Benefit-Cost Analysis of California's Hexavalent Chromium Drinking Water Standard

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Statutory Criteria for Setting Drinking Water Standards in California [HSC §116365(b)]

1. MCL set by USEPA, if any.
2. Public Health Goal set by Office of Environmental Human Health Hazard Assessment (OEHHA).
3. Technological feasibility.
4. Economic feasibility.

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Determining Economic Feasibility Requires Benefit-Cost Analysis

- 'Economic feasibility' is not defined
  - by statute.
  - by Calif. Dept. of Public Health (CDPH) through rulemaking.
- Conventional definition in personal, private and other public sector settings: Benefits > costs.
- BCA is therefore essential for standard-setting.

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CDPH's BCA Contains at Least Six Fatal Defects

1. It materially underestimates *engineering* costs.
2. It does not estimate *opportunity* costs.
3. It does not estimate benefits.
4. It materially understates cost-effectiveness ratios by misinterpreting OEHHA's cancer risk assessment.
5. It does not say which alternative MCLs are (or are not) economically feasible.
6. It assumes OEHHA's estimate of low-dose cancer risk is correct.

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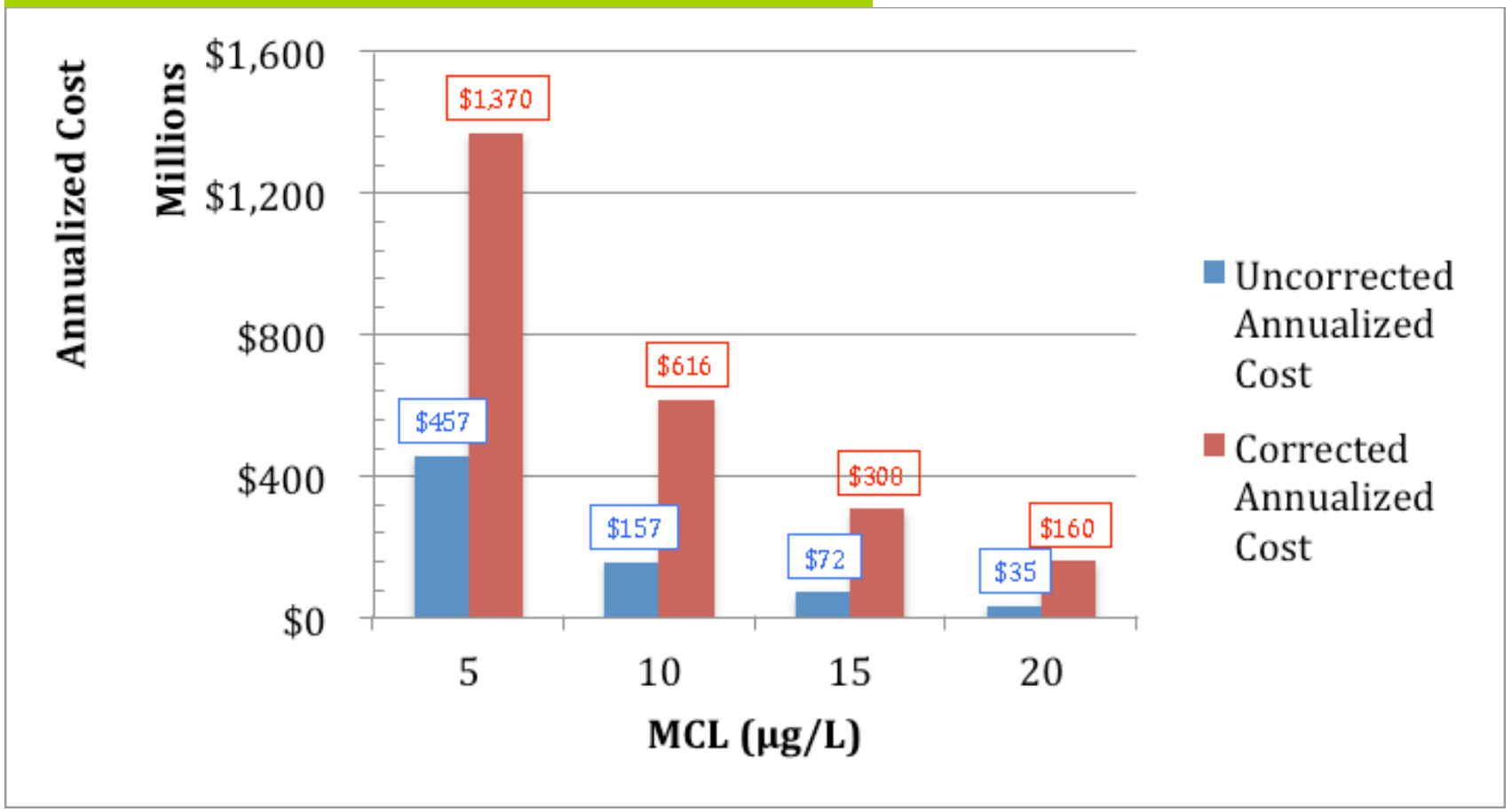
See Session T3-G (1:30, Governor's Square 11).

Fatal Defect 1

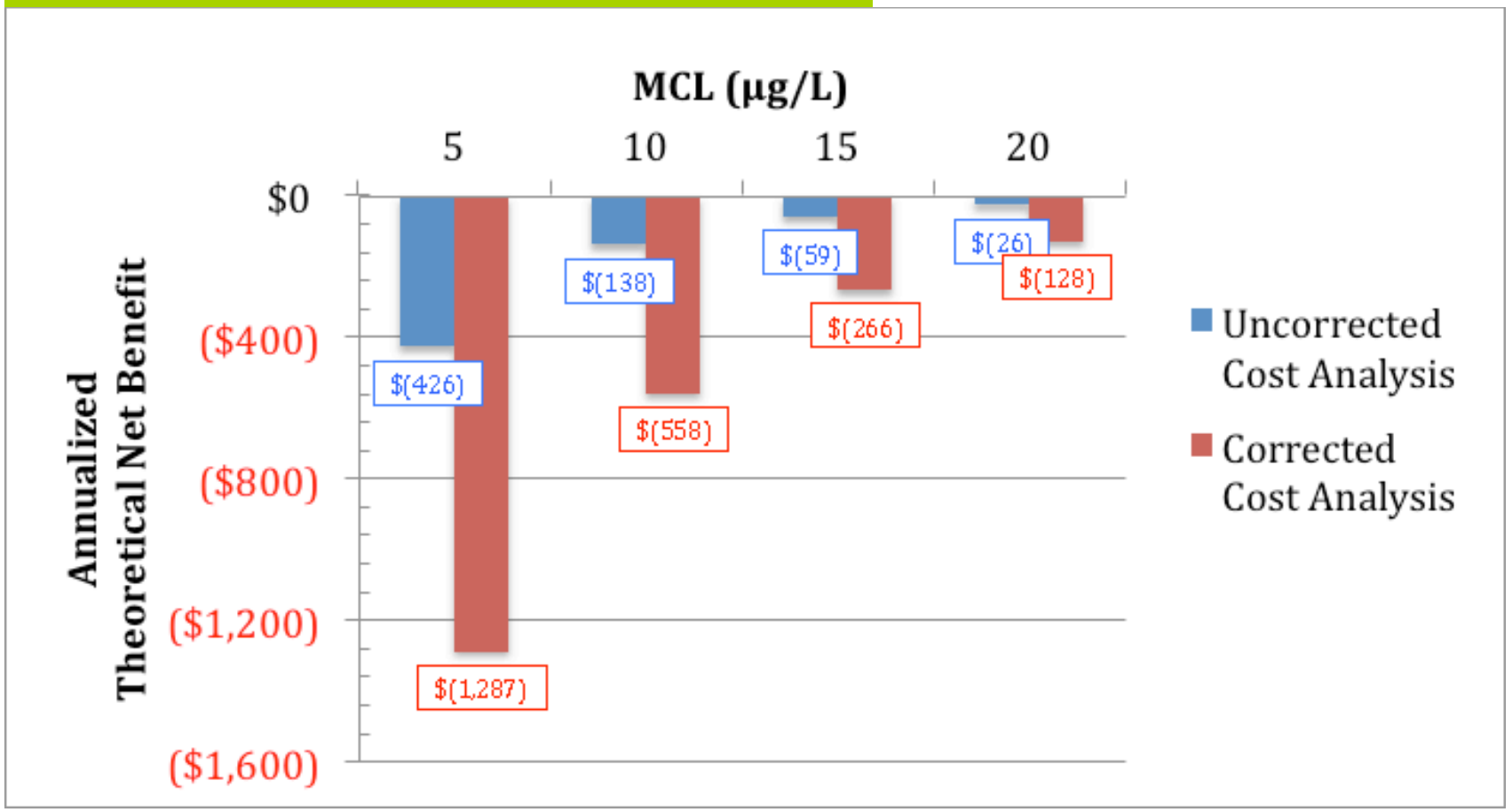
CDPH CBA MATERIALLY UNDERESTIMATES ENGINEERING COSTS

Uncorrected and Corrected Statewide Annualized Engineering Costs



Source: Najm (2013).

Uncorrected and Corrected Annualized Theoretical Net Benefit



Sources: Najm (2013) and Belzer (2013a, 2013b).

Fatal Defect 2

CDPH CBA DOES NOT ESTIMATE *OPPORTUNITY* COSTS

‘Cost’ is Limited to Treatment Technology

1. When engineering costs per household are low, it might be ‘good enough for government work.’
2. For households served by small water systems, engineering costs may be several thousand dollars per household per year.
3. Difference between opportunity cost and engineering cost may exceed the calculated value of theoretical cancer risk reduction.

Fatal Defect 3

CDPH CBA DOES NOT ESTIMATE BENEFITS

Benefits Can Be Estimated, but Weren't

1. CDPH calculates C-E ratios based on OEHHA cancer risk model, but does not estimate benefits.
2. OEHHA cancer risk model permits benefits to be estimated given certain assumptions:
   a. OEHHA risk model is correct.
   b. USEPA VSL is an acceptable upper-bound of the value of preventing a small intestine cancer (5-year mortality risk in California: 35%).

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Case Study: Willows, California
Costs Exceed Benefits by 9x to 13x

Cr(VI) MCL (ppb) Cr(VI) Reduction (ppb)	5 11.8	10 7.8	20 0.0
CANCER CASES PER HOUSEHOLD PER YEAR			
OEHHA estimated cases background	.000028	.000028	.000028
OEHHA estimated cases prevented	.000014	.000009	.000000
Incidence in Colusa/Glenn/Tehama Cos.	.000050	.000050	.000050
BENEFITS PER HOUSEHOLD PER YEAR			
Annualized	$35	$23	$0
Present value	$500	$330	$0
COSTS PER HOUSEHOLD PER YEAR			
Annualized	$300	$300	$0
Present value	$4,300	$4,300	$0

Sources: Belzer (2013a, 2013b).

Case Study: Dixon, California
Costs Exceed Benefits by 5x to 30x

Cr(VI) MCL (ppb) Cr(VI) Reduction (ppb)	5 14.1	10 10.1	20 2.1
CANCER CASES PER HOUSEHOLD PER YEAR			
OEHHA estimated cases background	.000036	.000036	.000036
OEHHA estimated cases prevented	.000019	.000013	.000003
Incidence in Solano Co.	.000004	.000004	.000004
BENEFITS PER HOUSEHOLD PER YEAR			
Annualized	$48	$35	$7.20
Present value	$690	$500	$100.
COSTS PER HOUSEHOLD PER YEAR			
Annualized	$220.	$220.	$220.
Present value	$3,200.	$3,200.	$3,200.

Sources: Belzer (2013a, 2013b).

Annualized Benefit and Cost per Household, Najm Case Studies

MCL Avg Δ Cr(VI)	Coachella Valley [2-21 µg/L]		Woodland [6-30 µg/L]		Oak Trail Mutual [17-19 µg/L]		Tierra Buena #1 [12 µg/L]	
	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost
MCL=5 µg/L Δ −12 µg/L	$29.04	$1,207	$55.07	$1,539	$47.39	$14,692	$41.15	$13,300
MCL=10 µg/L Δ −8 µg/L	$19.36	$744	$36.71	$1,288	$31.59	$14,531	$27.43	$13,182
MCL=15 µg/L Δ −4 µg/L	$9.68	$286	$18.36	$1,190	$15.80	$14,467	$0	$0
MCL=20 µg/L Δ −2 µg/L	$4.84	$98	$9.18	$848	$7.90	$14,467	$0	$0

Population, households, and annualized cost: Najm (2013), Figures 14, 18, 22, and 26; reported source water concentrations are in [square brackets]. Benefits calculated by author based on methodology devised in Belzer (2013). Figures are reported as calculated, but readers are cautioned that they include excess precision.

Sources: Najm (2013) and Belzer (2013a, 2013c).

Fatal Defect 4

CDPH MATERIALLY UNDERSTATES C-E RATIOS BY MISINTERPRETING OEHHA'S CANCER RISK ASSESSMENT

If Risk Is Linear without Threshold, Risk Reduction Is Linear without Threshold Also

- OEHHA cancer risk model assumes every unit of exposure poses the same risk, regardless of timing or the quantity of past exposure.
- Risk reduction must follow the same model.
- CDPH calculates C-E ratios as if the full amount of risk reduction is realized immediately.

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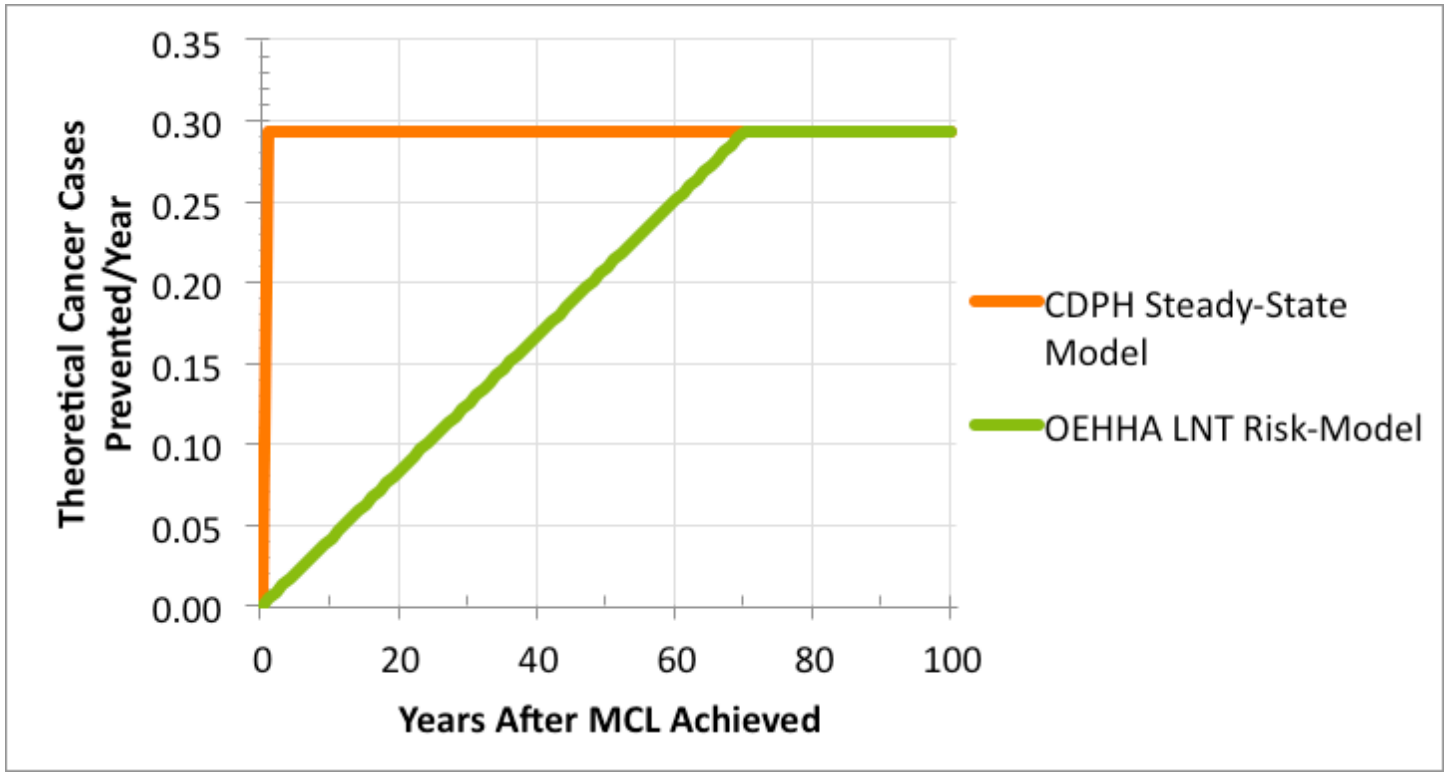
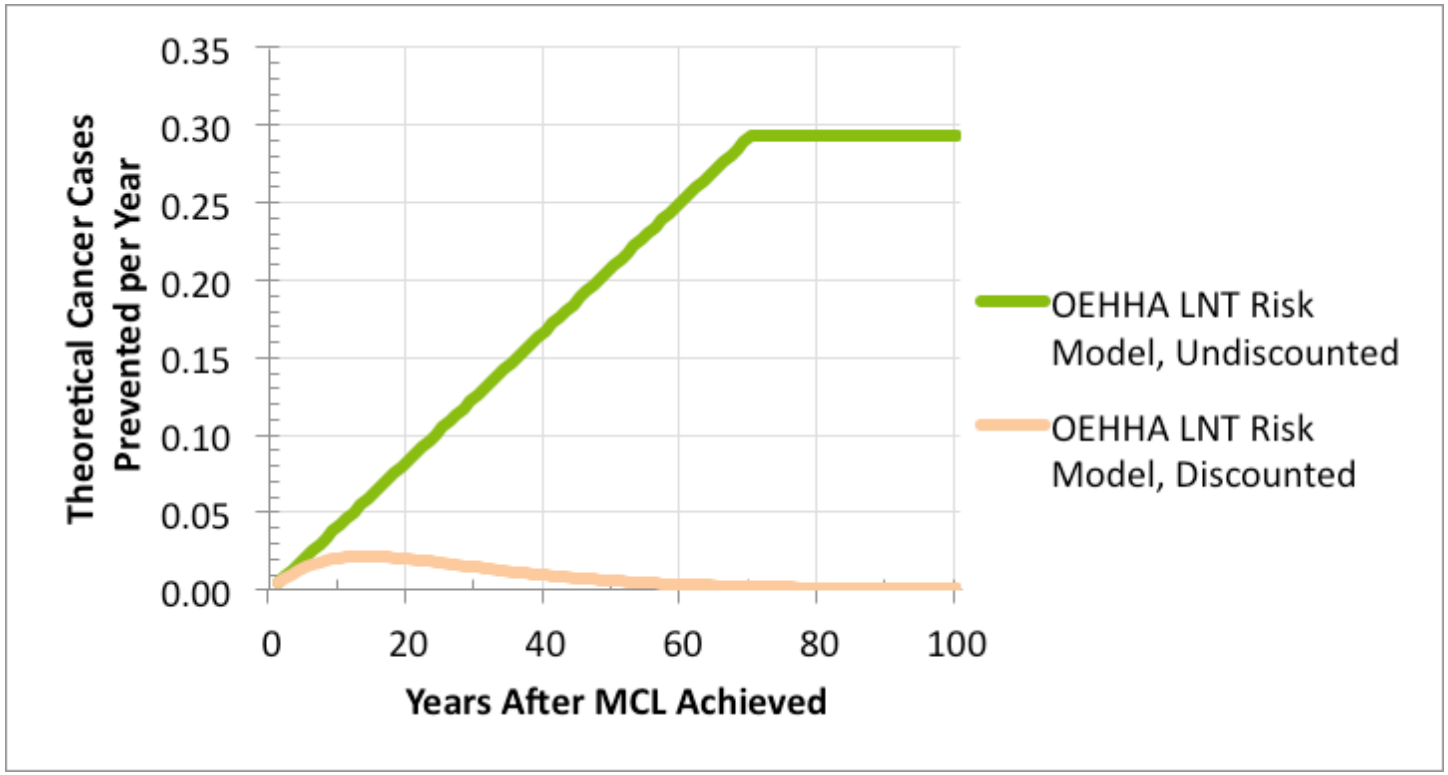
Theoretical Cancer Cases Prevented per Year; CDPH Steady-State Model vs. OEHHA LNT Risk Model (Small Water System, MCL = 1 μg/L)



Theoretical Cancer Cases Prevented per Year; Undiscounted and Discounted at 7% (Small Water Systems, MCL = 1 µg/L)



Fatal Defect 5

CDPH CBA DOES NOT ADDRESS ECONOMIC FEASIBILITY

Economic Feasibility is a Key Statutory Criterion

1. CDPH benefit-cost analysis is silent.
2. An economics-based definition:
   benefits exceed costs.
   a. Consistent with other State agency definitions.
   b. Consistent with private decision-making.
   c. Using this definition, no MCL < 50 ppb is economically feasible.
3. What definition is required to include $200m+ per cancer case?

SUMMARY AND CONCLUSIONS

CDPH Benefit-Cost Analysis Is Invalid and Unreliable for Decision-Making Even if OEHHA Risk Assessment is Accurate

1. CDPH BCA of alternative hexavalent chromium MCLs contains at least 5 fatal errors; work products this substandard must be rejected.
2. CDPH is required by law to include *economic feasibility* in standard-setting, but its cost-benefit analysis neither defines it nor analyzes it.
   a. Scientific (i.e., testable) def'n: benefits < costs.
   b. Policy def'n: all others; subjective & untestable.
3. Correcting only *some* errors yields B/C < 0.1.

References

RICHARD B. BELZER, 2013a. *A Review of the California Department of Public Health's Cost-Benefit Analysis in Support of a Proposed Primary Drinking Water Standard for Hexavalent Chromium (Cr VI)*.

RICHARD B. BELZER, 2013b. *A Review of the California Department of Public Health's Cost---Benefit Analysis in Support of a Proposed Primary Drinking Water Standard for Hexavalent Chromium [Cr(VI)]: Addendum with Third---Party Cost Estimates*.

RICHARD B. BELZER, 2013c. *Costs and Benefits of a Hexavalent Chromium Drinking Water Standard in Willows and Dixon, California*.

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH, 2013. *Procedure for Cost-Benefit Analysis of Hexavalent Chromium*.

ISSAM NAJM, 2013. *Review of CDPH's Economic Analysis Supporting the Draft California MCL for Hexavalent Chromium in Drinking Water.*

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