

Prepared in cooperation with the Lahontan Regional Water Quality Control Board

A Plan for Study of Natural and Man-Made Hexavalent Chromium, Cr(VI), in Groundwater near a Mapped Plume, Hinkley, California

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The Pacific Gas and Electric Company (PG&E) Hinkley compressor station (fig. 1), in the Mojave Desert 80 miles north-east of Los Angeles, is used to compress natural gas as it is transported through a pipeline from Texas to California. Between 1952 and 1964, cooling water used at the compressor station was treated with a compound containing chromium to prevent corrosion. After cooling, the wastewater was discharged to unlined ponds, resulting in contamination of soil and groundwater in the underlying alluvial aquifer (Lahontan Regional Water Quality Control Board, 2013). Since 1964, cooling-water management practices have been used that do not contribute chromium to groundwater.

In 2007, a PG&E study of the natural background concentrations of hexavalent chromium, Cr(VI), in groundwater estimated average concentrations in the Hinkley area to be 1.2 micrograms per liter ($\mu\text{g/L}$), with a 95-percent upper-confidence limit of 3.1 $\mu\text{g/L}$ (CH2M-Hill, 2007). The 3.1 $\mu\text{g/L}$ upper-confidence limit was adopted by the Lahontan Regional Water Quality Control Board (RWQCB) as the maximum background concentration used to map the plume extent. In response to criticism of the study's methodology,



Figure 1. Pacific Gas and Electric (PG&E) compressor station, Hinkley, California, March 2009. (Photo by Steven Perry, Arcadis, Inc., courtesy of PG&E).

and an increase in the mapped extent of the plume between 2008 and 2011, the Lahontan RWQCB (Lahontan Regional Water Quality Control Board, 2012) agreed that the 2007 PG&E background-concentration study be updated.

The purpose of the updated background study is to evaluate the presence of natural and man-made Cr(VI) near Hinkley, Calif. The study also is to estimate natural background Cr(VI) concentrations in the aquifer upgradient and downgradient from the mapped Cr(VI) contamination plume, as well as in the plume and near its margins. The study was developed by the U.S. Geological Survey (USGS) in collaboration with a technical working group (TWG) composed of community

members, the Independent Review Panel (IRP) Manager (Project Navigator, Ltd.), the Lahontan RWQCB, PG&E, and consultants for PG&E.

The scope of the study includes eight tasks and publication of four reports (table 1, shown on page 12). The proposal is available at <http://ca.water.usgs.gov/projects/hinkley/>; a video describing the study is available at <http://ca.water.usgs.gov/media/hinkley-groundwater-chromium.html>. The study agreement was approved by the State Water Resources Control Board in January 2015; field-data collection began in March 2015; the study is scheduled to be completed in December 2019.

Table 1. Tasks and questions addressed by the U.S. Geological Survey background study, January 2015 to December 2019, Hinkley, California.

Task		Purpose
Task 1:	Evaluation of existing data.	Identify areas near the mapped hexavalent chromium, Cr(VI), plume having water-quality of concern to the study.
Task 2:	Analyses of rock and alluvium.	Determine if there are natural geologic sources of chromium in the area and if these sources are contributing Cr(VI) to groundwater.
Task 3:	Analyses of chemical and environmental tracers in water from wells.	Determine the chemical and isotopic (including other environmental tracers) composition of water from selected wells throughout the study area with respect to (1) the sources and chemical processes controlling Cr(VI) occurrence and (2) the source, movement, and age of the groundwater relative to the timing of Cr(VI) releases from the Pacific Gas and Electric (PG&E) compressor station.
Task 4:	Evaluation of local conditions.	Determine how differences in local geohydrology in the western, northern (including Water Valley), and eastern (including the plume and upgradient area) subareas influence natural Cr(VI) in groundwater and the movement of anthropogenic (man-made) Cr(VI) from the compressor station.
Task 5:	Evaluation of groundwater movement.	Evaluate how changing hydrologic conditions in the study area over time influence the movement of water and Cr(VI) through aquifers underlying Hinkley Valley.
Task 6:	Evaluation of the presence of natural and anthropogenic Cr(VI).	Identify areas in the aquifer containing man-made Cr(VI) from releases at the PG&E compressor station and areas that contain Cr(VI) from other sources.
Task 7:	Estimation of background Cr(VI) concentrations.	Estimate background Cr(VI) in parts of the study area affected by discharges from the PG&E compressor station.
Task 8:	Fate of chromium during and after in situ reduction.	Determine if chromium in the in situ reactive zone is permanently removed from solution.
Report preparation and project timeline.		Four reports are identified in the proposal, and completion of the project is scheduled for December 2019.

Other Resources

Technical documents and regulatory orders related to the Cr(VI) contamination at Hinkley are available from the Lahontan RWQCB website, http://www.waterboards.ca.gov/lahontan/water_issues/projects/pge/index.shtml.

Other documents intended for the public and interested stakeholders are available from the IRP Manager website, <http://www.hinkleygroundwater.com/>.

Acknowledgments

This work is being done under an agreement with the State Water Resources Control Board with funding provided by Pacific Gas and Electric. Funding for the study is held in trust by the State in an escrow account to ensure unbiased and independent completion of the study.