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Suggested Framework for Economic Feasibility Analysis

Response to the California State Water Resources Control Board, February 2020 White Paper, "*Economic Feasibility Analysis in Consideration of a Hexavalent Chromium MCL*"

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Executive Summary

As part of the next steps in reissuing a Maximum Contaminant Level (MCL) for hexavalent chromium [Cr(VI)], the State Water Resources Control Board (Board) is seeking stakeholder input on ideas and methods for evaluating the economic feasibility of proposed MCL alternatives. In response to this call, Corona Environmental Consulting has worked with the Southern California Water Coalition (SCWC), along with several other water utility groups and individual water utilities, to develop this suggested framework for how the Board should analyze economic feasibility. This framework is structured around two key questions:

1. Do the proposed MCLs (or other standards or policies) provide public health benefits that justify the costs of implementation? If benefits are deemed to exceed or otherwise justify costs, then
2. Is the MCL affordable?

We believe the Board should adopt a methodology based on the proposed framework as a systematic and consistent approach to evaluate the economic feasibility of a new Cr(VI) MCL and all future potential drinking water standards. The proposed framework is summarized below; additional detail is provided in the subsequent paper.

Screening level assessment

Before proceeding to set an MCL, the framework first proposes a screening-level assessment to ensure that suitable data is available to describe the full range of impacted system sizes and locations and analyze the corresponding benefit and cost implications. This assessment should identify whether further data collection and/or technical analysis is warranted. The initial screening should consist of the following components:

- Ensure that sufficient occurrence data are available by system size and geographic location.
- Ensure risk assessment calculations are based on the best available information.
- Ensure that benefits can be quantified for the risk-driving health endpoint.

Benefit-cost analysis

BCA is a necessary step to help ensure that the MCL will be an efficient and effective investment of resources in public health protection. This includes the following steps:

- Consider statewide capital/initial costs as well as operations, maintenance, and replacement costs for best available technology, as well as costs for non-treatment options.
- Analyze benefits relative to costs incrementally across possible MCL levels to understand where the change in benefits is greatest relative to the cost.
- Consider feedback from the affordability assessment to inform selection of the MCL.

Affordability assessment

The final step in the economic feasibility framework is to evaluate the affordability of the proposed MCL resulting from the BCA. This includes the following steps:

- Apply community-level affordability metrics to determine whether the proposed MCL is affordable for impacted communities. We agree with the Board that no one metric or threshold is sufficient as a decision rule for identifying affordability concerns. However, several methods

and metrics exist that will allow the Board to identify those communities for which the cost of compliance will pose an undue economic hardship for a disproportionate number of households.

- Quantify the range of potential assistance needs based on those communities for which costs associated with compliance are deemed to be unaffordable.
- Evaluate the ability of the state to provide the projected level of assistance, including through grants, loans, and other methods. A key consideration in this assessment is to understand whether the demand will divert spending on infrastructure rehabilitation and other necessary investments that are likely to provide greater health protection benefits to ratepayers.

Small system considerations

Most proposed MCLs will be more economically and technically challenging for small systems to satisfy compared to large systems. However, the populations served by these small systems deserve the same level of public health protection as larger systems.

The costs of all potential options for small system compliance should be examined, including for point of use treatment, consolidation (both physical and/or managerial/technical consolidation options), and non-treatment options. The resulting impacts to individual communities should be assessed and examined as part of the affordability assessment.

Introduction

In February 2020, the State Water Resources Control Board (Board) released the white paper: "*Economic Feasibility Analysis in Consideration of a Hexavalent Chromium MCL*" that identified key issues for establishing and assessing the economic feasibility of maximum contaminant levels (MCLs). The white paper highlighted the challenges associated with conducting benefit cost analysis, assessing affordability, and evaluating/addressing concerns for small systems within the context of economic feasibility. The Board presented ideas and methodologies arising from the hexavalent chromium [Cr(VI)] MCL rulemaking process that may also be applied in the development of other drinking water standards.

As alluded to in the whitepaper, economic feasibility is a complex, multi-faceted issue that requires consideration of a range of analytic tools and associated metrics. We agree with the point that the Board raises in the whitepaper that no single method or metric is sufficient. However, a haphazard approach that may vary appreciably across potential rulemakings is not a sound methodology for establishing prudent standards to protect public health. Rather, we believe that the Board needs to develop a systematic and consistent framework, using multiple methods and metrics, for evaluating the economic feasibility of all future potential drinking water standards.

This response paper presents a suggested framework for MCL development in California that addresses the need for economic feasibility assessment when promulgating an MCL. This paper addresses points made in the Board's whitepaper and provides a framework for how economic feasibility assessment can be accomplished, not just for reconsideration of the Cr(VI) MCL, but for all contaminants of emerging concern. Given the importance of this subject, continued dialog between the Board, stakeholders, and the public and follow on collaboration is warranted to craft meaningful and long-lasting policy for addressing economic feasibility analysis.

The framework described herein is designed as an iterative process that recognizes potential differences in and limits of data availability, both across system sizes and different contaminants. Before proceeding to set an MCL, the framework first requires an initial screening assessment to ensure that accurate data are available to represent a reasonable range of impacted system sizes and locations and corresponding benefit and cost implications. This screening-level analysis should identify when further data collection and/or technical analysis is warranted, avoiding missteps caused by significant data gaps or inaccurate data.

After meeting the requirements of the initial screening assessment, this framework is structured around two key questions:

1. Do the proposed MCLs (or other standards or policies) provide public health benefits that justify the costs of implementation? If benefits are deemed to exceed or otherwise justify costs, then
2. Is the MCL affordable?

Benefit cost analysis (BCA) addresses the core first question of whether a potential MCL is a worthwhile investment of the public's monies in public health protection. For MCL options that are deemed sound investments, affordability analysis provides additional metrics to understand affordability at the community level for water system customers.

The following sections describe the suggested framework for MCL development that incorporates economic feasibility analysis. The first major step in that framework is to examine available cost and occurrence data, as is described in the next section.

Occurrence Data and Cost Data

There are two critical categories of data that are necessary for the development of an MCL:

- Occurrence data – which show occurrence of the contaminant at different locations and at different concentrations throughout the state, and
- Cost data – which show the expected cost for utilities to remove that contaminant through water treatment to comply with the potential MCL.

Occurrence data need to be collected through a sampling process. California has relied on the state-based Unregulated Contaminant Monitoring Regulations, continued voluntary sample submission, and Federally mandated processes such as the Unregulated Contaminant Monitoring Rule (UCMR) when looking for occurrence data for a new contaminant. In some instances, data may not be sufficient to support development of a new MCL. In the case of the initial Cr(VI) MCL setting process, the Initial Statement of Reasons (ISOR) described key limitations in the available data , including method detection limits, small system exemptions, and lack of electronic reporting of data from local primacy agencies. The ISOR acknowledged the data limitations could lead to underrepresenting impacted sources and higher than expected costs of compliance once those sources identified contaminant concentrations of concern during routine monitoring required under the new regulations.

The initial Cr(VI) MCL is an instance where impacted sources were underrepresented due to limited occurrence data. Corona Environmental Consulting's analysis of the State's drinking water quality database Cr(VI) results collected and reported since the initial MCL was implemented reveals more sources are affected at a 10 µg/L Cr(VI) MCL than described in the ISOR. This analysis calculates running annual average (RAA) concentrations through the end of 2019 for each Active Raw (AR) and Active Untreated (AU) source served by Community Water Systems and Non-Transient Non-Community Water Systems intended to be consistent with the initial Cr(VI) MCL ISOR approach. The analysis indicates that 501 sources would be affected at a 10 µg/L Cr(VI) MCL as compared with the 311 sources described in the ISOR – a 62% increase. More importantly, 178 sources from small systems serving fewer than 200 connections would be affected at a 10 µg/L Cr(VI) MCL as compared with just 65 sources described in the ISOR – a 174% increase that nearly triples the number of small systems facing compliance requirements. Table 1 displays the affected sources as identified in the ISOR, compared with the updated analysis of the State's drinking water quality database Cr(VI) results collected and reported since the initial MCL was implemented through the end of 2019.

Table 1. Comparison of ISOR and updated number of Cr(VI) affected sources by Service Connection Group

Cr(VI) MCL (µg/L)	ISOR Number of Affected Sources by Service Connection Group					Updated Number of Affected Sources by Service Connection Group				
	<200	200-<1,000	1,000-10,000	≥10,000	Total	<200	200-<1,000	1,000-10,000	≥10,000	Total
1	424	130	561	1,372	2,487	1,149	200	669	1,588	3,606
5	156	49	192	421	818	397	72	267	493	1,229
10	**65**	**13**	**81**	**152**	**311**	**175**	**30**	**120**	**176**	**501**
15	35	5	40	65	145	89	12	65	87	253
20	14	1	19	33	67	46	7	34	41	128
25	3	-	9	19	31	23	5	13	24	65
30	2	-	5	9	16	15	3	4	21	43

Using 80% of the MCL as the more traditional threshold for water utility planning purposes (8 µg/L) finds that 751 sources are affected across all service connection groups and 232 sources are affected among small systems serving fewer than 200 connections.

The reassessment of the Cr(VI) MCL now has the benefit of updated and comprehensive occurrence data. However, for future rules, a first step in the process should be to evaluate the occurrence data. If data by system size and geographic location in the state are not adequate to describe occurrence, then additional sampling will be needed.

An additional issue to be addressed with sampling is that of occurrence data for the "State smalls" category (defined as systems with less than 15 connections served, or less than 25 persons). There is no regulatory requirement that this size category be addressed. However, these systems should be considered, as directed under the Human Right to Water Act. The Board's new Safe and Affordable Funding for Equity and Resilience program (SAFER) program may need to consider providing funding to state small utilities in order to help support sampling from the state smalls category and affected state smalls will increase the total obligation of SAFER funds.

Cost data are typically analyzed during the MCL setting process based on the Board's assessment of the best available technology to remove the contaminant being considered. For the initial Cr(VI) MCL analysis, the Board identified the best available technologies as reduction/coagulation/filtration, ion exchange, and reverse osmosis and relied upon weak base anion exchange treatment with disposable resin as the basis for cost estimates. Treatment feasibility research and implementation conducted after the initial Cr(VI) MCL was implemented improved upon Cr(VI) treatment feasibility and costs, but predominantly for large systems. Sufficient data must be gathered to confidently assess treatment costs for all affected sources including those at small systems.

Screening-Level Assessment

The implication of the preceding discussion on occurrence and cost data is that a screening-level assessment should be conducted before the Board decides to proceed with MCL development. That feasibility assessment should consist of the following components:

- If occurrence data do not cover the full range of system sizes, including those with less than 200 connections, as well as state smalls with less than 15 connections, or there are not sufficient samples from each region in the state, the Board should consider additional sampling to fill these gaps.
- There should also be an initial assessment of the available studies and data regarding risk reduction benefits. Specifically, there should be data available on the relationship between exposure and health outcomes related to cancer and/or other significant adverse health endpoints of concern. If this relationship is not well described in the literature, the Board should consider requesting additional assessment of the health risks. In the case of Cr(VI), it was not clear from the literature at the time, and it appears even less likely based on more recent literature, that there is a carcinogenic effect via ingestion at relevant concentrations.
- For benefit assessment to be relevant, risk assessment calculations must be based on the best available information, especially when new scientific information post-dates existing the Public Health Goal (PHG); in these cases, the PHG should be updated before the MCL is developed.

A related point is that once an MCL is promulgated, utilities need a longer implementation period than they are currently afforded to comply. Less time to comply means higher costs to utilities due in part to having to rush through the process to identify appropriate compliance measures, evaluate the environmental impacts of alternative compliance options, raise the necessary funding, and implement the compliance approach by the compliance deadline. In addition, inadequate compliance periods result in the threat of unavoidable MCL violations that force water systems to use limited resources for legal expenses and costly alternative measures that are often temporary and duplicative, or worst yet measures that can increase customer risks associated with lost water supplies.

The steps outlined above can be thought of as a screening level assessment that ensures the MCL selection proceeds with a sufficient understanding of the occurrence of the contaminant and the costs and benefits avoiding adverse health effects. This screening level assessment should be integrated into the MCL development process to ensure the necessary data are available to support decision-making.

Benefit-Cost Analysis (BCA)

BCA is the first step in determining whether an MCL is a sound investment in public health protection. It is part of a two-step process for analyzing economic feasibility – BCA addresses the core question of whether a potential MCL appears to be a worthwhile investment of the public's monies in public health protection statewide. The second step in that process is to analyze the affordability for water systems at the community level, as discussed in the next section.

Costs used in the BCA should include the full lifecycle costs associated with the compliance option(s) over a relevant planning horizon. This assessment should include capital/initial costs, and operations, maintenance and replacement costs. These costs should be summarized for use in the BCA, and the

affordability analysis, in terms of total costs, by system size, per household, by primary water source (surface water vs groundwater), and by other relevant factors.

Quantifying risk reduction benefits requires applying applicable dose-response models (or related relevant science-based benchmarks) to empirically characterize how much risk reduction is anticipated from alternative MCLs and the associated reductions in exposure levels. For many carcinogens, for example, an estimate of the reduction in anticipated lifetime cancer cases may be developed for anticipated reductions in the drinking water exposure levels (from baseline, and across alternative MCL options).

BCA allows for incremental analysis of the possible choices of MCLs. At each possible MCL, the analysis shows the quantified benefits relative to the dollar value of costs. The objective of the BCA analysis is to determine the point where the benefits from regulation are the greatest, which is the point where the change in benefits (marginal benefits) from one MCL to the next MCL is equal to the change in costs (marginal costs).

Health risk reduction benefits can be difficult to fully quantify or monetize, and typically subject to considerable uncertainty. However, there are well-established economic frameworks that have established methods for addressing uncertainty and missing information in BCAs (e.g. U.S. EPA 2014, DeSousa et al. 2011, Raucher et al. 2002). If an important health endpoint such as cancer cases avoided can be quantified at different MCLs, this information can be used to understand the change in benefit that accompanies the change in cost when considering incremental changes in MCLs – even if additional benefits are known to exist but cannot be fully quantified. A comprehensive accounting of public health benefits is desirable but not necessary to perform an informative BCA. In this case, as increasingly stringent MCLs are considered, the BCA should address the question – at what point do incremental costs start to accelerate relative to gains in additional public health benefit?

The magnitude of these additional benefits should be described qualitatively and considered alongside the quantified benefits when considering the benefits relative to the costs of a change in MCL. Likewise, uncertainties in benefit quantification or valuation should be explored through sensitivity analysis, especially to understand if any uncertainties would influence the choice of MCL.

Several options can help inform how much weight to give to unquantified benefits (U.S. EPA, 2014). If benefits already exceed costs without the unquantified benefits, then a discussion of the unquantified benefits reinforces an already obvious outcome. If quantified benefits are less than costs, a “break-even” analysis can help inform valuation of the unquantified benefit. In a “break-even analysis”, the analyst calculates the difference between the quantified cost and benefits. This gives the amount that the unquantified benefit must be in order to make the total benefits comparable to the total costs. It can sometimes be obvious whether the omitted benefit is likely (or not) to be worth the amount of money needed to fill the gap. This approach still leaves room for judgment and interpretation and advances the policy deliberations by characterizing the unquantified benefits in a systematic way.

Choice of MCL will in part be influenced by the affordability assessment, as described in the next step. These steps should be conducted iteratively to identify an economically feasible statewide solution for which the affordability challenges can be managed.

Evaluating Affordability at the Community and State Level

The next step in the economic feasibility framework is to evaluate affordability within the following context:

- Determine whether the proposed MCL is affordable for impacted communities.
- Quantify the potential need for assistance based on selected affordability indicators.
- Evaluate the ability of the state to provide assistance to those communities for which treatment is deemed unaffordable.

Community level affordability pertains to the collective ability to pay for investments in drinking water facilities, as well as the operations and maintenance (O&M) expenses required to sustainably deliver services in full compliance with applicable laws and regulations. It is a reflection of both the economic vulnerability of the community, as well as the financial capability of the utility that serves the community.

While the Board's white paper defines affordability as "the impact on the individual," the goal of an affordability assessment in this context is to identify those communities for which the cost of compliance will pose an undue economic hardship for a disproportionate number of households. This in turn affects the ability of a community to pay for treatment, as they cannot recover associated costs through water rates.

We agree with the Board that no one metric or threshold is sufficient as a decision rule for identifying affordability concerns. We therefore recommend that the Board apply a range metrics that provide an indication of the prevalence of households in a given community that are likely to face affordability challenges, as well as a metric that evaluates the financial burden of compliance costs for households at a specified income level (often referred to as a household burden indicator or affordability ratio). These metrics should be developed for all impacted communities and across system sizes.

As a starting point, the Board can easily determine the number of affected community water systems at various MCL levels that are designated as Disadvantaged Communities (DACs) or Severely Disadvantaged Communities (SDACs), consistent with methodology adopted by other State agencies. For example, drawing on block group-level Census data, Corona Environmental Consulting's analysis of statewide occurrence data indicates that 15% of sources affected at a 10 µg/L Cr(VI) MCL are located in system service areas that fall entirely within Census block groups that qualify for DAC or SDAC status. For sources affected at a 10 µg/L Cr(VI) MCL in systems serving fewer than 200 connections, 33% are in systems that have their entire service area within a Census block group that qualifies for DAC or SDAC status. Identifying DACs and SDACs helps to provide an initial screening/indication of impacted communities that are likely to face affordability challenges, although specific thresholds for DAC/SDAC status should be further evaluated (i.e., the percentage of the service area that falls within a qualifying Census block group). Table 2 shows the number and % of Cr(VI) affected sources in systems that have their entire service area within a Census block group that qualifies for DAC or SDAC status.

Table 2. Updated number and % of Cr(VI) affected sources in 100% DAC + SDAC Systems by Service Connection Group

Cr(VI) MCL (µg/L)	Updated Number of Affected Sources in 100% DAC + SDAC Systems by Service Connection Group					% of Affected Sources in 100% DAC + SDAC Systems by Service Connection Group				
	<200	200-<1,000	1,000-10,000	≥10,000 [a]	Total	<200	200-<1,000	1,000-10,000	≥10,000	Total
1	406	56	59	-	521	35%	27%	9%	0%	14%
5	142	16	27	-	185	35%	22%	10%	0%	15%
10	**61**	**6**	**14**	**-**	**81**	**33%**	**19%**	**11%**	**0%**	**15%**
15	30	4	6	-	40	30%	29%	8%	0%	14%
20	12	2	4	-	18	23%	25%	9%	0%	12%
25	7	1	3	-	11	25%	20%	20%	0%	15%
30	5	-	2	-	7	29%	0%	33%	0%	14%

a. Larger systems (i.e., >10,000 connections) consist of multiple Census block groups and therefore do not meet the simple DAC/SDAC criteria applied in this example; analyses may be performed to determine the percentage of households within larger communities that partially fall within DAC/SDAC block groups.

Another prevalence measure recently put forth by the National Association of Clean Water Agencies (NACWA), American Water Works Association (AWWA), and the Water Environment Foundation (WEF, 2019) is the percentage of the population within the service area living at or below 200% of the federal poverty level (FPL). Recognizing the limitations of the FPL as a measure of economic need, including its failure to account for household non-discretionary spending and differences in the cost of living across regions and communities, it still provides a reasonable approximation of the magnitude of households that may face affordability challenges. NACWA, AWWA, and WEF do not put forth a specific threshold at which this metric indicates an affordability concern; however, a lower end threshold of 20% may result in a moderate to high economic burden, depending on the outcome of other recommended indicators.

Several experts and agencies have put forth metrics intended to measure the household financial burden associated with water, wastewater, and/or stormwater-related compliance costs. These metrics generally compare the cost associated with a basic level of household water use to specified household income levels. EPA's Residential Indicator (RI), which examines the average per household cost of wastewater services relative to a benchmark of 2% of service area Median Household Income (MHI), was the first of such indicators developed to evaluate the affordability of water-related mandates (and is specific to wastewater). The RI has been widely criticized for its use of MHI and its failure to account for the costs of other non-discretionary items that make up a household budget (e.g., housing, health care, energy), among other factors. More recent indicators have been developed to better assess challenges for low-

income households (e.g., by comparing costs across the income spectrum), as well as to account for the range of essential costs that low-income households face.

As a starting point, the cost per household for compliance with proposed MCLs may provide an indication of affordability concerns. For example, the Initial Statement of Reasons for Cr(VI) (2013) published an estimated annualized cost of $5,630 per connection for an MCL set at 10 µg/L for systems with less than 200 connections. No additional analysis is needed to demonstrate that this cost raises affordability concerns. However, this average reflects costs associated with the best available technology. When evaluating costs within the context of affordability, instances when use of the best available technology are not affordable for a system should be identified. In these cases, costs for non-treatment options (system consolidation, water source blending, well deepening, etc.) should be also be considered.

In instances when the cost per household is not immediately recognized as unaffordable, the Board can examine the impact of costs on low-income households by applying metrics designed to assess household burden. We recommend that the Board evaluate the cost per household (i.e., annualized costs, including O&M) associated with the proposed MCL (at various levels and for relevant treatment technologies) and compare it to income levels that better reflect the realities of low-income households within impacted communities (e.g., lowest income quintile, income levels that approximate minimum thresholds for a "living wage"). While some affordability metrics require levels of information and data that are not readily available for individual communities, there are several metrics the Board can adopt that are less data intensive and/or can be adapted to meet the goals of the intended analysis. The Board can conduct analyses to determine what the existing typical household bill would have to be (in addition to the cost of compliance) in order to meet specific thresholds. A similar analysis may be conducted across system sizes to evaluate how household financial burdens may change based on a utility's ability to finance capital improvements over a specified period, as well as the addition of O&M costs that the water system will incur.

The selected prevalence and household burden metrics should allow for the identification of communities in which the costs of compliance are unaffordable at the community level. Further research and comparative analysis are needed to identify the thresholds at which compliance costs and socioeconomic conditions within a community trigger consideration for this designation.

The next step is to quantify the need for assistance at all relevant MCL levels. This includes the range of compliance costs for identified communities across best available treatment technologies and other potentially applicable compliance strategies. Needs should be analyzed assuming a range of thresholds for selected indicators that would qualify a given community for assistance. The State should then evaluate the potential for loans and grants to meet projected needs. Solutions should be tailored to the needs of individual water systems and account for the limitations of current alternatives to source water treatment.

To the extent that state funding (e.g., through grants or loans) is identified as a means to address system needs when MCLs are not affordable, the Board should establish that the funding or financing source(s) have the capacity to accommodate associated demand/needs. A key consideration in this assessment is to understand whether the demand will divert spending on infrastructure rehabilitation and other necessary investments that are likely to provide greater health protection benefits to ratepayers. We note the Board's new SAFER program is working to meet the goals of safe, accessible, and affordable drinking

water for all Californians considering current MCLs. This dialog about economic feasibility of potential future MCLs for contaminants such as Cr(VI) will certainly impact the SAFER program, and therefore must be considered by the Board and further coordinated to understand statewide cost implications. In prioritizing communities for funding or financing assistance, the State should consider relevant utility financial capability indicators and require communities eligible for assistance to develop a long-range financial plan and key financial criteria, as recommended by NACWA, AWWA, and WEF (2019).

Consideration of Small Systems

As described in the Board's white paper, small water systems are typically more affected by the cost of new regulations because they have a smaller customer base amongst whom they can spread the cost of compliance. This is why it is essential for the Board's analysis to ensure it is economically and technically feasible for these small water systems to comply with the proposed MCL using identified best available technology. It would be inappropriate to exclude these small water systems from the analysis or to hide their inability to comply with a proposed MCL by averaging costs over all affected water systems.

Most proposed MCLs will be more economically and technically challenging for small systems to satisfy compared to large systems. We agree with the Board that the populations served by these small systems deserve the same level of public health protection as larger systems.

It is important to identify costs to households, by community system size, including for small systems. The costs of all potential options for small system compliance should be examined, including for point of use treatment, consolidation (both physical and/or managerial/technical consolidation options), and non-treatment options. The resulting impacts to individual communities should be assessed and examined as part of the affordability assessment described above. The solution for small system challenges ultimately resides in implementation of this proposed framework, including identifying the most cost-effective solutions that are protective of public health.

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