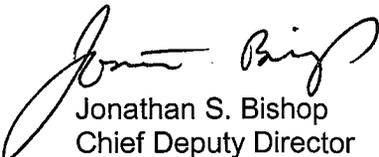


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**State Water Resources Control Board**

**TO:** Stewart Black  
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**FROM:**   
Jonathan S. Bishop  
Chief Deputy Director  
**EXECUTIVE OFFICE**

**DATE:** November 20, 2013

**SUBJECT:** TOPOCK COMPRESSOR STATION: REMEDY REQUIREMENTS  
ASSOCIATED WITH INJECTION OF GROUNDWATER CONTAINING  
NATURALLY OCCURRING ARSENIC

The California Department of Toxic Substances Control (DTSC) is the lead state agency overseeing the soil and groundwater investigation and cleanup surrounding the Pacific Gas and Electric Company (PG&E) Topock Compressor Station (Topock Site). DTSC has been working with PG&E on the selected groundwater remedy at the Topock Site. The selected groundwater remedy, as more fully described below, involves injecting water to flush the hexavalent chromium plume through an In-situ Reactive Zone (IRZ) in conjunction with institutional controls and monitored natural attention.

As part of completing the remedial design, PG&E has asked the State Water Resources Control Board (State Water Board) whether, and under what circumstances, groundwater pumped from a nearby groundwater basin that contains naturally occurring arsenic at levels above the applicable groundwater water quality objective of 10 parts per billion (ppb) may be injected as part of the groundwater remedy into a receiving groundwater basin with arsenic levels below the 10 ppb water quality objective. If injection of the groundwater with arsenic concentrations above 10 ppb is allowed, DTSC has asked the State Water Board what conditions would govern injection and the remedy.

*Short Answer*

In appropriate circumstances and with appropriate conditions, groundwater containing naturally occurring levels of arsenic above the applicable water quality objective may be injected into a groundwater basin in order to implement a groundwater flushing remedy. The selected

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FELICIA MARCUS, CHAIR | THOMAS HOWARD, EXECUTIVE DIRECTOR

groundwater remedy described below satisfies those circumstances, and subject to the conditions described below, the injection may proceed. However, the applicable or relevant and appropriate requirement (ARAR) for arsenic will still be the 10 ppb water quality objective and the arsenic water quality objective in the receiving groundwater must be met within the earlier of (i) 20 years after achieving the remedial action objective for chromium or (ii) 20 years after ceasing injection of the water containing naturally occurring arsenic at concentrations above the water quality objective.

The foregoing does not mean, however, that non-native groundwater must meet the water quality objective for arsenic at the time of injection. Instead, if treatment or blending of the arsenic-containing water is not desirable for cultural or economic reasons, then compliance with the water quality objective in the receiving groundwater may be achieved through processes such as dispersion, diffusion, and adsorption, so long as compliance with the water quality objective (i) occurs in a reasonable period of time and (ii) does not impact existing or probable future beneficial uses *within* the arsenic plume resulting from the injected, non-native groundwater.

#### *Selected Groundwater Remedy*

DTSC has identified the preferred groundwater remedy as Alternative E, "In-Situ Treatment with Freshwater Flushing." DTSC selected this remedy in its Groundwater Remedy Statement of Basis. Likewise, the U.S. Department of the Interior simultaneously selected this preferred remedy in its Record of Decision for the CERCLA Remedial Action addressing groundwater contamination, which is being conducted concurrently due to contamination having impacted federal lands. As described in the Statement of Basis, Alternative E involves flushing to push the hexavalent chromium plume through an IRZ located along National Trails Highway.

The freshwater flushing would be accomplished through a combination of freshwater injection and treated groundwater reinjection (see below) in wells upgradient of the hexavalent chromium plume. This selected alternative would also include using extraction wells near the Colorado River shoreline to capture the plume, accelerate cleanup of the floodplain, and draw the groundwater with elevated hexavalent chromium through the treatment zone. Additional extraction wells would be located in an area northeast of the Topock Compressor Station where the flushing efficiency from injection wells alone is relatively poor. Groundwater extracted from the near-river wells and wells northeast of the Topock Compressor Station would then be treated with a carbon food source to reduce hexavalent chromium concentrations to a maximum of 32 ppb, the remediation target background level, and the water would then be reinjected upgradient of the hexavalent chromium plume. Institutional controls would also be imposed to restrict surface land uses and prevent the use of groundwater. Finally, monitored natural attenuation would be utilized as a long-term component to address residual hexavalent chromium that may remain in recalcitrant portions of the aquifer after in-situ treatment.

#### *Havasu National Wildlife Refuge-1 (HNWR-1) Well*

PG&E has evaluated a number of potential supplies of freshwater. While some of the effort continues, PG&E's current question arises in the context of the HNWR-1 well. This existing water supply well is located on the Arizona side of the Colorado River. When used in combination with the treated groundwater, the HNWR-1 well appears to be productive enough to generate sufficient quantities of water to operate the injection flushing system contemplated by the groundwater remedy. However, the HNWR-1 well contains arsenic concentrations of

about 15 ppb, which is above the water quality objective of 10 ppb and which is also higher than the naturally occurring levels of arsenic in the receiving groundwater basin.

#### *Remedy Requirements*

Groundwater containing naturally occurring levels of arsenic above the applicable water quality objective of 10 ppb from the HNWR-1<sup>1</sup> well may be injected into the groundwater basin at the Topock Site since the injection of substantial quantities of water are necessary, based on modeling results, to effectively move the hexavalent chromium plume towards the IRZ in a reasonable period of time. While it is preferred that a supply well be used that contains arsenic concentrations below the water quality objective to ensure immediate compliance with the Colorado River Basin Water Board's Basin Plan arsenic water quality objective, if such a well is not available and treatment is not desirable for cultural or economic reasons, then the need for timely cleanup of the hexavalent chromium plume to protect public health and the environment becomes the paramount, and overriding, reason to allow the use of the HNWR-1 well in these fact-specific and limited circumstances.

Allowing the use of this well does not jeopardize compliance with other legal requirements. In particular, the ARAR for arsenic will still be the 10 ppb water quality objective, and the water quality objective in the receiving groundwater must be met within the earlier of (i) 20 years after achieving the remedial action objective for chromium or (ii) 20 years after ceasing injection of the water containing naturally occurring arsenic at concentrations above the water quality objective. PG&E's consultants, through modeling, have predicted that dispersion, diffusion, and adsorption will occur when this flushing remedy is implemented, resulting in compliance with the 10 ppb arsenic water quality objective within a reasonable period of time. Further, because of institutional controls contemplated by the remedy, no water supply wells are anticipated within the injection zone or resulting arsenic plume, so injected, non-native groundwater will not impact probable future beneficial uses within the arsenic plume.

Therefore, with respect to the remedy at the Topock Site, and subject to the following limitations, the State Water Board concludes that groundwater from the HNWR-1 well, despite temporarily exceeding the water quality objective for arsenic, may be injected at the Topock Site to ensure timely and effective implementation of the in-situ flushing remedy in order to protect public health and the environment.

- This conclusion is based on modeling that shows the limited spatial and temporal extent of the injected groundwater arsenic plume. Current modeling projects that any exceedance of the arsenic water quality objective will be limited to 150 feet radially away from the injection well locations. Monitoring wells must be established to confirm this modeling prediction. If the leading edge of the arsenic plume extends more than 150 feet away from the injection well locations, PG&E must immediately re-assess its modeling calculations and quickly identify interim actions it can take to limit the migration of the arsenic plume. These interim actions may include triggering activation of the

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<sup>1</sup> As discussed below, PG&E is evaluating other potential water supply well sources on the Arizona side of the Colorado River. Even if those other sources do not provide a superior water quality to HNWR-1, but are instead used because they provide a more sustainable source of injection water, the conclusions expressed in this letter for HNWR-1 would be equally applicable to those other Arizona sources.

contingency plan for arsenic pretreatment PG&E was directed by DTSC to include in its 60 percent groundwater remedy design. In the event the arsenic plume exceeding the water quality objective extends 225 feet from any of the points of injection, then PG&E shall immediately cease further injection of untreated water from the HNWR-1 well and DTSC should either (i) require pretreatment to remove arsenic prior to injection or (ii) require another source of freshwater in order to meet the water quality objective.

- This conclusion is further based on the absence of any existing or probable future drinking water use downgradient of the injection wells within the modeled arsenic plume. DTSC's selected remedy contemplates restrictions on drinking water and irrigation supply wells within the hexavalent chromium plume. Federal land managers have established, and will maintain until groundwater ARARs are achieved, similar institutional controls for lands under their jurisdiction. Comparable restrictions should apply to the modeled arsenic plume. Nonetheless, in the unlikely event that a drinking water well is developed near the injection well locations, the injection shall be managed to assure full compliance with water quality objectives at the monitored drinking water well. This will require further modeling to account for the capture zone of any newly developed drinking water well.
- This conclusion is further based on existing modeling showing that the arsenic concentration in the groundwater impacted by the injection will return to natural background levels within 20 years after ceasing injection of water containing the naturally occurring arsenic. This is a reasonable period of time given the other factors identified in this letter.
- Finally, this conclusion is based on existing data and analyses concerning the lack of readily available potable water for direct injection. PG&E, under DTSC's direction, is continuing to evaluate alternative sources of freshwater that could be directly injected in immediate compliance with the arsenic water quality objective or at arsenic levels below HNWR-1 levels. While most of the freshwater source alternatives have been eliminated based on production quantities, cost, or cultural issues, PG&E and DTSC are investigating one additional well location within the Havasu National Wildlife Refuge in Arizona (Site B) and also evaluating deeper wells in the immediate vicinity of the HNWR-1 well. That investigation is on-going, and PG&E will be providing the water quality and quantity results in a formal report in the near future. If those results show that the Site B well or the deeper wells tested in the immediate vicinity of HNWR-1 can produce water of a superior quality to HNWR-1, those wells should be developed and used for the Topock remedy instead of HNWR-1.

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