Stanford WOODS INSTITUTE for the ENVIRONMENT

Research Brief

California Water: Quantity, Quality and Public Health

Issue Overview

Maintaining a safe drinking water supply is a top priority for California citizens and policymakers alike. Multiple layers of federal and state laws set strict limits on the levels of pollutants deemed safe for human consumption. However, through agriculture, industry and resource extraction, we have inadvertently created new causes of water pollution. This brief is based on recent findings detailing how human activities create pathways for cancer-causing contaminants, arsenic and chromium, to enter California's groundwater supply.

Points for Policymakers

- The naturally occurring and benign form of chromium (chromium-3) can be transformed into the toxic, carcinogenic form of the metal (chromium-6) through human activities. This is significant for groundwater management as the prevalence of chromium-3 affects a far greater area, involving more wells and a larger population throughout California than any industrial sources of chromium-6;
- Analyzing California groundwater data has shown there is widespread transformation of chromium-3, particularly around the coasts and Central Valley, that corresponds to groundwater pumping and agricultural activity; "hotspots" of chromium-6 are found around industrial areas of Los Angeles and throughout the San Francisco Bay Area;
- Arsenic is commonly found in many underground aquifers and poses a risk of contamination when those aquifers are pumped for drinking water;
- Over-pumping in the San Joaquin Valley has resulted in land subsidence and a significantly increased probability that groundwater is contaminated with arsenic two to three times greater than World Health Organization standards. However, aquifers can recover to normal levels if over-pumping is stopped.

Photo: CA DWR

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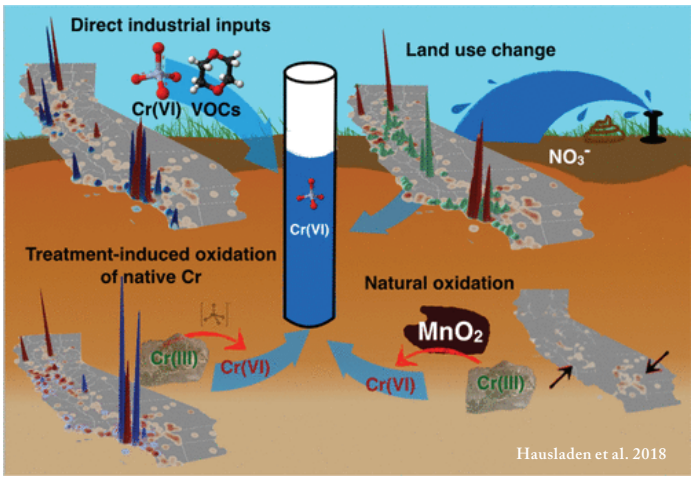
Background

Water quality is strictly monitored and controlled at the state and federal levels by setting maximum contaminant levels for chemicals, metals and other toxic substances. Chromium and arsenic are both commonly occurring elements that, if ingested, can pose human health risks, especially bladder, liver and other forms of cancer. Hexavalent chromium (or chromium-6) became infamous through Erin Brockovich's fight for the rights of residents in Hinckley, California, where drinking water was contaminated by the compound. Largely in response to that case, California set a state drinking water standard to limit allowable levels of chromium-6 below the EPA standard.



While water quality has been closely regulated in California, water quantity – especially the extraction of groundwater – had been largely unregulated until the 2014 passing of the state's Sustainable Groundwater Management Act. Groundwater supplies approximately 40 percent of water usage in California, and is likely to play a much larger role in the future. Understanding aquifer management will become increasingly critical as the state continues to balance future needs with sustainable water quantity and quality.

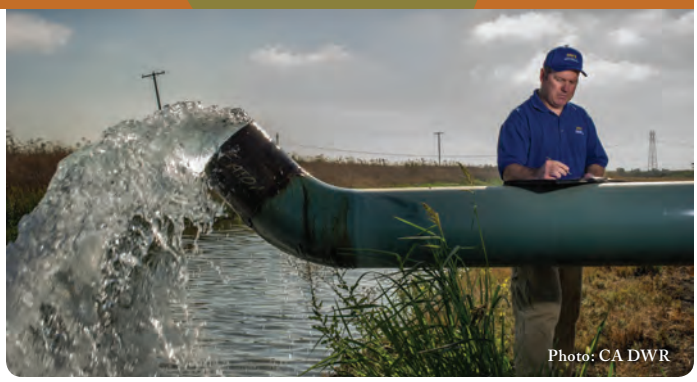


Photo: CA DWR

The connection between water drawdown, specifically as it applies to groundwater quality, is just beginning to be understood. Additional research in this area is necessary, but there is evidence that pumping of groundwater that leads to land subsidence also opens pathways for toxins such as chromium-6 and arsenic to enter the water supply.

About the Authors

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This brief is based on the papers *Overpumping leads to California groundwater arsenic threat* by Ryan Smith, Rosemary Knight and Scott Fendorf in the journal *Nature Communications* and *Hexavalent Chromium Sources and Distribution in California Groundwater* by Debra Hausladen, Annika Alexander-Ozinskas, Cynthia McClain and Scott Fendorf in the journal Environmental Science and Technology.