

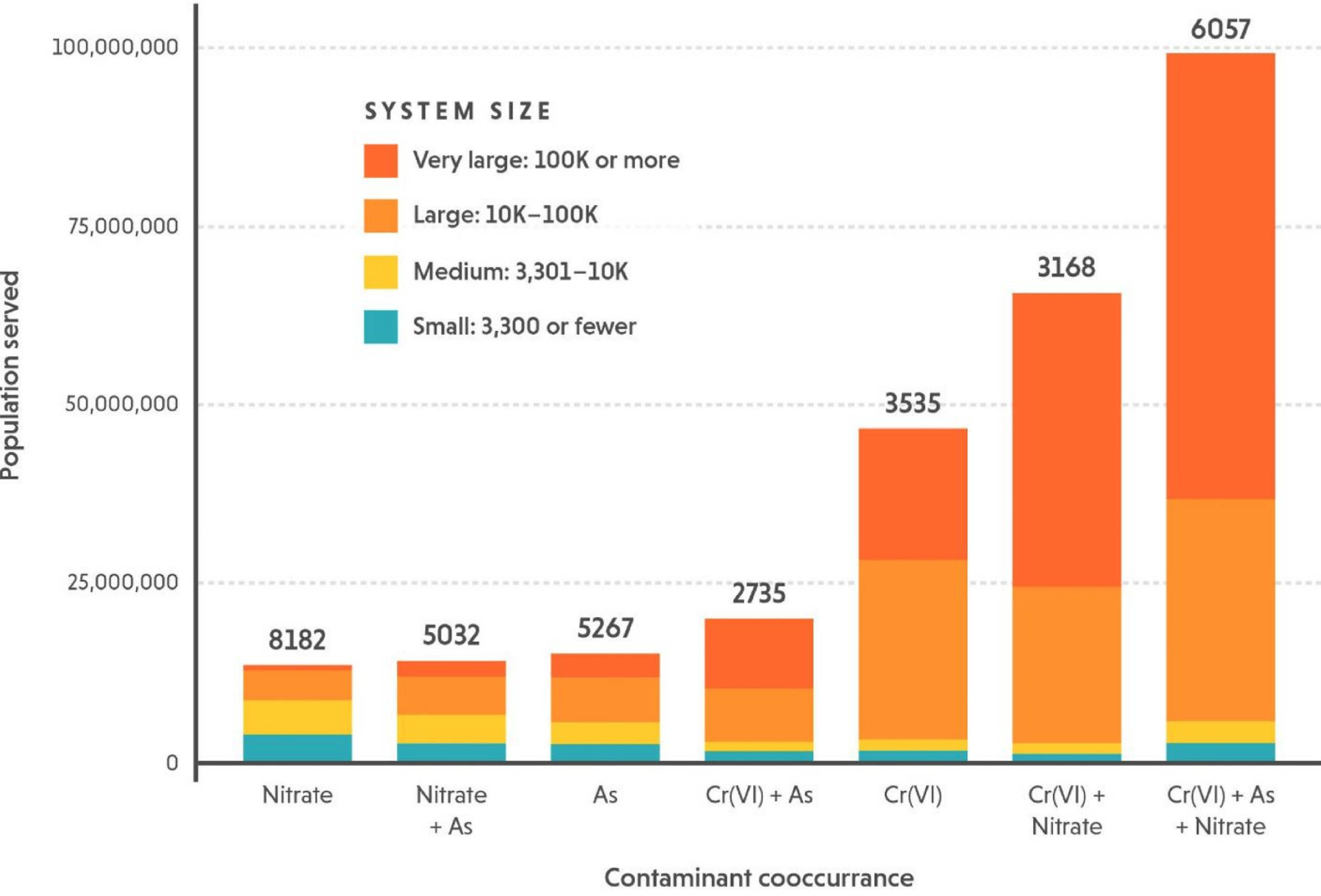
Simultaneous Removal of Co-occurring Contaminants Reduces Drinking Water-Attributed Cancer Risk: A United States Case Study

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Removal of co-occurring contaminants produces significantly greater potential benefit estimates compared to evaluation of one contaminant at a time. Here we present a framework for calculating avoidable lifetime cancer cases from simultaneously reducing hexavalent chromium and arsenic concentrations in drinking water using U.S. data as a case study.

Detection and co-occurrence above health-based benchmarks of Cr(VI), arsenic, and nitrate in community water systems.



Analysis of decreased cancer risk associated with the simultaneous reduction of co-occurring drinking water contaminants provides information for establishing new frameworks for mitigating contaminants and protecting public health from pollution. Consideration of the health and economic benefits associated with removal of co-occurring contaminants may help underscore the value of regulations that encourage the use of such technologies. It could also support the development of more efficient approaches for drinking water treatment.

National analysis of the percent reduction in arsenic needed to increase lifetime cases avoided.



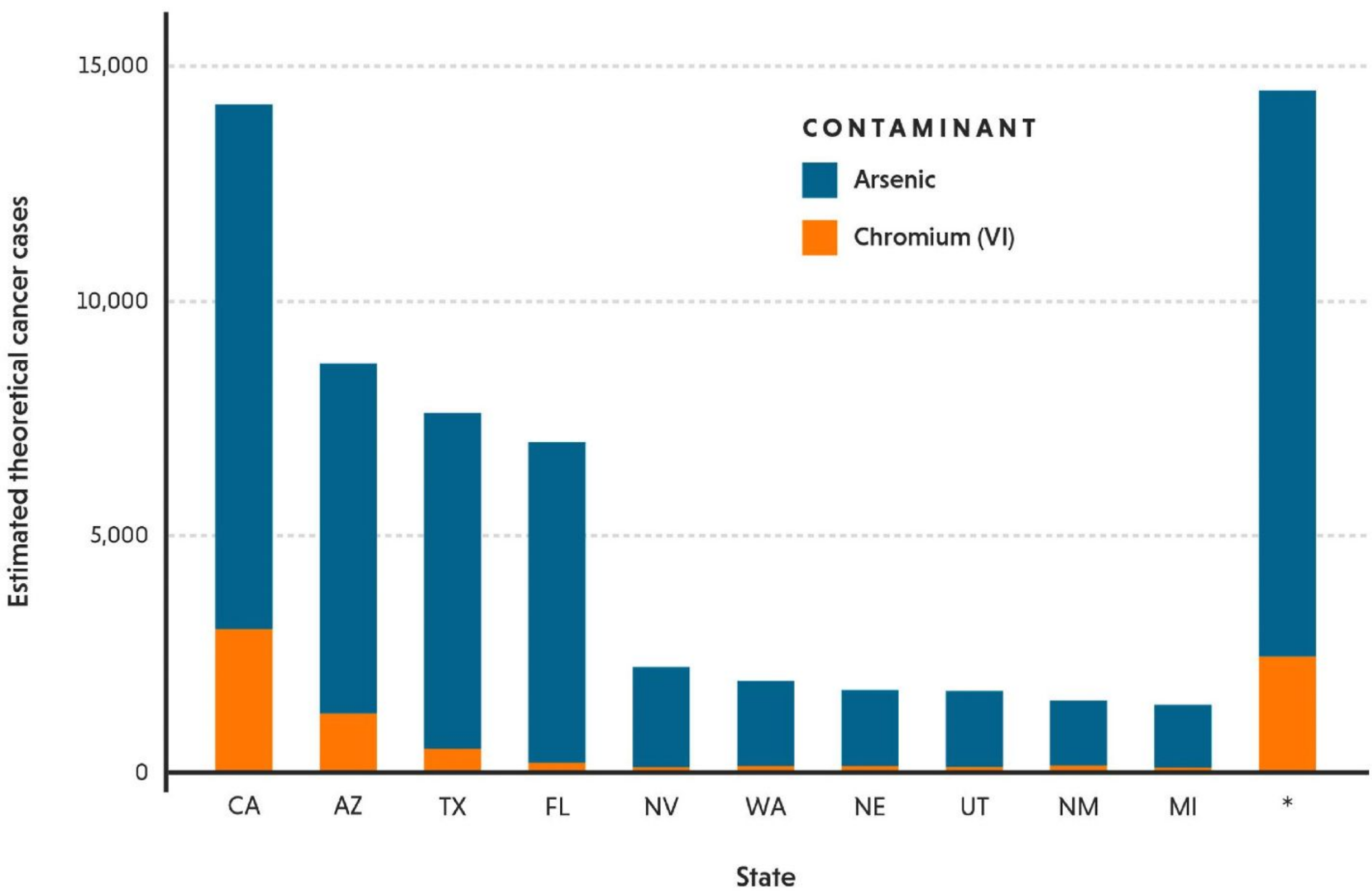
Estimated lifetime cancer cases avoided for Cr(VI) reduction scenarios in California

Hypothetical Cr(VI) MCL	Estimated number of systems impacted	Estimated lifetime cancer cases avoided
0.02 µg/L	1,305-2,526	3,724-4,454
1 µg/L	756-886	2,633-2,809
2 µg/L	544-567	2,034-2,093
5 µg/L	250-252	1,114-1,131
10 µg/L	87	455-459

This is a simplified version of the full results that appear in Table 1. For complete data and statistical details, please refer to the original table in the published paper. Ranges here reflect treatment of non-detect values as 0-1 µg/L.

For the entire U.S., an estimated 7,410 lifetime cancer cases from Cr(VI) exposure and 43,418 from arsenic exposure could be avoided if drinking water concentrations were reduced to their respective one-in-a-million cancer risk levels in systems with Cr(VI) detections. For hypothetical maximum contaminant levels of Cr(VI) at 10 and 5 µg/L, estimated avoidable lifetime cancer cases for the entire United States are 575 and 1,320 respectively. At these same hypothetical limits for Cr(VI), simultaneously reducing arsenic by 42% and 28% would double the number of lifetime cases avoided.

Number of theoretical cancer cases potentially avoided with improved water quality scenarios.



Hypothetical Cr(VI) MCL	Lifetime cancer cases avoided ^a	Percent reduction of arsenic to double cases avoided	Percent reduction of arsenic to quadruple cases avoided
10 µg/L	575	42%	(Not possible) ^b
5 µg/L	1,320	28%	84%
2 µg/L	2,865	27%	80%

This is a simplified version of the full results that appear in Table 1. For complete data and statistical details, please refer to the original table in the published paper. ^aThe calculated lifetime cancer cases avoided is based on direct-measured concentrations of Cr(VI) and Cr(VI) estimated from total chromium in groundwater systems. ^bThe maximum theoretical cases reduced with a 100% reduction of arsenic in impacted systems is estimated to be 1,370.