Appendix B - NOP Comment Letters

Bringing Water Together

Sent via ELECTRONIC MAIL to ddwhexavalentchromium@waterboards.ca.gov

December 6, 2021

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, CA 95812-0100

RE: ACWA Comment Letter regarding Notice of Preparation of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

Dear Ms. Niemeyer:

The Association of California Water Agencies (ACWA) appreciates the opportunity to submit written comments to the State Water Resources Control Board (State Water Board) regarding the Draft Program Environmental Impact Report (EIR) for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (MCL) following the public workshop held on November 29, 2021. ACWA represents over 460 local public water agencies that supply water for domestic, agricultural, and industrial uses to over 90% of California's population. ACWA's public agency members are entrusted with the responsibility of supplying the public with safe and reliable drinking water. ACWA appreciates State Water Board's role in determining an MCL for Hexavalent Chromium. Ensuring the safety of drinking water supplies by complying with all relevant state and federal standards is the highest priority of these agencies.

ACWA supports the State Water Board's decision to seek input from interested stakeholders on the preparation of a draft program EIR and hopes this effort results in a comprehensive evaluation of the potential impacts of complying with a new Hexavalent Chromium MCL. ACWA provides the following comments for the State Water Board as it moves forward with the development of an EIR for the development of an MCL for Hexavalent Chromium.

Comment 1- ACWA encourages recirculating the Notice of Preparation to all responsible agencies.

ACWA encourages recirculating the Notice of Preparation (NOP) to ensure that all responsible agencies are able to provide input to this process ahead of the development

of a Maximum Contaminant Level (MCL) for Hexavalent Chromium. NOPs are issued to provide input opportunities for responsible and trustee agencies, as well as interested members of the public, as to the scope and content of the EIR for a project. Preparation and circulation of an NOP are set forth in the State CEQA Guidelines to ensure this purpose is met. We are concerned that the current timeline will not enable all interested agencies to provide input because of:

- The quick comment deadline following the November 29 workshop
- Concern that not all agencies required to implement and carry out methods of compliance with the eventual Hexavalent Chromium MCL have been reached for input.
- Concern that the NOP lacks a finite project description (17 possible options) which makes very unclear what the Hexavalent Chromium MCL will be proposed. Each option will have different environmental impacts.

Comment 2- ACWA encourages further consideration of technical and economic issues in development of this Environmental Impact Report.

ACWA encourages further consideration of economic and physical issues in the development of the EIR because the resulting MCL could have significant impacts on the environment. The cost of compliance with the MCL for Hexavalent Chromium must be further analyzed because it will shape the behavior of public water agencies and the environmental impacts. Areas of concern to ACWA members that deserve further consideration in the EIR include:

- **Increased customer rates could result from public water agency efforts to comply.** The cost of compliance with an overly stringent MCL could shape not only the behavior of water agencies, but also of ratepayers who could face dramatic increases in monthly costs because of public water agencies' efforts to comply with the MCL. The benefits to public health of the Project should balance with the cost of compliance. Taking a larger share of community financial resources imposes foreseeable environmental and social impacts needs to be examined and understood.
- **Shift from groundwater usage to surface water usage**. The high cost of compliance with an overly stringent MCL could cause water agencies to shift from groundwater usage to surface water usage, and the EIR must analyze the potential environmental impacts of this reasonably foreseeable shift. The shift to surface water usage would have numerous deleterious impacts on the environment, including decreased in-stream flows and adverse impacts to fish and wildlife.
- **Decreasing economic feasibility of relying on groundwater supply.** We have concerns that the Project could threaten the economic feasibility of groundwater reliance in California, which would be devastating for the State and its people. While the NOP does not offer a definite project description, it suggests that the MCL for Hexavalent Chromium could be as low as 1 ppb.

- **Exacerbating drought conditions by limiting available water supply.** High treatment costs could result in increased use of surface water and other, non-groundwater sources of water. In a time of drought, the MCL could exacerbate water insecurity in California. Wells with water exceeding the MCL may be shut down where treatment of the water is not economically feasible. This shut down of impacted wells would be contrary to existing state policies emphasizing reliance on local water sources.
- **Increased dependency on surface waters would increase the need for water storage.** The MCL could spur a wave of reasonably foreseeable water storage and conveyance projects, as water agencies increasingly use surface waters to avoid the costs of compliance with the MCL. Water storage needs will require flooding large areas of land to store water, and the environmental impacts of transforming the environment in this manner should be further examined.

Comment 3- ACWA encourages the State Water Board to develop a new Public Health Goal for Hexavalent Chromium.

ACWA encourages a review of the current public health goal (PHG) for Hexavalent Chromium and the development of a new risk assessment to determine the de minimis lifetime cancer risk from exposure to Hexavalent Chromium based on the most recent scientific information available. A revised PHG could better inform the State Water Board in determining the proper MCL for Hexavalent Chromium and streamline any EIR regarding MCL for Hexavalent Chromium to best select from the 17 options proposed.

ACWA appreciates consideration of these comments. If you have any questions regarding these comments, please contact me at NickB@acwa.com or (916) 441-4545.

Sincerely,

Nicholas Blair
Regulatory Advocate

cc: The Honorable Joaquin Esquivel, Chair, State Water Resources Control Board
The Honorable Sean Maguire, Board Member, State Water Resources Control Board
Ms. Eileen Sobeck, Executive Director, State Water Resources Control Board
Mr. Darrin Polhemus, Deputy Director, State Water Resources Control Board Division of Drinking Water
Mr. Michael Lauffer, Chief Counsel, State Water Resources Control Board
Mr. Dave Eggerton, Executive Director, Association of California Water Agencies
Ms. Cindy Tuck, Deputy Executive Director for Government Relations, Association of California Water Agencies

December 6, 2021

State Water Resources Control Board
Office of Chief Counsel
Attn: Kim Niemeyer
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Sacramento, CA 95812-0100
By email to: ddw-hexavalentchromium@waterboards.ca.gov

Subject: Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)

Dear Kim Niemeyer:

The California-Nevada Section, American Water Works Association (CA-NV AWWA)is pleased to submit the following comments in response to the Notice of Preparation (NOP) of a Draft Program Environmental Impact Report (DEIR) on the Project. With over 4,700 individual members and over 470 water utilities of all types in our organization, CA-NV AWWA has a strong interest in the State Water Board's actions in regulating drinking water, including with hexavalent chromium.

We submit the following comments on environmental impacts that should be considered in preparing an Environmental Impact Report on adopting a regulation for hexavalent chromium.

1. **Clarify the full scope of this Programmatic EIR**. As required by the California Environmental Quality Act (CEQA) [14 CCR §15187] the State Water Resources Control Board must analyze the "reasonably foreseeable methods by which compliance with [the] … regulation will be achieved." The NOP identifies three treatment technologies considered Best Available Technology, and it states that Public Water Systems (PWSs) can consider other alternatives, with several examples provided. Those alternatives are in fact "reasonably foreseeable methods of compliance" that require environmental analysis under CEQA. Thus, the Programmatic EIR needs to be clear that its scope includes several of the actions triggered by adoption of a proposed MCL.
    - The scope of the EIR needs to cover all actions the State Water Board may take in implementing the regulation. Thus, for example, the EIR should cover an order by the State Water Board mandating the consolidation of two or more water systems, as a means of complying with the regulation.
    - The scope of environmental analysis must include all the alternatives (BAT as well as the listed alternatives PWSs could consider) as "reasonably foreseeable methods of compliance" with the adopted MCL. The NOP identifies as alternatives, "the removal of contaminated source wells from use, blending of a contaminated source with an uncontaminated source to meet the MCL prior to distribution, drilling and constructing a new well in an uncontaminated aquifer, switching from contaminated groundwater to surface water, or consolidation with another water system that meets the MCL."

2. **Consider the environmental impacts of the foreseeable compliance actions (three BAT and the four alternative compliance strategies) available to PWSs**. Notwithstanding the lack of precision about the scope

in the comment above, we believe it is incumbent on the State Water Board to consider and compare the environmental impacts that will be caused by the proposed regulation, at each of the possible Maximum Contaminant Levels. Some examples, not intended to be an exhaustive list, would logically include:

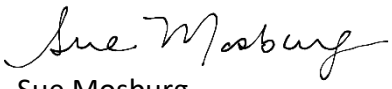
- Impacts from siting and construction of new water conveyance and/or treatment systems, such as land disturbance, traffic, noise, and air pollution;
- Impacts from the water treatment process and removal of hexavalent chromium, such as noise, energy use with attendant climate and air quality effects, transportation and disposal of solid and/or liquid waste streams containing concentrated amounts of hexavalent chromium (the source of which may be natural occurrence);
- Impacts from the alternative strategies for compliance with the regulation, especially of switching from contaminated groundwater to surface water as the source of drinking water;
- The relative increase or reduction of the environmental impacts from setting a lower (more stringent) or higher (less-stringent) MCL for the 17 levels to be considered.

3. **Include analysis of physical changes related to the social and economic effects of compliance with the regulation**. A new mandatory requirement imposed on a community's available financial resources will have impacts that reach to the environment. For disadvantaged communities (DACs or severely DACs), the cost of complying with a new MCL will acutely strain the ability to meet other community environmental needs, such as public sanitation facilities, or parks. Economic effects on such communities have foreseeable environmental impacts, and the evaluation of the Project must consider physical effects which, by taking a larger share of community financial resources, impose foreseeable environmental changes. Despite state mandates, we expect the Draft EIR must include a robust discussion of a No Action alternative.

4. **Additional issues may be relevant to the DEIR**.
    - We believe the State Water Board needs to establish a reasonable timeframe (of three to five years) for PWSs to achieve compliance with new drinking water regulations, with hexavalent chromium serving as a prime example.
    - We are also extremely troubled by a recent appellate court decision[1] reversing a lower court's summary judgment in favor of the city of Vacaville. This split decision of the Ninth Circuit allows a citizen suit to proceed on grounds that by serving drinking water that complies with the current hexavalent chromium MCL, the city is in violation of the Resource Conservation and Recovery Act (RCRA) by "transporting" a hazardous substance subsurface to its drinking water wells. Such an interpretation of RCRA would impute major environmental impacts to any agency with hexavalent chromium in its drinking water source and should be considered in the Draft EIR.

We appreciate the opportunity to suggest these issues and questions for evaluation in the Draft Programmatic Environmental Impact Report.

Sincerely,



Sue Mosburg
Executive Director

[1] California River Watch v. City of Vacaville. http://cdn.ca9.uscourts.gov/datastore/opinions/2021/09/29/20-16605.pdf

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Re: COMMENTS – Notice of Preparation of a Draft Program Environmental Impact Report, Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)

Dear Kim Niemeyer:

The Beaumont Cherry Valley Water District (BCVWD or "District"), a municipal retail water agency regulated by the Division of Drinking Water (DDW), submits these comments in response to the State Water Resources Control Board's (State Water Board or SWRCB) Notice of Preparation (NOP) of an environmental document for the development and adoption of a regulation for hexavalent chromium (Cr6) Maximum Contaminant Level (MCL), the "Project". BCVWD was impacted by the previous MCL which has since been withdrawn. BCVWD was required to take several of our very large production wells offline to comply with the previous MCL. At the time BCVWD was evaluating various technologies for treatment and our preliminary evaluation of the treatment technology at the time was that it would impact our financially disadvantaged community significantly.

BCVWD is a responsible agency for the Project, as it is, a water district that will be required to comply with the new MCL and approve "methods of compliance" with the MCL (State CEQA Guidelines, § 15381.) The MCL may significantly impact BCVWD, its ratepayers, and the environment. BCVWD was disappointed that these impacts were not properly evaluated for the 2014 chromium-6 MCL. BCVWD supports the State Water Board's decision to seek input from interested stakeholders on the preparation of a draft program environmental impact report and hopes this effort results in a comprehensive evaluation of the potential impacts of complying with a new chromium-6 MCL. In the spirit of cooperation with the State Water Board, BCVWD provides these written comments to help ensure that the State Water Board complies with the California Environmental Quality Act (Pub. Resources Code, § 21000, et seq.: "CEQA").

BCVWD service area is 28 sq. mi., located primarily in Riverside County though the BCVWD has some watershed lands in San Bernardino County. BCVWD serves the

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City of Beaumont and the unincorporated community of Cherry Valley. The current population served by BCVWD, as reported in our 2020 Urban Water Management Plan (UWMP), is 59,259, with 19,995 service connections (as of 09/30/2021). In Beaumont, based on preliminary data from the 2020 census, 54.6% of the population are minority or mixed race; 13.5% of the population is 65 years of age and older; in Cherry Valley, 27.3% of the population are over 65 years of age; portions of the City of Beaumont are classified as a disadvantaged community. Much of the service area is on a fixed or low income. BCVWD is much like other smaller water agencies in California.

BCVWD relies exclusively on groundwater and imported State Project Water which is recharged at the BCVWD's recharge site and subsequently extracted with only chlorination required. BCVWD's wells were tested for Cr6 as part of the data collection program prior to establishing the previous MCL and three wells were impacted. These wells were either taken out of service or connected to the BCVWD's non-potable water system. The service area is growing rapidly; maintaining adequate well supply is a challenge due to the uncertainty of the costs for Cr6 treatment and the disposal of the residuals from the treatment process. A problem many agencies in California will be facing with the implementation of the Cr6 MCL.

The establishment of an MCL for chromium-6 directly concerns BCVWD, as BCVWD's groundwater is impacted by naturally occurring chromium-6 due to the local geology. BCVWD thus desires that any MCL for chromium-6 that is established by the State Water Board have a meaningful opportunity for risk reduction and be technologically and economically feasible, as required by law. Such an MCL would allow BCVWD to continue providing a sustainable and affordable public water supply to its residents.

BCVWD is concerned, however, about the impacts of an unduly stringent MCL that might require BCVWD to construct economically infeasible facilities or deploy treatment options at enormous cost. Both the construction of new facilities and the deployment of treatment options would have significant impacts on the environment. Moreover, a new MCL could result in the shutting down of groundwater wells and increasing demands on surface water supplies in a time of significant and historic drought. As a result, BCVWD's ratepayers—many of whom are economically vulnerable – could see significant increases in their monthly water expenses. BCVWD urges the State Water Board to consider these important concerns when drafting the EIR and selecting the proper MCL.

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The NOP indicated the State Water Board is considering 17 possible MCLs (from 1 to 15, 20, and 25 µg/L). The Project scope also includes the reasonably foreseeable methods of compliance which include:

- Treatment technologies
- Removal of contaminated source wells from use
- Blending of a contaminated source with an uncontaminated source to meet the MCL prior to distribution
- Drilling and constructing a new well in an uncontaminated aquifer
- Switching from contaminated groundwater to surface water
- Consolidation with another water system that meets the MCL.

BCVWD's comments focus on the following issues:

- The "Project" is defined inadequately; there is too broad a range of MCLs to properly evaluate the affordability and the socio-economic impacts and other impacts under CEQA
- Sound Science and Affordability
- Treatment Technologies and Residuals Disposal

Project Definition

The Project needs definition. The environmental impacts of an MCL ranging from 1 to 25 µg/L covers 2.5 orders of magnitude. BCVWD does not believe that this wide range of MCL can be adequately addressed. Generally, when an EIR is prepared, the project is clearly defined and reasonably equivalent alternatives in addition to the "no project" are evaluated. With MCLs ranging over 2.5 magnitudes, it does not seem reasonable that the environmental impact of the "alternative MCLs" can be properly evaluated. BCVWD believes the SWRCB should narrow the range of MCLs to be evaluated. The range of the MCLs should be based on affordability, socio-economic impact, water resource impacts, reduction in health risk, as well as other impacts.

Sound Science and Affordability

BCVWD recognizes the potential health risk with consumption of Cr6 over the long term. Much of the data used by the Office of Environmental Health Hazard Assessment (OEHHA) in the development of the Public Health Goal (PHG) and the original MCL is outdated. There is new information published that should have been analyzed to develop appropriate MCL vs. increased health risk "curves." This had been discussed and commented on several months ago. It appears that those comments

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have not been considered in the development of the "project." The science and methodology used to develop the MCLs proposed and the health risk benefits from the alternatives should be addressed in the Environmental Impact Report (EIR).

Before setting the MCL, BCVWD requests the State Water Board consider, first and foremost, the affordability of the selected MCL concentration in the preparation of the EIR. The selected MCL will impact low income and minority communities and seniors, not only in BCVWD's service area, but service areas throughout California. Small systems will be the hardest hit financially; and they can least afford the expensive treatment technology for Cr6 or replacement water sources.

The previous MCL was 10 μg/L and impacted three (3) of BCVWD's large wells with a total capacity of close to 6,000 gallons/minutes (gpm). This is 8.6 million gallons per day (mgd) or about 1/3 of BCVWD's maximum summer day demand. In other words, BCVWD would lose 1/3 of its summer-day water supply until treatment can be implemented. Blending is not an option since BCVWD's wells are separated from one another by a considerable distance and conveyance of the water to a central blending facility (which would be required by DDW prior to distribution) would be costly. BCVWD could abandon the wells, which are relatively new, and elect to purchase more imported water from Northern California at a considerably higher cost than pumping groundwater, but that option would have an impact on the Delta. The State Water Board should understand that BCVWD recharges the imported water as part of a conjunctive use project to maximize the yield from the State Water Project (SPW) when water is available. This will be ever-more important to BCVWD and the rest of California when the impacts of climate change on the State Water Project are considered. Recharging of SPW and then recovering it in an aquifer with natural Cr6 may not be economical, depending on the MCL selected. If the MCL is set very low, subsequent treatment of the recharged water would be needed or force BCVWD to construct a surface water treatment plant and use imported water. Conjunctive use projects all over the State could be significantly impacted.

When all factors are considered, the State Water Board should not just focus on the affordability of providing treatment for Cr6 but look at the affordability and environmental impacts of the treatment alternatives that have been proposed by the State Water Board.

Treatment Technologies and Residuals Disposal

The technology for the treatment of Cr6 is evolving with newer technologies using stannous chloride ($SnCl_2$), with and without filtration, and perhaps others (Stannous chloride is not NSF approved for water treatment.) Traditionally ion exchange was

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used, but this process has significant environmental impacts resulting from the disposal of the regeneration chemicals. Reverse osmosis has a relatively large volume (about 20% of the incoming water) of residual wastewater containing about 4 or 5 times the well water Cr6 concentration. This is not easily disposed of and the EIR must consider this when evaluating the MCL. Setting a very low MCL will mean larger volumes of residual wastewater to be disposed of since partial, side-stream, reverse osmosis or ion exchange treatment will not be possible.

In setting the MCL, the State Water Board must the consider the performance of the treatment technologies. Reverse osmosis systems will likely perform well at even low Cr6 concentrations, but that may not be true other technologies. The State Water Board must consider on-going full scale or demonstration project performance in the establishment of appropriate treatment technologies, not just laboratory or pilot plant work. Reverse osmosis recovery is only about 80%, which means that 20% of the feed water containing the Cr6 will be lost. The State Water Board should address the impacts on the "replacement" water source, i.e., imported water from the Colorado River, State Project Water, etc. in the EIR.

The listed treatment technologies have residuals. These residuals now contain the Cr6 removed from the water supply in one form or another, only in a significantly greater concentration. Where these residuals are disposed have their own environmental impact(s) which must be fully addressed in the EIR.

Recommendation for a Staged Approach

BCVWD urges the State Water Board to consider a "staged approach" for implementation of the MCL. If the MCL is set unreasonably low initially, this will force water systems into installing proven, but expensive-to-construct and operate, systems, only to find out later that lower-cost technology could have been installed. If the MCL is staged, there is less pressure on installing an expensive system immediately. Perhaps a system that meets an intermediate level MCL would suffice for a while until technology catches up. A staged approach would allow time to conduct pilot and demonstration-scale treatment technologies, evaluate alternatives to meet the near-term MCL, develop financial plans to meet more long-term MCLs, and secure NSF approval for technologies, if needed. The treatment technologies are costly to construct and operate. Training and certification of operators for these technologies will put a financial burden on small systems and communities. Financial plans must be developed implement treatment or develop new water supplies, as well as adoption of rate structures to operate and maintain the treatment technology. Water agencies need time to strategize, plan, and implement these systems. A staged MCL would provide this time.

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Summarizing

BCVWD appreciates the opportunity to provide comments on this very important project and appreciates the State Water Board's consideration of our comments which can be summarized:

- Narrow the range of MCLs to better define the project and focus the environmental impact analysis
- Ensure the EIR addresses the science, health risk and affordability of the MCLs through the use of new studies and data
- Thoroughly evaluate the impacts of alternative MCLs and treatment and residual disposal technologies versus the benefits, i.e., reduction in health risk
- Evaluate the impacts, including the economic impact, of the need to secure additional water resources to implement alternative water supplies or residuals disposal
- Consider and evaluate a staged approach to the MCL

If the State Water Board has any questions, contact Dan Jaggers, PE, General Manager, Beaumont Cherry Valley Water District, (951)-845-9581, or Dan.Jaggers@bcvwd.org. Thank you again for considering our comments.
Sincerely yours,

12/6/2021

Dan Jaggers, PE
General Manager

BCVWD Respond to NOP 20211206.docx

Officers

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Sonoma Water

Greg Woodside, Vice President
Orange County Water District

Vice President
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Affiliate Members

Rosedale-Rio Bravo Water Storage District

Institutional/Educational Membership

Groundwater Resources Assn of CA
Lawrence Berkeley National Laboratory

Legislative Advocate

Rosanna Carvacho Elliott
Clear Advocacy

December 6, 2021

VIA E-MAIL: ddw-hexavalentchromium@waterboards.ca.gov

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State Water Board
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RE: Notice of Preparation of a Draft Program Environmental Impact Report Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

Dear Ms. Niemeyer,

On behalf of the California Groundwater Coalition (CGC), thank you for the opportunity to comment on the Notice of Preparation (NOP) of a Draft Program Environmental Impact Report Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project). CGC members include public and private groundwater managers located throughout California and consist of experts with technical, legal, and professional groundwater and related expertise.

CGC respectfully requests that the State Water Board complete a full Environmental Impact Report (EIR) for the Project, following the science and risk assessment while also considering the cost and benefit of treatment options, especially for disadvantaged communities that lack access to financial resources and the ability to raise water rates on their customers.

The State Water Board should follow the science and risk assessment when selecting a maximum contaminant level (MCL) for hexavalent chromium (Chromium 6). Unfortunately, at this point the Project is being undertaken without using the best available science. The State Water Board is basing the MCL on a Public Health Goal (PHG) that is more than ten years old and is derived from a study by the National Toxicology Program that is almost fifteen years old. This ignores the Office of Environmental Health Hazard Assessment's (OEHHA) determination, five years ago, that more scientific information requires an updated PHG.

Additionally, the cost and benefit of different treatment options must be considered prior to adopting an MCL. The NOP provides potential methods of compliance depending on the best available technologies identified or alternative measures to reduce Chromium 6 in the distribution system. The cost impacts of these

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compliance methods will be the most harmful to disadvantaged communities where increased water rates compromise affordability and access.

CGC respectively requests that the State Water Board base the new Chromium 6 MCL on an updated PHG through OEHHA that incorporates the best available science.

Thank you for the opportunity to provide these comments on the NOP. If you have questions about any of CGC's comments please contact our Legislative Advocate, Rosanna Carvacho Elliott at 916-812-6519 or rosanna@clearadvocacy.com.

Sincerely,

Ann DuBay
President, California Groundwater Coalition

Officers and Board of Directors:
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James Crawford, Vice President
Jason Wen, Treasurer
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Dan Arrighi
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Cities:
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Public Water Districts:
Central Basin Municipal Water District
La Habra Heights County Water District
Orchard Dale Water District
Pico Water District
South Montebello Irrigation District

Public Utilities:
California-American Water Company
California Domestic Water Company
California Water Service Company
California Water Service Company (Dominguez)
Golden State Water Company
Liberty Utilities
Los Angeles Department of Water and Power
San Gabriel Valley Water Company
Suburban Water Systems

Mutual Water Companies:
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Maywood Mutual Water Company No. 2
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December 6, 2021

Ms. Kim Niemeyer
Senior Staff Counsel
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Subject: Comments on Notice of Preparation (NOP) of a Draft Program Environmental Impact Report for Adoption of a Regulation for the Hexavalent Chromium (Chromium-6) Maximum Contaminant Level ("Project")

Dear Ms. Niemeyer:

Please accept the following comments by the Central Basin Water Association (CBWA) about the Notice of Preparation for Adoption (NOP) of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium (Chromium 6) Maximum Contaminant Level (MCL). This is being described in the NOP as "the Project." The State Water Resources Control Board (SWRCB) is the lead agency under the California Environmental Quality Act (CEQA) for this potential regulation. The CBWA consists of 44 water suppliers situated in the area that overlies the Central groundwater Basin in Los Angeles County. Collectively, CBWA members provide domestic water service to nearly one million residents. CBWA has made, and continues to make, significant local investments in conservation programs and infrastructure through our member agencies and in cooperation with other groundwater management agencies.

The SWRCB must directly notify and consult responsible agencies under CEQA Guidelines. CBWA members are responsible agencies for the Project. As drinking water suppliers, they will be required to comply with the new MCL adopted under this Project, meaning some of them will necessarily employ a treatment technology (one of the Best Available Technologies or a different technology) or an alternative method to achieve compliance, a few of which are foreseen and identified in the NOP. Any of these methods of compliance may have significant environmental impacts. The NOP inaccurately states that "[w]ater systems with hexavalent chromium exceeding the proposed MCL are located throughout the state and specific locations are not currently known." The SWRCB has obtained significantly more data in recent years on the occurrence of hexavalent chromium and the public water systems that will be directly affected by an MCL.

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CEQA Guidelines call for more direct notification of responsible agencies, which would either be every public drinking water system in California, or at least those drinking water systems that presently use a water source containing chromium-6 near at or above the proposed MCL.

The Project Need is questionable and must be reexamined. We are concerned the need for the Project rests on outdated and inaccurate scientific information as represented in the Public Health Goal (PHG) from 2011. The Office of Environmental Health Hazard Assessment (OEHHA) at that time established the PHG for chromium-6 at 0.02 ppb, based on a *de minimis* lifetime cancer risk from exposure in drinking water. OEHHA was obligated to reconsider this PHG on a five-year cycle, but while more recent scientific information on the human health effects of ingesting chromium-6 indicates that the risk is far less than previously thought, the PHG has not been reviewed—or if reviewed, no justification provided for maintaining the old PHG. With a reevaluation of readily available, peer-reviewed scientific evidence, the Project may not be needed.

Modify the range of alternatives and include a No Action alternative. A "No Action" alternative to the Project should thoroughly examine the question from the preceding paragraph. Chromium-6 is currently regulated in drinking water by California's MCL of 50 µg/L for total chromium, which is more stringent than the federal MCL of 100 µg/L. The NOP indicates, "The SWRCB is considering 17 possible MCLs (1 to 15, 20, and 25 µg/L)." Analyzing the impacts of MCLs at 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, *and* 15 µg/L unnecessarily complicates the analysis and confounds the objective to "describ[e] the project and the potential environmental effects to enable the responsible agencies to make a meaningful response" [CEQA Guidelines (14 CCR § 15082)]. The SWRCB should reduce the number of possible MCLs to a few numbers across that range, such as 1, 5, 10 and 15 µg/L, plus 20 and 25 µg/L.

The Project is likely to cause many environmental impacts that need to be analyzed in the EIR. Although the Project is not specific, and does not describe the environmental impacts, as stated above, it does suggest some of the implementation actions Public Water Systems may opt for, to achieve compliance with the MCL. Environmental consequences directly resulting from adopting a new drinking water regulation for chromium-6 will depend on the actions to comply with the MCL, and may include:

- Construction of treatment plants – changed land use, increased noise, dust or other air emissions
- Operation of treatment plants – air pollution and greenhouse gas emissions from increased power use and transportation of treatment chemicals and treatment residuals; disposal of concentrated chromium-6 in liquid or solid residuals, which may be classified as hazardous wastes
- Changing water sources – shifting from a groundwater source to surface water may impact air quality due to conveyance pumping, stress on aquatic and other biological resources including sensitive species.

Cumulative impacts must be analyzed. Chromium-6 occurs occurs in water sources across many regions of the state, as shown by data the SWRCB has collected. The cumulative environmental effects of a new MCL could be quite significant, especially at the more stringent MCLs, and must be evaluated.

Economic effects of the MCL may result in impacts to the physical environment. For any community, but especially communities with many low-income residents, the economic and social effects of a new regulatory mandate impinge on other choices about the use of limited financial resources. In this way, a stringent MCL will have impacts to the physical environment, limiting coboammunity-wide opportunities for trees and other healthy landscapes, parks and outdoor recreation, sanitation, recycling programs, and so forth. Likewise, as water rates rise to cover the cost of treatment or alternative strategies to comply with the MCL, individual households' opportunities to create a more healthful physical environment will be constrained in similar ways. These effects need to be analyzed in the Program EIR.

On behalf of our members, CBWA appreciates the opportunity to submit these recommendations for a thorough and complete environmental review of the proposed Project. We look forward to continuing to offer constructive input in the CEQA process and, if the Project moves ahead, in the SWRCB's regulatory process.

Sincerely,

Mark Grajeda
President, Board of Directors
Central Basin Water Association

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December 6, 2021

VIA E-MAIL AND U.S. MAIL

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, CA 95812-0100
ddw-hexavalentchromium@waterboards.ca.gov

Re: Comment Letter re Notice of Preparation of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

Dear Ms. Niemeyer,

The City of Coachella ("City") submits these written comments in response to the State Water Resources Control Board's ("State Water Board") Notice of Preparation ("NOP") of a Draft Program Environmental Impact Report ("EIR") for the adoption of a regulation for the maximum contaminant level ("MCL") for hexavalent chromium ("chromium-6"). According to the NOP, the project at issue in the Draft Program EIR entails (i) seventeen (17) possible MCLs for chromium-6 (1 to 15, 20, and 25 parts per billion ("ppb")); and (ii) "reasonably foreseeable methods of compliance" with the MCLs (collectively, the "Project").

The City is a responsible agency for the Project, as it operates its own public water system, and will be required to comply with the new MCL. (State CEQA Guidelines, § 15381.) The MCL would significantly impact the City, its ratepayers, and the environment. Given the potential impacts of the MCL, the City appreciates the State Water Board's commitment to prepare an EIR for the Project. To protect the environment and stakeholders, the EIR must include a robust analysis of the Project's potential environmental impacts. The City hopes that its written comments will help the State Water Board fully analyze, mitigate, and avoid the potential environmental impacts of the Project in compliance with the California Environmental Quality Act (Pub. Resources Code, § 21000, et seq.: "CEQA").

1. <u>The Project Could Dramatically Impact The City Of Coachella, Its Ratepayers, And The Environment</u>.

The City of Coachella is located in Riverside County on the eastern edge of the Coachella Valley. The City has a population of approximately 45,000 residents, most of whom are economically disadvantaged. The median household income in the City is approximately $35,000. As discussed further below, the proposed Project could have potentially significant

impacts on the environment and on the City's ratepayers, many of whom will not be able to afford the rate increases necessary to offset the costs of compliance with an overly stringent MCL.

The City will be uniquely impacted by the setting of a new MCL because groundwater is the City's only water source. The City operates its own public water system, obtaining its water from six groundwater wells that have a total pumping capacity of approximately 16.9 million gallons per day. This groundwater has naturally occurring chromium-6 that is the result of the valley's geology. For this reason, the City has long been concerned about the establishment of an MCL for chromium-6 that protects public health while being both technologically and economically feasible, as required by law. Such an MCL would allow the City to continue to provide a sustainable public water supply to its residents.

The Project, however, could result in an MCL that is neither technologically nor economically feasible for the City, with crushing impacts on the City, its ratepayers, and the environment. For example, the previous MCL of 10 ppb for chromium-6—in effect between 2014 and 2017, when a court invalidated the MCL—would have created significant challenges for the City's public water system. To implement the previous MCL of 10 ppb, the City developed plans to construct and operate a strong base anion exchange system, which would have cost $36.2 million to construct. Implementing this treatment technology to achieve an MCL of 10 ppb would have resulted in a 120 percent increase in average water rates per customer over a five year period. This would have resulted in increases of approximately $53 per month or $636 per year for the City's ratepayers—an increase many ratepayers could not afford then, and an increase which even fewer ratepayers can afford now amidst the challenges of surging inflation and the Covid-19 pandemic.

Remarkably, the proposed Project here may result in an MCL ten times more onerous than the invalidated MCL of 10 ppb. The Project proposes an MCL as low as 1 ppb—a standard that would devastate the City and its ratepayers by endangering the economic feasibility of the City's only water source and the City's ability to maintain a sustainable public water supply system.

The City is concerned that an unduly stringent MCL might require the City to construct economically infeasible facilities or to deploy other treatment options at enormous cost. Both the construction of new facilities and the deployment of treatment options would significantly impact the environment. For example, an overly stringent MCL could result in the shutting down of groundwater wells and increasing demands on surface water supplies in a time of significant and historic drought. The proposed MCL could have enormous adverse economic impacts on the City and its ratepayers, but these impacts are not just economic—they will translate into significant and unavoidable environmental impacts. These impacts must be avoided, and the means to avoid them is by adopting an economically and technologically feasible MCL. The City urges the State Water Board to consider these important concerns when drafting the EIR and selecting the proper MCL. As discussed below, CEQA requires analysis of these impacts.

2. <u>The NOP Is Procedurally Defective And Must Be Recirculated</u>.

The purpose of an NOP is to solicit guidance from responsible and trustee agencies, as well as interested members of the public, as to the scope and content of the EIR for a project. (State CEQA Guidelines, § 15375.) Requirements governing the preparation and circulation of an NOP

are set forth in the State CEQA Guidelines to ensure this purpose is met. (See State CEQA Guidelines, § 15082.) Unfortunately, these requirements have not been met with the State Water Board's NOP regarding the Project.

A. The NOP has not been sent to all responsible and trustee agencies

The State Water Board, as lead agency for the Project, is required to send the NOP to each responsible and trustee agency for the Project by "either certified mail or any other method of transmittal that provides it with a record that the notice was received." (State CEQA Guidelines, § 15082(a).) The State Water Board, however, has not met this basic and fundamental requirement. Because the "project scope includes not only setting the MCL for hexavalent chromium, but also the reasonably foreseeable methods of compliance," every water district or other entity that is required to implement and carry out methods of compliance with the MCL is a responsible agency for the Project. (State CEQA Guidelines, § 15381 [defining responsible agency].)

The City is a responsible agency for the Project because it operates its own public water system with naturally occurring hexavalent chromium, and the City will be required to deploy facilities or treatment methodologies to bring its facilities into compliance with the new MCL. (State CEQA Guidelines, § 15381.) Yet, the State Water Board did not send a copy of its NOP to the City via certified mail—a violation of CEQA. The NOP must be recirculated and sent to all responsible agencies via a method of transmittal that provides the State Water Board with a record that the notice was received.

B. The NOP has not been filed with all relevant County Clerks

The State Water Board is also required to file the NOP "with the county clerk of each county in which the project will be located." (State CEQA Guidelines, § 15082(a).) Again, the State Water Board has failed to comply with this requirement. The NOP was not filed in Riverside County, nor was it filed in the State's largest metropolitan area, Los Angeles County. The NOP acknowledges that the Project includes "a statewide regulation that would apply to all public drinking water systems in the State of California," and that "water systems with hexavalent chromium exceeding the proposed MCL are located throughout the state." (NOP, p. 1.) Presumably for this reason, OPR lists the Project as occurring in every county in the State: https://ceqanet.opr.ca.gov/2021110099 The NOP should therefore be filed with the county clerk of every county in the State. (State CEQA Guidelines, § 15082(a).) This will ensure that the NOP serves its purpose of soliciting guidance from every responsible and trustee agency for the Project, as well as interested members of the public state-wide.

C. The NOP does not include a stable, finite project description

A stable, finite project description is necessary and paramount to comply with CEQA. (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 192-193.) Indeed, the adequacy of the project description is inextricably linked to the sufficiency of the analysis of the project's impacts on the EIR. (*Laurel Heights Improvement Ass'n v. Regents of Univ. of California* (1988) 47 Cal.3d 376.) For this reason, an NOP must provide responsible agencies and the public "with

sufficient information describing the project ... to enable the responsible agencies to make a meaningful response." (State CEQA Guidelines, § 15082(a)(1).)

A "project description that gives conflicting signals to decision makers and the public about the nature and scope of the project is fundamentally inadequate and misleading" and violates CEQA. (*Washoe Meadows Community v. Dept. of Parks and Rec.* (2017) 17 Cal.App.5th 277, 281.) Accordingly, courts have repeatedly held that a lead agency violates CEQA where it does not identify a single finite proposed project, but instead identifies an assortment of alternative projects. (*Washoe Meadows, supra*, 17 Cal.App.5th at p. 281 [CEQA violated where lead agency did not identify a proposed project, but described five different alternative projects without specifying a preferred alternative]; *Stopthemilleniumhollywood.com v. City of Los Angeles* (2019) 39 Cal.App.5th 1, 20.) Where the lead agency does not commit to a stable, finite project description, but rather analyzes a variety of alternatives or concepts, it is immaterial that the lead agency thoroughly analyzes each of the alternatives. Even if the environmental impacts of each alternative is analyzed, the failure to present a stable, finite project description is prejudicial error under CEQA. (*Stopthemilleniumhollywood.com, supra*, 39 Cal.App.5th at p. 20.)

Here, the State Water Board, like the lead agency in *Washoe Meadows*, has not committed to a stable, finite project description. Rather, the State Water Board calls out **seventeen** very different alternative projects—i.e., seventeen possible MCLs for chromium-6 (1 to 15, 20, and 25 ppb)—without specifying a preferred alternative. Each of these projects would have different environmental impacts requiring different mitigation measures.

For example, the City's comments regarding a proposed MCL of 1 ppb would be dramatically different from its comments on a proposed MCL of 25 ppb. These are completely different projects with different environmental impacts, and they cannot be lumped together in the same NOP. Likewise, the NOP vaguely asserts that the Project includes "foreseeable methods of compliance," but fails to specify what precisely this entails. These vague and noncommittal characterizations of the Project deprive responsible agencies and the public of the opportunity to comment on an accurate, stable, and finite project description. This is a violation of CEQA. (*Washoe Meadows, supra*, 17 Cal.App.5th at p. 281; *Stopthemilleniumhollywood.com, supra*, 39 Cal.App.5th at p. 20.) To remedy this violation, the State Water Board must issue a new, recirculated NOP that identifies a single, proposed MCL for chromium-6.

D. The NOP does not describe any of the project's potential environmental impacts

The NOP <u>must</u> include a discussion of the "probable environmental effects of the project." (State CEQA Guidelines, §15082(a)(1).) The NOP does not do this. Nor could it, given that a prerequisite to identifying a project's potential effects is first identifying the project, and the NOP does not identify a single proposed project. Moreover, the project description must include all components of the project—including the preconstruction, construction, and operational phases of the Project—so that the impacts of each phase may be properly analyzed. To comply with CEQA, the NOP must be revised to identify the project being analyzed and the probable environmental effects of that project, and the revised NOP must then be recirculated to all responsible agencies.

E. The NOP does not identify whether the project will touch or concern any sites listed on the "Cortese List"

The NOP indicates that the Project will apply statewide, but does not specify whether the Project will touch or concern any hazardous waste sites listed on the "Cortese list" under Government Code section 65962.5. The NOP is thus defective under CEQA, and should be recirculated to specify this information. (Pub. Resources Code, § 21092.6(a).)

3. Comments Regarding The Scope Of The EIR.

A responsible agency should generally respond to a NOP with comments identifying the significant environmental issues and reasonable alternatives and mitigation measures that the responsible agency will need to have explored in the Draft EIR. (State CEQA Guidelines, § 15082(b).) The City, as a responsible agency, is limited in its ability to identify the Project's significant environmental impacts and proposed measures to mitigate those impacts because, as discussed above, the NOP does not provide a stable, finite, and accurate project description on which the City can offer comment. Nor does the NOP identify the probable environmental effects of the project so that the City could identify reasonable mitigation measures and alternatives addressing such effects. For these reasons, and the reasons discussed above, the City repeats its request that the NOP be revised and recirculated to comply with CEQA.

While the City hopes to see a recirculated NOP, in the interim, the City provides the following comments regarding the scope of the EIR and some of the direct and indirect impacts of the Project that the EIR must identify, analyze, and mitigate to the extent feasible.

A. The EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment.

The EIR must serve as an informational document that will inform public agency decision makers and the public generally of the significant environmental effects of the Project, identify possible ways to minimize the Project's significant effects, and describe reasonable alternatives to the Project. (State CEQA Guidelines, § 15121(a).) To achieve this purpose, the EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment. (State CEQA Guidelines, § 15382 ["economic change related to a physical change may be considered in determining whether the physical change is significant"].)

The cost of compliance with the MCL for chromium-6 would shape the behavior of both water agencies and ratepayers, and the environmental impacts of this reasonably foreseeable behavior must be analyzed in the EIR. To do so, the EIR must analyze and discuss the costs of complying with MCL, and how activity in response to such costs could potentially impact the environment. The City provides a non-exhaustive list of examples of how behavior responding to the cost of the MCL could result in a potentially significant impact on the environment.

(1) Shift from groundwater usage to surface water usage. The high cost of compliance with an overly stringent MCL could cause water agencies to shift from groundwater

usage to surface water usage, and the EIR must analyze the potential environmental impacts of this reasonably foreseeable shift. Indeed, Yolo County water agencies have already made this shift. The shift to surface water usage would have numerous deleterious impacts on the environment, including decreased in-stream flows and adverse impacts to fish and wildlife.

(2) Increased dependency on surface waters would increase the need for water storage. The MCL could spur a wave of reasonably foreseeable water storage and conveyance projects, as water agencies increasingly use surface waters to avoid the costs of compliance with the MCL. The EIR must analyze the environmental impacts of these projects, including their impacts on air quality, water quality, and biological resources. Moreover, the need for water storage would require flooding large areas of land to store water, and the environmental impacts of transforming the environment in this manner must be analyzed.

(3) The EIR must analyze the reasonably foreseeable environmental impacts of the Project resulting from increased rates to ratepayers. The cost of compliance with an overly stringent MCL would shape not only the behavior of water agencies, but also of ratepayers who could face dramatic increases in monthly costs as a result of their water agencies' efforts to comply with the MCL. For example, economically vulnerable ratepayers unable to afford these increased costs may be forced to migrate from a service area with high MCL compliance costs to a service area that either has lower such costs or an area that is better able to distribute such costs among a greater number of ratepayers. This migration is a reasonably foreseeable response to higher water rates, and the environmental effects of such migration must be analyzed in the EIR. These impacts could include (1) rural blight, as ratepayers in smaller service areas with high MCL compliance costs migrate to more metropolitan service areas, where the costs of such compliance can be distributed among a larger population; (2) VMT associated with such migration; (3) air quality and greenhouse gas impacts related to such migration; and (4) substantial unplanned population growth in areas with lower MCL compliance costs and the displacement of substantial numbers of people in areas with high MCL compliance costs.

B. The EIR must analyze the environmental impacts of reasonably foreseeable methods of compliance with the MCL.

The Project as described in the NOP has two components—setting the MCL for chromium-6, and "reasonably foreseeable methods of compliance" to meet the new MCL. The EIR must analyze the potential environmental impacts of both components of the Project. The City has several concerns regarding the future analysis of the "reasonably foreseeable methods of compliance."

(1) The EIR cannot analyze reasonably foreseeable methods of compliance without soliciting comment from the agencies tasked with such compliance. It is unclear how the State Water Board intends to determine what constitutes the reasonably foreseeable methods of compliance with the MCL. Given that individual water agencies would be tasked to comply with the MCL, the best means to ascertain the reasonably foreseeable methods of compliance with the MCL is to solicit comments from each water agency in the State, all of which are responsible agencies for this Project. This has not been done. The State Water Board should recirculate the NOP to all water agencies in the State to solicit comments regarding how these agencies might

comply with the MCL. Failure to do so would arbitrarily limit the EIR's analysis of "reasonably foreseeable methods of compliance." Moreover, and as discussed above, to solicit meaningful information from these agencies, it is imperative that the NOP be revised to provide a stable, finite project description—i.e., a single preferred MCL, so that water agencies can speak to how they would comply with such an MCL.

(2) The EIR must analyze the potential environmental impacts resulting from the construction and operation of treatment plants. The City identifies the construction of treatment plants as one reasonably foreseeable method of compliance with the MCL, and as such, the environmental impacts of the construction and operation of treatment plants across the State must be analyzed in the EIR. Notably, potentially significant environmental impacts resulting from the construction of these plants include, but are not limited to, the following: (i) increased emissions of toxic air contaminants (e.g., diesel exhaust particulate), criteria pollutants (e.g., NOx), and greenhouse gases during construction; (ii) increased discharge of pollutants in stormwater runoff during and after construction; and (iii) increased cumulative environmental burden in disadvantaged communities served by regulated water systems. Moreover, treatment plants require space, and the construction of new plants in areas with significant land constraints could result in potentially significant impacts relating to, among other things, agricultural land, biological resources (including various Habitat Conservation Plans), and tribal cultural resources.

(3) The EIR must analyze the potential environmental impact resulting from the proposed Best Available Technologies. The NOP identifies several proposed best available technologies ("BATs"): ion exchange, reduction-coagulation/filtration, and reverse osmosis. The environmental impacts of using these BATs must be analyzed. Notably, the use of the proposed BATs would have potentially significant impacts relating to hazardous waste, as the BATs generate treatment residuals that must be managed as hazardous waste in California. The processing and disposal of these treatment residuals would further result in potentially significant impacts that must be analyzed in the EIR. For example, the shipment of treatment residuals to offsite disposal facilities would result in increased TAC, criteria pollutants, and VMT. The BATs would also result in increased disposal of hazardous waste, increasing pressure on limited in-state Class 1 landfill capacity. Moreover, the proposed BATs may result in potentially significant impacts relating to energy and GHG emissions. This is because the proposed BATs are energy intensive and typically require power from the electric grid rather than local renewable resources. Furthermore, transporting hazardous wastes great distances to other states for disposal also impacts energy and GHG emissions. In short, the Project may have potentially significant impacts resulting from the proposed BATs. The EIR must disclose, analyze, and to the extent feasible, mitigate the environmental effects associated with the BATs and their treatment residuals.

C. The EIR must analyze the cumulative impacts of the Project.

The EIR is required to discuss the cumulative impacts of the Project. (State CEQA Guidelines, § 15130.) In particular, the Project would require water agencies to engage in activity to either modify existing sources to comply with the MCL or to shift to an alternative water source (e.g., surface waters) that would allow the agencies to avoid treatment costs associated with MCL compliance. There are hundreds of water agencies in the State of California.

(https://www.acwa.com/about/directory/ [directory of California water agencies].) Each impacted agency likely would be engaging in activity that would impact the environment in response to the MCL, and the cumulative impact of this activity would almost certainly be significant. The cumulative impacts of this activity must be analyzed in the EIR. (State CEQA Guidelines, § 15130.)

D. The State Water Board must consider a reasonable range of alternatives, including a less intense alternative to the Project.

"An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." (State CEQA Guidelines, § 15126.6.(a).) Here, because the Project has two components (setting the MCL for chromium-6, and methods of compliance to meet the new MCL), any alternatives developed must take into account both components of the Project. Thus, for example, the EIR must analyze alternatives that involve less impactful treatment options than the BATs set forth in the NOP.

4. <u>The Project Should Not Result In An MCL That Makes Reliance On Groundwater Economically Infeasible</u>.

The City has concerns that the Project could threaten the economic feasibility of groundwater reliance in California, which would be devastating for the State and its people. While the NOP does not offer a definite project description, it suggests that the MCL for chromium-6 could be as low as 1 ppb. An unreasonably stringent MCL would run afoul of public policy and cause great harm to many Californians. For example:

A. Increased dependency on surface waters undermines drought resiliency. As noted above, the high treatment costs associated with an MCL could result in increased use of surface water and other, non-groundwater sources of water. Wells with water exceeding the MCL may be shut down where treatment of the water is not economically feasible. This shut down of impacted wells would be contrary to existing state policies emphasizing reliance on local water sources. In a time of drought, the MCL could exacerbate water insecurity in California. This must be avoided.

B. The Project could frustrate achievement of the Human Right to Water goals.

On September 25, 2012, Governor Brown signed AB 685, making California the first state in the nation to legislatively recognize the human right to water. The Project, however, could result in a shutdown of impacted groundwater wells. This, compounded with uncertain access to state grant funding, would compromise water supply reliability and access to drinking water. Increased water rates compromise water affordability and lead to public health issues caused by decreased disposable income, which is strongly correlated with negative health impacts. These impacts would be most pronounced in socioeconomically disadvantaged communities. The City urges the State Water Board to consider these and other environmental justice concerns when contemplating the proper MCL for chromium-6.

5. The Project's Environmental Impacts Could Be Avoided By Developing A New Public Health Goal For Chromium-6.

In July 2011, the Office of Environmental Health Hazard Assessment ("OEHHA") established a public health goal ("PHG") for chromium-6 of 0.02 ppb, representing a de minimis lifetime cancer risk from exposure to chromium-6 in drinking water, based on studies in laboratory animals. Since then, scientific information on the impacts of chromium-6 on human health has advanced substantially. The most recent scientific information on the health effects of human ingestion of chromium-6 in drinking water indicates that MCLs at or above the upper end of the MCLs set forth in the NOP are fully health protective. In October 2016, OEHHA announced this substantial new information warrants a review of the chromium-6 PHG, which to date has not been performed.

The City urges a reassessment of the current PHG and the development of a new risk assessment to determine the de minimis lifetime cancer risk from exposure to chromium-6 based on the most recent scientific information available. The revised PHG, based on the most recent science available, would then better guide the State Water Board in determining the proper MCL for chromium-6. And, from a CEQA perspective, this would streamline any EIR regarding MCL for chromium-6 by eliminating from consideration the most stringent proposed MCLs, which are the MCLs likely to have the most significant environmental impacts. Both the people of California and the environment will benefit from a reassessment of the PHG for chromium-6.

6. Request for Notices.

The City requests to be added to the notification and distribution lists for all notices relating to the Project, including all (i) CEQA-related notices, and (ii) public meeting/hearing notices issued pursuant to state and local law, including CEQA, the Ralph M. Brown Act, and the Bagley-Keene Act. The satisfaction of this written request is required by CEQA (Public Resources Code, § 21092.2), the Ralph M. Brown Act (Government Code, § 54954.1), and the Bagley-Keene Act (Government Code, § 11125).

7. Conclusion.

The City looks forward to working with the State Water Board to ensure that this Project receives the careful review that it deserves. Thank you for your consideration of the City's input.

Sincerely,

on behalf of. Dr. Gabriel Martin - City Manager

Indio Water Authority
Your Water. Our Responsibility.

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Sent via ELECTRONIC MAIL to DDW-HEXAVALENTCHROMIUM@WATERBOARDS.CA.GOV

Date: December 6, 2021

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, CA 95812-0100

RE: Comment Letter Regarding Notice of Preparation of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

Dear Ms. Niemeyer:

The Indio Water Authority (IWA) submits these written comments to the State Water Resources Control Board (State Water Board) regarding the Draft Program Environmental Impact Report (EIR) for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (MCL). The City of Indio is located approximately 120 miles east of Los Angeles and approximately 30 miles east of the City of Palm Springs, in Riverside County. Indio, along with nine other cities in the region, comprises a geographical area commonly known as "The Coachella Valley." Indio is the largest city in the Coachella Valley with a growing population of approximately 90,000 residents. IWA was established by a Joint Powers Authority to provide water service to the majority of the Indio community and has close to 24,000 service connections, a number that continues to grow as system demands increase due to growing development. The City of Indio has a predominantly disadvantaged community, with residents struggling to meet their monthly expenses.

In 2015, the City of Indio experienced a hard felt economic set-back brought on by the prior MCL of 10 parts per billion (ppb) previously set by the State Water Board. During that time, IWA lost 13 of the 20 production wells. IWA exhausted all available financial resources to construct costly wellhead treatment facilities for only 3 wells. Since the City does not have an imported supply to augment groundwater, IWA operated a stressed production system with only half of the groundwater production wells. With this harsh experience to our disadvantaged residents in mind, the IWA has prepared the following comments.

1. Consider a MCL of 25 ppb to minimize technical, economic, and environmental impacts.
2. Recirculate the Notice of Preparation (NOP) to all responsible agencies.
3. Take into consideration that IWA, as well as many other water agencies throughout the State, do not have surface or imported water to make up for lost well production. The lack of a supplemental surface water supply poses an economic hardship to the disadvantaged communities.
4. Consider extreme statewide drought conditions and the negative impacts that the MCL will have on already stressed local water supplies.

Indio Water Authority
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5. Consider developing a new Public Health Goal for Hexavalent Chromium instead of an MCL.
6. Consider alternative treatment options that are much more economically feasible to implement.
7. Consider analyzing potential environmental impacts, such as hazardous waste production from the Best Available Technologies (BAT).

IWA's comments presented in this letter are based on prior experience, and we encourage the State Water Board to consider this information during the development of the MCL and EIR. Thank you for the opportunity to comment as we value your time and effort on this very important matter.

Sincerely,

Reymundo Trejo, PE
Interim General Manager

ec:

Miguel Pena
Michelle Tse
Brian Kinder
Roman Gonzalez
Luis Hernandez
Brandon Gonzalez
Eduardo Escobar

From: Maria Encinas
To: WB-DDW-HexavalentChromium
Subject: Comments for EIR public scoping meeting for new Chromium 6 MCL
Date: Monday, December 6, 2021 8:07:40 PM
Attachments: notice_of_preparation.pdf

EXTERNAL:

Kim Niemeyer,

Thank you for the opportunity to comment on the development of the Hexavalent Chromium EIR. Our agencies comments and/or questions are below:

1. For agencies that were required to submit Corrective Action Plans (CAP) in 2017, was the information included in these CAPs studied and examined further by the Water Board? Was any of the information included in the EIR?
2. Only three BAT technologies were discussed. Which others were analyzed and why were they excluded?
3. One of BAT technologies discussed is reverse osmosis. Not only is it the most expensive option but it's also not an environmentally friendly one when it comes to water use. For agencies with GSPs and Drought Shortage Contingency plans, GPCD will increase and may put agencies out of compliance. For some agencies where the disposal of hazardous waste is not an option due to logistics or other reasons, will they receive an exemption from water curtailments or restrictions?
4. The Water Board should consider a no action alternative based on proposed actions potentially not having any negative effects on the environment.
5. Consider a compliance period at least five years after the new MCL is set.

Please let us know if you have any questions.

Sincerely,

Maria Encinas, CFM
Water Resources Coordinator
Management Analyst
Department of Public Works
City of Patterson | 1 Plaza | Patterson CA 95363
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mencinas@ci.patterson.ca.us | www.ci.patterson.ca.us

From: Matt van der Linden
To: WB-DDW-HexavalentChromium
Cc: Xenia Bradford; Mike Mathews; Mark Infanti; Paeter Garcia
Subject: Proposed Hexavalent Chromium Maximum Contaminant Level
Date: Tuesday, November 30, 2021 9:30:41 AM

EXTERNAL:

Dear State Water Resources Control Board:

The City of Solvang respectfully requests that the Hexavalent Chromium Maximum Contaminant Level (MCL) be set no less than 25 ug/L (ppb). Any MCL below 25 ug/L will impose a significant financial hardship on the City of Solvang. The City of Solvang with a population of only 6,126 has already spent over $60 million over the past 20 years importing State water (northern California surface water) to reduce our reliance on local groundwater. However, State water is highly unreliable, and as a result during most years Solvang must rely heavily on our local groundwater. In addition, the Notice of Preparation indicates that blending is a method of compliance. However, if the MCL is set below 25 ug/L then blending essentially becomes a non-viable option as a path to compliance.

Again, the City of Solvang respectfully requests that the Hexavalent Chromium Maximum Contaminant Level (MCL) be set no less than 25 ug/L.

Sincerely,

***Matt van der Linden*, PE**
Utilities Director
City of Solvang
1644 Oak Street
Solvang, CA 93463
(805) 688-5575 x222

CITY OF
WINTERS
California
Est. 1875

December 6, 2021

RECEIVED
DEC 8 2021
Office of
Chief Counsel

VIA E-MAIL AND U.S. MAIL

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, CA 95812-0100
ddw-hexavalentchromium@waterboards.ca.gov

Re: Comment Letter re Notice of Preparation of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

Dear Ms. Niemeyer,

The City of Winters ("City") submits these written comments in response to the State Water Resources Control Board's ("State Water Board") Notice of Preparation ("NOP") of a Draft Program Environmental Impact Report ("EIR") for the adoption of a regulation for the maximum contaminant level ("MCL") for hexavalent chromium ("chromium-6"). According to the NOP, the project at issue in the Draft Program EIR entails (i) seventeen (17) possible MCLs for chromium-6 (1 to 15, 20, and 25 parts per billion ("ppb")); and (ii) "reasonably foreseeable methods of compliance" with the MCLs (collectively, the "Project").

The City is a responsible agency for the Project, as it is a small community water system that will be required to comply with the new MCL. (State CEQA Guidelines, § 15381.) The MCL would significantly impact the City, its ratepayers, and the environment. Given the potential impacts of the MCL, the City appreciates the State Water Board's commitment to prepare an EIR for the Project. To protect the environment and stakeholders, the EIR must include a robust analysis of the Project's potential environmental impacts. The City hopes that its written comments will help the State Water Board fully analyze, mitigate, and avoid the potential environmental impacts of the Project in compliance with the California Environmental Quality Act (Pub. Resources Code, § 21000, et seq.: "CEQA").

1. <u>The Project Could Dramatically Impact The City Of Winters, Its Ratepayers, And The Environment.</u>

The State Water Board's proposed MCL for chromium-6 would significantly impact the City, which derives 100 percent of its water from ground water with naturally occurring chromium-6. The City relies on five groundwater wells to provide water to its residents, and these wells have chromium-6 levels ranging from 7.2 ppb to 17 ppb. Accordingly, 100 percent

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TREASURER
Shelly Gunby

CITY MANAGER
Kathleen S. Trepa

MCL. The City urges the State Water Board to consider these important concerns when drafting the EIR and selecting an MCL. CEQA requires analysis of these impacts.

2. The NOP Is Procedurally Defective And Must Be Recirculated.

The purpose of an NOP is to solicit guidance from responsible and trustee agencies as to the scope and content of the EIR for a project. (State CEQA Guidelines, § 15375.) Requirements governing the preparation and circulation of an NOP are set forth in the State CEQA Guidelines to ensure this purpose is met. (See State CEQA Guidelines, § 15082.) Unfortunately, these requirements have not been met with the State Water Board's NOP regarding the Project.

A. The NOP has not been sent to all responsible and trustee agencies

The State Water Board, as lead agency for the Project, is required to send the NOP to each responsible agency for the Project by "either certified mail or any other method of transmittal that provides it with a record that the notice was received." (State CEQA Guidelines, § 15082(a).) The State Water Board, however, has not met this basic and fundamental requirement. Because the "project scope includes not only setting the MCL for hexavalent chromium, but also the reasonably foreseeable methods of compliance," every water district or other entity that is required to implement and carry out methods of compliance with the MCL is a responsible agency for the Project. (State CEQA Guidelines, § 15381 [defining responsible agency].)

The City is a responsible agency for the Project because it operates its own public water system, and the City will be required to deploy facilities or treatment methodologies to bring its facilities into compliance with the new MCL. (State CEQA Guidelines, § 15381.) Yet, the State Water Board did not send a copy of its NOP to the City via certified mail—a violation of CEQA. The NOP must be recirculated and sent to all responsible agencies via a method of transmittal that provides the State Water Board with a record that the notice was received.

B. The NOP has not been filed with all relevant County Clerks

The State Water Board is also required to file the NOP "with the county clerk of each county in which the project will be located." (State CEQA Guidelines, § 15082(a).) Again, the State Water Board has failed to comply with this requirement. The NOP was not filed in Yolo County, nor was it filed in the State's largest metropolitan areas, such as Los Angeles County or Riverside County. The NOP acknowledges that the Project includes "a statewide regulation that would apply to all public drinking water systems in the State of California," and that "water systems with hexavalent chromium exceeding the proposed MCL are located throughout the state." (NOP, p. 1.) Presumably for this reason, OPR lists the Project as occurring in every county in the State: https://ceqanet.opr.ca.gov/2021110099 The NOP should therefore be filed with the county clerk of every county in the State. (State CEQA Guidelines, § 15082(a).) This will ensure that the NOP serves its purpose of soliciting guidance from every responsible and trustee agency for the Project, as well as interested members of the public state-wide.

C. The NOP does not include a stable, finite project description

components of the project—including the preconstruction, construction, and operational phases of the Project—so that the impacts of each phase may be properly analyzed. To comply with CEQA, the NOP must be revised to identify the project being analyzed and the probable environmental effects of that project, and the revised NOP must then be recirculated to all responsible agencies.

E. The NOP does not identify whether the project will touch or concern any sites listed on the "Cortese List"

The NOP indicates that the Project will apply statewide, but does not specify whether the Project will touch or concern any hazardous waste sites listed on the "Cortese list" under Government Code section 65962.5. The NOP is thus defective under CEQA, and should be recirculated to specify this information. (Pub. Resources Code, § 21092.6(a).)

3. <u>Comments Regarding The Scope Of The EIR.</u>

A responsible agency should generally respond to a NOP with comments identifying the significant environmental issues and reasonable alternatives and mitigation measures that the responsible agency will need to have explored in the Draft EIR. (State CEQA Guidelines, § 15082(b).) The City, as a responsible agency, is limited in its ability to identify the Project's significant environmental impacts and proposed measures to mitigate those impacts because, as discussed above, the NOP does not provide a stable, finite, and accurate project description on which the City can offer comment. Nor does the NOP identify the probable environmental effects of the project so that the City could identify reasonable mitigation measures and alternatives addressing such effects. For these reasons, and the reasons discussed above, the City repeats its request that the NOP be revised and recirculated to comply with CEQA.

While the City hopes to see a recirculated NOP, in the interim, the City provides the following comments regarding the scope of the EIR and some of the direct and indirect impacts of the Project that the EIR must identify, analyze, and mitigate to the extent feasible.

A. The EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment.

The EIR must serve as an informational document that will inform public agency decision makers and the public generally of the significant environmental effects of the Project, identify possible ways to minimize the Project's significant effects, and describe reasonable alternatives to the Project. (State CEQA Guidelines, § 15121(a).) To achieve this purpose, the EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment. (State CEQA Guidelines, § 15382 ["economic change related to a physical change may be considered in determining whether the physical change is significant"].)

The cost of compliance with the MCL for chromium-6 would shape the behavior of both water agencies and ratepayers, and the environmental impacts of this reasonably foreseeable behavior must be analyzed in the EIR. To do so, the EIR must analyze and discuss the costs of complying with MCL, and how activity in response to such costs could potentially impact the environment. The City provides a non-exhaustive list of examples of how behavior responding to the cost of the MCL could result in a potentially significant impact on the environment.

imperative that the NOP be revised to provide a stable, finite project description—i.e., a single preferred MCL, so that agencies can speak to how they would comply with such an MCL.

(2) The EIR must analyze the potential environmental impacts resulting from the construction and operation of treatment plants. The City identifies the construction of treatment plants as one reasonably foreseeable method of compliance with the MCL, and as such, the environmental impacts of the construction and operation of treatment plants across the State must be analyzed in the EIR. Notably, potentially significant environmental impacts resulting from the construction of these plants include, but are not limited to, the following: (i) increased emissions of toxic air contaminants (e.g., diesel exhaust particulate), criteria pollutants (e.g., NOx), and greenhouse gases during construction; (ii) increased discharge of pollutants in stormwater runoff during and after construction; and (iii) increased cumulative environmental burden in disadvantaged communities served by regulated water systems. Moreover, treatment plants require space, and the construction of new plants in areas with significant land constraints could result in potentially significant impacts relating to, among other things, agricultural land, biological resources (including various Habitat Conservation Plans), and tribal cultural resources.

(3) The EIR must analyze the potential environmental impact resulting from the proposed Best Available Technologies. The NOP identifies several proposed best available technologies ("BATs"): ion exchange, reduction-coagulation/filtration, and reverse osmosis. The environmental impacts of using these BATs must be analyzed. Notably, the use of the proposed BATs would have potentially significant impacts relating to hazardous waste, as the BATs generate treatment residuals that must be managed as hazardous waste in California. The processing and disposal of these treatment residuals would further result in potentially significant impacts that must be analyzed in the EIR. For example, the shipment of treatment residuals to offsite disposal facilities would result in increased TAC, criteria pollutants, and VMT. The BATs would also result in increased disposal of hazardous waste, increasing pressure on limited in-state Class 1 landfill capacity. Moreover, the proposed BATs may result in potentially significant impacts relating to energy and GHG emissions. This is because the proposed BATs are energy intensive and typically require power from the electric grid rather than local renewable resources. Furthermore, transporting hazardous wastes great distances to other states for disposal also impacts energy and GHG emissions. In short, the Project may have potentially significant impacts resulting from the proposed BATs. The EIR must disclose, analyze, and to the extent feasible, mitigate the environmental effects associated with the BATs and their treatment residuals.

C. The EIR must analyze the cumulative impacts of the Project.

The EIR is required to discuss the cumulative impacts of the Project. (State CEQA Guidelines, § 15130.) In particular, the Project would require public agencies to engage in activity to either modify existing water sources to comply with the MCL or to shift to an alternative water source (e.g., surface waters) that would allow the agencies to avoid treatment costs associated with MCL compliance. There are hundreds of water agencies in the State of California. (https://www.acwa.com/about/directory/ [directory of California water agencies].) This does not include the many public water systems in the State, including the City. Each impacted agency likely would engage in activity that would impact the environment in response to the MCL, and the cumulative impact of this activity would almost certainly be significant. The cumulative impacts of this activity must be analyzed in the EIR. (State CEQA Guidelines, § 15130.)

animals. Since then, scientific information on the impacts of chromium-6 on human health has advanced substantially. The most recent scientific information on the health effects of human ingestion of chromium-6 in drinking water indicates that MCLs at or above the upper end of the MCLs set forth in the NOP are fully health protective. In October 2016, OEHHA announced this new information warrants a review of the chromium-6 PHG, which to date has not been performed.

The City urges a reassessment of the current PHG and the development of a new risk assessment to determine the de minimis lifetime cancer risk from exposure to chromium-6 based on the most recent scientific information available. The revised PHG, based on the most recent science available, would then better guide the State Water Board in determining the proper MCL for chromium-6. And, from a CEQA perspective, this would streamline any EIR regarding MCL for chromium-6 by eliminating from consideration the most stringent proposed MCLs, which are the MCLs likely to have the most significant environmental impacts. Both the people of California and the environment will benefit from a reassessment of the PHG for chromium-6.

6. Request for Notices.

The City requests to be added to the notification and distribution lists for all notices relating to the Project, including all (i) CEQA-related notices, and (ii) public meeting/hearing notices issued pursuant to state and local law, including CEQA, the Ralph M. Brown Act, and the Bagley-Keene Act. The satisfaction of this written request is required by CEQA (Public Resources Code, § 21092.2), the Ralph M. Brown Act (Government Code, § 54954.1), and the Bagley-Keene Act (Government Code, § 11125).

7. Conclusion.

The City looks forward to working with the State Water Board to ensure that this Project receives the careful review that it deserves. Thank you for your consideration of the City's input.

Sincerely,

Wade Cowan, Mayor
City of Winters

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COACHELLA VALLEY WATER DISTRICT

Established in 1918 as a public agency

GENERAL MANAGER
Jim Barrett

CLERK OF THE BOARD
Sylvia Bermudez

ASSISTANT GENERAL MANAGER
Robert Cheng

ASSISTANT GENERAL MANAGER
Dan Charlton

November 30, 2021

RECEIVED
DEC 6 2021
Office of
Chief Counsel

VIA EMAIL AND U.S. MAIL: DDW-HEXAVALENTCHROMIUM@WATERBOARDS.CA.GOV

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, CA 95812-0100

Dear Ms. Niemeyer:

Subject: Comment Letter regarding Notice of Preparation of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

The Coachella Valley Water District ("CVWD") submits these written comments in response to the State Water Resources Control Board's ("State Water Board") Notice of Preparation ("NOP") of a Draft Program Environmental Impact Report ("EIR") for the adoption of a regulation for the maximum contaminant level ("MCL") for hexavalent chromium ("chromium-6"). According to the NOP, the project at issue in the Draft Program EIR entails (i) seventeen (17) possible MCLs for chromium-6 (1 to 15, 20, and 25 parts per billion ("ppb")); and (ii) "reasonably foreseeable methods of compliance" with the MCLs (collectively, the "Project").

CVWD is a responsible agency for the Project, as it is a water district that will be required to comply with the new MCL and approve "methods of compliance" with the MCL. (State CEQA Guidelines, § 15381.) The MCL may significantly impact CVWD, its ratepayers, and the environment. CVWD was disappointed that these impacts were not properly evaluated for the 2014 chromium-6 MCL. CVWD supports the State Water Board's decision to seek input from interested stakeholders on the preparation of a draft program environmental impact report and hopes this effort results in a comprehensive evaluation of the potential impacts of complying with a new chromium-6 MCL. In the spirit of cooperation with the State Water Board, CVWD provides these written comments to help ensure that the State Water Board complies with the California Environmental Quality Act (Pub. Resources Code, § 21000, et seq.: "CEQA").

1. The Project Could Have Significant Impacts on the Coachella Valley Water District and its Ratepayers.

CVWD formed in 1918 to protect and conserve local water sources. Since then, CVWD has grown into a multifaceted agency that delivers irrigation and domestic water, collects and recycles wastewater, provides regional storm water protection, replenishes the groundwater basin, and promotes water conservation. CVWD serves the water needs of more than 109,000 homes and business across a service area spanning approximately 1,000 square miles-from the San Gorgonio Pass to the Salton Sea, mostly within the Coachella Valley in Riverside County, but also extending into portions of Imperial and San Diego counties.

The establishment of an MCL for chromium-6 directly concerns CVWD, as the Coachella Valley's groundwater is impacted by naturally occurring chromium-6 due to the valley's geology. CVWD has thus long desired that any MCL for chromium-6 that is established by the State Water Board have a meaningful opportunity for risk reduction and be technologically and economically feasible, as required by law. Such an MCL would allow CVWD to continue providing a sustainable and affordable public water supply to its residents.

CVWD is concerned, however, about the impacts of an unduly stringent MCL that might require CVWD to construct economically infeasible facilities or deploy treatment options at enormous cost. Both the construction of new facilities and the deployment of treatment options would have significant impacts on the environment. Moreover, a new MCL could result in the shutting down of groundwater wells and increasing demands on surface water supplies in a time of significant and historic drought. As a result, CVWD's ratepayers—many of whom are economically vulnerable—could see significant increases in their monthly water expenses. CVWD urges the State Water Board to consider these important concerns when drafting the EIR and selecting the proper MCL. As discussed below, CEQA requires analysis of these impacts.

2. <u>The NOP is Procedurally Defective and Must Be Recirculated</u>.

The purpose of an NOP is to solicit guidance from responsible and trustee agencies, as well as interested members of the public, as to the scope and content of the EIR for a project. (State CEQA Guidelines, § 15375.) Requirements governing the preparation and circulation of an NOP are set forth in the State CEQA Guidelines to ensure this purpose is met. (See State CEQA Guidelines, § 15082.) Unfortunately, these requirements have not been met with the State Water Board's NOP regarding the Project.

A. The NOP has not been sent to all responsible and trustee agencies

The State Water Board, as lead agency for the Project, is required to send the NOP to each responsible and trustee agency for the Project by "either certified mail or any other method of transmittal that provides it with a record that the notice was received." (State CEQA Guidelines, § 15082(a).) The State Water Board, however, has not met this fundamental requirement. Because the "project scope includes not only setting the MCL for hexavalent chromium, but also the reasonably foreseeable methods of compliance," <u>every</u> water district or other entity that is required to implement and carry out methods of compliance with the MCL is a responsible agency for the Project. (State CEQA Guidelines, § 15381 [defining responsible agency].)

CVWD is a responsible agency for the Project because it is a duly organized and established water agency within California that possesses a water system with known hexavalent chromium and it will be required to deploy facilities or treatment methodologies to bring its facilities into compliance with the new MCL. (State CEQA Guidelines, § 15381.) Yet, the State Water Board did not send a copy of its NOP to CVWD via certified mail—a violation of CEQA. The NOP must be recirculated and sent to all responsible agencies via a method of transmittal that provides the State Water Board with a record that the notice was received.

B. The NOP has not been filed with all relevant County Clerks

The State Water Board is also required to file the NOP "with the county clerk of each county in which the project will be located." (State CEQA Guidelines, § 15082(a).) Again, the State Water Board has failed to comply with this requirement. The NOP was not filed in Riverside County, nor was it filed in the State's largest metropolitan area, Los Angeles County. The NOP acknowledges that the Project includes "a statewide regulation that would apply to all public drinking water systems in the State of California," and that "water systems with hexavalent chromium exceeding the proposed MCL are located throughout the state." (NOP, p. 1.) Presumably for this reason, OPR lists the Project as occurring in every county in the State: https://ceqanet.opr.ca.gov/2021110099 The NOP should therefore be filed with the county clerk of every county in the State. (State CEQA Guidelines, § 15082(a).) This will ensure that the NOP serves its purpose of soliciting guidance from every responsible and trustee agency for the Project, as well as interested members of the public state-wide.

C. The NOP does not include a stable, finite project description

A stable, finite project description is necessary and paramount to comply with CEQA. (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 192-193.) Indeed, the adequacy of the project description is inextricably linked to the sufficiency of the analysis of the project's impacts on the EIR. (*Laurel Heights Improvement Ass'n v. Regents of Univ. of California* (1988) 47 Cal.3d 376.) For this reason, an NOP must provide responsible agencies and the public "with sufficient information describing the project … to enable the responsible agencies to make a meaningful response." (State CEQA Guidelines, § 15082(a)(1).)

A "project description that gives conflicting signals to decision makers and the public about the nature and scope of the project is fundamentally inadequate and misleading" and violates CEQA. (*Washoe Meadows Community v. Dept. of Parks and Rec.* (2017) 17 Cal.App.5th 277, 281.) Accordingly, courts have repeatedly held that a lead agency violates CEQA where it does not identify a single finite proposed project, but instead identifies an assortment of alternative projects. (*Washoe Meadows*, *supra*, 17 Cal.App.5th at p. 281 [CEQA violated where lead agency did not identify a proposed project, but described five different alternative projects without specifying a preferred alternative]; *Stopthemilleniumhollywood.com v. City of Los Angeles* (2019) 39 Cal.App.5th 1, 20.) Where the lead agency does not commit to a stable, finite project description, but rather analyzes a variety of alternatives or concepts, it is immaterial that the lead agency thoroughly analyzes each of the alternatives. Even if the environmental impacts of each alternative is analyzed, the failure to present a stable, finite project description is prejudicial error under CEQA. (*Stopthemilleniumhollywood.com*, *supra*, 39 Cal.App.5th at p. 20.)

Here, the State Water Board, like the lead agency in *Washoe Meadows*, has not committed to a stable, finite project description. Rather, the State Water Board calls out **seventeen** very different alternative projects—i.e., seventeen possible MCLs for chromium-6 (1 to 15, 20, and 25 ppb)—without specifying a preferred alternative. Each of these projects would have different environmental impacts requiring different mitigation measures.

For example, CVWD's comments regarding a proposed MCL of 1 ppb would be dramatically different from its comments on a proposed MCL of 25 ppb. These are completely different projects with different environmental impacts, and they cannot be lumped together in the same NOP. Likewise, the NOP vaguely asserts that the Project includes "foreseeable methods of compliance," but fails to specify what precisely this entails. These vague and noncommittal characterizations of the Project deprive responsible agencies and the public of the opportunity to comment on an accurate, stable, and finite project description. This is a violation of CEQA. (*Washoe Meadows, supra*, 17 Cal.App.5th at p. 281; *Stopthemilleniumhollywood.com, supra*, 39 Cal.App.5th at p. 20.) To remedy this violation, the State Water Board must issue a new, recirculated NOP that identifies a single, proposed MCL for chromium-6.

D. The NOP does not describe any of the project's potential environmental impacts

The NOP must include a discussion of the "probable environmental effects of the project." (State CEQA Guidelines, §15082(a)(1).) The NOP does not do this. Nor could it, given that a prerequisite to identifying a project's potential effects is first identifying the project, and the NOP does not identify a single proposed project. Moreover, the project description must include all components of the project—including the preconstruction, construction, and operational phases of the Project—so that the impacts of each phase may be properly analyzed. To comply with CEQA, the NOP must be revised to identify the project being analyzed and the probable environmental effects of that project, and the revised NOP must then be recirculated to all responsible agencies.

E. The NOP does not identify whether the project will touch or concern any sites listed on the "Cortese List"

The NOP indicates that the Project will apply statewide, but does not specify whether the Project will touch or concern any hazardous waste sites listed on the "Cortese list" under Government Code section 65962.5. The NOP is thus defective under CEQA, and should be recirculated to specify this information. (Pub. Resources Code, § 21092.6(a).)

3. Comments Regarding the Scope of the EIR.

A responsible agency should generally respond to a NOP with comments identifying the significant environmental issues and reasonable alternatives and mitigation measures that the responsible agency will need to have explored in the Draft EIR. (State CEQA Guidelines, § 15082(b).) CVWD, as a responsible agency, is limited in its ability to identify the Project's significant environmental impacts and proposed measures to mitigate those impacts because, as discussed above, the NOP does not provide a stable, finite, and accurate project description on which CVWD can offer comment. Nor does the NOP identify the probable environmental effects of the project so that CVWD could reasonably identify reasonable mitigation measures and alternatives addressing such effects. For these reasons, and the reasons discussed above, CVWD repeats its request that the NOP be revised and recirculated to comply with CEQA.

While CVWD hopes to see a recirculated NOP, in the interim, CVWD provides the following comments regarding the scope of the EIR and some of the direct and indirect impacts of the Project that the EIR must identify, analyze, and mitigate to the extent feasible.

A. The EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment.

The EIR must serve as an informational document that will inform public agency decision makers and the public generally of the significant environmental effects of the Project, identify possible ways to minimize the Project's significant effects, and describe reasonable alternatives to the Project. (State CEQA Guidelines, § 15121(a).) To achieve this purpose, the EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment. (State CEQA Guidelines, § 15382 ["economic change related to a physical change may be considered in determining whether the physical change is significant"].)

The cost of compliance with the MCL for chromium-6 would shape the behavior of both water agencies and ratepayers, and the environmental impacts of this reasonably foreseeable behavior must be analyzed in the EIR. To do so, the EIR must analyze and discuss the costs of complying with MCL, and how activity in response to such costs could potentially impact the environment. CVWD provides a non-exhaustive list of examples of how behavior responding to the cost of the MCL could result in a potentially significant impact on the environment.

(1) Shift from groundwater usage to surface water usage. The high cost of compliance with an overly stringent MCL could cause water agencies to shift from groundwater usage to surface water usage, and the EIR must analyze the potential environmental impacts of this reasonably foreseeable shift. Indeed, Yolo County water agencies have already made this shift. The shift to surface water usage would have numerous deleterious impacts on the environment, including decreased in-stream flows and adverse impacts to fish and wildlife.

(2) Increased dependency on surface waters would increase the need for water storage. The MCL could spur a wave of reasonably foreseeable water storage and conveyance projects, as water agencies increasingly use surface waters to avoid the costs of compliance with the MCL. The EIR must analyze the environmental impacts of these projects, including their impacts on air quality, water quality, and biological resources. Moreover, the need for water storage would require flooding large areas of land to store water, and the environmental impacts of transforming the environment in this manner must be analyzed.

(3) The EIR must analyze the reasonably foreseeable environmental impacts of the Project resulting from increased rates to ratepayers. The cost of compliance with an overly stringent MCL would shape not only the behavior of water agencies, but also of ratepayers who could face dramatic increases in monthly costs as a result of their water agencies' efforts to comply with the MCL. For example, economically vulnerable ratepayers unable to afford these increased costs may be forced to migrate from a service area with high MCL compliance costs to a service area that either has lower such costs or an area that is better able to distribute such costs among a greater number of ratepayers. This migration is a reasonably foreseeable response to higher water rates, and

the environmental effects of such migration must be analyzed in the EIR. These impacts could include (1) rural blight, as ratepayers in smaller service areas with high MCL compliance costs migrate to more metropolitan service areas, where the costs of such compliance can be distributed among a larger population; (2) VMT associated with such migration; (3) air quality and greenhouse gas impacts related to such migration; and (4) substantial unplanned population growth in areas with lower MCL compliance costs and the displacement of substantial numbers of people in areas with high MCL compliance costs.

B. The EIR must analyze the environmental impacts of reasonably foreseeable methods of compliance with the MCL.

The Project as described in the NOP has two components—setting the MCL for chromium-6, and "reasonably foreseeable methods of compliance" to meet the new MCL. The EIR must analyze the potential environmental impacts of both components of the Project. CVWD has several concerns regarding the future analysis of the "reasonably foreseeable methods of compliance."

(1) The EIR cannot analyze reasonably foreseeable methods of compliance without soliciting comment from the agencies tasked with such compliance. It is unclear how the State Water Board intends to determine what constitutes the reasonably foreseeable methods of compliance with the MCL. Given that individual water agencies would be tasked to comply with the MCL, the best means to ascertain the reasonably foreseeable methods of compliance with the MCL is to solicit comments from each water agency in the State, all of which are responsible agencies for this Project. This has not been done. The State Water Board should recirculate the NOP to all water agencies in the State to solicit comments regarding how these agencies might comply with the MCL. Failure to do so would arbitrarily limit the EIR's analysis of "reasonably foreseeable methods of compliance." Moreover, and as discussed above, to solicit meaningful information from these agencies, it is imperative that the NOP be revised to provide a stable, finite project description—i.e., a single preferred MCL, so that water agencies can speak to how they would comply with such an MCL.

(2) The EIR must analyze the potential environmental impacts resulting from the construction and operation of treatment plants. CVWD identifies the construction of treatment plants as one reasonably foreseeable method of compliance with the MCL, and as such, the environmental impacts of the construction and operation of treatment plants across the State must be analyzed in the EIR. Notably, potentially significant environmental impacts resulting from the construction of these plants include, but are not limited to, the following: (i) increased emissions of toxic air contaminants (e.g., diesel exhaust particulate), criteria pollutants (e.g., NOx), and greenhouse gases during construction; (ii) increased discharge of pollutants in stormwater runoff during and after construction; and (iii) increased cumulative environmental burden in disadvantaged communities served by regulated water systems. Moreover, treatment plants require space, and the construction of new plants in areas with significant land constraints could result in potentially significant impacts relating to, among other things, agricultural land, biological resources (including various Habitat Conservation Plans), and tribal cultural resources.

(3) The EIR must analyze the potential environmental impact resulting from the proposed Best Available Technologies. The NOP identifies several proposed best available technologies ("BATs"): ion exchange, reduction-coagulation/filtration, and reverse osmosis. The environmental impacts of using these BATs must be analyzed. Notably, the use of the proposed BATs would have potentially significant impacts relating to hazardous waste, as the BATs generate treatment residuals that must be managed as hazardous waste in California. The processing and disposal of these treatment residuals would further result in potentially significant impacts that must be analyzed in the EIR. For example, the shipment of treatment residuals to offsite disposal facilities would result in increased TAC, criteria pollutants, and VMT. The BATs would also result in increased disposal of hazardous waste, increasing pressure on limited in-state Class 1 landfill capacity. Moreover, the proposed BATs may result in potentially significant impacts relating to energy and GHG emissions. This is because the proposed BATs are energy intensive and typically require power from the electric grid rather than local renewable resources. Furthermore, transporting hazardous wastes great distances to other states for disposal also impacts energy and GHG emissions. In short, the Project may have potentially significant impacts resulting from the proposed BATs. The EIR must disclose, analyze, and to the extent feasible, mitigate the environmental effects associated with the BATs and their treatment residuals.

C. The EIR must analyze the cumulative impacts of the Project.

The EIR is required to discuss the cumulative impacts of the Project. (State CEQA Guidelines, § 15130.) In particular, the Project would require water agencies to engage in activity to either modify existing sources to comply with the MCL or to shift to an alternative water source (e.g., surface waters) that would allow the agencies to avoid treatment costs associated with MCL compliance. There are hundreds of water agencies in the State of California. (https://www.acwa.com/about/directory/ [directory of California water agencies].) Each impacted agency likely would be engaging in activity that would impact the environment in response to the MCL, and the cumulative impact of this activity would almost certainly be significant. The cumulative impacts of this activity must be analyzed in the EIR. (State CEQA Guidelines, § 15130.)

D. The State Water Board must consider a reasonable range of alternatives, including a less intense alternative to the Project.

"An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." (State CEQA Guidelines, § 15126.6.(a).) Here, because the Project has two components (setting the MCL for chromium-6, and methods of compliance to meet the new MCL), any alternatives developed must take into account both components of the Project. Thus, for example, the EIR must analyze alternatives that involve less impactful treatment options than the BATs set forth in the NOP.

4. <u>The Project Should Not Result In An MCL That Makes Reliance On Groundwater Economically Infeasible</u>.

CVWD has concerns that the Project could threaten the economic feasibility of groundwater reliance in California, which would be devastating for the State and its people. While the NOP does not offer a definite project description, it suggests that the MCL for chromium-6 could be as low as 1 ppb. An unreasonably stringent MCL would run afoul of public policy and cause great harm to many Californians. For example:

A. Increased dependency on surface waters undermines drought resiliency.

As noted above, the high treatment costs associated with an MCL could result in increased use of surface water and other, non-groundwater sources of water. Wells with water exceeding the MCL may be shut down where treatment of the water is not economically feasible. This shut down of impacted wells would be contrary to existing state policies emphasizing reliance on local water sources. In a time of drought, the MCL could exacerbate water insecurity in California. This must be avoided.

B. The Project could frustrate achievement of the Human Right to Water goals.

On September 25, 2012, Governor Brown signed AB 685, making California the first state in the nation to legislatively recognize the human right to water. The Project, however, could result in a shutdown of impacted groundwater wells. This, compounded with uncertain access to state grant funding, would compromise water supply reliability and access to drinking water. Increased water rates compromise water affordability and lead to public health issues caused by decreased disposable income, which is strongly correlated with negative health impacts. These impacts would be most pronounced in socioeconomically disadvantaged communities. CVWD urges the State Water Board to consider these and other environmental justice concerns when contemplating the proper MCL for chromium-6.

5. <u>The Project's Environmental Impacts Could Be Avoided By Developing A New Public Health Goal For Chromium-6</u>.

In July 2011, the Office of Environmental Health Hazard Assessment ("OEHHA") established a public health goal ("PHG") for chromium-6 of 0.02 ppb, representing a de minimis lifetime cancer risk from exposure to chromium-6 in drinking water, based on studies in laboratory animals. Since then, scientific information on the impacts of chromium-6 on human health has advanced substantially. The most recent scientific information on the health effects of human ingestion of chromium-6 in drinking water indicates that MCLs at or above the upper end of the MCLs set forth in the NOP are fully health protective. In October 2016, OEHHA announced this substantial new information warrants a review of the chromium-6 PHG, which to date has not been performed.

CVWD urges a reassessment of the current PHG and the development of a new risk assessment to determine the de minimis lifetime cancer risk from exposure to chromium-6 based on the most recent scientific information available. The revised PHG, based on the most recent science available, would then better guide the State Water Board in determining the proper MCL for chromium-6. And, from a CEQA perspective, this would streamline any EIR regarding MCL for chromium-6 by eliminating from consideration the most stringent proposed MCLs, which are the MCLs likely to have the most significant environmental impacts. Both the people of California and the environment will benefit from a reassessment of the PHG for chromium-6.

6. Request for Notices.

CVWD requests to be added to the notification and distribution lists for all notices relating to the Project, including all (i) CEQA-related notices, and (ii) public meeting/hearing notices issued pursuant to state and local law, including CEQA, the Ralph M. Brown Act, and the Bagley-Keene Act. The satisfaction of this written request is required by CEQA (Public Resources Code, § 21092.2), the Ralph M. Brown Act (Government Code, § 54954.1), and the Bagley-Keene Act (Government Code, § 11125).

7. Conclusion.

CVWD looks forward to working with the State Water Board to ensure that this Project receives the careful review that it deserves. Thank you for your consideration of CVWD's input.

Sincerely,

Steve Bigley
Director of Environmental Services
Coachella Valley Water District

SB: ms\Env Srvs\2021\Comment Ltr NOP Chromium 6 MCL.doc
File: 0566.02

December 6, 2021

State Water Resources Control Board
Office of Chief Counsel
Attn: Kim Niemeyer
P. O. Box 100
Sacramento, CA 95812-0100
By email to: ddw-hexavalentchromium@waterboards.ca.gov

Subject: Comments on Notice of Preparation (NOP) of a Draft Program Environmental Impact Report for Adoption of a Regulation for the Hexavalent Chromium (Chromium-6) Maximum Contaminant Level ("Project")

The Community Water System Alliance (CWSA) submits these comments in support of the State Water Resources Control Board's (Water Board) effort to identify and analyze the environmental impacts of the above-named Project. CWSA is a group of municipal utilities, water and community service districts, and water companies allied around the principle of large water systems helping small ones. Our members include both large and small, urban and rural water systems ranging from California's central coast to the Coachella Valley, most of which serve disadvantaged communities. Our comments reflect this focus on the special challenges faced by smaller community water systems in maintaining compliance with all water regulations.

The Water Board must directly notify and consult responsible agencies under CEQA Guidelines. CWSA members are responsible agencies for the Project. As drinking water suppliers, they will be required to comply with the new MCL adopted under this Project, meaning some of them will necessarily employ a treatment technology (one of the Best Available Technologies or a different technology) or an alternative method to achieve compliance, a few of which are foreseen and identified in the NOP. Any of these methods of compliance may have significant environmental impacts. The NOP inaccurately states that "[w]ater systems with hexavalent chromium exceeding the proposed MCL are located throughout the state and specific locations are not currently known." The Water Board has obtained significantly more data in recent years on the occurrence of hexavalent chromium and the public water systems that will be directly affected by an MCL. CEQA Guidelines call for more direct notification of responsible agencies, which would either be every public drinking water system in California, or at least those drinking water systems that presently use a water source containing chromium-6 near, at or above the proposed MCL.

The Project Need is questionable and must be reexamined. We are concerned the need for the Project rests on outdated and inaccurate scientific information as represented in the Public Health Goal (PHG) from 2011. The Office of Environmental Health Hazard Assessment (OEHHA) at

that time established the PHG for chromium-6 at 0.02 ppb, based on a *de minimis* lifetime cancer risk from exposure in drinking water. OEHHA was obligated to reconsider this PHG on a five-year cycle, but while more recent scientific information on the human health effects of ingesting chromium-6 indicates that the risk is far less than previously thought, the PHG has not been reviewed—or if reviewed, no justification provided for maintaining the old PHG. With a reevaluation of readily available, peer-reviewed scientific evidence, the Project may not be needed.

Modify the range of alternatives and include a No Action alternative. A "No Action" alternative to the Project should thoroughly examine the question from the preceding paragraph. Chromium-6 is currently regulated in drinking water by California's MCL of 50 µg/L for total chromium, which is more stringent than the federal MCL of 100 µg/L. The NOP indicates, "The State Water Board is considering 17 possible MCLs (1 to 15, 20, and 25 µg/L)." Analyzing the impacts of MCLs at 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, *and* 15 µg/L unnecessarily complicates the analysis and confounds the objective to "describ[e] the project and the potential environmental effects to enable the responsible agencies to make a meaningful response" [CEQA Guidelines (14 CCR § 15082)]. The State Water Board should reduce the number of possible MCLs to a few numbers across that range, such as 1, 5, 10 and 15 µg/L, plus 20 and 25 µg/L.

The Project is likely to cause many environmental impacts that need to be analyzed in the EIR. Although the Project is not specific, and does not describe the environmental impacts, as stated above, it does suggest some of the implementation actions Public Water Systems may opt for, to achieve compliance with the MCL. Environmental consequences directly resulting from adopting a new drinking water regulation for chromium-6 will depend on the actions to comply with the MCL, and may include:

- Construction of treatment plants – changed land use, increased noise, dust or other air emissions
- Operation of treatment plants – air pollution and greenhouse gas emissions from increased power use and transportation of treatment chemicals and treatment residuals; disposal of concentrated chromium-6 in liquid or solid residuals, which may be classified as hazardous wastes
- Changing water sources – shifting from a groundwater source to surface water may impact air quality due to conveyance pumping, stress on aquatic and other biological resources including sensitive species.

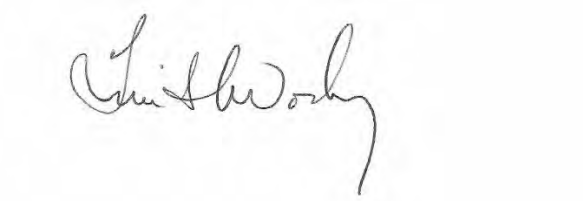
Cumulative impacts must be analyzed. Chromium-6 occurs in water sources across many regions of the state, as shown by data the Water Board has collected. The cumulative environmental effects of a new MCL could be quite significant, especially at the more stringent MCLs, and must be evaluated.

Economic effects of the MCL may result in impacts to the physical environment. For any community, but especially communities with many low-income residents, the economic and social effects of a new regulatory mandate impinge on other choices about the use of limited financial resources. In this way, a stringent MCL will have impacts to the physical environment, limiting community-wide opportunities for trees and other healthy landscapes, parks and outdoor recreation, sanitation, recycling programs, and so forth. Likewise, as water rates rise to cover the cost of treatment or alternative strategies to comply with the MCL, individual households'

opportunities to create a more healthful physical environment will be constrained in similar ways. These effects need to be analyzed in the Program EIR.

On behalf of our members, CWSA appreciates the opportunity to submit these recommendations for a thorough and complete environmental review of the proposed Project. We look forward to continuing to offer constructive input in the CEQA process and, if the Project moves ahead, in the State Water Board's regulatory process.

Sincerely,



Community Water Systems Alliance

Kristin Bloomer, President (Division 5)
James Cioffi, Vice President (At large)
Joseph K. Stuart, Secretary-Treasurer (At large)
Patricia G. Oygar, Director (At large)
Paul Ortega, Director (Division 4)

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DESERT WATER

Mark S. Krause, General Manager-Chief Engineer
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Krieger & Stewart, Consulting Engineers

December 6, 2021

VIA EMAIL: DDW-HEXAVALENTCHROMIUM@WATERBOARDS.CA.GOV

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, CA 95812-0100

Subject: Comment Letter regarding Notice of Preparation of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

Dear Ms. Niemeyer:

Desert Water Agency (DWA) appreciated the opportunity to submit written comments in response to the State Water Resources Control Board's (State Water Board) Notice of Preparation (NOP) of a Draft Program Environmental Impact Report (EIR) for the adoption of a regulation for the maximum contaminant level (MCL) for chromium-6.

According to the NOP, the project at issue in the Draft Program EIR entails (i) seventeen possible MCLs for chromium-6 (1 to 15, 20, and 25 parts per billion (ppb)); and (ii) "reasonably foreseeable methods of compliance" with the MCLs (collectively, the Project).

DWA is a water agency that will be required to comply with the new MCL and approve methods of compliance with the MCL. The MCL may significantly impact DWA, its customers and the environment. DWA supports the State Water Board's decision to seek input from interested stakeholders on the preparation of a draft program environmental impact report.

<u>A MCL Below 25 ppb Could Have Significant Impacts on DWA and its Customers</u>

Desert Water Agency was formed in 1961 for the purpose of water management and importation in a 325-mile swath of western Coachella Valley. The Agency later acquired several private water companies and began providing drinking water to Palm Springs and portions of Cathedral City and unincorporated Riverside County.

The establishment of an MCL for chromium-6 directly concerns DWA, as the Coachella Valley's groundwater is impacted by naturally occurring chromium-6 due to the valley's geology. DWA has thus long desired that any MCL for chromium-6 that is established by the State Water Board have a meaningful opportunity for risk reduction and be technologically and

economically feasible, as required by law. Such an MCL would allow DWA to continue providing a sustainable and affordable public water supply to its residents.

DWA is concerned about the impacts of an unduly stringent MCL that might require DWA to construct economically infeasible facilities or deploy treatment options at enormous cost. Both the construction of new facilities and the deployment of treatment options would have significant impacts on the environment. Moreover, a new MCL could result in the shutting down of groundwater wells and increasing demands on surface water supplies in a time of significant and historic drought. As a result, DWA customers, many of whom are fixed-income seniors, could see significant increases in their monthly water expenses. DWA urges the State Water Board to consider these important concerns when drafting the EIR and selecting the proper MCL.

A Preferred Alternative and Fewer MCL Options Would be More Appropriate

The State Water Board calls out seventeen possible MCLs for chromium-6 (1 to 15, 20, and 25 ppb)—without specifying a preferred alternative. Each of these projects would have different environmental impacts requiring different mitigation measures.

DWA comments regarding a proposed MCL of 1 ppb would be dramatically different from its comments on a proposed MCL of 25 ppb. These are completely different projects with different environmental impacts. The NOP vaguely asserts that the Project includes "foreseeable methods of compliance," but fails to specify what precisely this entails. These vague and noncommittal characterizations of the Project deprive responsible agencies and the public of the opportunity to comment on an accurate, stable, and finite project description.

Cost of Compliance Impact Not Adequately Assessed

The cost of compliance with the MCL for chromium-6 would shape the behavior of both water agencies and ratepayers, and the environmental impacts of this reasonably foreseeable behavior must be analyzed in the EIR. To do so, the EIR must analyze and discuss the costs of complying with MCL, and how activity in response to such costs could potentially impact the environment. For example, if agencies had to adjust their source of supply due to compliance issues or concerns.

DWA has concerns that the Project could threaten the economic feasibility of groundwater reliance in California, which would be devastating for the State and its people. While the NOP does not offer a definite project description, it suggests that the MCL for chromium-6 could be as low as 1 ppb. An unreasonably stringent MCL would run afoul of public policy and cause great harm to many Californians, including those within DWA's jurisdiction.

On September 25, 2012, Governor Brown signed AB 685, making California the first state in the nation to legislatively recognize the human right to water. The Project, however, could result in a shutdown of impacted groundwater wells. This, compounded with uncertain access to state grant funding, would compromise water supply reliability and access to drinking water. Increased water rates compromise water affordability and lead to public health issues caused by decreased disposable income, which is strongly correlated with negative health impacts. These impacts would be most pronounced in socioeconomically disadvantaged communities. DWA urges the State Water Board to consider these and other environmental justice concerns when contemplating the proper MCL for chromium-6.

More Consultation on Reasonably Foreseeable Methods of Compliance Needed

The State Water Board should recirculate the NOP to all water agencies in the State to solicit comments regarding how these agencies might comply with the MCL. Failure to do so would arbitrarily limit the EIR's analysis of "reasonably foreseeable methods of compliance." Moreover, and as discussed above, to solicit meaningful information from these agencies, it is imperative that the NOP be revised to provide a stable, finite project description—i.e., a single preferred MCL, so that water agencies can speak to how they would comply with such an MCL.

Environmental Analysis of Treatment Facilities/Technologies is Insufficient

DWA identifies the construction of treatment plants as one reasonably foreseeable method of compliance with the MCL, and as such, the environmental impacts of the construction and operation of treatment plants across the State must be analyzed in the EIR. Treatment plants require space, and the construction of new plants in areas with significant land constraints could result in potentially significant impacts relating to, among other things, agricultural land, biological resources (including various Habitat Conservation Plans), and tribal cultural resources.

The Best Available Technologies (BATs) also have an array of environmental impacts from hazardous waste to GHG associated with the disposal. These should be evaluated for all of the projects under consideration.

DWA looks forward to working with the State Water Board to ensure that this Project receives the careful review that it deserves. Thank you for your consideration of DWA's input.

Sincerely,

Mark S. Krause

Mark S. Krause
General Manager-Chief Engineer

December 6, 2021

Via Email

Kim Niemeyer,
Office of Chief Counsel
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812
Email: ddw-hexavalentchromium@waterboards.ca.gov

RE: Scoping Comments on the Draft Environmental Impact Report for Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level

Dear Ms. Niemeyer,

On behalf of the undersigned organizations, we offer the following scoping comments on the Draft Environmental Impact Report (EIR), pursuant to the California Environmental Quality Act (CEQA) for the State Water Resources Control Board's (SWB) adoption of a regulation for the Hexavalent Chromium Maximum Contaminant Level (MCL).

Our various organizations have advocated for a health protective MCL for Hexavalent Chromium for 16 years. Though California was required to establish a drinking water standard for this contaminant by 2004,[1] the MCL was established 10 years later and only after the Natural Resources Defense Council (NRDC) and the Environmental Working Group (EWG) filed a successful lawsuit against the department for failing to act in a timely manner. Moreover, the

[1] See SB 351 (Ortiz) https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200120020SB351, and Cal. Health & Safety Code § 116365.5.

final MCL was indefensible due to an inadequate economic analysis that left impacted communities asking why the regulation was five hundred times higher than the Public Health Goal (PHG), and allowed industry to successfully challenge it in court in 2017. Since then, little progress, beyond a limited white paper on economic analyses, has been made and Californians living in 53 counties continue to be exposed to a dangerous carcinogen.

I. The SWB Should Comply With CEQA Through a Mitigated Negative Declaration

The SWB has not explained why it is considering a programmatic EIR for compliance with CEQA, when past packages to adopt new MCLs have relied on a mitigated negative declaration (MND). Given the delay associated with getting this proposed MCL package out for release, we are concerned that a full EIR process will increase the overall time in approving an MCL with little added benefit. The SWB has not indicated, and it does not seem evident, that there are any impacts associated with selecting an MCL that could cause significant and unavoidable impacts, thus requiring an EIR. Further, any localized impacts that may be significant would not be properly considered in a statewide programmatic EIR and would best be considered at the local level by water agencies carrying out the CEQA process. For example, any increase in greenhouse gas emissions by a water system in complying with a proposed MCL would be deemed significant based on its cumulative contribution as compared to a threshold of significance established by a local air pollution control district, with thresholds ranging from 1,100 to 10,000 metric tons of carbon dioxide equivalent per year. The SWB has similarly used MNDs when promulgating MCLs in the past, most recently with the MCL for 123-TCP in 2020. Given the limited benefit and increased delay and cost of a programmatic EIR, the SWB should instead prepare an MND for this MCL.

II. The SWB Should Consider Stannous Chloride, Drilling New Wells, Consolidation of Non-Compliant Water Systems with Nearby Systems and Other Compliance Methods as a Best Available Technology for Treatment of Hexavalent Chromium

During the CEQA workshop held on November 29, 2021 it was stated that despite successful piloting of stannous chloride (SnCl2) to reduce Hexavalent Chromium in drinking water, it is not included as one of the treatment options under CEQA scoping. We deem this to be an inappropriate exclusion given the potential of stannous chloride to provide some water systems with not only a less expensive, but also more environmentally sound option to address Hexavalent Chromium levels, as well as total Chromium. This exclusion will artificially increase the cost of compliance with the proposed MCL during this process, leading to an inappropriately biased result. While we understand that there is concern about residual SnCl2 in treated water, including this treatment under the heading of Reduction-Coagulation/Filtration provides an opportunity to avoid that problem. According to Kennedy, et. al., SnCl2 treatment, followed by sand filtration not only reduced Hexavalent and other forms of Chromium significantly, but "Total tin and turbidity removal were similar, decreasing to below 0.050 mg/L and raw water levels, respectively".[2]

[2] Kennedy, et. al., Stannous Chloride Reduction–Filtration for Hexavalent and Total Chromium Removal from Groundwater, (Mar. 2020), *available at* https://awwa.onlinelibrary.wiley.com/doi/10.1002/aws2.1174.

Other MCL packages also consider low impact, low cost, reasonably foreseeable options for compliance, including drilling new wells and consolidating non-compliant water systems with nearby systems. These options should be considered as part of this MCL package as well. The SWB must include SnCl2 treatment and other compliance methods, such as consolidation and new sources, as compliance methods when considering options and impacts in the CEQA document and cost considerations when proposing an MCL.

III. The SWB Must Accurately Reflect the Existing Environmental Setting to Include Impacts Associated with Hexavalent Chromium Consumption and Existing Options and Efforts to Fund Compliance

The SWB is required under CEQA to establish the existing environmental setting for this regulation.[3] CEQA defines the environmental setting as the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published.[4] Describing the environmental setting accurately and completely for each environmental condition in the vicinity of the Project is critical to an accurate and meaningful evaluation of environmental impacts. A CEQA document must also describe the existing environmental setting in sufficient detail to enable a proper analysis of project impacts.[5] An accurate description of the affected environment is an essential prerequisite for an adequate analysis of Project impacts. Here, the SWB must consider the existing impacts from Hexavalent Chromium on the public and the state and opportunities for funding compliance that will reduce any impacts water agencies would face in complying with the law.

Hexavalent Chromium is highly toxic to people and when present in water prevents the public from using their tap water for drinking, cooking, or sanitation. The CEQA document should explain the number of people who are currently exposed to Hexavalent Chromium in their water and the likely impacts people face when establishing the existing environmental setting. This discussion should include a robust discussion of how people are faced with increased costs through purchasing bottled water, being unable to cook in their home, and the health impacts associated with exposure. These impacts must be considered as impacts of the no-project alternative and these impacts must be deducted from any costs associated with bringing water systems into compliance with a proposed MCL.

The CEQA document should also discuss the opportunities that exist to help water systems, particularly small water systems serving small or disadvantaged communities, to meet compliance with an MCL and deduct these available funds from cost estimates. Once an MCL is set, the SWB can provide funding for infrastructure and operations and maintenance needed to

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[3] *See, e.g.*, *Communities for a Better Env't v. S. Coast Air Quality Mgmt. Dist.* (Mar 15, 2010) 48 Cal.4th 310, 316; *Fat v. City of Sacramento* (2002) 97 Cal.App.4th 1270, 1278, *citing* Remy, et al.; Guide to the Calif. Environmental Quality Act (1999) p. 165.
[4] CEQA Guidelines §15125(a)(1); *Riverwatch v. City of San Diego* (1999) 76 Cal.App.4th 1428, 1453.
[5] 14 CCR § 15125; *Galante Vineyards v. Monterey Peninsula Water Mgmt. Dist.* (1997) 60 Cal.App.4th 1109, 1121-22.

comply with the MCL through the Safe and Affordable Funding for Equity and Resilience (SAFER) Program. Infrastructure funds may also be available for all water systems through the existing Safe Drinking Water Revolving Fund, which has received an influx of funding from the state and which will receive a large amount of funding from a recently passed federal infrastructure bill. The CEQA document should also mention these resources when considering how compliance with a proposed MCL would impact water systems and communities.

Finally, the CEQA document should consider existing efforts to treat existing contaminants in ways that would also bring water systems into compliance with a proposed MCL for Hexavalent Chromium. For example, treatment methods for existing MCLs for nitrate and arsenic contamination also include ion exchange and reverse osmosis technologies and many of these systems are in areas facing Hexavalent Chromium contamination. This significant overlap of treatment needs certainly reduces the cost of compliance with any proposed MCL and must be considered as part of the existing environmental setting.

IV. The SWB Must Consider the Human Right to Water When Selecting a Preferred Alternative

Pursuant to existing law, the SWB must consider the human right to right water when promulgating any regulation.[6] This means that for the range of actions the SWB is considering as part of the CEQA document, the SWB must explain how each alternative would affect the public's right to safe, clean, affordable, and accessible drinking water for adequate human consumption, cooking, and sanitary purposes. The SWB should include this consideration into its selection of a preferred alternative and select the alternative that provides the greatest fulfillment of the human right to water.

V. The SWB Should Conduct a Racial Equity Analysis of Exposure to Hexavalent Chromium

The SWB recently passed a resolution condemning Racism, Xenophobia, Bigotry, and Racial Injustice and Strengthening Commitment to Racial Equity, Diversity, Inclusion, Access, and Anti-Racism. Specifically, the resolution highlighted racial disparity that exists when looking at which communities face unsafe drinking water. Given the industrial nature of Hexavalent Chromium exposure and historical practice of redlining communities of color to force them to live near industrial sources or siting new industrial sources near existing communities of color, it is possible that Hexavalent Chromium exposure will be disproportionately felt by communities of color. Given the process the SWB is undertaking to understand and correct racism within the water sector and move towards a more equitable future, we believe the SWB should also conduct a racial equity analysis as part of this process.

[6] Cal. Water Code § 106.3 subd. (b).

VI. The Public Health Goal Remains Best Available Science for Determining Health Impacts from Hexavalent Chromium and Should Continue to Guide the MCL

The Office of Environmental Health Hazard Assessment (OEHHA) is considered one of the preeminent scientific bodies in the country and takes a rigorous, peer reviewed approach to establishing Public Health Goals (PHG) for drinking water contaminants. OEHHA compiles research on both animal and human health impacts, prepares a comprehensive health risk assessment based on those studies, and then puts their work through a peer review process as well as public comment, before finalizing their PHGs. OEHHA's PHGs represent the level at which, based on current science, "the level of a chemical contaminant in drinking water ...does not pose a significant risk to health"[7] in people who drink that water for 70 years. For carcinogens, the agency uses a one in a million risk level. With this in mind, and based on studies in mice exposed to Hexavalent Chromium in drinking water by the National Toxicology Program as well as data from China correlating increased stomach cancer and Hexavalent Chromium in drinking water, OEHHA established its PHG at 0.02 ppb. That analysis was approved via the peer reviewer process. OEHHA has since reviewed new studies on the health impacts of Hexavalent Chromium, but has determined that none of them thus far would lead to a revision of the current PHG. Thus, the SWB is justified in relying on the PHG as best available as to the health impacts from Hexavalent Chromium exposure.

Several commenters during the scoping presentation noted that additional studies have been conducted that call into question the health impacts of Hexavalent Chromium. The MCL process seeks to establish an MCL as close as possible to the PHG, meaning the PHG should be the primary means by which the SWB determines impacts from Hexavalent Chromium and that additional studies are not relevant and act to further delay the final establishment of this MCL.The SWB has significant deference in which studies they rely on when determining impacts to health.[8] The mere existence of a contrary study does not mean that the SWB must include that study's findings in its CEQA document. We believe that the SWB should continue to rely on OEHHA's PHG for defining the health impacts from Hexavalent Chromium.

Thank you for your consideration of these comments. We look forward to continuing to engage in this process to promote the most health-protective MCL possible.

Sincerely,

Kyle Jones
Policy Director
Community Water Center

Andria Ventura
Legislative and Policy Director
Clean Water Action

[7] https://oehha.ca.gov/water/public-health-goals-phgs
[8] *See Sierra Club v. Fresno* (2018) 6 Cal.5th 502, 512-513.

Erin Brockovich
Founder
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Bob Bowcock
Managing Director
Integrated Resource Management, Inc.

Michael K. Claiborne
Directing Attorney
Leadership Counsel
for Justice and Accountability

Bill Allayaud
California Director of Government Affairs
Environmental Working Group

Brandon Dawson
Executive Director
Sierra Club California

Cc: Chair Esquivel, Vice Chair D'Adamo, and Boardmembers Firestone, Maguire, and Morgan

Höganäs

9 December 2021

Ms. Kim Niemeyer
State Water Board
Office of Chief Counsel
PO Box 100
Sacramento, CA 95812-0100

RE: Response of Chromium Regulation Notice of Preparation

Dear Ms. Niemeyer

Höganäs Environment Solutions, LLC (HES) recently received notice of the California WaterBoard's proposed changes to the Total and Hexavalant Chromium VI (CrTot / CrVI) regulations.

HES was very active on chromium removal applications in California in 2016-2019. As a part of that work we completed validation pilot testing and received conditional acceptance of our Cleanit-LC iron based media from your division on 3 July 2018 (attached).

As cited in the attached Conditional Acceptance Letter issued by your department, *Höganäs' Cleanit-LC process can reliably achieve total and hexavalent chromium removal to non-detect concentrations*, even in the presence of common co-contaminants. Our Cleanit-LC process also offers a number of very important advantages for chromium removal in municipal treatment applications, including:

- Proven Cr VI Removal
- Robust Process Chemistry
- Very High Water Recovery
- Minimal Waste Production
- Sustainable Iron-Based Chemistry
- Extremely Simple and Cost-Effective Operation
- Proven Project Delivery Models

Given our technology has already been validated to meet any expected new rule, we ask that our process be specifically listed as a Best Available Technology with regard to any new rules.

Höganäs is happy to support the California Waterboard's regulatory review process in any way. Please feel free to contact me, or anyone on our team, if we can be of assistance in any way.

Best Regards-

Höganäs Environment Solutions, LLC

Louis LeBrun, PE
President & General Manager
Hoganas Environment
O 984.333.0300
M 919.996.9372
louis.lebrun@hotmail.com

13846 Conference Center Drive ♦ Apple Valley, California 92307
Phone (760) 946-7000 ♦ Fax (760) 240-2642 ♦ www.mojavewater.org

December 6, 2021

Via email: ddw-hexavalentchromium@waterboards.ca.gov

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, CA 95812-0100

Re: Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)

Dear Kim Niemeyer:

The Mojave Water Agency (MWA) respectfully submits comments for the "Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level".

The Mojave Water Agency (MWA) is a State Water Contractor located in Southern California and encompasses approximately 4,900 square miles. MWA is tasked with managing the regions groundwater supply and provides imported water for our local stakeholders. The population in MWA's service area is approximately 500,000 people, which nearly 80% are in a disadvantaged community and 60% are in a severely disadvantaged community. The population in our service area exclusively relies upon groundwater for drinking water, with some of our region's groundwater containing naturally occurring hexavalent chromium.

Since much of the MWA region is economically disadvantaged and severely economically disadvantaged, the MWA requests that the State take careful consideration to ensure that the adoption of an MCL for hexavalent chromium properly considers the human right to water and the affordability of drinking water. The project scope also includes a list of Best Available Technologies, all of which would be a cost burden for affected small water systems to adopt, both for capital costs, as well as operation and maintenance costs.

If an MCL is adopted that would negatively impact the water systems in our region, we respectfully request that the State provide resources to help our disadvantaged and severely disadvantaged communities to mitigate any financial constraints that would impact the ability for our residents to obtain affordable drinking water.

Respectfully,

Allison Febbo
General Manager
Mojave Water Agency
760-946-7000
AFebbo@mojavewater.org

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NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

November 12, 2021

Kim Niemeyer
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100

Re: 2021110099, Adoption of a Regulation of the Hexavalent Chromium Maximum Con Project, Statewide

Dear Ms. Niemeyer:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements.** If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:

- **a.** A brief description of the project.
- **b.** The lead agency contact information.
- **c.** Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
- **d.** A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).

- **a.** For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:

- **a.** Alternatives to the project.
- **b.** Recommended mitigation measures.
- **c.** Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:

- **a.** Type of environmental review necessary.
- **b.** Significance of the tribal cultural resources.
- **c.** Significance of the project's impacts on tribal cultural resources.
- **d.** If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:

- **a.** Whether the proposed project has a significant impact on an identified tribal cultural resource.
- **b.** Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:

a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or

b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:

a. Avoidance and preservation of the resources in place, including, but not limited to:

i. Planning and construction to avoid the resources and protect the cultural and natural context.

ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.

b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:

i. Protecting the cultural character and integrity of the resource.

ii. Protecting the traditional use of the resource.

iii. Protecting the confidentiality of the resource.

c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.

d. Protecting the resource. (Pub. Resource Code §21084.3 (b)).

e. Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).

f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:

a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.

b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.

c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf.

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
   - **a.** The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
   - **b.** Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/.

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
   - **a.** If part or all of the APE has been previously surveyed for cultural resources.
   - **b.** If any known cultural resources have already been recorded on or adjacent to the APE.
   - **c.** If the probability is low, moderate, or high that cultural resources are located in the APE.
   - **d.** If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
   - **a.** The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.

b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:

a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.

b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.

a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.

b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.

c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Andrew.Green@nahc.ca.gov.

Sincerely,

Andrew Green

Andrew Green
Cultural Resources Analyst

cc: State Clearinghouse

From:	Nick M
To:	WB-DDW-HexavalentChromium
Cc:	Nick Massetti; Answers@OEHHA
Subject:	Fwd: Comment: Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)
Date:	Friday, December 10, 2021 12:08:12 PM
Attachments:	Hexavalent Chromium and stomach cancer 2019.pdf

EXTERNAL:

Date: December 10, 2021
To: Water Boards, Kim Niemeyer
From: Dominic Massetti, Redwood Lodge Water Company CPUC #WTD-439
(408) 406-6315
Regarding: PROJECT TITLE: Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)

This note constitutes additional and an amended public comment input related to the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level.
On November 5, 2021 I submitted the information shown below asserting that the 2019 study by Suh, et. al. obviates the need to change the current MCL.
At its November 29, 2021 public forum related to the EIR related to this MCL update the Water Boards assured attendees that this study had been considered by OEHHA and that although no PHG has been issued in its regard the study by Suh, et. al. was deemed irrelevant.
In a series of subsequent communications with OEHHA I was provided the following assessment by OEHHA which confirms the Water Board's report of November 29. However, I disagree and provide the following critique of the OEHHA conclusion for the consideration of the Water Board as it considers a change to the MCL for Cr(VI).

Firstly here is the OEHHA assessment I received of the study by Suh, et. al.:

"On Thu, Dec 9, 2021 at 11:10 AM Answers@OEHHA <Answers@oehha.ca.gov> wrote:

This was a response approved by our Deputy Director for Scientific Programs – Vincent Cogliano.

The Suh et al. (2019) publication examined both animal and human studies. With regards to their meta-analysis of human studies, Suh et al. (2019) only included occupational studies that involved exposures occurring through inhalation. As such, the route of exposure in these studies differs from that typically occurring from drinking water. In addition, many of the human studies included in the Suh et al. (2019) meta-analysis likely involved significant weaknesses including exposure

misclassification, confounding, and the healthy worker effect.

In contrast, OEHHA's PHG was derived using the National Toxicology Program's 2008 animal study (NTP 2008). A key advantage of this study is that it involved consumption of Cr(VI) in drinking water, a directly relevant exposure pathway. In addition, issues such as confounding or exposure misclassification are far less likely in this study than in the human studies reviewed by Suh et al. (2019). Importantly, increases in digestive-tract tumors were reported in both rats (oral) and mice (small intestine) in the NTP study (2008), and these increases were seen in both males and females of both species. It is important to note that carcinogens can cause tumors in animals at sites that are different from those that would occur in humans, and this does not negate any cancer risk to humans. OEHHA judged this study to be of very high quality. Suh et al. (2019) rated this study as low risk of bias in every domain but one and placed it in their highest tier of overall quality (Tier 1).

In summary, because of the more relevant exposure pathway, and because of the overall very high quality of the NTP (2008) study, it remains the best study for assessing the cancer risk of Cr(VI) in humans."

Here are my comments:
1. The OEHHA statement: " Suh et al. (2019) only included occupational studies that involved exposures occurring through inhalation." represents an apparent misreading or misunderstanding of the study. The studies were indeed occupational studies in humans but not in any sense inhalation <u>only</u> studies.
From Suh Page 142: "this systematic review focused on studies of the following populations and exposure conditions: (1) workers with occupational inhalation or ingestion exposure to Cr(VI), (2) non-occupational populations with ingestion exposure to Cr(VI), and (3) experimental animals with ingestion exposure to Cr(VI)."
Ingestion clearly means swallowing and ingestion in humans if not specifically via drinking water would obviously be more relevant to the effects of Cr(Vl) on human digestive systems than a drinking water study in mice and rats.
In addition, Suh, et. al. refer to human drinking water studies outside their immediate study that were notable non the less and deserved inclusion. See Page 141: " Finally, several studies of human populations with environmental exposures to Cr(VI) have been published, and conflicting results exist in these studies as well. Most notable among these literature are three studies of a population of villagers in China exposed to Cr(VI) in drinking water. The original publication (Zhang and Li 1987) was followed-up by two subsequent analyses of the original data that reached different conclusions (Beaumont et al. 2008; Kerger et al. 2009). While Beaumont et al. (2008) reported an increase in stomach cancer among villagers exposed to Cr(VI) in drinking water, Kerger et al. (2009) <u>found no increase in stomach cancer among the same villager population when the comparison rates were from villages with uncontaminated drinking water.</u> Kerger et al. (2009) concluded that differences in risk factors and

demographics of the industrialized area, used as the source of control rates in the Beaumont et al. (2008) study, influenced the findings."
So, to state that the study involved exposures occurring through inhalation with an implication that that is all they studied and that they did not include ingestion, which is pointedly relevant to drinking water in humans, is a mischaracterization and misrepresentation of the facts. This misleads to the false impression that this study has no relevance to Cr(Vl) in drinking water ingested by humans and is a disservice to the water supply community.
As a point of emphasis, had one looked at the references cited in the study one would find five studies involving ingestion of drinking water in humans wherein drinking water was stated in the titles of those references.

2. The OEHHA statement: "In addition, many of the human studies included in the Suh et al. (2019) meta-analysis likely involved significant weaknesses including exposure misclassification, confounding, and the healthy worker effect." appears to have been included in order to discredit the study by discrediting the underlying human studies. Again a fair reading of the study would easily conclude that the expert scientific panel led by Suh considered in detail the significant weaknesses including misclassification, confounding, etc. and compensated for those with rigorous scientifically based methodology in order to extract the truly meaningful conclusions. One can likely conclude that this comment is an unfair and unfounded and perhaps self-serving mischaracterization based on unsubstantiated opinion and not any scientific methodology like that employed by the work of Suh et. al..

3. The OEHHA statements about the 2008 NTP animal study involving a directly relevant pathway (drinking water and digestive tract) could be interpreted to imply that this study is more relevant to the impact of Cr(Vl) in humans than the study by Suh. However in the NTP document (NTP TR 546 July 2008) it clearly states: "The interpretive conclusions presented in NTP Technical Reports are based only on the results of these NTP studies. Extrapolation of these results to other species, including characterization of hazards and risks to humans, requires analyses beyond the intent of these reports." Also later on Page 12 "Thus, the actual determination of risk to humans from chemicals found to be carcinogenic in laboratory animals requires a wider analysis that extends beyond the purview of these studies." So it is improper to imply that the NTP 2008 study in rats and mice has any more relevance to humans than the Suh study.
Further the OEHHA statement that "Suh et al. (2019) rated this NTP study as low risk of bias in every domain but one and placed it in their highest tier of overall quality (Tier 1)" is completely true, but it apparently misses an important point of the Suh analysis of this NTP study. That point is that if this study is so well done and regarded because of its comprehensiveness and rigor then the findings of the NTP 2008 study showing no cancer found in the stomachs, which relate to humans, while it

was found other gastrointestinal areas less relating to humans is significant on its own. Thus the conclusion in the Suh study on page 146 "Overall, the final level of confidence in the animal evidence stream was high; thus, there is high level of confidence in the evidence base supporting a lack of association between ingestion of Cr(VI) and stomach cancer in experimental animals."

Therefore I submit that the OEHHA conclusion above: " In summary, because of the more relevant exposure pathway, and because of the overall very high quality of the NTP (2008) study, it remains the best study for assessing the cancer risk of Cr(VI) in humans," is dramatically flawed in that the study by Suh, et. al. is clearly a better study for assessing the cancer risk in humans than the NTP 2008 study in mice and rats. I can only hope that the OEHHA will revise their assessment prior to completing any PHG on the subject and fairly represent this study.

I then repeat my message of November 5, 2021
So there is no scientific reason to increase the Cr(Vl) MCL any higher than it already is.
Our State Small CPUC regulated water system of fourteen customers will not survive any added testing costs and to require a test for a hazard that does not exist would be a criminal imposition and a threat to the fragile water supply in our community as well as the State. Please do your homework and read this study and give it the proper weight in your deliberations.

Thank you,

---------- Forwarded message ---------
From: **Nick M** <nickmassetti@ieee.org>
Date: Fri, Nov 5, 2021 at 4:09 PM
Subject: Comment: Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)
To: <ddw-hexavalentchromium@waterboards.ca.gov>
Cc: Nick Massetti <nickmassetti@ieee.org>

Date: Nov 5, 2021
To: Water Boards
From: Dominic Massetti, Redwood Lodge Water Company CPUC #WTD-439
(408) 406-6315
Regarding: PROJECT TITLE: Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)

There is no need for an change in the Hexavalent Chromium MCL from its current value a recent study has shown that Cr(Vl) does not pose a stomach cancer hazard in humans.

The WaterBoard website
at https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.html
states: "In July 2011 OEHHA established a PHG for chromium-6 of 0.02 µg/L. The PHG represents a *de minimis* lifetime cancer risk from exposure to chromium-6 in drinking water, based on studies in laboratory animals."
That study in laboratory animals has been shown to be faulty and replacement studies in humans have shown the opposite.

The attached study is summarized described here and its abstract verifies this fact.

CRITICAL REVIEWS IN TOXICOLOGY 2019, VOL. 49, NO. 2, 140–159
https://doi.org/10.1080/10408444.2019.1578730

Hexavalent chromium and stomach cancer: a systematic review and meta-analysis

Mina Suh(a) , Daniele Wikoff(b) , Loren Lipworth(c) , Michael Goodman(d) , Seneca Fitch(e) , Liz Mittal(e) , Caroline Ring(f) and Deborah Proctor(a)

a ToxStrategies, Inc, Mission Viejo, CA, USA;
b ToxStrategies, Inc, Asheville, NC, USA;
c Vanderbilt University Medical Center, Nashville, TN, USA;
d Emory University Rollins School of Public Health, Atlanta, GA, USA;
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"ABSTRACT: Hexavalent chromium [Cr(VI)] is known to cause lung cancer in workers of certain industries, but an association with stomach cancer is uncertain and widely debated. Systematic review and meta-analyses were conducted to assess the risk of stomach cancer mortality/morbidity in humans and experimental animals exposed to Cr(VI). In accordance with the protocol (PROSPERO #CRD4201605162), searches in PubMed and EmbaseVR , and reviews of secondary literature bibliographies, were used to identify eligible studies. Critical appraisal of internal validity and qualitative integration were carried out using the National Toxicology Program's Office of Health Assessment and Translation (OHAT) approach; meta analyses were conducted based on the occupational data (the only data suitable for quantitative assessment). Forty-seven publications (3 animal, 44 occupational, 0 non-occupational) met the eligibility criteria. Stomach cancer was only observed in one high risk of bias animal study, and in the low risk of bias studies no stomach cancer was observed. Thus, confidence in this evidence base is high. Environmental epidemiology studies did not meet eligibility criteria because exposure and outcome were not measured at the individual level. Meta-analyses of human data resulted in overall meta relative risks of 1.08 (95% CI: 0.96–1.21) including all studies and 1.03 (95%CI: 0.84–1.26) excluding studies associated with the highest risk of bias. Because most occupational studies have high risk of bias for confounding and exposure domains, the overall confidence in this evidence base is low to moderate. Combining the streams of evidence per the OHAT approach, Cr(VI) does not pose a stomach cancer hazard in humans."

So there is no scientific reason to increase the Cr(Vl) MCL any higher than it already is.
Our State Small CPUC regulated water system of fourteen customers will not survive any added testing costs and to require a test for a hazard that does not exist would be a criminal imposition and a threat to the fragile water supply in our community as well as the State.

Please do your homework and read this study and give it the proper weight in your deliberations.

This comment is submitted in accordance with the following instructions:

Please submit your written comments to ddwhexavalentchromium@waterboards.ca.gov or via mail to Kim Niemeyer, State Water Board, Office of Chief Counsel P.O. Box 100 Sacramento, California 95812-0100. In your response, please indicate the public agency or other entity you represent, and the name and phone number of a contact person.

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REVIEW ARTICLE

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Hexavalent chromium and stomach cancer: a systematic review and meta-analysis

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ABSTRACT

Hexavalent chromium [Cr(VI)] is known to cause lung cancer in workers of certain industries, but an association with stomach cancer is uncertain and widely debated. Systematic review and meta-analyses were conducted to assess the risk of stomach cancer mortality/morbidity in humans and experimental animals exposed to Cr(VI). In accordance with the protocol (PROSPERO #CRD4201605162), searches in PubMed and Embase®, and reviews of secondary literature bibliographies, were used to identify eligible studies. Critical appraisal of internal validity and qualitative integration were carried out using the National Toxicology Program's Office of Health Assessment and Translation (OHAT) approach; meta-analyses were conducted based on the occupational data (the only data suitable for quantitative assessment). Forty-seven publications (3 animal, 44 occupational, 0 non-occupational) met the eligibility criteria. Stomach cancer was only observed in one high risk of bias animal study, and in the low risk of bias studies no stomach cancer was observed. Thus, confidence in this evidence base is high. Environmental epidemiology studies did not meet eligibility criteria because exposure and outcome were not measured at the individual level. Meta-analyses of human data resulted in overall meta relative risks of 1.08 (95% CI: 0.96–1.21) including all studies and 1.03 (95%CI: 0.84–1.26) excluding studies associated with the highest risk of bias. Because most occupational studies have high risk of bias for confounding and exposure domains, the overall confidence in this evidence base is low to moderate. Combining the streams of evidence per the OHAT approach, Cr(VI) does not pose a stomach cancer hazard in humans.

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Introduction

The risk of cancer associated with occupational exposure to hexavalent chromium [Cr(VI)] has been studied for over 100 years, in hundreds of studies, from a wide spectrum of industries (IARC 1990, 2012; NIOSH 2013). Among workers in certain industries, such as chromate production, pigment production, and chrome plating, a significant increase in lung cancer risk has long been recognized (IARC 1990; OSHA 2006; ATSDR 2012; NIOSH 2013; Proctor et al. 2014). Cr(VI) is

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classified as a known human carcinogen by the International Agency for Research on Cancer (IARC). IARC's conclusion is based on sufficient evidence in humans that Cr(VI) compounds cause cancer of the lung, and positive associations observed with cancer of the nose and nasal sinuses (IARC 2012). IARC indicated, "There is little evidence that exposure to chromium(VI) causes stomach or other cancers" (IARC 2012). However, recent reviews and meta-analyses report conflicting findings. Two of those meta-analyses found no evidence of an association between stomach cancer and Cr(VI) exposure (Cole and Rodu 2005; Gatto et al. 2010), but a more recent meta-analysis reported a significantly greater risk of stomach cancer in Cr(VI)-exposed workers (Welling et al. 2015). Each meta-analysis used different inclusion criteria, and only Cole and Rodu (2005) considered socioeconomic status (SES) and study quality. Interestingly, Cole and Rodu (2005) reported a significantly decreased risk of stomach cancer in studies that adjusted for SES (Meta-SMR: 82, CI: 69–96), but a significantly increased risk in studies that did not consider differences in SES (Meta-SMR: 137, CI: 123–153).

Although Cr(VI) is rapidly absorbed into cells, before that absorption occurs, it may be converted through extracellular reduction to the trivalent form [Cr(III)] in biological fluids and tissues; notably, gastric fluid, blood, and liver have significant reducing capacity (De Flora et al. 1997). Because Cr(III) is not well absorbed and has not been shown to be carcinogenic, and perhaps for this reason, the potential for carcinogenicity due to Cr(VI) outside the lung is limited. The question of whether reduction of Cr(VI) to Cr(III) in stomach contents is sufficient to protect against carcinogenicity has been studied for several decades (Donaldson and Barreras 1966; De Flora and Boido 1980; Finley et al. 1997) and has been a controversial issue considered in regulatory guidelines and several reviews (U.S. EPA 1991; De Flora 2000; Proctor et al. 2002; Sedman et al. 2006; OEHHA 2011; De Flora et al. 2016). Still, stomach cancer in association with Cr(VI) exposure has long been suspected among highly exposed workers, because oral exposures may occur through swallowing particles and hand-to-mouth contact. Observations from historical industry exposures, in highly contaminated work environments, have included reports of gastritis, ulcers, and stomach upset among workers of the chromium chemical production industry (Mancuso 1951; PHS 1953). Further, historical accounts of working conditions include evidence of oral exposures based on appearance of yellow-stained teeth and tongues (PHS 1953). Although not observed consistently, some occupational studies have reported a significant increase in stomach cancer risk among subcohorts of Cr(VI)-exposed worker populations (e.g. Davies et al. 1991; Korallus et al. 1993). Thus, occupational data are thought to provide important evidence for evaluating the risk of stomach cancer among populations exposed to Cr(VI).

In addition to evidence from occupational epidemiology studies, data from animal toxicology studies contribute insight into the overall assessment of hazard and risk. Typical of animal toxicology studies, the administered doses of Cr(VI) in these studies far exceed potential human exposures. Nonetheless, animal studies offer an evidence stream traditionally used for both hazard identification and risk assessment. For the purpose of this review, important characteristics of animal data include low risk of bias in exposure characterization, because exposure occurred by oral administration with relatively precise measures of individual dose, as compared to the human data. The animal study data also include conflicting and somewhat controversial findings because tumors of the stomach have only been reported in the forestomach of mice, a structure of the stomach that humans lack.

Finally, several studies of human populations with environmental exposures to Cr(VI) have been published, and conflicting results exist in these studies as well. Most notable among these literature are three studies of a population of villagers in China exposed to Cr(VI) in drinking water. The original publication (Zhang and Li 1987) was followed-up by two subsequent analyses of the original data that reached different conclusions (Beaumont et al. 2008; Kerger et al. 2009). While Beaumont et al. (2008) reported an increase in stomach cancer among villagers exposed to Cr(VI) in drinking water, Kerger et al. (2009) found no increase in stomach cancer among the same villager population when the comparison rates were from villages with uncontaminated drinking water. Kerger et al. (2009) concluded that differences in risk factors and demographics of the industrialized area, used as the source of control rates in the Beaumont et al. (2008) study, influenced the findings.

To date, no review or meta-analysis of Cr(VI) has utilized a structured guidance for systematic review of the primary studies, such as those of the National Toxicology Program (NTP) Office of Health Assessment and Translation (OHAT) and the Cochrane *Handbook for Systematic Review of Interventions* (The Cochrane Collaboration 2011; Rooney et al. 2014; NTP OHAT 2015). Given these methodological considerations, the inconsistent results, conclusions, and interpretations of the previously published reviews suggest that the literature on the association between Cr(VI) exposure and stomach cancer risk needs to be reexamined using methods consistent with the current state of the science. Thus, the overall objective of this research is to conduct a systematic review and meta-analysis to determine whether there is a significantly increased risk of stomach cancer mortality and morbidity associated with Cr(VI) exposures in humans or experimental animals using current methods. To that end, the NTP OHAT (2015) *Handbook for Conducting Systematic Reviews* was used to conduct a systematic review of human and animal evidence, and NTP OHAT criteria were used to critically appraise the risk of bias in each study. A meta-analysis of occupational exposure literature was then conducted to quantify the risk of stomach cancer among worker populations (the only data suitable for such quantitative assessment).

Materials and methods

Protocol development

A multidisciplinary research team was assembled with expertise and experience consistent with standards for conducting a systematic review (Eden et al. 2011). The research team

included two subject-matter experts (MS and DP), a systematic review expert (DW), and a scientific advisory board (SAB) with expertise in epidemiology and meta-analysis (LL and MG). Please see tables in the acknowledgments and declaration of interest for roles of each collaborator and author, including the SAB members.

This systematic review was conducted in accordance with the registered protocol (PROSPERO CRD42016051625). Elements of the protocol include the research question, literature search syntax and strategy, types of studies to be included, specifications of the population, exposure, comparator, and outcome (PECO), details of the risk-of-bias assessment and strategy for data synthesis, meta-analysis of subgroups or subsets, and conflict-of-interest information for each research team member. As described in the registered protocol, this systematic review focused on studies of the following populations and exposure conditions: (1) workers with occupational inhalation or ingestion exposure to Cr(VI), (2) non-occupational populations with ingestion exposure to Cr(VI), and (3) experimental animals with ingestion exposure to Cr(VI). The comparator groups included: (1) workers with no or low occupational exposure to Cr(VI) per specifications by the authors of the primary studies, (2) non-occupational populations identified by the authors of the primary studies having no ingestion exposure to Cr(VI), and (3) control animals that were not orally exposed to Cr(VI). The outcome of interest for the human data was stomach cancer morbidity and/or mortality as reported by the primary study authors. For animal data, we evaluated the number of incident stomach cancers per dose or experimental group, patterns of statistical significance, and dose-response as reported by the authors of the primary studies.

Literature search

The literature search was conducted using two databases (Embase® and PubMed), with the search syntax specified in the protocol (PROSPERO CRD42016051625). The literature search syntax was developed via multiple pilot exercises involving a series of validation checks and several iterations and considered all search terms used in the previous meta-analyses (Cole and Rodu 2005; Gatto et al. 2010; Welling et al. 2015). The final literature search was executed by an information specialist (SF) on March 20, 2018. All literature search results were de-duplicated and uploaded into the DistillerSR software for subsequent screening. Hand searching was the primary method used for identification of animal studies and supplemental for human studies. These included reviews of the citations in previously published meta-analyses and government agency documents on Cr(VI), such as those of the National Institute for Occupational Safety and Health (NIOSH), Agency for Toxic Substances and Disease Registry (ATSDR), IARC, California Office of Environmental Health Hazard Assessment (OEHHA), and USEPA (IARC 1990; USEPA 2010; OEHHA 2011; ATSDR 2012; IARC 2012; NIOSH 2013). A final validation review of the search findings was conducted by the subject-matter experts (MS and DP) prior to the initiation of study screening.

Table 1. Inclusion criteria.

Category	Details
For inclusion	Experimental animals with chronic administration of Cr(VI) by drinking water or oral intake
	Humans with non-occupational (environmental) exposures to Cr(VI) via ingestion
	Humans with occupational exposures to Cr(VI) Workers in chromate production, stainless-steel welding, chrome pigment production, chrome plating/electroplating, ferrochrome production industries Leather tanners included if the authors of primary studies specifically indicate exposure to Cr(VI) or process such as "two bath" process Cement workers included if authors of primary studies indicated that the occupation involved cement production because Cr(VI) is known to potentially produced in the kiln
	Other occupations (not specified above) will be included if the authors of primary studies indicated that workers were exposed to Cr(VI). This distinction was made because of evidence of increased cancer risk from Cr(VI) exposure has not been specifically reported for these other occupations generally, and other risk factors including asbestos, solvent, and arsenic exposures, have been indicated.
For exclusion	Workers with no occupational Cr(VI) exposure. Individuals with no non-occupational (environmental) Cr(VI) exposure. Human occupational and non-occupational studies, where exposure to Cr(VI) is not specifically evaluated nor stated. Experimental animals without chronic ingestion of Cr(VI).
	Studies that do not provide quantitative data of stomach cancer risk morbidity or mortality, or risks cannot be reasonably calculated based on the information provided by the authors of the primary studies
	Proportionate mortality ratio (PMR) and proportionate cancer mortality ratio (PCMR) studies Studies that do not assess risk at the individual level (e.g. registry studies based on occupational titles, ecological studies)

Study screening and selection

Table 1 presents the study's inclusion and exclusion criteria. Studies in languages other than English were included if they met the inclusion criteria. If multiple studies were published on the same cohort population, the most recent/updated results were included (Langard 1990; Lipworth et al. 2011; Gibb et al. 2015; Proctor et al. 2016). Proportionate mortality ratio (PMR) and proportionate cancer mortality ratio (PCMR) studies were excluded—it is widely acknowledged that these types of studies are difficult to interpret, because they cannot measure risks or rates due to lacking population denominator data (Aschengrau and Seage 2003; Rothman et al. 2008; Guha et al. 2010). Additionally, studies that did not assess risk at the individual level (i.e. ecologic studies) were excluded. For completeness, a brief characterization of the excluded PMR and ecologic studies is provided in Supplemental Tables A and B.

Title and abstract screening was conducted independently by SF. An iterative process was ultimately employed for screening titles and abstracts along with full text, because many epidemiologic studies of Cr(VI) are focused on lung cancer, and titles and abstracts often presented information for this cancer type and not stomach cancer. As a critical additional step, MS and SF hand searched reference citations from published meta-analyses and government agency

reports and publications issued after these agency reports (IARC 1990; Cole and Rodu 2005; Gatto et al. 2010; U.S. EPA 2010; OEHHA 2011; ATSDR 2012; IARC 2012; NIOSH 2013; Welling et al. 2015) to identify studies missed by the electronic search and title and abstract screening. Seven studies were included based on hand searching and full text review (Moulin et al. 1990, 1992; Moulin, Wild, Haguenoer, et al. 1993; Moulin et al. 1995; Sorahan and Harrington 2000; Smailyte et al. 2004; Proctor et al. 2016).

Data extraction

Data extractions were performed independently by three reviewers (see tables in the acknowledgments and declaration of intent) using Microsoft Excel for Mac (2018 Version). One Japanese study (Itoh et al. 1996) required the use of a translation service (Honyaku USA, Inc., Torrance, CA). MS and DP did not assess Proctor et al. (2016) because they are authors of that study. Three studies in French (Moulin et al. 1992; Moulin, Wild, Toamain, et al. 1993; Moulin et al. 1995) were translated to English by a team member. For each study, information was extracted on population/animal descriptions and size, study design, exposure assessment and dosing methods, and results, including the number of stomach cancer cases; information was also extracted for relative risk (RR) estimates, including SMR, standardized incidence ratio (SIR), risk ratio, or odds ratio (OR). For experimental animal studies, stomach cancer numbers and incidence rates were included. Information on dose-response and/or statistical significance, as discussed by the primary study authors, was also included along with discussions by the authors of the primary studies regarding confounding factors and limitations.

Some occupational studies reported multiple stomach cancer RR estimates for workers in separate jobs or in different plants; in those instances, estimates were extracted for each category when applicable. In other studies, stomach cancer estimates were provided for the overall worker population, as well as for several sub-cohorts (e.g. Sorahan et al. 1987; Davies et al. 1991; Becker 1999). Per specifications of the registered protocol (PROSPERO CRD42016051625), stomach cancer estimates for the different occupations and plants were extracted. In cases where qualitative exposure categories were provided, the RR estimate for high-exposure categories noted by the primary study authors was extracted, in addition to the RR estimate for the entire cohort population. Therefore, multiple RR estimates for non-overlapping workers from a single study were incorporated when applicable. When warranted, Open Source Statistics for Public Health was used to calculate mortality risk ratios (available at: http://www.openepi.com/SMR/SMR.htm). Quality check was performed to ensure that the details extracted (including the RR estimates) were accurate, and that information for overlapping workers was not included. For one pair of follow-up studies (Korallus et al. 1993; Birk et al. 2006), the cohorts partially overlapped. Of the 901 workers in the cohort of Birk et al. (2006), 678 were the same as those in the Korallus et al. (1993) study, which had a total of 1417 workers. Birk et al. (2006) examined only workers hired after a change in the chromate production processes in the same two plants studied by Korallus et al., but also included new workers with hire dates after the inclusion cutoff in the Korallus et al. (1993) study. The findings of Korallus et al. (1993) were used in the meta-analysis, because the cohort is larger; however, in a sensitivity analysis, the results reported by Birk et al. (2006) were substituted for those of Korallus et al. (1993).

Critical appraisal via risk-of-bias assessment (internal validity)

After data extraction, three reviewers performed a risk-of-bias assessment (see tables in the acknowledgments and declaration of intent). NTP OHAT recommends assessing risk of bias by considering various methodological aspects relevant to specific study design to "address the extent to which results of included studies should be relied on" (NTP OHAT 2015). Risk of bias was assessed according to the NTP OHAT Risk of Bias Rating Tool for Human and Animal Studies (NTP OHAT 2015).

The NTP OHAT approach includes 11 risk-of-bias questions or domains for evaluating internal validity, and each question is applicable to one to six study design types (Supplemental Table C) (NTP OHAT 2015). NTP OHAT recommends that each study be given the following ratings[1] for each question: " " (definitely high risk of bias), " " (probably high risk of bias), "+" (probably low risk of bias), or "+ +" (definitely low risk of bias). The specific instructions for scoring detailed in the NTP OHAT Risk of Bias Rating Tool (NTP OHAT 2015) were used to determine the ratings of the individual question components for all studies that were evaluated. Topic-specific refinements and/or interpretations (also recommended as part of using the tool) included:

> *Question 3: comparison groups for human studies*—As outlined in the PECO, the comparison groups were the general populations or workers in the plant who had limited or no exposures to Cr(VI); these comparator groups were specified by the authors of the primary studies. In occupational studies, the primary study authors used industrial hygiene data with airborne concentrations measured/estimated, and/or occupation and job titles, to identify the control or low-exposure workers. Those in administrative duties (e.g. secretaries, office clerks) were commonly indicated as the control or low-exposure groups. In studies with standardized mortality or incidence ratios, the comparator group was the standard population with age- and sex-specific mortality or incidence rates. In non-occupational studies, the comparator groups were populations indicated by the authors of the primary studies as being minimally exposed to Cr(VI) (i.e. not in proximity to the exposure source).

> *Question 4: confounding and modifying variables*—We identified asbestos, smoking, and SES as variables to be assessed to produce low risk of bias. It is well recognized (by authors of the primary studies) that asbestos and smoking can affect the measured associations between Cr(VI) exposure and stomach cancer. Increased risk of stomach cancer from smoking was reported to be significant in one systematic review and meta-analysis of cohort studies (Ladeiras-Lopes et al. 2008). The

[1]The NTP OHAT (2015) *Handbook* and the Risk of Bias tool describe the ++, +, , or output as answer formats; for the purposes of this assessment, we have chosen to use the term "ratings" to represent the domain-based output.

Institute of Medicine Committee on Asbestos evaluated occupational cohort and case-control studies and observed some evidence of dose-dependence and consistent pattern of fairly moderate increases risk of stomach cancer from asbestos exposure; however, causal inference between asbestos and stomach cancer was indicated as suggestive but not sufficient (IOM 2006). As noted earlier, differences in results among studies with SES control were found in the meta-analysis of Cole and Rodu (2005).

Question 11: other threats to internal validity—This question was developed to represent potential bias associated with experimental conditions of animals that threatened the validity of the study but were not covered in other domains (i.e. Q5—identical housing and husbandry practices and Q7—attrition). In this evidence base, Borneff et al. (1968) and Mackenzie et al. (1958) reported infections (e.g. mousepox, respiratory) and in Borneff et al. (1968), cannibalism that resulted in early mortality for the experimental animals. As such, Q11 herein addressed the health of the animals from the context of potentially biasing response due to biological differences associated with sickness (vs. differences in conditions between control/exposed groups or accounting for attrition from early mortality due to diseases; Q5 and 7, respectively).

Quality assurance was conducted with overlapping reviews for a subset of studies (i.e. a second reviewer conducted data extraction and risk-of-bias assessment). These overlapping evaluations were mostly consistent. For human occupational data, a few differences for Question 8 (exposure characterization) were resolved by MS.

Following critical appraisal of internal validity, we used NTP OHAT's tier system to characterize the overall risk of bias for each study as a way of comparing the internal validity across the evidence base. Tier 1 studies were determined to have definitely low or probably low risk of bias, and Tier 3 studies had definitely high or probably high risk of bias (NTP OHAT 2015). Tier 2 studies were those that met neither the criteria for Tier 1 nor the criteria for Tier 3. Although NTP OHAT recommendations propose these classifications, they do not provide specific guidance on how the tiers should be assigned. We developed two approaches for tier classification. Both approaches were used for tiering human data; for animal data, only the second approach was used. Approach 1 placed emphasis on the ratings for the key questions (Question 4, 8, and 9) as identified by NTP OHAT. For a study to be classified as Tier 1, there had to be no " " or " " ratings in any key question and no " " rating in other questions. If a study had two negative ratings for the key questions (" "or " "), it was classified as a Tier 3 study. Question 4 was not evaluated for experimental animal studies, and thus this approach was not considered for tiering the animal data.

Approach 2 considered the overall average ratings across all questions, and thus a numerical value must be given to each score to calculate an average. If a particular question was assigned a " " (definitely high risk of bias) on the basis of the OHAT tool, it received a 2, " " (probably high risk of bias) was assigned a 1, and "+" (probably low risk of bias) and "+ +" (definitely low risk of bias) received 1 and 2, respectively. The numbers across all questions were summed and a mean rating per study was used to assign each study to one of the three tiers using the cutoffs of >0.7, from 0.7 to 0.6, and less than 0.6 for Tiers 1–3, respectively. These cutoffs were based on division by three of the range of possible ratings (2 to 2) for each question. Unlike Approach 1, Approach 2 equally weights each domain in the assignment of studies to a tier. Per NTP OHAT guidance regarding weighting of key domains, Approach 1 was the primary approach to determine study tiers used in the meta-analyses described below. Approach 2 was included as an additional measure of comprehensiveness and transparency. NTP OHAT indicated that Tier 3 studies could be excluded due to high concern about bias on the key elements such as exposure assessment, outcome assessment, and confounding/selection; they may be "too problematic to provide any useful evidence and should not be included in any synthesis" (Sterne et al. 2014; NTP OHAT 2015). As such, Tier 3 studies were not included in several meta-analyses.

Meta-analysis

Meta-analyses were conducted based on human data. All meta-analyses were conducted by LM with oversight of CR and MS. Meta-analysis was conducted using the "metafor" package in R (R Core Team 2016). Meta-RR and 95% confidence intervals (95% CI) were calculated using random-effects models. Weights of the studies contributing to the meta-RRs were also determined in R for each analysis. Forest plots were developed using R.

A funnel plot was developed in R to visualize whether results were symmetrical. Meta-analyses are based on published studies, and it is known that studies with null results are less likely to be published (Thornton and Lee 2000; Dwan et al. 2013). To assess the possibility of publication bias, a Trim and Fill test (Duval and Tweedie 2000) and Egger's regression test (Egger et al. 1997) for funnel plot asymmetry were performed. The Trim and Fill test was essentially the results of an alternative random-effects meta-analysis model, with studies that made the funnel plot asymmetrical trimmed, and new "studies" added to make the funnel plot symmetrical. The meta-RR from a Trim and Fill test should not be interpreted as a more valid estimate, but if it is markedly different from the original meta-RR, it may suggest that publication bias could be influencing the results. With the Egger's test, we examined the relationship between normalized study outcomes (effect size/standard error) and study precision (inverse of study standard error) where a significant regression coefficient indicates asymmetry in the funnel plot, which in turn implies publication bias.

Meta-analyses were conducted as outlined in the protocol (PROSPERO CRD42016051625). They included evaluation of the overall evidence stream (Analysis 1; $n = 44$, no studies excluded) as well as a series of analyses (Analysis 2 through 8) based on study type, industry type, exposure category, and study quality (as measured by risk of bias) (Table 2).

To account for internal validity as suggested by NTP OHAT, Analysis 2 excluded Tier 3 studies (i.e. those with high risk of bias) from the overall meta-analysis, and Analysis 3 was limited to all Tier 1 studies (i.e. those with low risk of bias). Analyses 4a and 4b were limited to cohort or case-control studies, respectively, to characterize the results by study type.

Table 2. Meta-analysis descriptions.

Analysis	Description
1	All Studies
2	From Analysis 1, eliminate Tier 3 studies with -2 or -1 ratings in the key questions (Approach 1 for tier classification)[a,c]
3	Tier 1 studies only – Based on overall risk of bias ratings (Approach 2 for tier classification) [b,c]
4a	Cohort studies only
4b	Case-control studies only[d]
5	Sub-groups: Identified by the study authors as high exposure groups[e]
6	Industries associated with increased lung cancer risk from Cr(VI) (i.e., chromate production, pigment production, plating, ferrochromium production)
7	From Analysis 4a, eliminate Tier 3 studies (Approach 1 for tier classification)[a,c]
8	From Analysis 6, eliminate Tier 3 studies (Approach 1 for tier classification)[a,c]

Integration of the risk of bias assessment results for the meta-analysis.
[a]Approach 1 for tier classification: Greater emphasis is placed on the ratings for the key questions as identified by NTP OHAT (2015). There were 31 studies classified as Tier 3.
[b]Approach 2 for tier classification: overall average ratings for the risk of bias questions is considered for tiering.
[c]No Tier 3 studies were identified with Approach 2. Approach 1 only identified one study for Tier 1 (Iaia et al. 2006).
[d]One case-control study was classified as Tier 3 (Moulin et al. 1992), which only left two studies (Krstev et al. 2005; Xu et al. 1996). Thus, additional analyses for the case-control study category was not conducted.
[e]All studies for Analysis 5 were classified as Tier 3 studies in the risk of bias assessment (Approach 1 for tier classification). Thus, additional analyses for the high exposure subcohort category were not conducted.

One study reported 0 and 12 stomach cancer deaths among female and male chrome plating workers, respectively, in the UK (Sorahan and Harrington 2000). The data for female workers were not included in the meta-analysis, but there were 167 female workers (in comparison to 920 male workers) and no stomach cancers reported so the impact of excluding females from this study was inconsequential.

Analysis 5 was conducted to evaluate the association between Cr(VI) and stomach cancer among workers in high exposure groups. Analysis 6 focused on industries that have been identified by IARC and United States Occupational Safety and Health Administration (OSHA) (IARC 1990; OSHA 2006; IARC 2012) to have evidence of significantly elevated lung cancer risk due to Cr(VI) exposure. These industries included chromate production, pigment production, chrome plating, ferrochromium production. Although welders were observed to have increased lung cancer risk, this increase in risk does not appear to be attributable to Cr(VI) exposure (IARC 1990; OSHA 2006; IARC 2012). For this reason, studies of welders were not included in Analysis 6.

Analysis 7 excluded Tier 3 studies from Analysis 4a; Analysis 8 excluded Tier 3 studies from Analysis 6. These analyses (along with Analyses 2 and 3) were used to integrate the risk-of-bias assessment results into the quantitative examination of the data.

Data integration, overall evaluation of confidence in the body of evidence, and development of conclusions

Confidence in the evidence and generation of conclusions followed the guidelines in the NTP (2015) Handbook for Conducting a Literature-Based Health Assessment Using OHAT Approach for Systematic Review and Evidence Integration. Per this approach, an initial rating for confidence, also referred to as the quality of evidence, was assigned per key features of study design elements including controlled exposure, exposure prior to outcome, individual outcome data, and comparison group used. The designations for initial confidence rating (high, moderate, low, very low) were based on Table 8 of NTP OHAT (2015). Once the initial confidence rating was established, consistency, directness, precision, publication bias, magnitude, and confounding were evaluated to adjust the initial confidence rating (either up- or down-grading). The final confidence ratings were assigned for animal and human evidence as well as overall. Continuing through the NTP OHAT process, the confidence ratings were integrated with the findings for the body of evidence to develop hazard conclusions by evidence stream and overall.

Results

Overall summary of the evidence base

Consistent with reporting requirements of systematic reviews (Moher et al. 2009), Figure 1 delineates the process of screening the literature to identify relevant studies. After excluding articles that did not meet the inclusion criteria based on review of titles and abstracts, 127 publications were found to be eligible for full-text review. Of those, 47 were included for data extraction. Of those included, 44 were occupational studies, and 3 were experimental animal studies. Figure 1 also presents different categories of exclusions; citations of the 80 excluded studies that underwent full text review, and specific reasons for exclusion, are listed in Supplemental Table D. For non-occupational populations with ingestion exposures to Cr(VI) ($n = 4$), all studies employed ecological designs and were excluded (Fryzek et al. 2001; Beaumont et al. 2008; Kerger et al. 2009; Linos et al. 2011). As such, they were not included for critical appraisal but were summarized as contextual information (Supplemental Table B).

Experimental animal data characterization

There were four experimental animal studies (reported in three publications, Mackenzie et al. 1958, Borneff et al. 1968 and NTP 2008) evaluating the carcinogenic effects of ingested Cr(VI) in drinking water. Two studies were 2-year cancer bioassays of Cr(VI) in drinking water described in one publication (NTP 2008). Third one was the 1-year drinking water study (Mackenzie et al. 1958). The fourth was a three-generation drinking-water study with a total duration up to 2.4 years; dosing duration varied by generation and was affected by early termination due to the virus (Borneff et al. 1968). Table 3 presents the experimental details and results for each individual study. Both males and females were evaluated across multiple species/strains, including B6C3F1 mice, F344/N rats, white NMRI mice, and Sprague–Dawley albino rats. In the Borneff et al. (1968) and Mackenzie et al. (1958) studies, other test groups were studied. Animals were given either tap water, detergent dissolved in drinking water, detergent plus Cr(VI) in drinking water, benzo[a]pyrene plus Cr(VI)

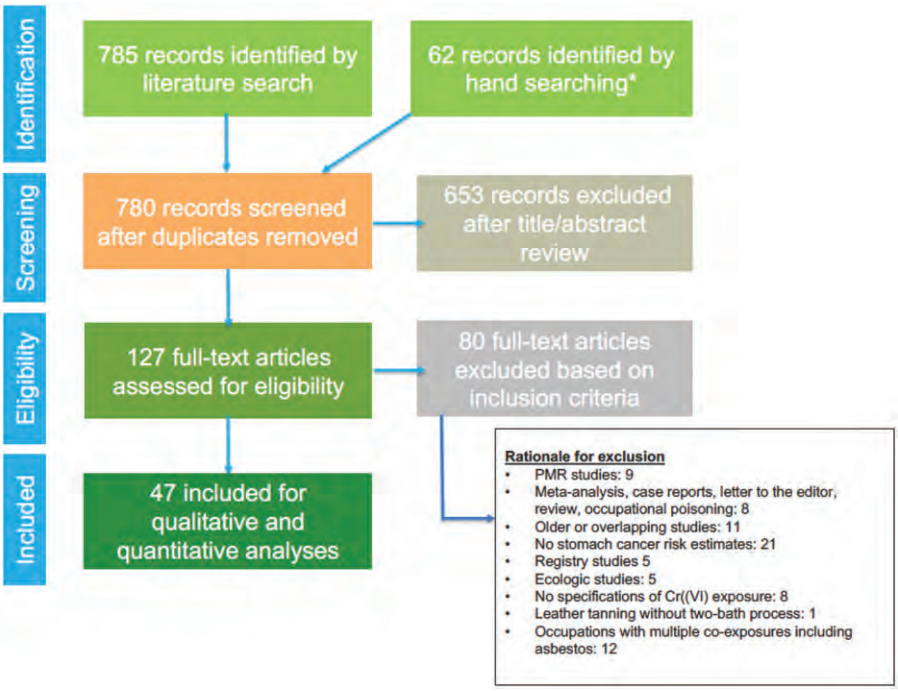

Figure 1. Literature Search Results (in accordance to PRISMA reporting). *Hand searching was based on the reference citations of previously published meta-analyses and recent government documents, i.e., ATSDR 2012; Cole and Rodu 2005; Gatto et al. 2010; NIOSH 2013; Welling et al. 2015.

in drinking water, Cr(III) in drinking water, or Cr(VI) in drinking water. For the Borneff et al. (1968) and Mackenzie et al. (1958) studies, the Cr(VI)-exposed groups were detergent plus Cr(VI) in drinking water and Cr(VI) in drinking water, respectively, and control groups were detergent in drinking water and tap water, respectively.

Morbidity and carcinogenicity associated with Cr(VI) exposure were examined in all four studies. No pathological changes or carcinogenic effects in tissues including the stomach were reported in Mackenzie et al. (1958). Limiting the analysis to PECO, in the NTP (2008) bioassays, no increase in stomach cancers were observed in mice or rats at any drinking-water concentrations. In Borneff et al. (1968), white NMRI mice exposed to detergent plus Cr(VI) in drinking water developed forestomach carcinoma (2/66 females) and/or papilloma (9/66 females, 1/35 males). Vehicle controls (those exposed to detergent alone in water only) also developed forestomach papilloma, but no carcinomas. The study authors indicated that incidence of forestomach tumors in treated mice was not significantly higher than controls and concluded that evidence of carcinogenicity was equivocal (Borneff et al. 1968). Considering the small number of studies and the lack of relevant events, further quantitative evaluation of the evidence (i.e. a meta-analysis) was not warranted.

Risk-of-bias evaluation

Figure 2 presents the individual risk-of-bias assessments and tiering classifications for the animal data. NTP (2008) bioassays were classified as Tier 1 with definitely low or probably low risk of bias for the various domains. NTP (2008) bioassays had comprehensive study designs, including randomization, ascertainment of exposures and doses, blinding of research personnel, and adequate outcome assessments and complete reporting. Additionally, no other potential threats to internal validity were observed. In contrast, the other two studies did not employ randomization and blinding of research personnel and had definitely or probably high risk of bias in several other domains. For Borneff et al. (1968), a definitely high risk of bias was assigned for the exposure domain. The initial concentration of Cr(VI) (134 mg/L) was described as being stable for 3 days; after 3 weeks, the authors indicated that the concentration of Cr(VI) was 80 mg/L, and the rest was reduced to Cr(III). Other threats to internal validity were also observed, with respiratory infection in Mackenzie et al. (1958) and cannibalism and ectromelia epidemy in Borneff et al. (1968). Based on the overall risk of bias, Mackenzie et al. (1958) and Borneff et al. (1968) were classified as Tier 2 and 3, respectively.

Evidence integration and overall evaluation of confidence in the body of evidence

Table 4 summarizes the elements of evidence integration and resulting confidence in the experimental animal data. The initial confidence rating for the experimental animal data was high. Confidence was increased by the consistency in the response (which also related to no dose response in all studies, no/low magnitude of response in all studies, and no unexplained inconsistencies). The evidence contained high-quality studies, including two Tier 1 studies having low risk of bias and thus confidence in the internal validity, and all four studies having a high level of external validity, because the studies' objectives were to directly evaluate toxicological effects of ingested Cr(VI). Overall, the final level of confidence in the animal evidence stream was high; thus, there is high level of confidence in the evidence base supporting a lack of

Table 3. Data extraction of experimental animal studies ($n = 4$).

Study	Species (strain)	Gender (number)	Test compound and dose groups	Route, Cr(VI) concentration/dose[a]	Study duration	Stomach tumor incidence	Overall tier for risk of bias[b]	Limitations (as stated by author)
NTP (2008)	Rat, F344/N	Males (50 per dose group), females (50 per dose group)	Cr(VI) as sodium dichromate dihydrate (4 dose groups per gender per species) Negative control group also included per gender per species (tap water)	Ingestion (drinking water) Concentration: 0, 5, 20, 60, 180 mg/L (M/F) Dose: 0, 0.21, 0.77, 2.1, 5.9 mg/kg/day (M); 0, 0.24, 0.94, 2.4, 7.0 mg/kg/day (F)	2 years	Male: forestomach - 0/50, 0/50, 0/49, 0/50, 0/49; glandular stomach - 1/50,0/50, 0/49, 0/50, 1/49 Female: forestomach - 0/50, 0/50, 0/50, 0/50, 0/50; glandular stomach - 0/50, 0/50, 0/50, 0/50, 0/50 No evidence of Cr(VI)-related stomach cancer	1	None stated
NTP (2008)	Mouse, B6C3F1	Males (50 per dose group), females (50 per dose group)		Ingestion (drinking water) Concentration: 0, 5, 20, 60, 180 mg/L (F); 0, 5, 10, 30, 90 mg/L (M) Dose: 0, 0.38, 0.91, 2.4, 5.9 mg/kg/day (M); 0, 0.38, 1.4, 3.1, 8.7 mg/kg/day (F)	2 years	Male: forestomach - 1/50, 0/50, 0/48, 4/50, 0/48; glandular stomach - 1/50, 0/48, 0/48, 2/50, 0/47 Female: forestomach - 1/49, 2/49, 0/50, 0/48, 3/50; glandular stomach - 0/49, 1/48, 0/50, 0/48,0/50 No evidence of Cr(VI)-related stomach cancer	1	None stated
Borneff et al. (1968)	Mouse, White NMRI	Males (40), females (480)	4 groups. Group 1: detergent, Group 2: detergent plus Cr(VI) as potassium chromate, Group 3: detergent plus benzo[a]pyrene, Group 4: benzo[a]pyrene plus Cr(VI) as potassium chromate	Ingestion (drinking water) Household detergent "Pril" added to drinking water: 3% Benzo[a]pyrene (Group 4): 10 μg/ml (range 7-15) Cr(VI): 134 mg/L chosen as max tolerated without developing any damage; remained constant during the first 3 days. Was 80 mg/L after 3 weeks. Average uptake in Group 2: 13.5 mg/kg/day; Group 4: 12 mg/kg/day	3-generation (880 days)	Group 2: 2/66 F developed forestomach carcinoma; 9/66 F, 1/35 M developed forestomach papilloma. Group 4: 23/80 F, 12/26 M developed forestomach carcinoma. 26/80 F, 4/26 M developed forestomach papilloma. Vehicle controls also developed forestomach papilloma (F, 2/79; M, 3/47) but not carcinoma. The incidence of forestomach tumors in treated mice was not significantly higher than controls; study authors concluded evidence of carcinogenicity was equivocal.	3	Authors mentioned that groups that were given Cr(VI) (especially Group 4), cannibalism occurred. It was also mentioned that mice only reluctantly accepted the mixture of detergent, benzo[a]pyrene, and Cr(VI) in their drinking water (taking up a fluid closer to their requirements). Continuous decrease in the average weights from 7 month and onward observed for Group 4. In the 8th month of the experiment, an ectromely epidemy occurred in mice. Within 3 months, 512 animals died.
Mackenzie et al. (1958)	Rat, Sprague-Dawley albino	Experiment 1: 8 males and 8 females except the control group which contained 10 rats of each sex. Experiment 2: 9 females and 12 males	Experiment 1: control group given distilled water, Groups 2 to 6 given Cr(VI) as potassium chromate Experiment 2: Group 7 (control) given distilled water, Group 8 given Cr(VI) as potassium chromate, Group 9 given Cr(III) as chromic chloride	Ingestion (drinking water) Groups 2 to 6 in experiment 1: 0.12, 0.58. 1.2, 2.1, 3.0 mg/L Group 8 in experiment 2: 6.7 mg/L	1 year	No stomach tumors were reported	2	Mortality from respiratory infection occurred in both experiments.

M: Males; F: Females.
[a]Concentrations/doses were converted based on molecular weight of Cr(VI) and molecular weight of the test compound. For Borneff et al. (1968), average bodyweight of 0.02 kg assumed for mice in calculation of doses.
[b]Based on Approach 1 for tier classification.

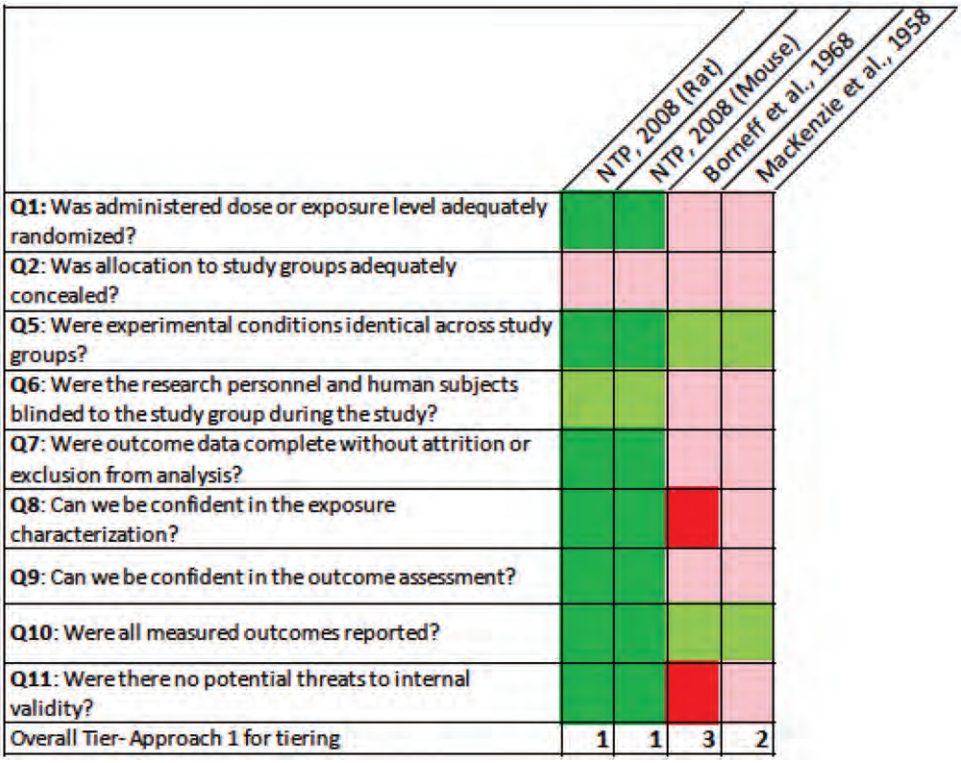

Figure 2. Risk of bias assessment and tier classifications for experimental animal studies ($n = 4$). Colors: red, (; definitely high risk of bias), pink (; probably high risk of bias), light green (+; probably low risk of bias), dark green (++; definitely low risk of bias). Tiers: 1 (Tier 1), 2 (Tier 2), 3 (Tier 3).

association between ingestion of Cr(VI) and stomach cancer in experimental animals.

Human data characterization

Of the 44 worker studies that were included, 3 used case-control design and 41 followed various occupational cohorts. Due to the large number of publications, all included studies are summarized in Supplemental Table E. Worker populations were from various countries in Scandinavia ($n = 14{,}672$), other parts of Europe ($n = 64{,}364$), East Asia ($n = 48{,}771$), and the United States ($n = 16{,}804$). The occupational categories of interest included cement packing, cement production, chromate production, pigment production, stainless steel, welding, ferrochromium production, plating, leather tanning, leather goods, foundry, painting, fur dressing, and aircraft manufacturing. No single industry dominated the evidence base, but 19 of the 44 studies were from industries known to have historically high exposures to Cr(VI), such as chromate production, pigment production, plating, and ferrochromium production. Stomach cancer mortality and morbidity estimates reported in studies of these industries were not significantly elevated (e.g. Axelsson et al. 1980; Hara et al. 2010; Huvinen and Pukkala 2013; Gibb et al. 2015).

A limited number of studies (Xu et al. 1996; Lipworth et al. 2011; Gibb et al. 2015; Proctor et al. 2016) performed Cr(VI) exposure reconstruction using job exposure matrices and industrial hygiene monitoring data. For the most part, quantitative measures of Cr(VI) exposure were not available. Several studies (Franchini et al. 1983; Amandus 1986; Sorahan et al. 1994; Becker 1999) placed workers in high-exposure categories based on longer duration of employment, time spent on a job or task, time since first exposure, or years from first employment. Latency was also used in conjunction with work tenure groups or categories of chrome plating (hard or bright) for calculating SMRs in Amandus (1986) and Franchini et al. (1983), respectively.

Lung cancer was the primary focus of most epidemiologic studies of Cr(VI) workers; although stomach cancer was evaluated, exposure-response relationship, when available, was examined only for lung cancer. Additionally, no Cox regression models or hazard ratios of stomach cancer were available. For some cohort studies ($n = 33$), stomach cancer mortality was examined by estimating SMR. Other cohort studies ($n = 11$) presented the results by SIR or standardized relative risk (SRR). In the case-control studies ($n = 3$), ORs were reported.

As noted previously, all studies evaluating non-occupational populations were ecologic ($n = 5$) (Bednar and Kies 1991; Fryzek et al. 2001; Beaumont et al. 2008; Kerger et al. 2009; Linos et al. 2011) and thus were excluded. For completeness, a description is provided herein for context, and tabular characterizations can be found in Supplemental Table B.

Risk-of-bias evaluation

With respect to the key elements of internal validity (NTP OHAT 2015)—adequacy of control for confounding, quality of exposure assessment, and accuracy of outcome ascertainment—the potential risk of bias in human studies was high for confounding and exposure assessment domains, but low with respect to outcome ascertainment (Supplemental Figure

Table 4. Summary of evidence synthesis and confidence in experimental animal studies.

Study type	Number of studies	Findings	Initial confidence rating[a]	Risk of bias	Unexplained inconsistency	Indirectness	Imprecision	Magnitude of effect	Dose-response	Consistency across study types	Final confidence rating[b]
Oral ingestion studies	4	No increases in stomach cancer incidence, not statistically significant, or no stomach cancers observed	High	– Two studies Tier 1 ↑; single Tier 3 ↓	– No unexplained inconsistencies	– All studies designed to directly evaluate oral exposures to Cr(VI) and cancer	– No imprecision reported in the 4 studies (Findings were negative, increasing confidence that no imprecision observed in any study)	↑ No significant effect observed in the 4 studies (increases confidence in no/low magnitude of effect)	– No dose-response reported in the 4 studies (increases confidence that no dose-response observed in any study)	↑ Results are consistent; no significantly increased stomach cancer observed in the 4 studies	High (++++): high confidence in the lack of effect

– No change in the initial confidence rating.
↑ Upgrade in the initial confidence rating.
↓ Downgrade in the initial confidence rating.
[a]Based on NTP OHAT (2015) Table 8 – Study design features for initial confidence rating.
[b]According to NTP OHAT (2015) Figure 6, factors decreasing confidence include risk of bias, unexplained inconsistency, indirectness, and imprecision. Factors increasing confidence include magnitude of effect, dose response, and consistency across study types.

S1). Most studies had a probably high or definitely high risk of bias for the confounding domain; limited information on smoking histories, SES and asbestos exposure were noted. A few studies performed statistical adjustment for confounding variables when calculating the stomach cancer RR estimates (Xu et al. 1996; Krstev et al. 2005; Ahn et al. 2006). Exposure characterization was limited, also leading to probably high or definitely high risk of bias for this domain, because no study quantified relative risk of stomach cancer by exposure level. Only two studies developed individual measures of exposure (Gibb et al. 2015; Proctor et al. 2016), and they were given definitely low risk of bias for the exposure domain.

The ratings were relatively consistent for confidence in the outcome assessment and completeness in reporting of outcomes (Supplemental Figure S1). A " " rating was given to three occupational studies (Moulin et al. 1990; Korallus et al. 1993; Deschamps et al. 1995) with regard to the confidence in the outcome assessment. For these studies, cause of death could not be ascertained from death certificates and had to be obtained from secondary sources such as doctor offices. For instance, death certificates are confidential and difficult to obtain in Germany, limiting outcome assessment (Korallus et al. 1993).

The potential risk of bias for other domains was generally low. Regarding the appropriateness of the comparison group, "++" ratings were given for the two occupational studies with internal controls (Moulin, Wild, Haguenoer, et al. 1993; Xu et al. 1996). Per instructions by the NTP OHAT handbook (NTP OHAT 2015), most occupational studies were given "+" ratings, because the controls were recruited within the same time frames and had similar participation and response rates. For the studies with " " ratings (Axelsson et al. 1980; Edling et al. 1986; Iaia et al. 2006; Koh et al. 2013), the authors provided details such as selection of controls from rural areas, presence of healthy-worker effect, and misclassification of workers.

Loss to follow-up or the presence of attrition was apparent in a handful of occupational studies. For example, one study of stainless steel foundry workers indicated that they excluded data for workers of Indian and Arab descent, due to the lack of complete information (Sorahan et al. 1994). Such studies, with attrition or exclusion of workers due to incomplete data, were assigned " " ratings. Regarding outcome reporting, nearly all studies reported on multiple causes of death, not just those limited to cancers; thus, completeness in reporting of outcomes was noted, and "++" ratings were given.

Using Approach 1 for Tier classification, only one study (Iaia et al. 2006) was placed in Tier 1; 12 and 31 studies were in Tier 2 and Tier 3, respectively (Supplemental Figure S1). Using Approach 2 for Tier classification, 8 studies were in placed in Tier 1, 36 studies in Tier 2, and no studies in Tier 3.

Meta-analysis

Meta-analyses were conducted based on the occupational data. When assessing all included studies, there was minimal to moderate heterogeneity ($I^2 = 25.1\%$) (Table 5), and the funnel plot appeared symmetrical (Figure 3), as supported by

Table 5. Meta-analysis results (Human occupational data).

Analysis	Description	Studies (N)	Meta-RR	95% CI	I^2
1	All Studies	44	1.08	0.96 to 1.21	25.1
2	Eliminate Tier 3 studies from Analysis 1 (Approach 1 for tier classification)[a,c]	13	1.03	0.84 to 1.26	19.8
3	Tier 1 studies only – Based on overall ratings (Approach 2 for tier classification)[b,c]	8	0.90	0.74 to 1.10	0.0013
4a	Cohort studies only	41	1.05	0.94 to 1.19	26.2
4b	Case-control studies only[d]	3	1.82	0.98 to 3.40	33.8
5	Sub-groups: Identified by the study authors as high exposure groups[e]	13	1.30	1.00 to 1.67	29.5
6	Industries with evidence of increased lung cancer risk[f]	19	1.11	0.90 to 1.37	28.8
7	Eliminate Tier 3 studies from Analysis 4a (Approach 1 for tier classification)[a,c]	11	0.94	0.78 to 1.13	3.71
8	Eliminate Tier 3 studies from Analysis 6 (Approach 1 for tier classification)[a,c]	7	1.14	0.77 to 1.68	34.9

Integration of the risk of bias assessment results for the meta-analysis.

[a]Approach 1 for tier classification: Greater emphasis is placed on the ratings for the key questions as identified by NTP OHAT. There were 31 studies classified as Tier 3.

[b]Approach 2 for tier classification: The overall average ratings for the risk of bias questions is considered for tieri ng.

[c]No Tier 3 studies were identified with Approach 2. Approach 1 only identified one study for Tier 1 (Iaia et al. 2006).

[d]One case-control study was classified as Tier 3 (Moulin et al. 1992), which only left two studies (Krstev et al. 2005; Xu et al. 1996). Thus, additional analyses for the case-control study category was not conducted. All studies for Analysis 5 were classified as Tier 3 studies.

[e]All studies for Analysis 5 were classified as Tier 3 studies in the risk of bias assessment (Approach 1 for tier classification). Thus, additional analyses for the high exposure subcohort category was not conducted.

[f]Chromate production, pigment production, plating, and ferrochromium production are industries in which Cr(VI) exposure specifically has been shown to be associated with increased cancer risk.

the results of Egger's Test ($p = 0.57$), and the Trim-and-Fill test (Supplemental Table F). The meta-RR across all 44 occupational studies was 1.08 (95% CI: 0.96–1.21) (Analysis 1; Table 5, Figure 4). Approximately half of the studies reported RRs < 1 when comparing exposed workers to the reference groups; RR estimates >2, were imprecise, and exhibited wide 95% CIs in comparison to those with RR estimates <2. As a sensitivity analysis, one study of foundry workers that contributed 23% weight (Sorahan et al. 1994) was removed, considering that Cr(VI) exposure may be insignificant compared to exposures to other chemicals in the foundry. The results were not changed (meta-RR = 1.06, 95% CI: 0.94–1.19, Analysis 1 all studies). Additionally, when replacing the data from Korallus et al. (1993) with those of Birk et al. (2006), the results were also not changed (meta-RR = 1.07, 95% CI: 0.95–1.20, Analysis 1 all studies). Table 5 also presents the results of subgroup analyses. All meta-RRs were of low magnitude and not statistically significant. The lowest I^2 values were achieved in the analyses that accounted for internal study validity. Figure 5 displays a forest plot of Analysis 2, which excluded Tier 3 studies; the meta-RR was 1.03 (95% CI: 0.84–1.26) with I^2 of 19.8%. The sub-analyses assessing the potential impact of study validity were based on Approach 1, because Approach 2 produced no Tier 3 studies.

Forest plots for Analyses 3 through 8 are presented as Supplemental Figures S2–S8. Analysis 3 included Tier 1 studies only ($n = 8$), and the meta-RR was 0.90 (95% CI: 0.74–1.10) with I^2 of 0.0013%. Analysis 4a included cohort studies only ($n = 41$); the meta-RR was 1.05 (95% CI: 0.94–1.19) with I^2 of 26.2%. Analysis 4 b included case-control studies only ($n = 3$); the meta-RR was 1.82 (95% CI: 0.98–3.40) with I^2 of 33.8%.

Analysis 5 ($n = 13$) evaluated sub-groups identified by study authors of the primary literature as having high Cr(VI) exposures; as discussed previously, there were no quantitative measures of Cr(VI) exposure for most occupational cohorts. The meta-RR was 1.30 (95% CI: 1.00–1.67) with I^2 of 29.5%. Analysis 6 ($n = 19$) evaluated the specific industries associated with high exposures to Cr(VI); the meta-RR was 1.11 (95% CI: 0.90–1.37) with I^2 of 28.8%. When excluding Tier 3 studies from Analysis 4 b (Analysis 7), the meta-RR was 0.94 (95% CI: 0.78–1.13) with I^2 of 3.71%. When Tier 3 studies were excluded from Analysis 6 (Analysis 8), the meta-RR was 1.14 (95% CI: 0.77–1.68) with I^2 of 34.9%.

Evidence integration and overall evaluation of confidence in the body of evidence

Table 6 summarizes the elements of evidence integration and resulting confidence in the human occupational data. Initial confidence was determined using the meta-analysis descriptions, specifically study design, exposure, and industry types. Per NTP OHAT (2015) categories, the initial confidence ratings ranged from very low to moderate for the human occupational data. Confidence decreased due to the high risk of bias present for the human occupational data; potential for bias in exposure and confounding domain was apparent. Confidence increased from low magnitude of effect and consistency across study types. Meta-analyses resulted in similar findings, with meta-RRs that were not substantially/significantly elevated. All the individual studies except (Sorahan et al. 1994) showed consistency in the lack of significantly elevated risk of stomach cancer. There was external validity, because the studies were fit-for-purpose with evaluations of disease mortality risk due to Cr(VI) exposure. Overall, the final level of confidence in the human database was low to moderate.

Synthesis of all evidence streams, and integrated conclusions

According to NTP OHAT, the risk-of-bias assessment and level-of-confidence rating were carried forward to the development of conclusions (NTP OHAT 2015). This involved translating the confidence ratings of each evidence stream and

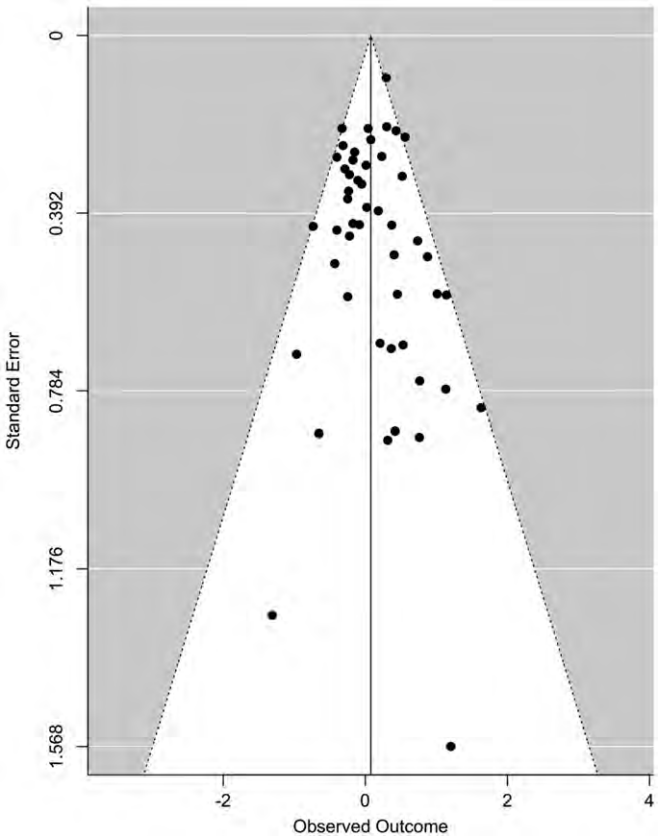

Figure 3. Funnel plot of all occupational studies ($n = 44$) included for meta-analysis.

developing overall conclusions (Figure 6). Because the meta-analyses of human data consistently demonstrated a lack of evidence for effect, and all of the data in animals demonstrated a lack of evidence for effect, the data are described in the direction of "no effect." There was low to moderate confidence in the human data demonstrating lack of evidence for effect, and high confidence in the animal data demonstrating lack of evidence for effect, thus leading to the overall conclusion that Cr(VI) is not identified to be a stomach-cancer hazard to humans. Because of the limitations of the human data related to uncertainty in exposure and confounding, the human data could be categorized as "not classifiable." However, when combined with the animal evidence, for which there is high confidence, the same hazard conclusion would be reached.

Discussion and conclusions

This is the first systematic review that combined evidence from both experimental animal and observational human data to assess the association between Cr(VI) exposure and stomach cancer. Using the NTP OHAT (2015) framework, we included critical appraisal of study validity as part of the qualitative and quantitative integration of evidence. The available animal evidence demonstrated no discernable evidence for an effect of Cr(VI) ingestion on cancer of the glandular stomach. Quantitative assessment of evidence in humans, which was limited to observational studies of occupational exposures, consistently produced relative risk estimates demonstrating a lack of evidence for an effect, especially after accounting for study validity, study design, and/or industry type. Integration of findings further supports a lack of evidence for hazard for Cr(VI) and stomach cancer in humans.

Evaluation and integration of study validity has become an important element of risk assessment. In the National Research Council's (NRC's) review of the USEPA's IRIS program, the role of evidence evaluation and integration as they relate to development of toxicity values is emphasized (National Research Council 2014). NRC further suggests that a risk-of-bias assessment be conducted on studies used as primary data sources for the hazard identification and dose-response assessments developed by the agency. The European Food Safety Authority, or EFSA, has also started to integrate study quality—measured by risk of bias—in their risk assessments (Mortensen et al. 2017). This systematic review confirms the utility of these types of approaches for assessing validity, thus characterizing the aspects that increase or decrease confidence in the findings. In this assessment, key limitations of the human evidence involved uncertainty in characterization of exposure and control for confounding such as SES and smoking. These aspects, however, are directly addressed by the studies in the animal evidence stream that involved controlled exposure (and lack of confounding). Thus, the data from the animal studies directly inform the shortcomings of the observational studies in humans, lending confidence to the overall conclusions.

With respect to meta-analysis, important methodological challenges include heterogeneity of study attributes and quality (Aschengrau and Seage 2003; Rothman et al. 2008). In addition, the general approach of meta-analysis as a way of summarizing the evidence has been questioned due to a lack of transparency and difficulties associated with replicating reported methods and results (Stroup et al. 2000; Simunovic et al. 2009). For these reasons, we included documentation of all steps and decisions in the registered protocol (PROSPERO CRD42016051625). PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) was also used to preserve transparency in reporting the individual studies and integrity of the approach and conduct of the current analyses (Moher et al. 2009; NTP OHAT 2015). We did not produce a single measure of association; instead, we used the meta-analysis to explore sources of heterogeneity across studies.

Our meta-analyses demonstrated no appreciable or significant increase in stomach cancer risk associated with occupational exposures to Cr(VI); low magnitude and high precision of the risk estimates were observed. In one sub-analysis (Analysis 4b), limited to three case-control studies, the risk ratio was elevated though not significantly (meta-RR = 1.82, 95% CI: 0.98–3.40; I^2=33.8%). However, this result was not supported by the more robust analysis based on 41 cohort studies (Analysis 4a: meta-RR = 1.05, 95% CI: 0.94–1.19, I^2=26.2%). The Meta-RRs for stomach cancer were not significantly elevated among workers in chromate production, pigment production, chrome plating, and ferrochromium production (Analysis 6; Table 5). Significant exposures to

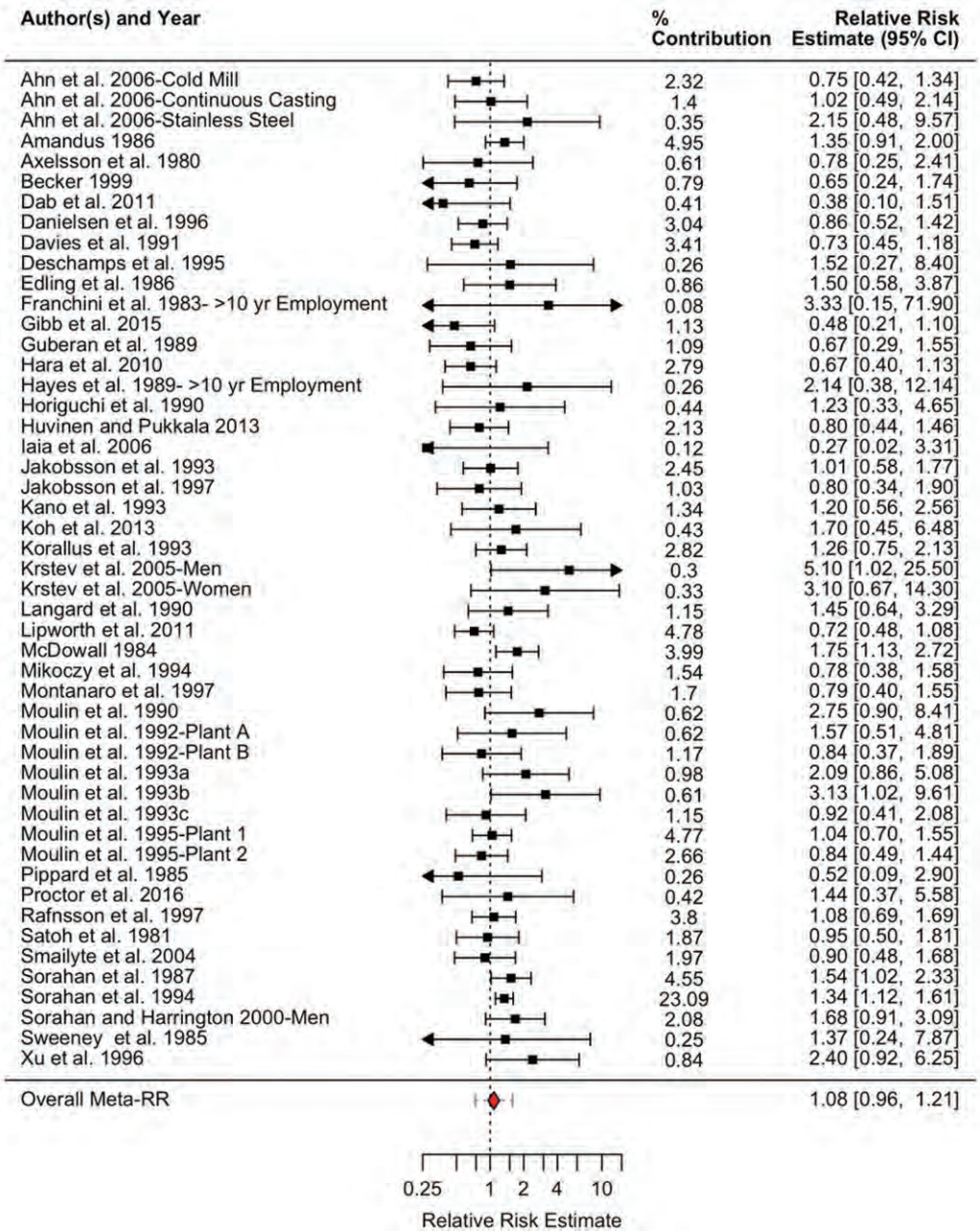

Figure 4. Meta-analysis 1: All human occupational studies ($n = 44$). For the individual studies, 95%CIs are calculated intervals based on the effect size and parameters of the random-effects model.

Cr(VI) have been observed for these industries, and OSHA and IARC have identified workers in these industries as having the highest risk of lung cancer associated with Cr(VI) exposure (IARC 1990; OSHA 2006; IARC 2012). Additionally, meta-analysis results were close to the null value when study quality was considered, and integration of the risk-of-bias assessment generally resulted in lower heterogeneity.

As discussed previously, dose-response data were limited or unavailable for stomach cancer. For the Painesville chromate production workers assessed in Proctor et al. (2016), exposure information was accessible. The cumulative Cr(VI) exposures were 0.002, 0.008, 0.15, 0.16, and 0.47 mg/m^3-year for five stomach cancer cases, which are relatively low exposures for the Painesville cohort, in which an increase in lung cancer risk was not observed at exposures <1 mg/m^3-yrs (Proctor et al. 2016). However, due to the low numbers of stomach cancer cases and lack of quantitative exposure data in other studies, a dose-response pattern could not be established or evaluated.

One limitation of this systematic review is that most occupational studies had a probably high or definitely high risk of bias for confounding and exposure. Statistical adjustment for confounding variables was presented in only three studies (Xu et al. 1996; Krstev et al. 2005; Ahn et al. 2006). Exposure characterization methods in most studies were of poor quality, and as discussed above, only a handful of studies conducted exposure assessment based on quantitative data and methods (Xu et al. 1996; Lipworth et al. 2011; Gibb et al.

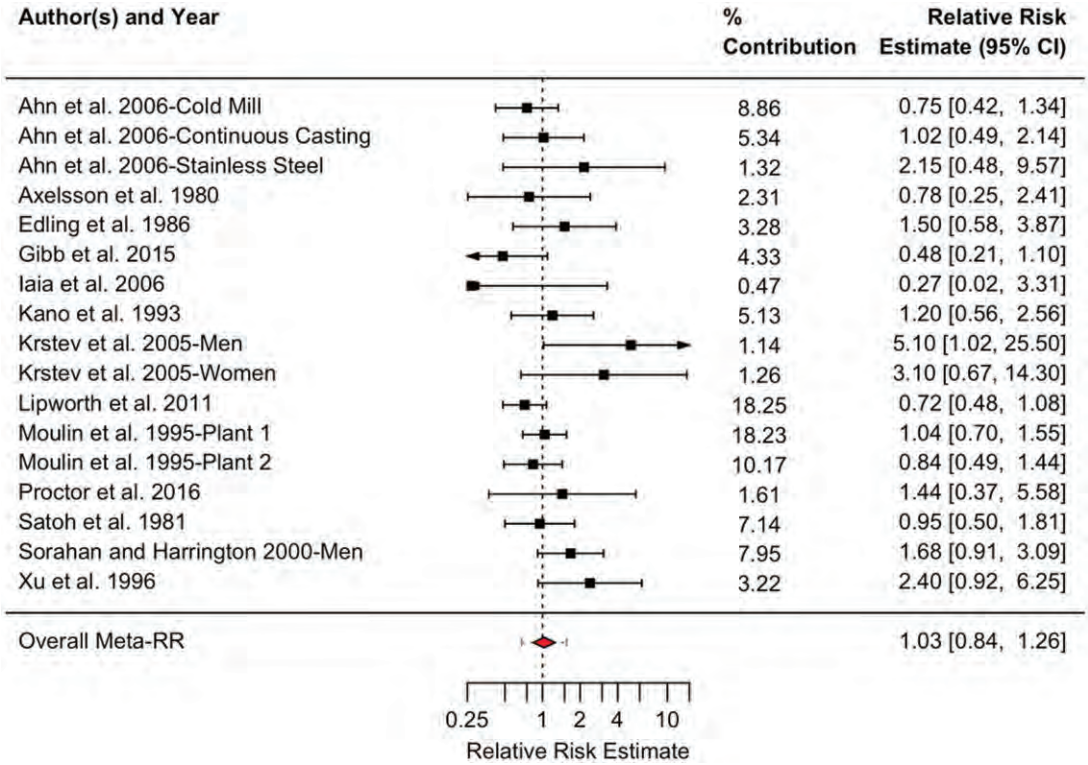

Figure 5. Meta-analysis 2: Tier 3 removed from human occupational studies (remaining studies, $n = 13$). For the individual studies, 95%CIs are calculated intervals based on the effect size and parameters of the random-effects model. Tier 3: Studies with definitely high or probably high risk of bias for at least two of the key NTP OHAT questions (Q4, Q8, and Q9 related to exposure, confounding, and outcome, respectively).

OHAT Framework: Step 6 - Translate Confidence Ratings into Level of Evidence of Health Effects							OHAT Framework: Step 7 - Integrate Evidence to Develop Hazard Identification Conclusions		
Confidence in the Body of Evidence		*Direction of effect or no effect*		*Level of Evidence for Health Effect*	*Human Data*	*Animal Data*		**Effect/No Effect Level of Evidence by Stream**	**Overall**
(++++) High	➡	Health effect/ No effect	➡	High	Low to moderate confidence in body of evidence	High confidence in the body of evidence demonstrating "no effect" between Cr(VI) ingestion and stomach cancer	Health Effects: • Known to be a hazard • Presumed to be a hazard • Suspected to be a hazard • Not classifiable to be a hazard No Effect • Not identified to be a hazard; inadequate to determine hazard to humans	Human: not identified/not classifiable to be a hazard to humans	Not identified to be stomach cancer hazard to humans
(+++) Moderate	➡	Health effect/ No effect	➡	Moderate					
(++) Low	➡	Health effect/ No effect	➡	Low				hazard	
(+) Very low or no evidence identified	➡	Health effect/ No effect	➡	Inadequate					

Figure 6. Application of the NTP OHAT (2015) framework of systematic review and evidence integration for developing hazard identification conclusions.

2015; Proctor et al. 2016). As a consequence, the level of confidence in the evidence from human studies was low to moderate. Additionally, data for non-occupationally exposed populations were sparse and low quality due to reliance on ecologic study design. For this reason, non-occupational studies could not be included in the systematic review and meta-analysis. It is also important to acknowledge that any systematic review involves an element of judgment. More quantitative bias-adjusted approaches could be employed in the future (Doi et al. 2013). Additional research and discussion are ongoing in the field of evidence-based toxicology, because practitioners recognize that existing tools could be refined to better categorize and integrate data in the context of chemical risk assessment (EFSA 2017).

This systematic review and meta-analysis was compared to the previous publications (Cole and Rodu 2005; Gatto et al. 2010; Welling et al. 2015) (Supplemental Table G); Supplemental Table H also identifies which studies were included in each of the different meta-analysis studies. The previous analyses did not consistently evaluate study quality and validity, likely because systematic review methods in environmental epidemiology and toxicology are relatively new. Only Cole and Rodu (2005) evaluated study quality, and performed meta-analyses according to the presence or absence of control for major cancer risk factors (specifically SES for stomach cancer). Cole and Rodu (2005) observed a statistically significant inverse association between Cr(VI) exposure and stomach cancer mortality (meta-SMR = 82) after controlling for SES; however, when SES was not considered, the association was in the opposite direction (meta-SMR = 137). Cole and Rodu (2005) noted that, of the 14 studies with control for SES, 12 had a stomach cancer SMR below 100; for studies ($n = 18$) without control for SES, all but two had stomach cancer SMRs greater than 100. Cole

Table 6. Summary of evidence synthesis and confidence in human occupational studies.

Study type[a]	Number of studies[a]	Findings[b]	Initial confidence rating[c]	Risk of bias	Unexplained inconsistency	Indirectness	Imprecision	Magnitude of effect	Dose-response	Consistency across study types	Final confidence rating[d]
All studies	44	Not statistically elevated meta-RR	Low to moderate	↓ Probably or definitely high risk of bias in exposure and confounding domains	– Meta-analyses resulted in similar findings, including sub-analyses that assessed potential influence of study quality or size	– Studies were fit-for-purpose, evaluating disease mortality risk (including stomach cancer) from Cr(VI) exposure	– Confidence intervals around meta-RR are narrow	↑ Magnitude of effect was not large and not statistically elevated	NR Data are not available for most studies. For one study with exposure estimates, unable to establish dose-response in Proctor et al. (2016)	↑ Results are consistent across the meta-analyses (results are not statistically elevated). All individual studies (except Sorahan et al.1994) show consistency in the lack of statistically elevated risk of stomach cancer	Low (++) to moderate (+++) confidence in the human database
Cohort	41	Not statistically elevated meta-RR	Low to moderate								
Case-control	3	Not statistically elevated meta-RR	Low to very low								
Sub groups: Identified by study authors as high exposure groups	13	Not statistically elevated meta-RR	Low to moderate		One study (Sorahan et al.1994) reported significantly elevated stomach cancer risk, but this Tier 3 study was of foundry workers with high risk of bias in exposure and confounding domains						
Industries associated with increased lung cancer risk from Cr(VI)	19	Not statistically elevated meta-RR	Low to moderate								

NR: Not reported.
– No change in the initial confidence rating.
↑ Upgrade in the initial confidence rating.
↓ Downgrade in the initial confidence rating.
[a]Based on meta-analysis descriptions listed in Table 2.
[b]Based on Meta-RRs presented in Table 5.
[c]Based on NTP OHAT (2015) Table 8 – Study design features for initial confidence rating.
[d]According to NTP OHAT (2015) Figure 6, factors decreasing confidence include risk of bias, unexplained inconsistency, indirectness, and imprecision. Factors increasing confidence include large magnitude of effect, dose response, and consistency across study types.

and Rodu (2005) concluded that studies that lacked control for the low economic status of Cr(VI) workers largely impacted the association observed between Cr(VI) exposure and stomach cancer. This is not surprising given that SES is an important variable to consider when evaluating stomach cancer. Several studies have consistently shown that higher SES is significantly associated with decreased stomach cancer mortality and incidence in the general population (Fontana et al. 1998; van Loon et al. 1998; Nagel et al. 2007; Donnelly et al. 2013). While we did not attempt to adjust for SES in this analysis, we note that the McDowall (1984) study of cement workers, included in this meta-analysis, reported an increasing trend in stomach cancer SMRs with decreasing SES, and the Sorahan et al. (1987) study of chromium platers, also included herein, concluded that "raised mortality from cancer of the stomach among male chrome platers is due, at least in part, to social class differences" [relative to the general population]. Although it is difficult to generalize across studies, it seems reasonable to infer that many of the primary studies included in this and the other stomach cancer meta-analyses for Cr(VI), have potential for confounding by SES.

The results of the meta-analyses by Gatto et al. (2010) and by Cole and Rodu (2005) are similar to those described here. In contrast, Welling et al. (2015) reported significantly increased risk of stomach cancer in association with occupational Cr(VI). The differences between findings across these reviews and meta-analyses may be attributable to the types of studies that were considered eligible for inclusion. Whereas Welling et al. (2015) included 56 studies with variable likelihood of Cr(VI) exposure, Cole and Rodu (2005) and Gatto et al. (2010) evaluated fewer studies (32 and 29, respectively), but those studies specifically focused on workers with known exposure to Cr(VI). For example, the Welling et al. (2015) meta-analysis incorporated a large Scandinavian survey study (Pukkala et al. 2009) that reported stomach cancer risk for brick layers, a group which original study authors characterized as exposed to asbestos and silica dust, but not chromium. On the other hand data for welders and smelting workers, which Pukkala et al. noted as having chromium exposures (speciation of chromium not indicated), were not included in the Welling et al. (2015) meta-analysis. Most importantly, none of the occupational subgroups were specified by Pukkala et al. as having exposures to Cr(VI). Herein, we have included only studies of workers with documented Cr(VI) exposure. It appears this methodological difference serves as the main explanation for the discrepancy between results reported by Welling et al (2015) and those observed in other meta-analyses.

Our findings are consistent with the known biological properties of ingested Cr(VI). Several studies have reported that, on ingestion, Cr(VI) is reduced to the less toxic and less bioavailable trivalent form [Cr(III)] (De Flora et al. 1987, 2016; Kirman et al. 2016). These results are also consistent with the conclusions of agencies such as IARC, ATSDR, and NIOSH that have conducted hazard identification to evaluate all disease risks associated with Cr(VI) using human and animal data but have not considered stomach cancer to be of significant or particular concern (NIOSH 1975; IARC 1990; ATSDR 2012; IARC 2012; NIOSH 2013).

In conclusion, a systematic assessment of the body of literature, with updated inclusion/exclusion criteria relative to previous assessments and considerations of internal validity, allows a more robust assessment of the association between Cr(VI) exposure and stomach cancer risk. Combining the streams of evidence, Cr(VI) was not identified to be a stomach cancer hazard in humans.

Acknowledgements

We acknowledge Dr. Annette Rohr at the Electric Power Research Institute (EPRI). Dr. Rohr is ToxStrategies' principal contact for EPRI. We thank Dr. Rohr for organizing the scientific advisory board (SAB), which provided guidance for this systematic review and meta-analysis. Dr. Rohr identified SAB members based on suggestions by ToxStrategies (MS and DP) and sent formal invitations in August 2017. The SAB consisted of three members (Dr. Tasha Beretvas of University of Texas Austin, Quantitative Methods Program in the Department of Educational Psychology; Dr. Loren Lipworth of Vanderbilt University Medical Center; and Dr. Michael Goodman of Emory University Rollins School of Public Health). The following table describes the roles and responsibilities of the SAB:

SAB Member Name	Expertise	Roles and Responsibilities
Michael Goodman Loren Lipworth Tasha Beretvas#	Epidemiology Epidemiology Statistics	Overall: Provide guidance on methods for systematic review and meta-analysis of Cr(VI) exposure and stomach cancer risk. Specific tasks are: 1. Discuss and agree upon the scope and focus of topic. 2. Approve systematic review framework (i.e. PRISMA) to be used. The framework to be used will be decided by ToxStrategies researchers. 3. Review and approve draft protocol to be written by ToxStrategies researchers. The protocol will include research questions, key search terms, inclusion/exclusion criteria, literature search strategy, risk of bias assessment methods, and strategies for meta-analyses and analyses of subgroups. 4. Review evidence tables (or summary of information) generated by ToxStrategies. 5. Review meta-analyses results. 6. Reviewed evidence synthesis and integration qualitative analysis results. 7. Review and comment on manuscript drafts; serve as coauthor if desired#

Dr. Beretvas indicated that she had limited availability to review the manuscript drafts and contribute to the content. In an email correspondence with Dr. Rohr at EPRI (sent November 2017), she wanted to be acknowledged but not be a coauthor.
Note: All SAB members received compensation from EPRI for participating.

We thank Dr. Rohr for reviewing the initial and final manuscript drafts and commenting on the clarity of presentation. We thank Dr. Tasha Beretvas for providing valuable statistical input for this systematic review. We thank Mr. Rick Nelson of ToxStrategies, for editorial assistance. We thank Ms. Alea Goodmanson, formerly of ToxStrategies, for participating in the data extraction and translating three studies in French to English

to facilitate data extraction and risk of bias assessment. The activities of all collaborators are described in the following table:

Collaborator Name	Activities
Tasha Beretvas	SAB member Provided input to the protocol Directed statistical analyses to be performed Reviewed data extraction, risk of bias assessment, and meta-analysis results
Alea Goodmanson	Participated in data extraction for epidemiology studies Translated three studies in French to English to facilitate data extraction and risk of bias (Moulin et al. 1992; Moulin, Wild, Toamain, et al. 1993; Moulin et al. 1995)
Rick Nelson	Reviewed the manuscript draft to provide editorial comments
Annette Rohr	Organized the SAB Reviewed the manuscript draft and suggested wording changes for clarity of presentation

Finally, the authors gratefully acknowledge the comments received from two journal reviewers, selected by the editor, who were anonymous to the authors. We appreciate and acknowledge the guidance offered by the Editor-in-Chief Dr. Roger McClellan for recommendations on the acknowledgments and declaration of interest.

Declaration of interest

The activities of the authors in preparation of the paper are provided in the following table:

Author Name	Activities
Mina Suh	Developed the protocol Reviewed literature search and screening results Conducted data extraction and risk of bias assessment and performed quality assurance/quality control Conducted evidence synthesis and integration qualitative analyses Designed and reviewed meta-analysis results Performed quality assurance/quality control of meta-analysis results Developed the initial manuscript draft, revised the manuscript, and finalized the manuscript
Daniele Wikoff	Developed the protocol Reviewed data extraction, risk of bias assessment, and meta-analysis results Reviewed evidence synthesis and integration qualitative analysis results Developed the initial manuscript draft, revised the manuscript, reviewed the final draft
Loren Lipworth	SAB Member Provided input to the protocol Reviewed data extraction, risk of bias assessment, and meta-analysis results Reviewed evidence synthesis and integration qualitative analysis results Reviewed and provided input on the manuscript (initial draft): development of introduction, study methods, results, and discussion sections Reviewed the revised draft and final manuscript
Michael Goodman	SAB Member Provided input to the protocol Reviewed data extraction, risk of bias assessment, and meta-analysis results Reviewed evidence synthesis and integration qualitative analysis results Reviewed and provided input on the manuscript (initial draft): development of introduction, study methods, results, and discussion sections Reviewed the revised draft and final manuscript

(*continued*)

Continued.

Author Name	Activities
Seneca Fitch	Conducted literature search and screening Conducted data extraction and risk of bias assessment and performed quality assurance/quality control Reviewed the initial draft and final manuscript and provided edits
Liz Mittal	Conducted meta-analyses and subgroup analyses Developed funnel and forest plots in R Reviewed the final manuscript and provided edits
Caroline Ring	Provided oversight of meta-analyses Performed quality assurance/quality control of meta-analysis results Conducted Trim and Fill test Conducted Egger's regression test Reviewed the final manuscript and provided edits
Deborah Proctor	Developed the protocol Reviewed literature search and screening results Reviewed data extraction, risk of bias assessment, and meta-analysis results Reviewed evidence synthesis and integration qualitative analyses Developed the manuscript draft, revised the manuscript, and finalized the manuscript

The authors include salaried scientists employed by ToxStrategies, which is a private consulting firm, and the paper was prepared during the normal course of employment. ToxStrategies was funded under contract to EPRI to conduct this systematic review and meta-analysis and prepare the manuscript for publication. ToxStrategies continues to provide scientific consulting and research oversight on projects funded by EPRI. With support from EPRI, ToxStrategies' scientists have published seven studies related to the carcinogenicity of Cr(VI) (Proctor et al. 2012; Proctor et al. 2014; Thompson et al. 2015; Young et al. 2015; Proctor et al. 2016; Thompson et al. 2017; Rager et al. 2019).

ToxStrategies (DP and MS) originally proposed the project to EPRI. EPRI is an independent nonprofit 501(c)3 organization, which is supported primarily by the electric industry in the United States and abroad (www.epri.com). EPRI and its contributors' interest in Cr(VI) is primarily related to the presence of Cr(VI) in some electrical power generation byproducts (e.g. fly ash), which have the potential to impact environmental media. Dr. Rohr reviewed the draft and final manuscript for clarity, and was the only EPRI reviewer.

DP and MS have given presentations on this and related Cr(VI) topics at scientific conferences and meetings with regulatory agencies with funding provided by EPRI, the American Chemistry Council and ToxStrategies. With funding by ToxStrategies, elements of this systematic review and meta-analysis were presented at the Society of Toxicology 2017 Annual Conference and ToxExpo in Baltimore (Abstract 1308) and at the Joint Annual Meeting of the International Society of Exposure Science and the International Society of Environmental Epidemiology in Ottawa in 2018 (Abstract 2996325). DP and MS have coauthored a previous meta-analysis of occupational exposure to Cr(VI) and cancers of the gastrointestinal tract (Gatto et al. 2010). DP has also been an expert in litigation involving the potential for lung cancer and respiratory effects related to occupational and environmental Cr(VI) exposure.

This research was conducted to inform the scientific and regulatory risk assessment of Cr(VI). The authors have sole responsibility for the writing and content of this paper.

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From:	Norm Benson
To:	WB-DDW-HexavalentChromium
Subject:	Comment on EIR scope for SWRCB proposed chromium-6 MCL
Date:	Wednesday, November 24, 2021 4:32:38 PM
Attachments:	image.png

EXTERNAL:

Kim Niemeyer
State Water Board
Office of Chief Counsel
P.O. Box 100
Sacramento, California 95812-0100

Hello, my name is Norm Benson. I am a licensed Water Treatment Operator and I contract my services to Crescent Bay Improvement Company in Lake County, California. With 22 household connections, Crescent Bay is classed as a community public water system under the 1974 Safe Drinking Water Act since it provides water to more than the minimum of 25 individuals year-round. You may recall the median community system in California serves 95 connections. This means more than half of the state's public water systems have fewer than 100 households over which to spread their costs. If Crescent Bay's total annual budget were a Californian, it would be below the poverty line, yet our water bill of $125/month is one of the highest in our county.

I hope everyone had a great Thanksgiving meal, and I hate to be the bearer of bad news, but it was filled with chemicals. Everything you ate was full of chemicals that have been shown to be toxins, mutagens and carcinogens when studied in rodents. Everything. But don't worry, if you bought organic food, they were all natural chemicals.[1] Potatoes, to name just one of the food offerings at Thanksgiving, contain solanine, chaconine, amylase inhibitors, and isonavones —which, respectively, irritate the gastrointestinal-tract, harm your nervous system, interfere with digestive enzymes, and mimic female sex-hormone activity. Potatoes also contain, all natural, arsenic.

When potato salad goes bad

Every toxic substance you can name, no matter how scary, has a safe level; and every substance you can name, no matter how natural or benign, even water, has a toxic level.

As I sit at my laptop composing this letter, I am sipping an insecticide-laced witches' brew of 2,000 chemical compounds, many of which are known by the State of California to cause cancer including: acrylamide, benzo(a)pyrene, benzaldehyde, benzene, benzofuran, caffeic acid, ethyl benzene, furan, furfural, hydrogen peroxide, and hydroquinone. I put a little cream in it, since the insecticide in the drink, caffeine, is rather bitter. Caffeine, by the way, is comparable in toxicity to the *worry du jour*: chromium-6 aka, CR(VI). And caffeine is widely ingested.

Caffeine's LOAEL (Lowest Observed Adverse Effect Level) of 2.5 mg/kg of body weight/day is quite close to that of chromium-6. Toxicologists then ramp that dose downward by several orders of magnitude to calculate a Reference Dose (RfD). Dr. Tamara L. Sorell writes, "The final RfD [for caffeine] would be 0.0025 mg/kg-day, a very small dose in the same range as RfDs for known toxicants such as hexavalent chromium [chromium-6] and potassium cyanide."[2] A quick back-of-the-envelope calculation says one drop of coffee is roughly 270 times above the "safe" RfD level for consumption.

Plants naturally incorporate minerals, including chromium-6, from the soil into their structure. The World Health Organization (WHO) estimates daily chromium intake from "typical North American diets to be 60–90 µg/day and may be generally in the range 50–200 µg/day." Consumption of alcoholic beverages further increase chromium consumption with "0.45 mg/liter for wine, 0.30 mg/liter for beer, and 0.135 mg/liter for spirits."

The State Water Resources Control Board relies on the Office of Environmental Health Hazard Assessment (OEHHA) for its public health goal. To an outsider, it all seems to use a "less is better" model as a heuristic guideline for safety. While this can be a useful rule of thumb, it is not scientific and can lead to unnecessary grief, especially when we are speaking of maximum contaminant levels (MCLs) far below the LOAEL dosage. And while the Board may well point out that Chromium-6 has no use in the body, this is not exactly true, since CR(VI) is ingested and changed to chromium-3 by the body's functions.[3] CR(III), is an essential mineral that the body needs. It is involved in the breakdown and absorption of carbohydrates, proteins, and fats, and enhances the action of the hormone insulin.[4]

Paracelsus, credited as the Father of Toxicology said, "What is there that is not poison? All things are poison and nothing is without poison. Solely the dose determines that a thing is not a poison."[5]

Chromium-6, CR(VI), is a natural substance and can be found in rocks, plants, soil and volcanic dust.[6] This means it can be found naturally in water. The question the Water Board then must answer is "When is the amount of chromium-6 safe for all to use?" If money were no object, then the Water Board's answer might be to use the "less is best" rule-of-thumb and say "zero."

But we live in the real world where we must judge the cost of something against benefit to be derived. Regulations are costly. In a 2008 report, the Small Business Administration calculated the annual cost of federal regulations in the United States at $1.75 trillion. "Had every U.S. household paid an equal share of the federal regulatory burden, each would have owed $15,586 in 2008." State, regional, and local regulations then proceed to pile on more costs per household. Additional regulation hits our mutual water company harder since we do not have as many people to bear these burdens. My friends and neighbors, who are also my bosses, want fewer regulations, not more. And they certainly do not want their money spent on something whose cost will exceed its benefit. The Water Board needs to prove this regulation is absolutely necessary for safety and not a speculative whim.

The Water Board's proposed actions prompt me to ask some pointed, but necessary, questions.

1. How many lives were saved, or illnesses prevented, by California's

requirement of a Maximum Contaminant Level (MCL) lower than the US EPA's MCL?

2. What is the cost[7] of no change of California's Cr(VI) MCL?
3. How many cancers will be prevented if the Water Board's Maximum Contaminant Level (MCL) is adopted?
4. How many years of life will be extended for California's population[8] if the Water Board's MCL is lowered from its current 50 µg/L to 25 µg/L, 15 µg/L, 10 µg/L or 1 µg/L?[9]
5. How many cancers or excess deaths occur annually per capita, when a community public water system is above California's current MCL but below the USEPA MCL?
6. It is my understanding that the standard metric for assessing the benefits of risk and proposed environmental regulations tradeoff between money and small risks of death is the 'value of statistical life' (VSL). Perhaps I missed its use in the White Paper? Why was VSL not employed?
7. Since California already has tighter standards than the EPA and yet people opt to buy bottled water which need only the FDA's criteria, why or how would a lower standard change that?
8. To see that the Water Board's MCL is effective, how will the Water Board track deaths, illnesses, and cancer cases tied to CR(VI) in drinking water?

In conclusion, I and my customers want more than speculation from the Water Board and its staff. Science is the pursuit of knowledge and understanding of the natural and social world using a systematic, evidence-based methodology. Science requires observation and measurement of predictions. 'I believe in science' is a statement generally made by people who don't understand what science is. Belief is the realm of religion; science inhabits that which can be observed and measured.

I thank the Water Board for taking my statement.

Norm Benson
Lower Lake, California
Life, Liberty, and the Pursuit of Coffee.
707-295-7107

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[1] If it wasn't "USDA organic" then 99.9 percent of the chemicals were natural.

[2] Sorell, Tamara L. 2016. "Approaches to the Development of Human Health Toxicity Values for Active Pharmaceutical Ingredients in the Environment." *The AAPS Journal* 18 (1): 92–101. https://doi.org/10.1208/s12248-015-9818-5.

[3] "recent kinetics and in vivo genotoxicity data demonstrate that Cr(VI) is reduced to nontoxic Cr(III) in saliva, in the acidic conditions of the stomach, and in blood. In short, at concentrations at least as high as the current U.S. maximum contaminant level (100 ppb), and probably at least an order of magnitude higher, Cr(VI) is reduced to Cr(III) prior to or upon systemic absorption. The weight of scientific evidence supports that Cr(VI) is not carcinogenic in humans via the oral route of exposure at permissible drinking-water concentrations."

Source: Proctor DM, Otani JM, Finley BL, Paustenbach DJ, Bland JA, Speizer N, Sargent EV. Is hexavalent chromium carcinogenic via ingestion? A weight-of-evidence review. J Toxicol Environ Health A. 2002 May 24;65(10):701-46. doi: 10.1080/00984100290071018. PMID: 12028825.

[4] https://www.hsph.harvard.edu/nutritionsource/chromium/ accessed 11/22/21 Harvard's School of Public Health

[5] Grandjean P. (2016). Paracelsus Revisited: The Dose Concept in a Complex World. Basic & clinical pharmacology & toxicology, 119(2), 126–132. https://doi.org/10.1111/bcpt.12622

[6] https://www.epa.gov/sdwa/chromium-drinking-water accessed Nov. 15, 2021

[7] 'Cost" is defined as increased deaths or sick leave due to illness.

[8] At present the life expectancy at birth for a Californian is 81.0 years according to https://www.simplyinsurance.com/average-us-life-expectancy-statistics/#section-11 (accessed November 20, 2021)

[9] Feel free to show as many decimal points as needed for the calculated answer.

Sent with ProtonMail Secure Email.

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December 6, 2021

Kim Niemeyer, Attorney
State Water Resources Control Board
P.O. Box 100 Sacramento, CA 95812
Submitted via email to ddw-hexavalentchromium@waterboards.ca.gov

Subject: OCWD comments on the NOP of a Draft Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (SCH 2021110099)

The Orange County Water District (OCWD or District) appreciates the opportunity to comment on the notice of preparation (NOP) for the State Water Resources Control Board's Draft Environmental Impact Report (EIR) for the adoption of a regulation for hexavalent chromium (CrVI) maximum contamination level (MCL) (SCH 2021110099).

OCWD is a special district formed in 1933 by an act of the California Legislature. The District manages the groundwater basin that underlies north and central Orange County. Water produced from the basin is the primary water supply for approximately 2.5 million residents living within the District boundaries. If an MCL is selected in the lower range of the proposed MCL values, it is possible that up to 70 wells, representing almost one third of the drinking water wells within District boundaries would require treatment.

It is OCWD's understanding that the State Water Board is developing a programmatic EIR that will consider and evaluate 17 possible MCLs (1 to 15, 20 and 25 µg/L). Additionally, the EIR will ascertain the environmental impacts of Best Available Technologies (BATs) for treatment of CrVI, which include Ion Exchange, Reverse Osmosis and Reduction-Coagulation/Filtration. Alternatives to treatment for compliance with possible MCLs are also available and their environmental impacts will be evaluated and quantified.

Hazardous Waste

The treatment of CrVI contaminated drinking water sources to levels below a future MCL will require removal of CrVI from the drinking water supply prior to it being served to the public. As a result, each BAT for treatment of CrVI will produce a concentrated source of CrVI in either the filtrate, ion exchange media or brine waste. It is OCWD's understanding that the concentrated CrVI waste will be considered hazardous waste. The EIR should discuss the process for determining if the treatment waste is classified as hazardous waste and quantify the volumes that will be generated for each of the BATs at each of the 17 possible MCLs. Further, the EIR should evaluate environmental impacts by considering the fate of the CrVI waste from each BAT.

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Energy

Each of the proposed BAT for treatment of CrVI will have different energy requirements to operate and maintain the treatment process. The EIR should provide analysis and quantify the additional energy that will be required to remove and/or reduce CrVI for each of the proposed MCLs. Alternative methods to comply with possible future MCLs will include abandoning and drilling new wells, blending, and where available will likely result in an increase in the volume of imported water, which is energy intensive. Increases in energy usage should be discussed and quantified for alternatives to treatment.

Greenhouse Gas Emissions

The increases in energy required to treat and comply with a possible CrVI MCL will have a direct impact on the quantity of greenhouse gases (GHG) generated. In addition to the increases in GHG generated by the additional energy that is required to treat drinking water through the BATs, increases in GHG attributed to MCL compliance through the alternatives to treatment should also be discussed and quantified. Additionally, the EIR should discuss and quantify the impact on GHG resulting from the life cycle of the BATs. This analysis should include, but is not limited to, the manufacturing of the BAT, transport and installation of materials, the regular transport and disposal of treatment process waste products, and the regular delivery of new BAT consumables (e.g., treatment media); lower MCLs will correspond to greater use and transport of these disposable consumables.

Consideration of Additional BAT Treatment

As State Water Resources Control Board staff are likely aware, the stannous chloride treatment process has shown promising results in reducing higher concentrations of CrVI to the less toxic trivalent chromium, CrIII, at several CrVI contaminated groundwater sites in California. Based on these results, the stannous chloride treatment process should be considered and evaluated as a possible future BAT.

If you have any questions, please contact Kevin O'Toole at (714) 378-8248 or kotoole@ocwd.com

Sincerely,

Michael R. Markus, P.E., D.WRE, BCEE, F.ASCE
General Manager

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SAN GABRIEL VALLEY WATER ASSOCIATION

VIA ELECTRONIC MAIL - DDW-hexavalentchromium@waterboards.ca.gov

December 6, 2021

Ms. Kim Niemeyer
Senior Staff Counsel
State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100 Sacramento,
California 95812-0100

Dear Ms. Niemeyer:

Subject: Comments by the San Gabriel Valley Water Association About the Notice of Preparation of a Draft Program Environmental Impact Report for Adoption of a Regulation for the Hexavalent Chromium Maximum Contaminant Level (Project)

Please accept the following comments by the San Gabriel Valley Water Association (SGVWA) about the Notice of Preparation for Adoption (NOP) of a Draft Program Environmental Impact Report for the Adoption of a Regulation for the Hexavalent Chromium (Chromium 6) Maximum Contaminant Level (MCL). This is being described in the NOP as "the Project." The State Water Resources Control Board (SWRCB) is the lead agency under the California Environmental Quality Act (CEQA) for this potential regulation.

The SGVWA represents municipal, investor-owned, special district and mutual water company water suppliers who provide water to over 2 million residents of the San Gabriel Valley. The SGVWA has a long history of defending our groundwater sources from pollutant contaminants including the Main San Gabriel Basin, U.S. EPA Superfund site, the nation's largest. In recovering clean-up costs from polluters, or making grant requests from state and federal agencies, the integrity of regulatory standards is key. Without use of best available science, remedies become second-guessed in the courts, and ultimately in the court of public confidence. Without an EIR that considers potential unintended consequences, the cost of meeting regulatory standards may also become unpredictable.

The SWRCB NOP advises that (17) possible MCLs (1 to 15, 20, and 25 µg/L) are being considered. The potential methods of compliance vary depending on the Best Available Technologies (BAT) identified, or alternative measures to reduce Chromium 6 concentrations in the distribution system. Based on our understanding of the options that would be economically feasible for all water systems, we have identified several concerns that should be considered in developing the draft EIR.

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http://www.sgvwa.org

Chief among our concerns is the fact that the project is being undertaken without using the best available science. Rather, the SWRCB is choosing to base the MCL on a Public Health Goal (PHG) that is more than ten years old and is derived from a study by the National Toxicology Program that is almost fifteen years old. This decision ignores the fact that the Office of Environmental Health Hazard Assessment determined 5 years ago that more recent scientific information requires an updated PHG. Other jurisdictions like Health Canada, have evaluated these more recent studies that are peer reviewed and readily available, and concluded that a standard of 50 ppb for total chromium – the same standard currently in place in California – will protect all populations from potentially harmful exposures to Chromium 6.

Three treatment technologies are identified as BAT for treating Chromium 6: Ion Exchange, Reduction-Coagulation/Filtration, and Reverse Osmosis. Public Water Systems are also encouraged to consider alternatives to treatment like the removal of contaminated source wells from use, blending of a contaminated source with an uncontaminated source to meet the MCL prior to distribution, drilling and constructing new wells in uncontaminated aquifers, switching from contaminated groundwater to surface water, or consolidation with another water system that meets the MCL.

All these alternative treatment and management methods would have detrimental impacts on the environment and people, both within and outside of California, and the project needs to evaluate measures to prevent or mitigate these impacts. The most effective mitigation measure would be to base the new Chromium 6 MCL on an updated PHG that incorporates the best available science. We request that the SWRCB reconsider the need for an updated PHG along with the following is a list of concerns and recommendations in the project EIR.

The State Board is required to directly notify and consult with responsible agencies during the scoping process to discuss probable environmental impacts of the project

- A public water agency that would need to build or approve a project to comply with the Chromium 6 MCL is a "responsible agency" under CEQA.
- The responsible agencies for this EIR are ascertainable. Appendix A lists the responsible agencies for a project implementing an MCL of 25 ug/L (from SWRCB data).
- The CEQA Guidelines require the State Board, as the lead agency, to send a Notice of Preparation (NOP) directly to the responsible agencies.
- Our members listed in Appendix A have not received a copy of the NOP from the State Board.
- The NOP needs to be corrected and recirculated to the responsible agencies.

The EIR must identify and analyze the environmental impacts of the proposed project

- The EIR must identify and analyze the direct impacts of the proposed project.
- The EIR must also analyze the reasonably foreseeable indirect impacts (or secondary impacts) of the proposed project.
- The project description must include all components of the project, including the planning, construction and operational phases.

The EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment

- The EIR must serve as an informational document to inform decision-making.
- To achieve this purpose, the EIR must analyze how the economic impacts of compliance with the MCL could result in physical impacts on the environment.
- The costs of compliance with the MCL will shape the behavior of both water systems and ratepayers, and the environmental impacts of these reasonably foreseeable behaviors must be analyzed in the EIR.

The project may cause a shift from groundwater usage to surface water usage

- The high treatment costs associated with Chromium 6 will make the use of surface water more attractive to many impacted water agencies.
- Several water agencies in Yolo County have already shifted their water supply from groundwater to outtakes on the Sacramento River.
- Greater reliance of surface waters will further decrease in-stream flows.
- Decreased in-stream flows will have negative impacts on in-stream and riparian habitat and on fish and wildlife.
- For example, the Department of Fish & Wildlife reported that just 2 percent of juvenile winter-run Chinook salmon in the Sacramento River survived this summer.

The project will cause an increased use of bottled water

- Many water systems will not be able to achieve immediate compliance with the new MCL.
- These water systems are required to disclose to their customers that their water exceeds the MCL for Chromium 6.
- This information will drive increased consumption of bottled water to avoid water above the Chromium 6 MCL.
- This will result in the increased use of plastic, increased generation of plastic waste and increased greenhouse gas (GHG) emissions associated with transportation of bottled water.

Impacts from construction of treatment plants

- Increased emissions of toxic air contaminants (e.g., diesel exhaust particulate), criteria pollutants (e.g., NOx) and GHGs during construction.
- Increased discharge of pollutants in stormwater runoff during and after construction.
- Exposure to contaminated soils in dense communities where treatment plants will be built.
- Displacement of families in residential communities where treatment plants will be built, as well as exposure to vehicle pollution in the transport of waste from the project site.

Disposal of treatment residuals

- Proposed best available technologies (BAT)—ion exchange, reverse osmosis, and reduction-coagulation/filtration—generate treatment residuals that must be managed as hazardous wastes in California.
- This will result in increased toxic air contaminants, criteria pollutants and GHG emissions from transporting treatment residuals to disposal facilities.
- This will also result in increased disposal of hazardous waste and either increased pressure on limited in-state Class 1 disposal capacity, or shipment of waste to other states where it will be subject to less stringent public health and environmental protection standards.
- Out of state disposal will also generate greater transportation emissions.

Negative impacts on achievement of Human Right to Water Act goals

- Closure of impacted wells and uncertain access to state grant funding compromises water supply reliability and access to drinking water

- Increased water rates compromise water affordability and lead to public health issues caused by decreased disposable income, which is strongly correlated to negative health impacts
- These impacts will be most pronounced in socioeconomically disadvantaged communities.

Increased dependency on surface waters undermines drought resiliency

- Closure of impacted wells is contrary to existing state policies emphasizing reliance on local water resources.

Water System Consolidations

- Consolidating private water systems because of one contaminant, Chromium 6, may result in stranded costs incurred in the treatment of other contaminants that are not subject to the same treatment methods.
- Untimely grants by the SWRCB, as experienced in the consolidation of East Porterville with the City of Porterville, may result in greater dependence on surface water or in human health impacts if existing facilities fail.

Reopening the current PHG and developing a new risk assessment may mitigate many of the environmental impacts of the MCL

- The most current scientific information on health effects from ingestion of Chromium 6 in drinking water indicates that alternative MCLs at or above the upper end of the MCLs currently under consideration are fully health protective.
- An MCL based on a PHG updated with the most current science will result in fewer environmental impacts, consistent with findings in other jurisdictions such as Health Canada.

We hope that you will accept these comments and avoid environmental and human impacts that would result from an MCL based on the outdated science that informs the existing PHG. Again, we urge the promulgation of a new PHG through OEHHA and thank you for this opportunity to inform your NOP process.

Submitted,

Greg Galindo
President, Board of Directors
San Gabriel Valley Water Association

November 24, 2021

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Re: COMMENTS –REGULATION FOR THE HEXAVALENT CHROMIUM MCL PROJECT

I would like to submit these comments regarding the "Adoption of a Regulation for the Hexavalent Chromium MCL". The community water system I am part of is the Strawberry Road Water Co-op #6, located in Royal Oaks, Monterey County, and we serve 28 households. The regulations will affect all water systems whether they are impacted by Chromium 6 or not.

In 2020, your board asked for responses to a White Paper on this same subject. This letter is a reiteration of my letter submtted in May 2020.

The White Paper asserted that a Cost-Benefit Analysis is limited in informing Economic Feasibility Guidelines because such analysis does not account for benefits gained by ending exposure to carcinogen, reduced cost to families who will no longer need bottled water or point of use treatment, costs associated with medical treatment associated with exposure to carcinogens. This argument skews the fundamental issue that there are serious health risks of not having access to clean and affordable water. It is striking that the State Water Resources Control Board thoughtfully addressed the health challenges of not having access to water and the needs and challenges facing the most economically vulnerable residents in the State in its Recommendations for a State Low Income Water Rate Assistance Program, but these insights and recommendations are noticeably missing from the White Paper. I strongly recommend that they be considered and incorporated in the final draft.

The White Paper asserted that economic feasibility criteria based on less than 5% of the State's population jeopardizes health protection for the remaining 95% and is not an acceptable public health policy. The State Water board highlights that the majority of water systems out of compliance with drinking water standards are small community systems and asserts that setting the standard ought to favor the economic might of the majority and disregard the limits of the minority. I disagree with the argument that the wealth of the many are more important than the needs of the few. It is not ethical to leave the poorest and smallest communities among us behind. The estimated costs of $5,600 per capita per year for systems with under 200 connections is not a cost that the systems, communities or households can reasonably bear. The lower cost of $65 per capita per year for systems of 10,000 connections in disadvantaged communities will also present significant challenges to already stretched and stressed budgets.

The White Paper asserted that there are a range of strategies and funding resources available to achieve compliance and to offset costs of new regulations (grants, low or no-interest loans, point of use or point of entry treatment, variances, exemptions, and consolidations). The reality, however, is that the strategies and funding sources proposed leave small water systems without many answers.. Many small water systems do not have the resources to hire experts to navigate the grant application process. Alternatives to grants for financial support to small systems that do not require engagement of expensive consultants and are easy to access are urgently needed. The Water Board's Office of Financial Assistance is not transparent about grant qualifications and priorities causing many water systems that try applying, left with rejection letters after having spent thousands for consultants needed in the application process.

Further, small systems generally do not have the resources to implement studies to evaluate alternative treatment options. The State Water Board cannot simply point to alternative compliance mechanisms to establish that a proposed MCL is economically feasible for affected systems without first determining if those options are actually viable for those systems. While I acknowledge that consolidation may be a potential solution for some small systems, it is not a one size fits all approach and carries with it significant costs which will likely require state investments to fully activate. Consolidation may pose a new set of problems if the entire area has contaminants. The State Water Board needs a strategic plan for financial and technical assistance when adopting each new MCLs that run in parallel with enforcement timelines.

The White Paper recommended that we differentiate “affordability” (ability of individual household to pay their water bill) from “economic feasibility” (ability of the overall state population served by public water systems to pay for compliance to a drinking water standard). The State Water Board claims that there currently is no agreed upon standard for determining “affordability” and that the connection between affordability and economic feasibility is complex and beyond scope of white paper. The White Paper elaborates that protection of public health and the cost to maintain it is an absolute priority and must be taken into account when developing budgets. The State Water Board makes clear that for an impacted water system, an additional compound or lower MCL of an existing compound will likely result in a general rate increase.

I do not believe it is reasonable or appropriate to differentiate affordability from economic feasibility. When the 10 ppb Cr6 standard was adopted, the cost of compliance was so high for some communities that the very ability to pay was in question.

The White Paper indicated that there is no federal MCL for CrVI and therefore the State is free to adopt an MCL level. I question this statement because I was not aware that the federal government eliminated the level they established years ago. If customers do not have the ability to pay such high costs, it affects not only affordability but economic feasibility because a water system that can't get paid by its customers cannot be expected to make purchases of treatment equipment. Ability to pay, affordability, and economic feasibility are on-going problems. Saying that it is up to each system and community to sort things out with budgets and rates in anticipation of potential future regulations is foolhardy and leaves the poorest among us as the casualty of achieving the “absolute priority of public health for the many”. Another concern is the ability of small systems to enforce any restrictions or changes with all of the homeowners. Some individuals may be of the mindset that they 'don't have to comply' and the ability to enforce any changes may be close to impossible with some individuals.

The White Paper was drafted to respond to the May 31, 2017 Superior Court of Sacramento County judgment invalidating the MCL and concern that the CDPH had not properly considered the economic feasibility of complying with the MCL. By and large, I do not believe that the Water Board's White Paper propoerly responded to the 2017 Sacramento County Superior Court order that invalidated the previous MCL. I remain of the opinion that the State regulations should accommodate the needs of small water systems and disadvantaged communities in assuring safe drinking water.

The issue of economic feasibility in drinking water standards is far too important to dead-end with public and written comments that will not be heard by the State Water Board. I strongly urge that the State Water Board adopt formal guidance and policy in determining economic feasibility in the adoption of safe drinking water standards, assuring that no one gets left behind in the board of safe drinking water.

Sincerely,

Susan McCall, Homeowner
Strawberry Road Water Co-op #6

Dear Sir/Madam,

I am really concerned about the public education about the origin of chromium 6. So I want to submit my comments regarding the scope of environmental impact report below.

The most economically feasible Strong base anion exchange (SBA) treatment can't be used after chlorine treatment because of stability issue of the resin and nitrosamine byproduct. Report of "ECONOMIC FEASIBILITY ANALYSIS In Consideration of a HEXAVALENT CHROMIUM MCL" and "Treatment Costs Data" didn't provide enough information about best available technology. Specifically, these reports didn't separate the original chromium 6 in raw water source and chromium 3 oxidation byproduct chromium 6 during the chlorine treatment and distribution. The later can't be removed by SBA. Other more expensive technologies are needed.

Chromium 3 provides essential mineral nutrition. Over chlorination could completely convert chromium 3 to chromium 6. My data review of EPA UCMR-3 chromium 6/total chromium ratio revealed complete dominance of chromium 6 in drinking water of California. If the origin of chromium 6 issue not studied and well addressed, the regulation too strict or too loose could risk reduced protection of scarce usable raw water source and discourage adoption of best available technology. During a draught emergency, it will cause significant environmental impact. And resident of small water system will not be able to get the help they needed.

Please consider the whole treatment process including chlorine treatment when reporting the environmental impact. Thank you.

Best,

Zheng Miao

Research Scientist II

CDPH