fourth bullet (bentonite clay):  <b>In addition, bentonite is not recommended for application in high TDS environments (e.g., &gt;5,000 parts per million) due to the adverse effects on its ability to properly swell and seal in these conditions.</b>	No additional comments.
12	DTSC-9	2.2.3	If the material was generated as drill cuttings, then <u>lead agencies</u> must agree that the material can be used as a component of either sealing or filler material for the purpose of well or borehole decommissioning (a variance may be required).	[DTSC Comment CG6]: Change text as a permit exemption may be used and since DOI and DTSC will, at a minimum, be approving agencies.  Underlined text indicates new text inserted into document. Deleted text includes “the permitting” agency.	The proposed edit has been incorporated into the document.	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
13	DTSC-10	2.3	Following evaluation of the well or borehole and in coordination with the <u>lead agencies</u> , it must be determined if the well can be decommissioned in place (with or without modification) or if the well materials must be removed.	Underlined text indicates new text inserted into document. Deleted text includes “the permitting” agency.	The proposed edit has been incorporated into the document.	No additional comments.
14	DTSC-11	2.3	The following subsections define the decommissioning scenarios that may apply pending completion of the well evaluation and coordination with <u>lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources)</u> , affected land owner, <u>Tribes</u> , and other stakeholders.	Underlined text indicates new text inserted into document. Deleted text includes “the permitting” agency.	The proposed edit has been incorporated into the document.	Tech in <b><u>bold and underlined</u></b> in the “Reference Text” column has been added globally as requested during the call.
15	DTSC-12	2.3.2	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with <u>lead agencies, responsible agencies</u> , affected land owner, and other stakeholders that the well should be decommissioned in place.	[DTSC Comment CG7]: The urban versus non-urban terms created concern to some tribes and distracted from the technical issues at hand. It is recommended that explicit reference to the term be minimized (see highlights in text and Figure 1). Perhaps just referencing the standards will suffice.  Underlined text indicates new text inserted into document. Deleted text includes “the permitting” agency.	The proposed edit has been incorporated into the document.  See response to comment DTSC-16 regarding the urban and non-urban topic.  Reference June 6, 2014 RTC Discussion and what changes result (e.g. Type 1 and Type 2).	As a result of the June 6, 2014 RTC Discussion the terms “urban” and “non-urban” have been removed from the SOP. These terms have been replaced throughout with “Type 1” and “Type 2”. A definition for these terms has been added to the beginning of Section 2.3. In addition, Figure 1 has been revised to include the new terminology.
16	DTSC-13	2.3.2	a. Non-urban Area – Place sealing material from total depth to near ground surface.	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
17	DTSC-14	2.3.2	b. Urban Area – Place sealing material from total depth to within 5 feet of the ground surface (bgs).	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
18	DTSC-15	2.3.2	c. For urban or non-urban area wells located outside an area of known or potential pollution or contamination as determined by the soil and/or groundwater quality data available for the location, evaluate using filler material in lieu of sealing material in portions of <u>the well casing</u> .	[DTSC Comment CG8]: Made edit assuming that well is left in place and could only fill well casing with filler or sealing material.  Yellow highlight added.  Underlined text indicates new text inserted into document. Deleted text includes “borehole”.	The proposed edits have been incorporated into the document.  See response to comment DTSC-16 regarding highlighted text.	See summary for comment DTSC-12.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
19	DTSC-16	2.3.2	<p>a. Non-urban Area – Remove all well head protection and excavate around the well casing to a depth of approximately 5 feet bgs, or as practicable. Remove all well materials to a depth of approximately 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.</p> <p>b. Urban Area – Remove all well head protection and excavate around the well casing to a depth of 5 <u>feet</u> bgs. <u>Remove</u> all well materials to a depth of 5 feet bgs, cap casing with sealing material <u>such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole</u>. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.</p>	<p>[DTSC Comment YA9]: Urban and non-urban decommissioning scenarios appear to be the same. If that the case, let’s not differentiate between the two.</p> <p>Yellow highlight added.</p> <p>Underlined text indicates new text inserted into document.</p>	<p>The proposed edits have been incorporated into the document.</p> <p>The following text in <b>bold</b> has been added at the end of Section 2.3.2 to address the comment regarding the urban and non-urban topic:</p> <p><b>Note that the urban and non-urban scenarios are only subtly different. While the urban scenario requires the removal of all well materials to a depth of 5 feet bgs (per CA well standards), non-urban areas do not require the removal of any well materials. The removal of well materials to a depth of approximately 5 feet bgs, or as practicable, is not required by CA well standards, but included per stakeholder comments.</b></p> <p>To further clarify this difference in the text, bullet 4a (decommission well head, non-urban area) has been revised to indicate a range of 1 to 5 feet bgs. The same revision has been made to Section 2.3.3, bullet 4a, and Figure 1.</p>	See summary for comment DTSC-12.
20	DTSC-17	2.3.3	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with <u>lead agencies</u> , <u>responsible agencies</u> , affected land owner, and other stakeholders that the well should be decommissioned in place, what modification work is required, and whether it is in a location considered to be urban.	Underlined text indicates new text inserted into document. Deleted text includes “the permitting”.	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
21	DTSC-18	2.3.3	a. Non-urban Area – Place sealing material from total depth to near ground surface, or in the event casing is removed, the new top of casing depth. If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with <u>lead agencies</u> , <u>responsible agencies</u> , affected land owner, and other stakeholders.	<p>Yellow highlight added.</p> <p>Underlined text indicates new text inserted into document. Deleted text includes “the permitting”.</p>	<p>The proposed edit has been incorporated into the document.</p> <p>See response to comment DTSC-16 regarding highlighted text.</p>	See summary for comment DTSC-12.
22	DTSC-19	2.3.3	b. Urban Area – Place sealing material from total depth to within 5 feet of the ground surface (bgs). If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with <u>lead agencies</u> , <u>responsible agencies</u> , affected land owner, and other stakeholders.	<p>Yellow highlight added.</p> <p>Underlined text indicates new text inserted into document. Deleted text includes “the permitting”.</p>	<p>The proposed edit has been incorporated into the document.</p> <p>See response to comment DTSC-16 regarding highlighted text.</p>	See summary for comment DTSC-12.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
23	DTSC-20	2.3.3	c. For urban or non-urban area wells located outside an area of known or potential pollution or contamination, evaluate using filler material in lieu of sealing material in portions of the borehole.	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
24	DTSC-21	2.3.3	a. Non-urban Area –Remove all well head protection and excavate around the well casing to a depth of approximately 5 bgs, or as practicable. Remove all well materials to a depth of approximately 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.  b. Urban Area – Remove all well head protection and excavate around the well casing to a depth of 5 bgs. Removal all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.	[DTSC Comment CG10]: See Comment YA9 above. Urban and non-urban decommissioning scenarios appear to be the same. If that the case, let’s not differentiate between the two.  Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
25	DTSC-22	2.3.4	Further, when removal is practicable, <u>lead agencies</u> , responsible agencies, affected land owner, or other stakeholders may determine this method preferable to others. Removal is typically conducted by over-drilling the existing well materials with larger diameter drilling tools.	Underlined text indicates new text inserted into document. Deleted text includes “the permitting”.	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
26	DTSC-23	2.3.4	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with <u>lead agencies</u> , responsible agencies, affected land owner, and other stakeholders that the well should be decommissioned by removal.	Underlined text indicates new text inserted into document. Deleted text includes “the permitting”.	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
27	DTSC-24	2.4	Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the <u>lead agencies</u> requirements.	Underlined text indicates new text inserted into document.	The proposed edit has been incorporated into the document.	No additional comments.
28	DTSC-25	2.4	The Well Decommissioning Report will be <u>submitted to lead agencies no later than 90 days after completion of well decommissioning activities.</u>	Underlined text indicates new text inserted into document.	The proposed text and text deletions have been incorporated into the document.	No additional comments.
29	DTSC-26	Figure 1	Between steps 3 and 4	Insert step: "Obtain approval to proceed from lead agencies"	The proposed revision to Figure 1 has been incorporated.	

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
30	DTSC-27	Figure 1	After step 13	Insert step: “Document all activities in a Well Decommissioning Report to be submitted no later than 90 days after the decommissioning event.	The proposed revision to Figure 1 has been incorporated.	
31	DTSC-28	Figure 1	Step 12	Delete “e.g., urban area vs. non-urban area” within the brackets.	The proposed revision to Figure 1 has been incorporated.	
32	Hargis + Associates, Inc. Fort Mojave Indian Tribe (FMIT)  April 19, 2013 Letter FMIT-1	General	No specific text.	The Tribe has asked for and supported this effort to proceduralize the decommissioning of the physical intrusions into the landscape created by the drilling of wells and boreholes. Nevertheless, the alternatives available for the decommissioning procedure remain hurtful as they represent a permanent disfiguration of the hallowed landscape across which the project will be constructed. Basically, once a well/borehole is in place, the options for decommissioning involve either the emplacement of foreign, unnatural materials in place of the materials emplaced for during well construction/operation, or attempting to destroy the original downhole materials. In the process of well destruction, however, an even greater disturbance results. Neither option is attractive to the Tribe. Avoiding further disturbances by not constructing additional wells/boreholes of course is the Tribe’s preference, particularly recognizing that the cumulative number of anticipated intrusions will perhaps be 350 or more before the project is over. Nevertheless, considering the reality that more disturbances will be created as a result of the remedy, the Tribe emphasizes that flexibility must be maintained. The decision as to how to proceed with decommissioning will necessarily be case-specific and requires advance discussions and consultations with the Tribes.	Comment noted. PG&E has drafted this SOP in coordination with the agencies and Tribes to meet regulatory requirements and minimize both disturbance and the placement of foreign materials. PG&E anticipates further discussions with and input from the Tribes on future work plans, as well as consultation with Tribes in accordance with the consultation protocol detailed in the Programmatic Agreement.	
33	FMIT-2	Preface	“This document was developed as a direct result of Tribal concerns ...	The preface claims that “This document was developed as a direct result of Tribal concerns ...” While this is in part true, it should be acknowledged that it would have been necessary to develop and SOP for this purpose for overall project purposes anyway. The Tribal request is consistent with the ARARs identified for this action.	Comment noted. The second sentence of the first paragraph has been edited to read as follows (new text in <b>bold</b> ):  This document was developed, <b>in part</b> , as a direct result of Tribal concerns that included dialog regarding future decommissioning activities at the site between PG&E, agencies, and Native American Indian Tribes (Tribes).	No additional comments.
34	FMIT-3	Preface	“... use of displaced site material in the decommissioning process ...”	The preface also asserts that the “... use of displaced site material in the decommissioning process ...” is based on Tribal input. This again is not a possibility related to Tribal input or preference. Provisions for backfilling certain boreholes with drill cuttings is an option that is commonly exercised, such as for exploratory borings. Nevertheless, the Tribe generally regards the earth materials removed from their natural place as a disturbance and potentially a desecration of the land. This section should probably also reference the preparation of an SOP for the handling and disposition of soils displaced as a result of project activities.	While permits are not required for the decommissioning of exploratory boreholes that do not reach the water table, based on the regulations, <del>it is not best industry practice to backfill boreholes with drill cuttings.</del>  The SOP for the handling of disposition of soils displaced as a result of project activities (Management Protocol for Handling and Disposition of Displaced Site Material) is referenced in Section 1.3. A reference to the use of displaced site material (Section 2.2.3) is already included in the first paragraph of the document.	The response has been revised per the discussion. Changes shown in <del>strikeout</del> .
35	FMIT-4	Preface	“exploratory borehole.”	The preface offers a definition of an “exploratory borehole.” Considering that the shelf life of this document is anticipated to be in excess of three decades, there should be a definition section for this term as well as others used throughout the text, such as “decommissioning,” “displaced site material,” “sealing material,” “filler material,” “monitor well,” “production or extraction well,” “injection well,” etc. It is understood that some of these terms do not presently appear in the text, but it is necessary to establish the types of wells/boreholes to which this SOP applies. Perhaps a section further explaining the applicability and scope of this SOP is needed.	The first sentence of the second paragraph of the SOP has been revised as follows (new text in <b>bold</b> ):  This SOP will be used as a reference to guide the development of future work plans required for agency, Tribal, and stakeholder review prior to conducting <b>all</b> well and borehole decommissioning tasks <b>associated with the groundwater remedy</b> .  Based on the revised text definition of well types would only add complexity to the SOP. The definition of “sealing material”, “filler material”, and “displaced site material” is provided in detail in Sections 2.2.1, 2.2.2, and 2.2.3, respectively.	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
36	FMIT-5	Section 1.0		Both California and Arizona regulatory requirements are outlined in Section 1.0, however, the respective subsections fail to mention provisions for variances within the regulations and guidance documents cited. Additionally, are there any conflicts between the rules promulgated by the two states?	<p>Section 1.2 (Regulatory Information – Arizona [ARARs #48 and #49]) states: <i>If an alternative method of decommissioning is proposed in lieu of the standard method, further substantive review is performed by ADWR to verify that the proposed methods apply, and whether appropriate fill materials were chosen. A proposal to use an alternative decommissioning method requires an application to ADWR for a variance from the well decommissioning rule (a deviation from the standard decommissioning method).</i></p> <p>The technical specifications and procedures for decommissioning well and exploratory boreholes presented in Section 2 of the SOP were developed to be in compliance with both California and Arizona regulations.</p>	No additional comments.
37	FMIT-6	Section 1.3		Section 1.3 discusses CERCLA exemptions for permitting proposed well abandonment. It refers to various discussions with San Bernardino County authorities in this regard and further indicates that, to date, no discussions have been scheduled. It is strongly recommended that PG&E initiate the further discussions with the respective regulatory authorities in both California and Arizona. In fact, it may be advisable to familiarize the regulatory personnel with the context of this particular procedure. The Tribe notes that a preliminary exchange has been made with the Arizona Department of Water Resources (ADWR) through the Arizona Department of Environmental Quality (ADEQ) in regard to the decommissioning of borings proposed in support of exploration for a freshwater source in Arizona. The February 28, 2013, letter from ADWR addresses a proposed variance for this purpose. This seems to indicate ADWR’s willingness to work with PG&E in regard to such requests. Accordingly, further liaison with these agencies may be helpful in future situations. If the Tribe can do anything to facilitate such discussions in the interest of its preferences, it stands ready to support such an effort.	<p>PG&amp;E appreciates the Tribe’s willingness to assist with discussions with state permitting agencies related to well decommissioning variance options. PG&amp;E anticipates holding these discussions with the agencies when future work plans that involves well decommissioning are being developed so that specific aquifer and well conditions can be contemplated in the context of potential variance options. Further, given that the groundwater remediation project is estimated to last for tens of years, the evaluation of variance options at the time each well decommissioning plan is developed will allow for potential changes in well decommissioning regulations to also be considered.</p>	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
38	FMIT-7	Section 2.0		<p>Section 2.0 discusses general procedures for decommissioning. Considering the subsections that follow, it appears that PG&amp;E is targeting a specific recommendation for the well/borehole decommissioning procedure under consideration. As discussed earlier, the Tribe requires discussion and consultation on a case-by-case basis because of the variation in construction characteristics, location, and other factors that enter into the decision. Accordingly, at the outset of such discussions, the Tribe would need information in regard to the alternative procedures available for each case. This information would facilitate the Tribes’ decisions on the long-term fate of the intrusions.</p>	<p>As stated at the beginning Section 2.0, <i>The information provided in this section is intended to be applicable for wells or boreholes located in either California or Arizona; however, it is assumed that the details included in the specific work plan(s) will be designed in compliance with the appropriate state regulations, and reviewed by the appropriate permitting agency.</i></p> <p>To more clearly acknowledge that potential for well decommissioning procedures that would require a variance to the applicable state regulations, the following statement in <b>bold</b> has been added to the document after the text referenced above:</p> <p><b>In addition, depending on the condition of the aquifer and well(s) subject to decommissioning, potentially applicable variance options that include the minimization of the placement of sealing material should be evaluated with the lead agencies during well decommission work plan development (e.g., Arizona Alternative 4 – variance option).</b></p> <p>In addition, the following text has been added to the end of the second paragraph in Section 1.2 (new text in <b>bold</b>):</p> <p><i>The Well Abandonment Handbook (WAH) provides a standard well decommissioning method to be used for the post-installation of any well or borehole, regardless of the aquifer or vadose zone conditions applicable to the well (Section IV A). In addition, the WAH details five alternative abandonment methods. The five alternatives are for specific vadose zone and aquifer conditions which may include contamination, single or multiple aquifers, or dry wells (Section IV B). For example, Alternative 4, which applies to wells that only penetrate a single aquifer without vertical flow components and no water quality contamination issues, might be applicable to wells in the Topock area that are 8-inches or greater in diameter. A variance option to Alternative 4 permits the use of clean fine sand to fill the well being decommissioned.</i></p> <p>Further, the text included in box number 13 on the decision flow chart presented in Figure 1 has been revised as follows (including text strikeout per comment DTSC-28 and with new text in <b>bold</b>):</p> <p>Place sealing/filler material within the borehole or well casing in accordance with regulatory and project-specific guidance, <b>and any permitting agency-approved variance conditions.</b></p>	<p>During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.</p>
39	FMIT-8	Section 2.2		<p>The subsections under Section 2.2 do not appear to recognize provisions for variances as discussed earlier. Indeed such scenarios need to be developed and discussions held with the respective regulatory authorities as to the acceptability, need and justifications, and technical rationale for such requests. To this point, the subcommittee has spent time on alternative conceptual designs. This SOP does not include or acknowledge this work.</p>	<p>The subsections under Section 2.2 simply present the different types of materials that can be used for various well or borehole decommissioning scenarios, and not is not intended to evaluate or disqualify variance well decommissioning options. See the response to FMIT-7, which adds text to more clearly acknowledge the potential for variance options.</p>	<p>During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.</p>

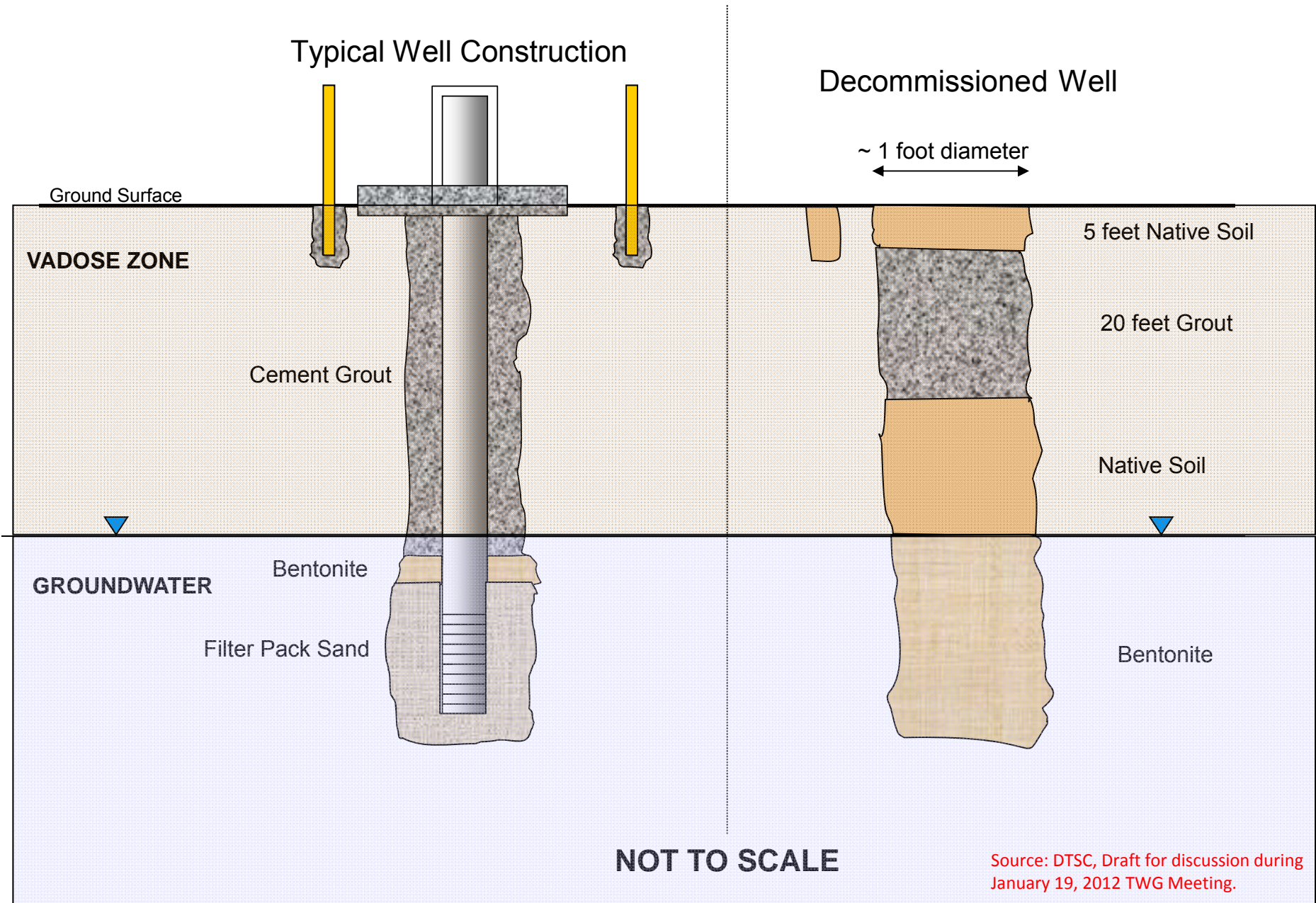
Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
40	FMIT-9	Section 2.3		Section 2.3 develops different scenarios. However, these scenarios only relate to standard situations and again do not consider the possibilities of variances. The situations in which variances are appropriate and applicable for consideration need to be developed in this procedure, otherwise those following the procedure will simply adhere strictly to the content. Additionally, this section appears to only consider the California rules, which distinguish between “urban” and “non-urban” areas. This, for example, is not a relevant consideration for the Site and is not referenced in the Arizona guidelines. The design for well decommissioning should not have to be a choice between these two options.	The evaluation of scenarios in Section 2.3 were developed in consideration of both California and Arizona regulations. The distinction between urban and non-urban is subtle and has been clarified as detailed in the response to comment DTSC-16. Both California and Arizona regulations detail specific procedures depending on aquifer and well conditions. California regulations do not reference any variance conditions, while the Arizona regulations reference alternatives to the recommended standard decommissioning procedure and some variance options associated with those alternatives. Variance conditions or potential scenarios that may or may not be approved by regulatory agencies should not be included in an SOP. Also, see comment FMIT-7.	During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.
41	FMIT-10	Section 2.4		Section 2.4 discusses “Well Decommissioning Reporting,” and specifies that the information be reported in the Topock Well Inventory. Is this information also reported in the Well Registry for the respective states?	Yes, well decommissioning reports are filed with ADWR and California DWR in accordance with the respective well standards for each state. As noted in the first sentence of Section 2.4 (including edit made in accordance with comment DTSC-24): Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements.	No additional comments.
42	FMIT-11	Figure 1		Figure 1 needs to be changed to reflect the above comments.	See response to comment FMIT-7.	No additional comments.
43	Hualapai Department of Cultural Resources (HDCR) April 24, 2013 Letter HDCR-1			On behalf of the Hualapai Tribe, we feel that is very important to have minimal disturbance in an area that has been under constant environmental change due to the operations of the Topock Compressor Station. As wells and well materials are intrusive, we feel that it is best that all well casings be left in-situ when and if wells are to be decommissioned. This will be the least intrusive and create the least amount of disturbance.	PG&E agrees that the decommissioning procedure which involves the least amount of disturbance that is acceptable to the regulatory agencies should be implemented. The following text in <b>bold</b> has been added to Section 2.3.2 (Decommissioning a Well in Place):  <b>This decommissioning option should be utilized whenever acceptable to the regulatory agencies as it represents the field procedures that are least intrusive and create the least amount of disturbance.</b>	No additional comments.
44	HDCR-2			In the process of decommissioning, Hualapai prefer that natural materials from the immediate vicinity be placed inside the well-casings, and that wells be capped with the least amount of invasive materials, i.e. concrete, steel bolts, etc. As wells come under the decommissioning process, Hualapai would like to be informed about each well that is going to be subject to decommissioning.	See response to comment FMIT-1 regarding consultation with the Tribes on future work plans, and FMIT-7 regarding clarifying information that is being added to the document to acknowledge the potential for variance conditions.	No additional comments.



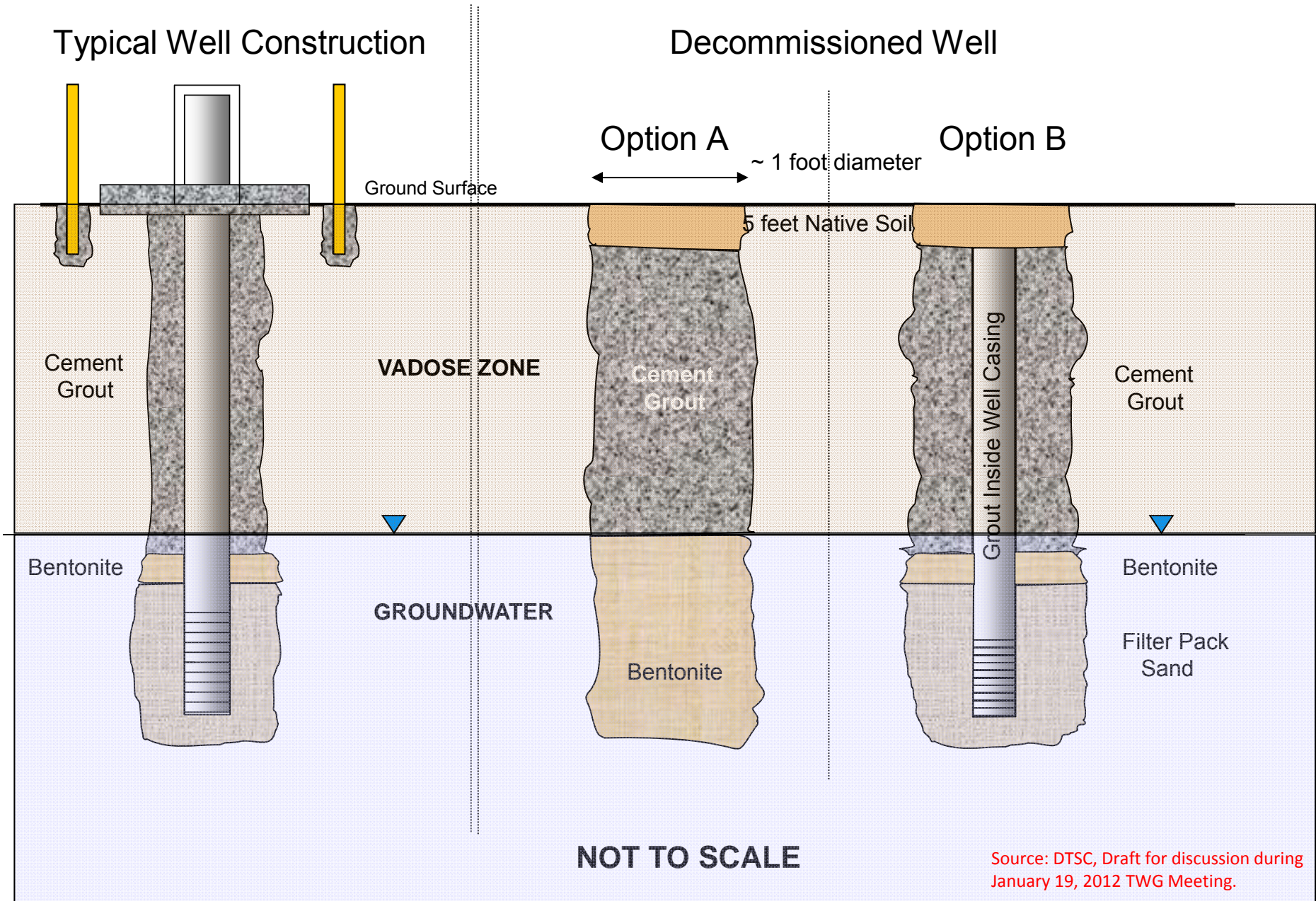
**Attachment B**

**Draft DTSC Concepts for Well and Borehole Decommissioning**

## Category 1: Contaminant Free – No Variance

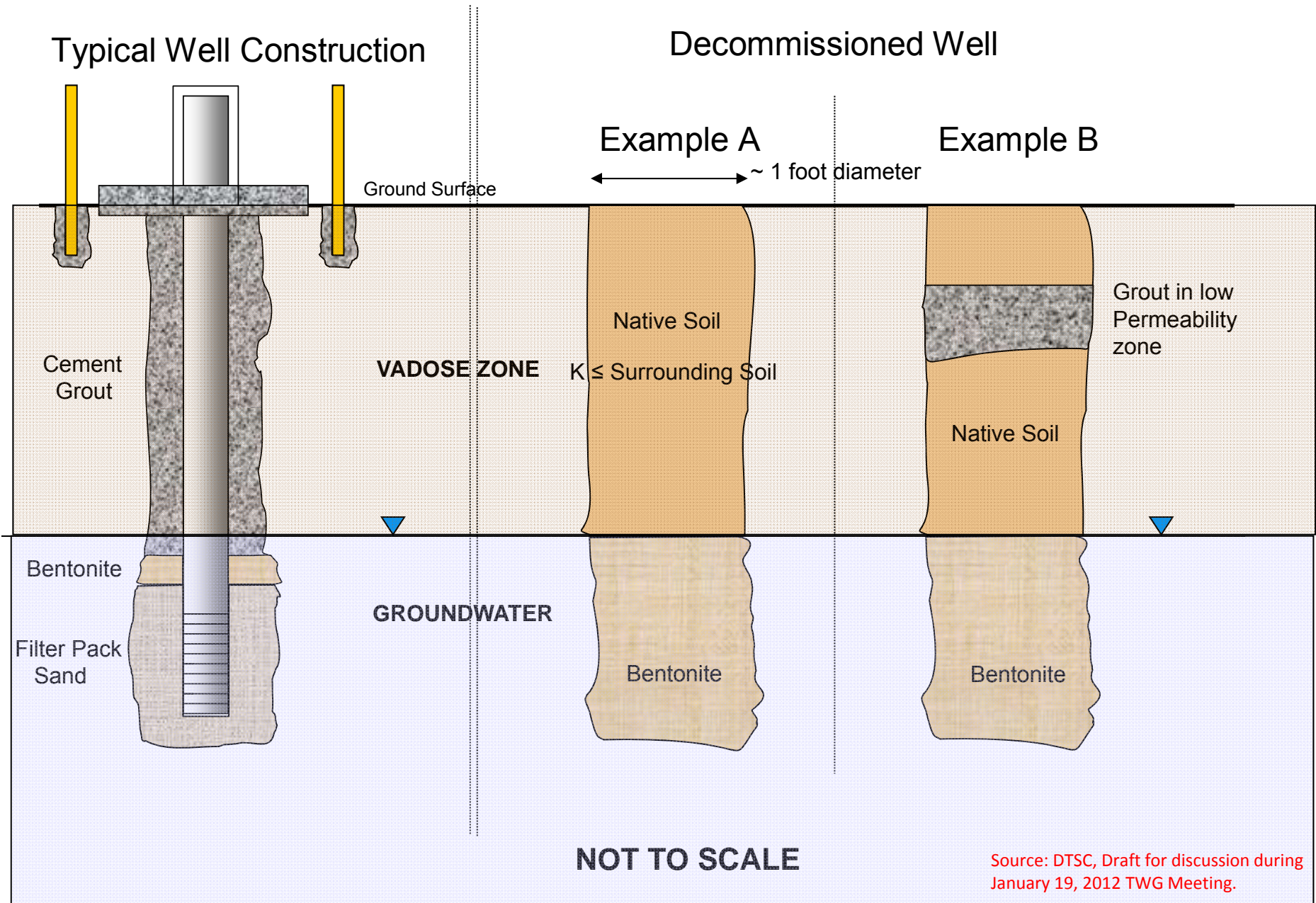


## Category 2: Contaminated Area – No Variance





## Category 3: Contaminant Free – Variance



# Attachment 2

## Photo Log





Photo 1 – Well TCS-4 with PVC extension and protective rock gabions prior to work.



Photo 2 – Well TCS-4 after rock gabion removal. Preparing for initial excavation.





Photo 3A – TCS-4 well head exposed and PVC extension removed. Note intact injection pipe.



Photo 3B – TCS-4 well head with welded steel casing extension. Note removed section of injection pipe.





Photo 4 – Placement of 24-inch diameter form over TCS-4 well head for mushroom cap placement.





Photo 5 – Completed restoration of TCS-4 work area following all decommissioning activities.

# Attachment 3

## Reporting Forms





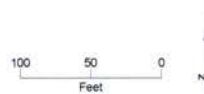


#### LEGEND

- DECOMMISSIONED WELL LOCATION
- ESTIMATED PIPELINE LOCATION<sup>1</sup>
- TOPOGRAPHIC CONTOUR (10-FOOT INTERVAL)
- TOPOGRAPHIC CONTOUR (2-FOOT INTERVAL)
- AOC 1 BOUNDARY
- SWMU 1 BOUNDARY

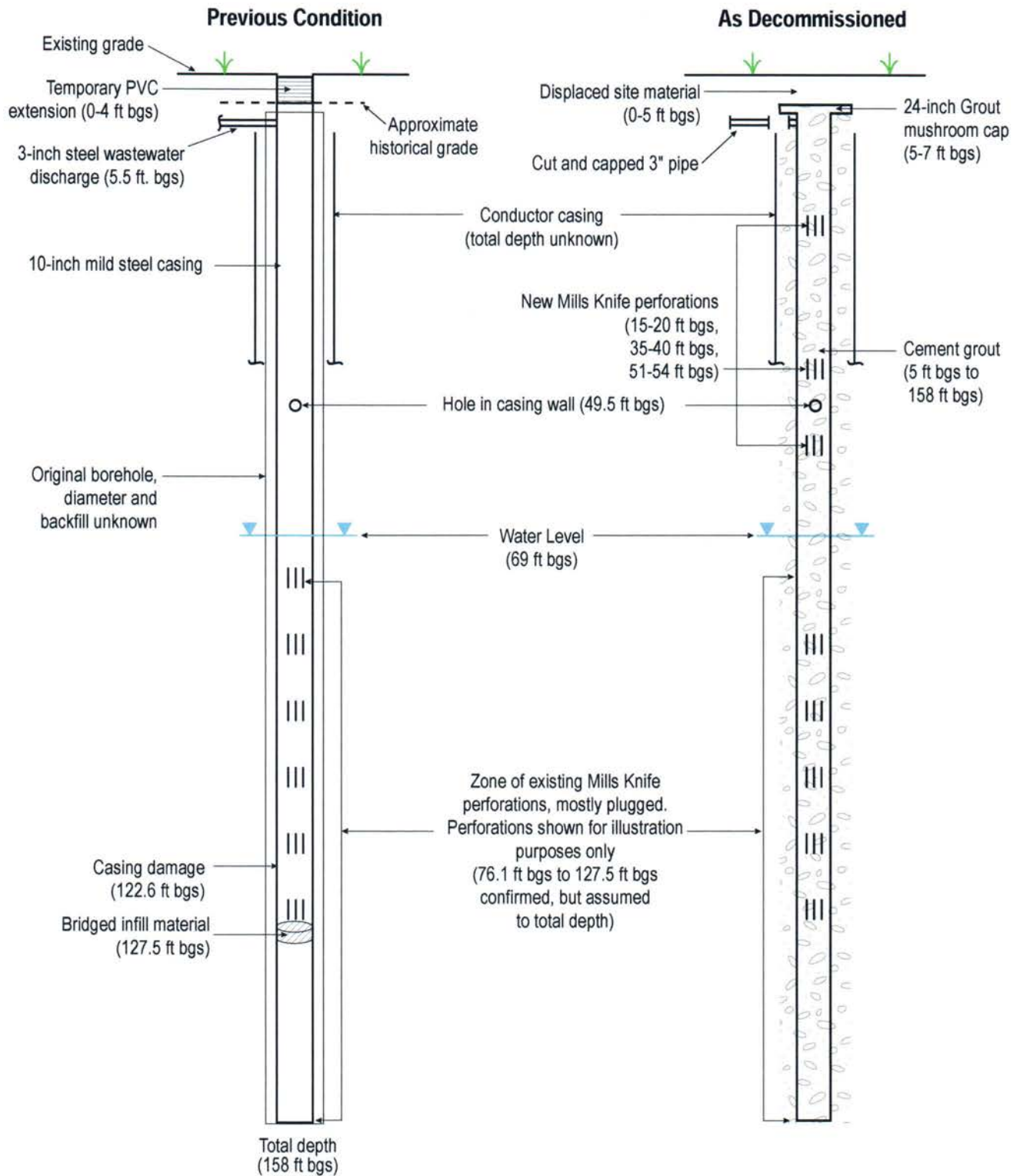
#### NOTES:

- <sup>1</sup>ESTIMATE LOCATION OF BURIED 3-INCH DIAMETER STEEL PIPE
- ESTIMATED VIA GEOPHYSICAL SURVEY PERFORMED ON APRIL 2, 3, AND 4, 2013



#### FIGURE 1 DECOMMISSIONED WELL TCS-4 LOCATION MAP

DECOMMISSIONING REPORT FOR  
TCS WELL NUMBER 4 (TCS-4)  
PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA



#### Notes

ft bgs = foot below ground surface

All depths relative to existing ground surface.

Drawings are not to scale.

**FIGURE 2**  
**TCS-4 WELL SCHEMATIC**  
 DECOMMISSIONING REPORT FOR  
 TCS WELL NUMBER 4 (TCS-4)  
 PG&E TOPOCK COMPRESSOR STATION  
 NEEDLES, CALIFORNIA

**ch2m:**



## Underground Injection Control (UIC)

### Underground Injection Wells Registration

Underground Injection Control in Region 9

General inquiries or send email to [R9iWells@epa.gov](mailto:R9iWells@epa.gov)

*Be sure to include your e-mail address if you'd like a response.*

Register any class of injection well using the inventory form below.

[How to Register Injection Wells](#)

[Common Questions](#)

#### Injection Well Inventory Form

Transaction Type (choose one): ☒ First time entry ☐ Change

##### ----- Facility Information -----

Facility Name: (Required)

PG&E Topock Compressor Station

This is a private residence ☐ true ☐ false

Street:

145453 National Trails Highway

Street 2:

City: (Required)

Needles

State: (Required)

CA ▼

Zip: (Required)

92363

Facility Phone:

760-326-5582

##### ----- Facility Location -----

County

San Bernardino ▼

Land ID:

RCRA ID, APN, or TMK or leave blank

650-161-08

Indicate the land ownership of the property: (Required)

- ☒ Private  
☐ Government-local, state  
☐ Government-federal  
☐ Government-tribal  
☐ Non-Profit

If Tribal select Tribe name: - None - ▼

NAICS Code

Numbers only, please. For industry/business, find NAICS code at [www.census.gov](http://www.census.gov)

Latitude

Latitudes in American Samoa should be entered as *negative* numbers. Free lat/long finder is [latlong.net](http://latlong.net)

 °N

Longitude

Enter positive numbers for degrees longitude east or negative numbers for longitude west, in this field.

Longitude (W or E)

Specify "W" for longitudes in the U.S., or "E" for longitudes in Guam & the Northern Mariana Islands.

---- Legal Contact Information: Owner or Other Responsible Party ----

Owner Contact Name:

Curt Russell

Email: (Required)

gcr4@pge.com

Organization: (Required)

Pacific Gas & Electric Company - Topock Compressor Station

Street:

145453 National Trails Highway

Street 2:

City: (Required)

Needles

State: CA ▼

Zip: (Required) 92363

----- Well Details -----

Total number of injection wells at this site: (Required)

If you would like to report other types of wells at this site, please submit this form, then use the back button to modify this entry or start over.

Number of identical wells reported below (Required)

Well Operating Status of your well(s):

- ☐ Planned/under construction
- ☐ Active
- ☐ Inactive/not plugged
- ☒ Plugged and approved by regulator
- ☐ Plugged and abandoned without approval

Plugged &amp; Abandoned?

If well(s) have been plugged and abandoned enter the *numerical* year only.

Injection Well Depth

(# of feet below ground surface)

- ☐ < 50
- ☒ 50 - 500
- ☐ > 500

Injection Purpose

- ☒ Disposal
- ☐ Energy production
- ☐ Hydraulic barrier
- ☐ Oil or mineral recovery
- ☐ Remediation
- ☐ Recharge
- ☐ Water supply storage and withdrawal

Injectate

Select the primary constituent of injected fluids.

- ☐ Storm drainage
- ☐ Irrigation runoff
- ☒ Non-contact cooling water
- ☐ Brine
- ☐ Combined industrial/sanitary
- ☐ Disinfected Tertiary Effluent (CA Title 22)
- ☐ Geothermal fluids
- ☐ Industrial Non-hazardous (describe in comments)
- ☐ Mine lixiviant
- ☐ Potable water
- ☐ Remedial fluids/air
- ☐ Septic tank effluent
- ☐ Untreated sewage

Dispersal Direction

Select the predominant plumbing orientation of the injection well(s):

horizontal such as a leachfield; vertical such as a drywell or seepage pit

- ☐ horizontal
- ☒ vertical

Injectate Sources

Please select one.

- ☒ From this site only
- ☐ This site and others

### Comments

Please list any local or state permits that authorize, monitor, or otherwise affect the reported injection well(s). If this site is subject to any relevant local or state



permits, or if you have any operational considerations for the injection well(s) that you would like to note, please list them here.

This well, referred to as Topock Compressor Station Well Number 4 (TCS-4), was decommissioned in accordance with the "Decommissioning Plan for Topock Compressor Station Well Number 4 (TCS-4)". The Work Plan was initially submitted to the California Department of Toxic Substances Control (DTSC) and the United States Department of the Interior (DOI), which are the lead agencies for the Topock Remediation Project, for review in July 2014. DOI approval of, and DTSC concurrence with, the Work Plan was received by PG&E via email on December 15, 2015. Activities performed to decommission this well were initiated on February 24, 2016 and were completed on March 9, 2016, and are summarized in the technical memorandum titled "Decommissioning Report for Topock Compressor Station Well

Your Name

If you are NOT the owner listed above, please enter your name here.

Mike Cavaliere

Your Email (Required)

mike.cavaliere@ch2m.com

Your Organization

Your organization if other than the contact above.

CH2M

**Submit Registration**

Last updated on April 28, 2016