Cost-Effectiveness of Perchlorate Drinking Water Treatment in California

Richard B. Belzer, PhD
Regulatory Checkbook
Mt. Vernon, VA

REGULATORY CHECKBOOK

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  - Mission: Promote high-quality, policy-neutral science and economics in regulatory decision making
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Procedures for Setting the California MCL

- Selects possible draft MCL concentrations for evaluation
- Evaluates the occurrence data
- Evaluates available analytical methods and estimates monitoring costs at various draft MCL concentrations
- Estimates population exposures at various draft MCL concentrations of the chemical
- Identifies best available technologies for treatment
- Estimates treatment costs at the possible draft MCL concentrations
- Reviews the costs and associated health benefits (health risk reductions) that result from treatment at the possible draft MCL concentrations
- Selects an MCL for proposal from the possible draft MCL concentrations considered above

Source: California Department of Health Services

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Kennedy/Jenks Consultants Report

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- Identify ‘potential beneficiaries’.
  - Health risk is controversial; National Academy review near completion will reduce uncertainty.
  - Subpopulation of concern is the developing baby.
    - No appreciable risk with sufficient iodine nutrition.
    - I nutrition generally adequate, enhanced by prenatal vitamins.
  - ‘Potential beneficiary’ defined: Developing baby whose mother does not take prenatal vitamins.

Scope of This Analysis

- Estimate monthly costs if spread across local ratepayers.
- Identify ‘potential beneficiaries’.
  - Why the qualifier ‘potential’?
    - Iodine deficiency is rare or nonexistent in the US.
    - Without iodine deficiency, objectively measured health benefits are likely to be zero.
    - Subjective benefits (e.g., ‘peace of mind’) are excluded.

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- Compare cost-effectiveness with an alternative that offers unambiguously greater public health benefits.

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  - Cost-effectiveness analysis is often preferred where health benefits are hard to monetize.
  - Cost-effectiveness analysis is routinely used to evaluate medical interventions.

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- Generally, the C-E ratio is monetized cost divided by non-monetized health benefits.
- In this analysis, the C-E ratio is monetized cost divided by potential number of beneficiaries. Why?
  - The existence of any health benefit is scientifically controversial; the NAS report may resolve this.
  - If benefits exist, their units will be controversial.

What Is Cost-Effectiveness?

- Generally, the C-E ratio is monetized cost divided by non-monetized health benefits.
- In this analysis, the C-E ratio is monetized cost divided by potential number of beneficiaries.
- Lower values are always preferred to higher values.

Summary of K/JC Results by Design Case

	150 gpm	300 gpm	600 gpm	1,000 gpm	2,000 gpm	5,000 gpm
Average Annual Cost ($K)	$92	$136	$220	$351	$619	$1,019
Average Annual Prod'n (AF)	54	188	349	743	1,351	2,286

Costs of Alternative MCLs

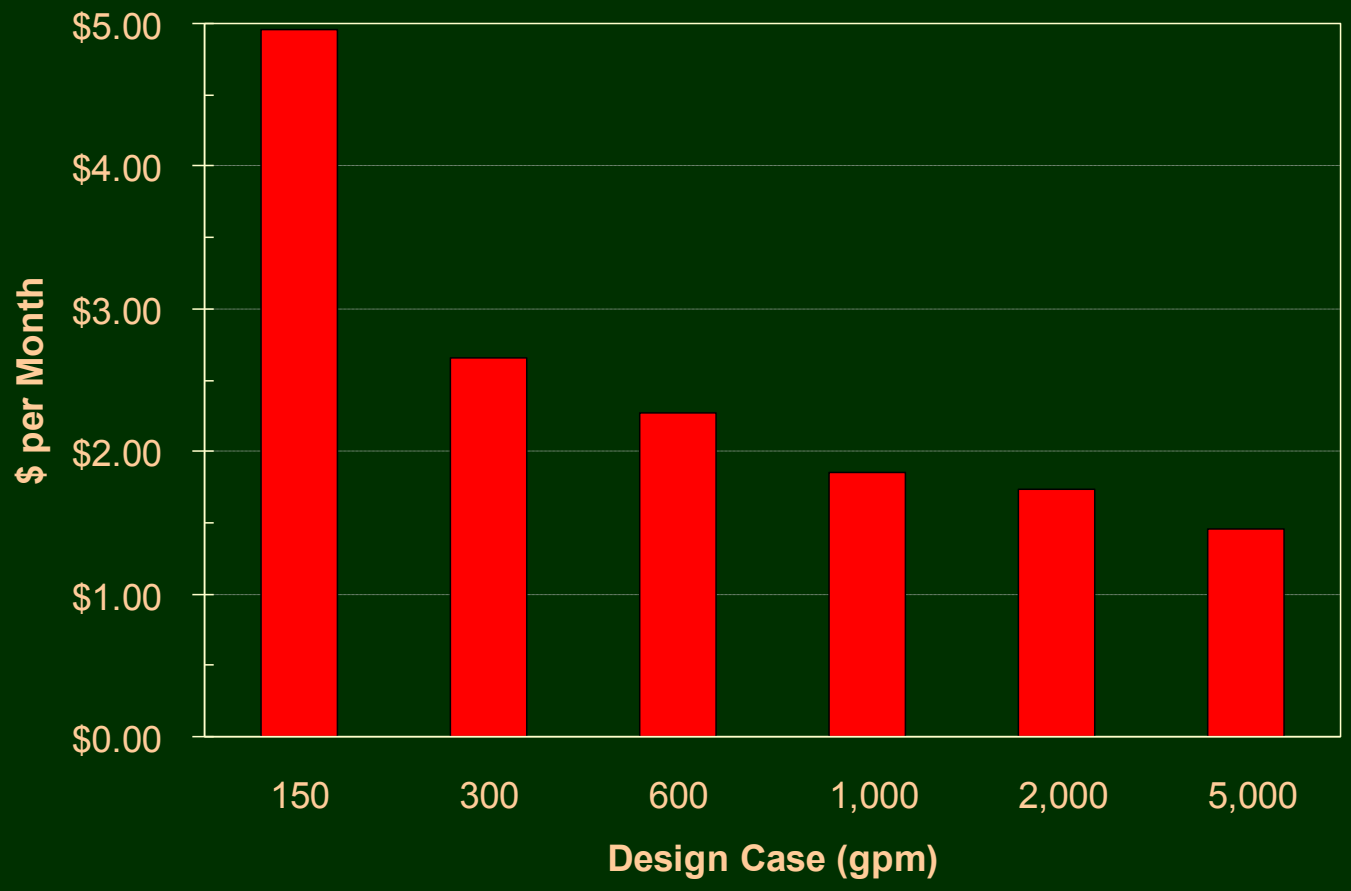
- Treatment technology is ‘lumpy’.
  - If source water < MCL, no treatment.
  - If source water > MCL, treatment.
- If treatment is required, cost does not depend on the choice of MCL.
- If treatment is not required, cost-effectiveness is irrelevant.
- This analysis explores the cost-effectiveness assuming treatment is required.

Estimated Population Served by Design Case

	150 gpm	300 gpm	600 gpm	1,000 gpm	2,000 gpm	5,000 gpm
Method #1	1,550	3,100	6,199	10,332	20,664	51,660
Method #2	1,544	5,376	9,979	21,245	38,630	65,365
Ratio	1.00	1.73	1.61	2.06	1.87	1.27
Average	**1,547**	**4,238**	**8,089**	**15,789**	**29,647**	**58,513**

[1] Derived from design case capacity.
[2] Derived from estimated annual water production.
[3] Annual household consumption: 146,000 gallons (AwwaRF).

Small Apparent Increase in Monthly Household Water Bills



Potential Beneficiaries Are a Small Subset of the Population Served

	150 gpm	300 gpm	600 gpm	1,000 gpm	2,000 gpm	5,000 gpm
Pop'n Served	1,547	4,238	8,089	15,789	29,647	58,513
♀ Pop'n[1] (50.9%)	787	2,157	4,117	8,036	15,090	29,783
Births[1] (2.7%)	21	58	111	217	407	804
No Prenatal Vitamins[2] (25%)	5	15	28	55	104	204

[1]US Census Bureau; US Census Bureau [Live Births/♀ Population = 2.7%].
[3] HNANES III.

What Percent of Babies are Iodine Deficient?

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- According to WHO, US is iodine replete.
- The Federal NHANES survey supports this conclusion.
  - Confirms that the US population is iodine replete.
  - Cannot be used to estimate the incidence of iodine deficiency.
  - Cannot address whether specific individuals are iodine deficient.

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- According to WHO, US is iodine replete.
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- According to WHO, US is iodine replete.
- The Federal NHANES survey supports this conclusion.
- It's hard for an individual to be iodine deficient.
  - Avoid iodine-rich foods (e.g., meat, fish, dairy, eggs), additives (e.g., carrageen, alginate, FD&C R3), iodized salt
  - Avoid supplements containing iodine (e.g., kelp, prenatal multivitamins)
  - Consume large amounts of iodine-blocking foods (e.g., cruciferous vegetables, spinach)

Cost-Effectiveness Gets Worse as the Incidence of Iodine Deficiency Declines

- Lower values are always preferred to higher values.
  - Cost-effectiveness ratio is lowest if all developing babies are iodine deficient.
  - Cost-effectiveness ratio is highest if all developing babies are iodine sufficient.

Cost-Effectiveness Gets Worse as the Incidence of Iodine Deficiency Declines

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- Because the population is iodine replete, incidence is expected to be very low.

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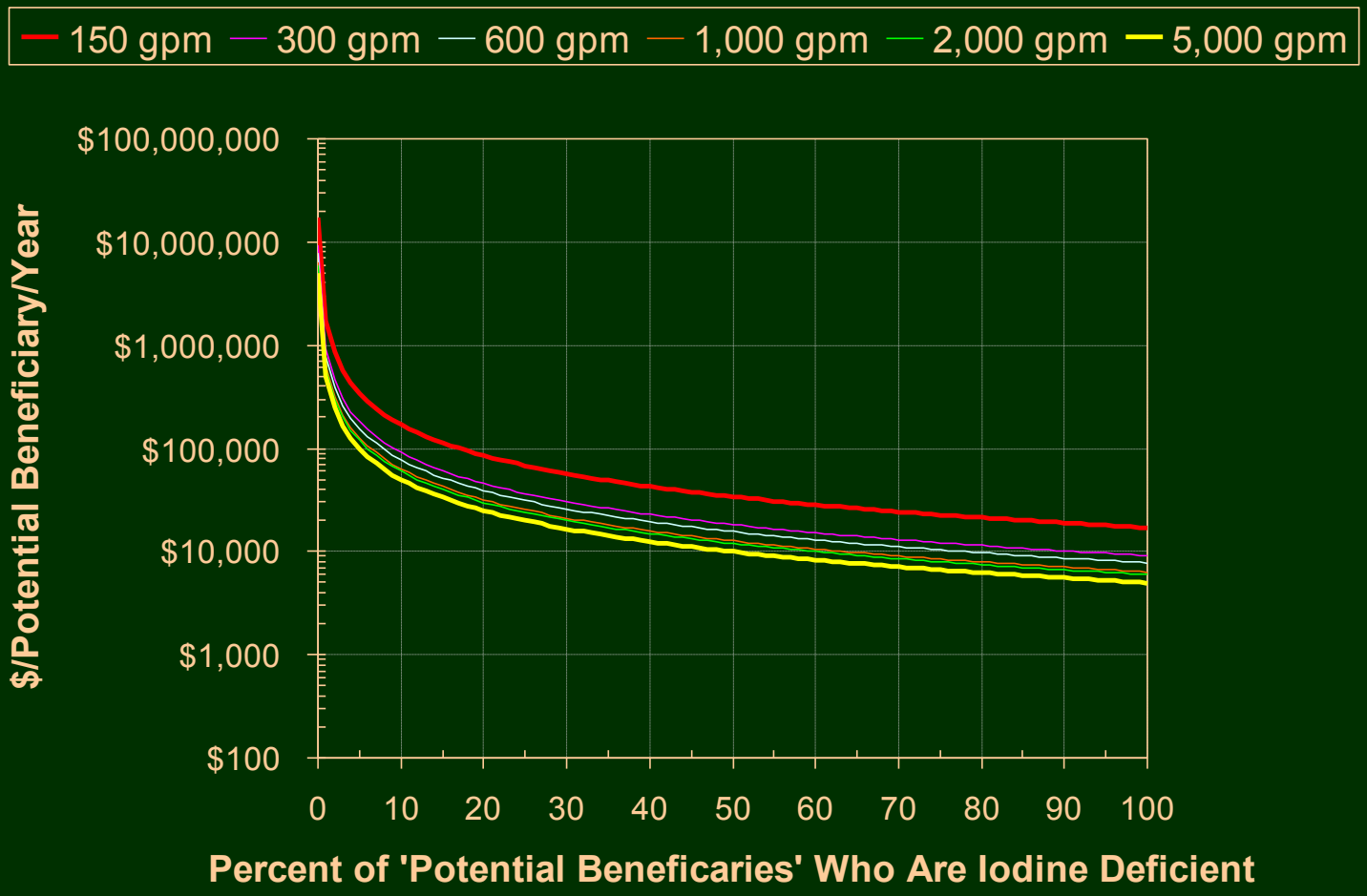
- Because the population is iodine replete, incidence is expected to be very low.
- Actual incidence is unknown, so this analysis shows results for all scenarios ranging from 0% to 100% incidence.

Annual Perchlorate Treatment Cost per Potential Beneficiary by Design Case



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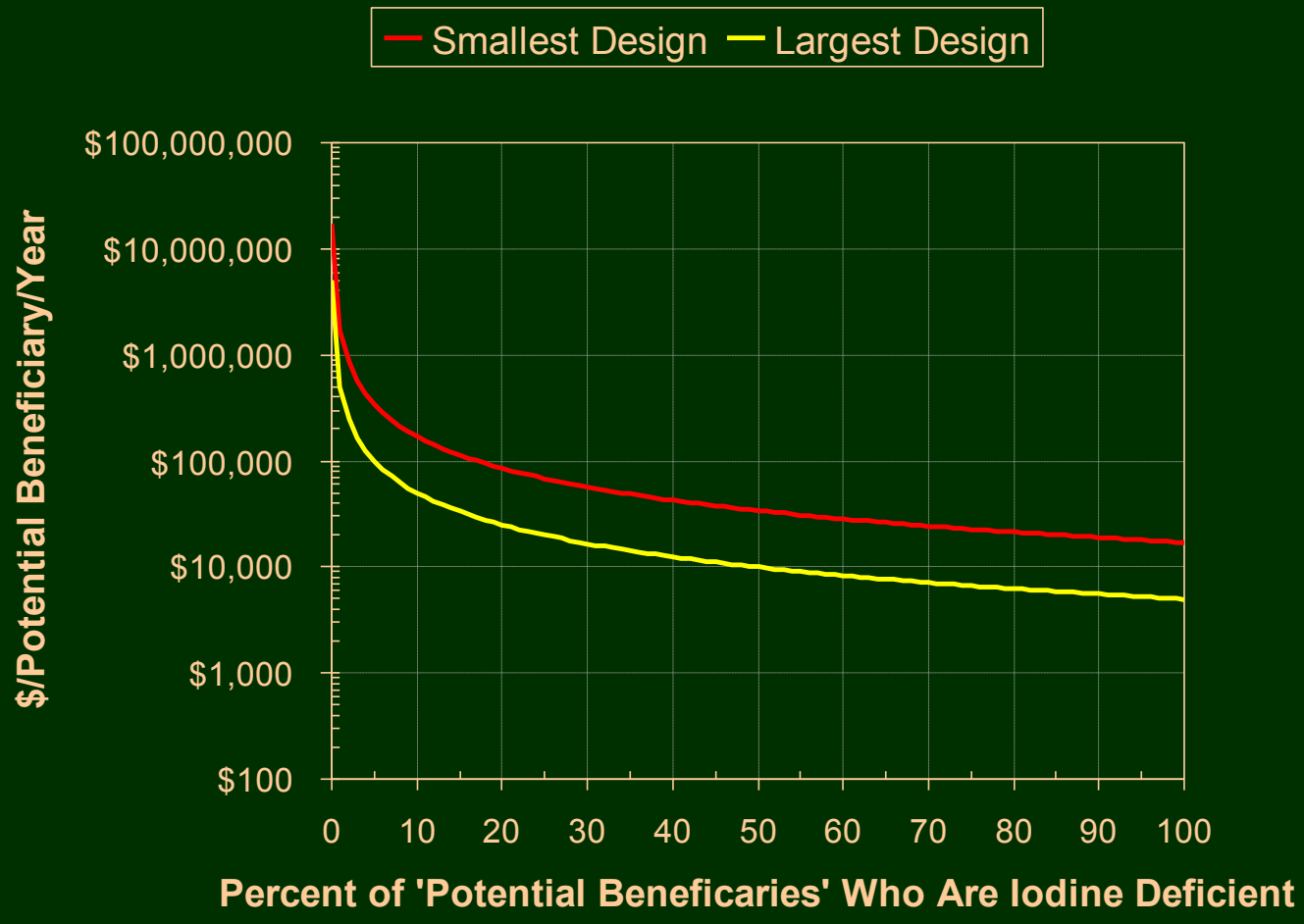


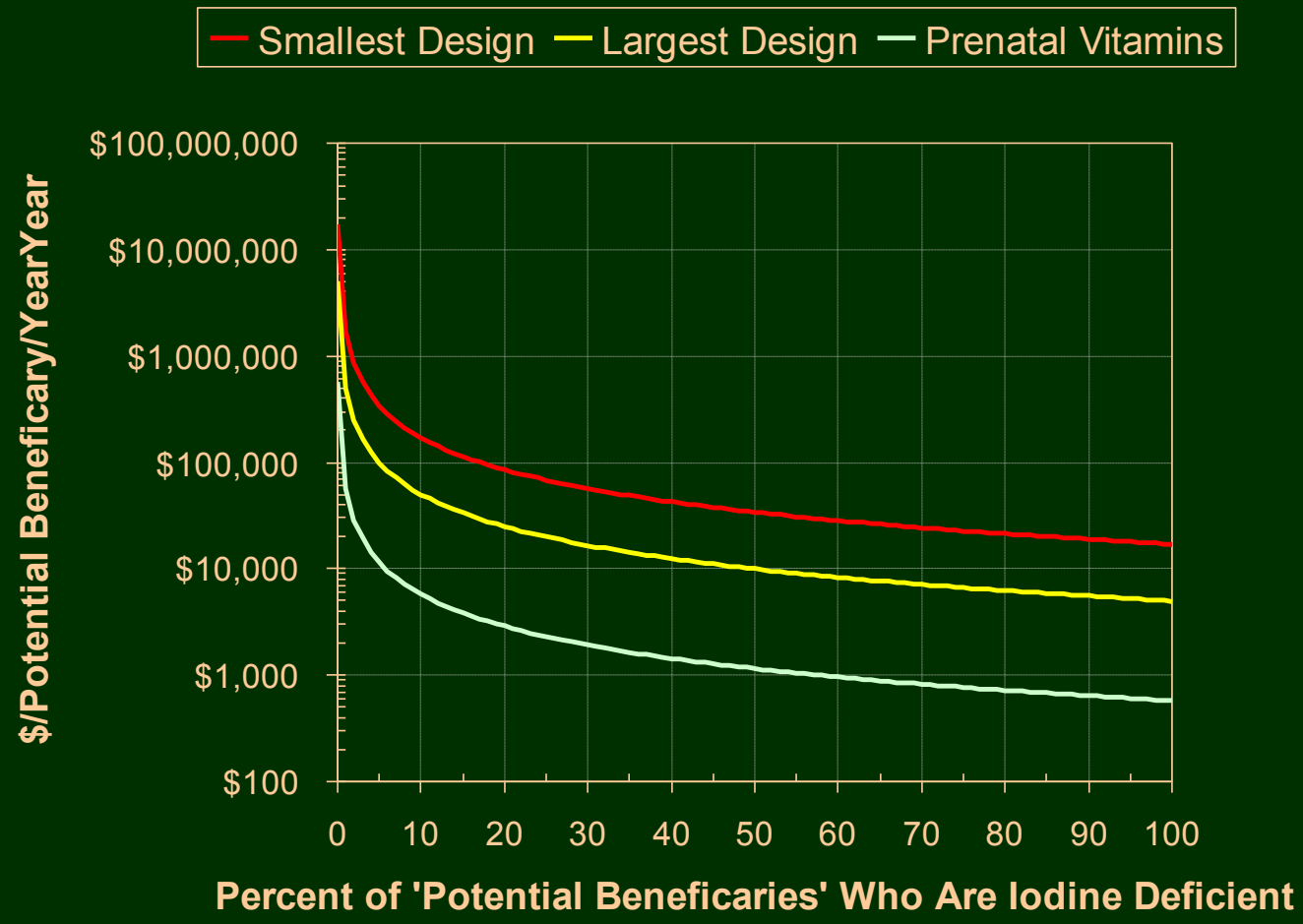
Cost of an Unambiguously Superior Alternative

- Supply prenatal vitamins.
  - 300 mcg iodine = 200% recommended daily value
  - < $25 for 120 capsules (2 months' supply)
  - $12 per month, $144 per year

Cost of an Unambiguously Superior Alternative

- Supply prenatal vitamins.
- Why is this alternative unambiguously superior?
  - It ensures that developing babies get adequate iodine nutrition.
  - It renders moot the uncertainty over low-level perchlorate risk.
  - It achieves other important health benefits (e.g., folic acid reduces risk of neural tube defects)

Cost-Effectiveness of Perchlorate Treatment v. Vitamin Supplementation*



*12 months' supply of prenatal vitamins with iodine for all pregnant women.

Costs per 'Potential Beneficiary' Compared

- Water treatment*

$5k-17k	100% ID
$500k-1,700k	1% ID
$5,000k-17,000k	0.1% ID

* Rounded to 2 significant figures

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- Prenatal vitamins**

$576	100% ID
$57,600	1% ID
$576,000	0.1% ID

* Rounded to 2 significant figures; *** Rounded to 3 significant figures

Costs per 'Potential Beneficiary' Compared

- Providing prenatal vitamins with iodine to ALL pregnant women is 10-30 times more cost-effective than water treatment.

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Costs per 'Potential Beneficiary' Compared

- Providing prenatal vitamins with iodine to ALL pregnant women is 10-30 times more cost-effective than water treatment.
- Implications
  - 10-30 times more babies protected at same cost.
  - Same number of babies protected at 3-10% of the cost.

* Rounded to 2 significant figures; *** Rounded to 3 significant figures

Conclusions

- Water treatment
  - Looks reasonable only if subsidized by non-beneficiaries.
  - Does not address underlying iodine deficiency, if it exists.

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  - Prevent fetal iodine deficiency.
  - Prevent other developmental health risks.

Conclusions

- Water treatment…
  - Looks reasonable only if subsidized by non-beneficiaries.
  - Does not address underlying iodine deficiency, if it exists.
- Prenatal vitamins offer significant public health advantages.
  - Prevent fetal iodine deficiency.
  - Prevent other developmental health risks.
- 10-30 times more cost-effective
  - Same benefits to babies at 3-10% of the cost.
  - 10-30 times as many babies protected for the same cost.

Questions?

Richard B. Belzer, PhD
Regulatory Checkbook
(703) 780-1850 v
(202) 476-1626 f
Belzer@RegulatoryCheckbook.Org