CHROMIUM-6
DRINKING WATER REGULATION

OUTLINE

- Chromium
- History of the Regulation
- Regulation Impact
- Occurrence in Water Supplies
- Treatment Options
- Non-Treatment Options
- Next Steps

CHROMIUM (Cr)

- Chromic oxide – 9th most abundant compound on earth's crust
- Occurs primarily as chromium-3 (CrIII; Trivalent Chromium) or chromium-6 (CrVI; Hexavalent Chromium)
  - CrIII, a required nutrient found in vegetables, fruits, meats, grains and yeast; essential to normal glucose, protein and fat metabolism in humans.
  - CrVI, found in the environment from the erosion of natural chromium deposits.

CHROMIUM (Cr)

- Some isolated industrial sources:
  - Stainless steel, leather tanning, wood preservation, textile dyes and corrosion protection.
  - Hinkley, CA
    - PG&E operates a compressor station to recompress the natural gas in their transmission pipelines.
    - CrVI was added to the water used in cooling towers to prevent rust in the machinery.
    - The contaminated water was stored in unlined ponds which entered the groundwater.

CHROMIUM REGULATION

- In 1977, the State of California set the State's Maximum Contaminant Level (MCL) for Total Chromium:
  - 0.05 mg/L = 50 ppb
  - Total Chromium = CrIII + CrVI
  - Assumes Total Chromium = CrVI
- About 1 drop in 250 – 55 gallon drums

CHROMIUM REGULATION

- 1977 - US Environment Protection Agency (EPA) adopted California's Total Chromium MCL:
  - 0.05 mg/L = 50 ppb (National MCL)
- 1991 - EPA raised the Total Chromium MCL:
  - 0.1 mg/L = 100 ppb (National MCL)
- 2000 - Erin Brockovich creates attention to CrVI and prompts legislature to focus on the development of a more stringent CrVI MCL.

CHROMIUM REGULATION

- 2001 – Utility agencies in CA begin monitoring for CrVI under CA UCMR
  - UCMR – Unregulated Contaminant Monitoring Rule
    - Currently in its third round; UCMR 3
    - The EPA selects 30 contaminants to monitor.
    - The data is used to support the decision to regulate a contaminant in the interest of protecting public health.

- 2001 – California Department of Public Health (CDPH) requests that the Office of Environmental Health Hazard Assessment (OEHHA) develop a Public Health Goal (PHG) for CrVI.

CHROMIUM VI REGULATION

- Oct, 2001 – Governor signed SB-351 requiring that the CDPH adopt a MCL for CrVI by 1/1/2004.

- Aug, 2009 – OEHHA releases draft PHG at 60 ppt.
  - 1 ppt = 1 drop in 20 Olympic-sized pools.

CHROMIUM VI REGULATION

- Dec, 2010 – OEHHA releases draft PHG at 20 ppt, which is then finalized in July, 2011.
  - With an approved PHG, the CDPH could now begin on setting an MCL for CrVI as required by SB-351 (2001).
  - CDPH is mandated by law to set the MCL as close as "**practically and economically feasible**" to the State's PHG

- Dec, 2013 - Superior Court rules in favor of NRDC/EWG and requires that CDPH set an MCL by Aug 31, 2013.

- Aug, 2014 – CDPH sets CrVI MCL at 10 ppb.

CHROMIUM VI REGULATION

- California Administrative Procedure Act allows up to one year to finalize new regulations (i.e. Aug 23, 2014)

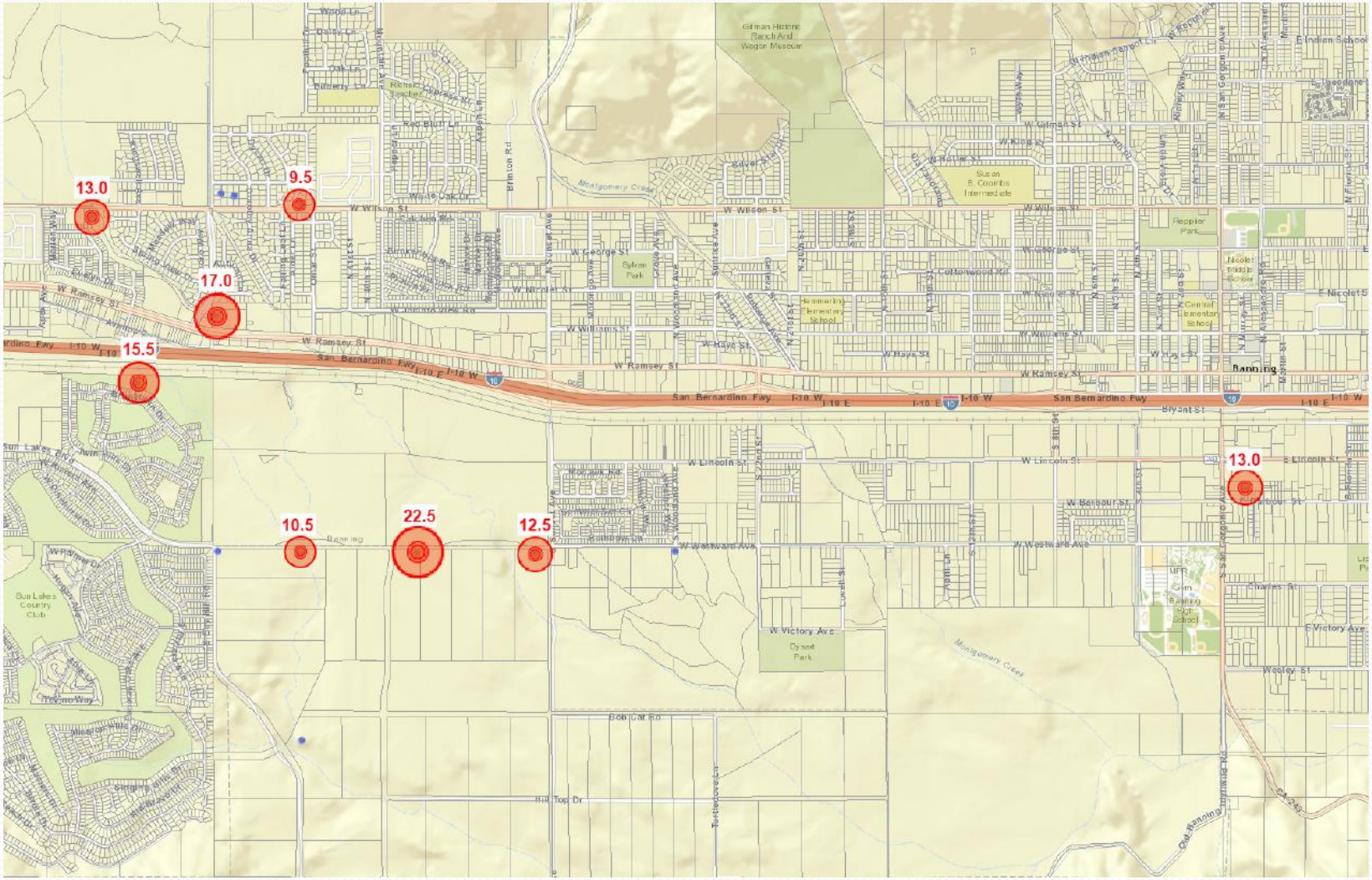
- CDPH dismisses most of 20,000 comments received.
  - CDPH underestimated the occurrence and compliance costs of meeting the new CrVI MCL.
  - Ex: CDPH database showed that the City of Banning only had 1 sources that would exceed the MCL, when in reality there are 7 sources.
  - Ex: CDPH database showed that the CVWD had 8 sources that would exceed the MCL, when in reality there are 30 sources.

- On June 20, 2014 water agencies received a letter from the CDPH stating that the new MCL for CrVI would become effective on July 1, 2014.

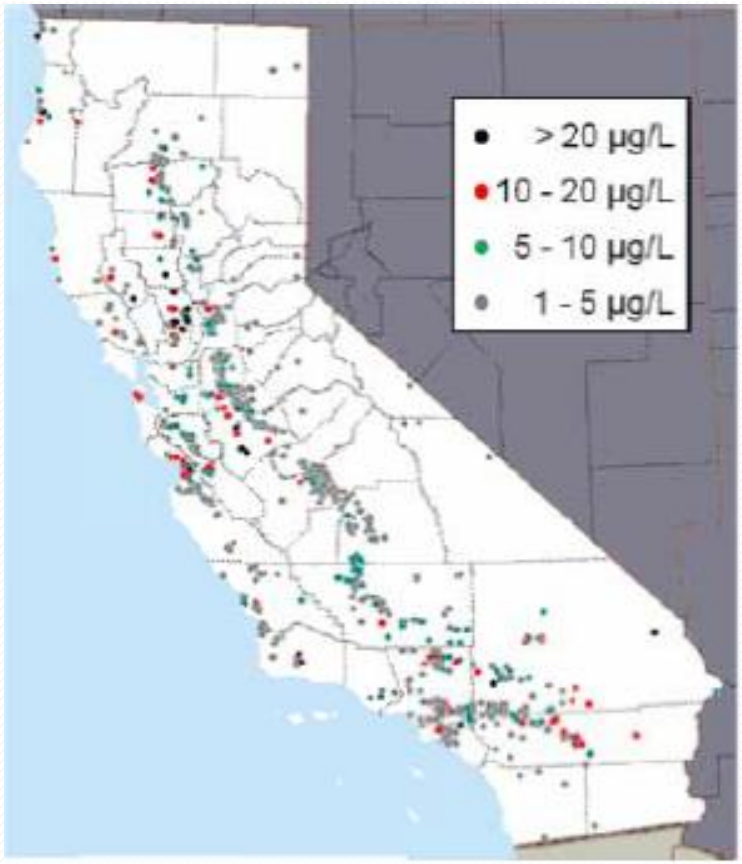
IMPACT OF NEW MCL

- Estimated Statewide Costs:
  - Capital Costs: $4.1 Billion
  - Annual O&M Costs: $231 Million
- Initial monitoring must begin on or before January 1, 2015.
- Quarterly monitoring is required when the MCL is exceeded.
  - Compliance is determined by whether a running annual average exceeds the MCL.

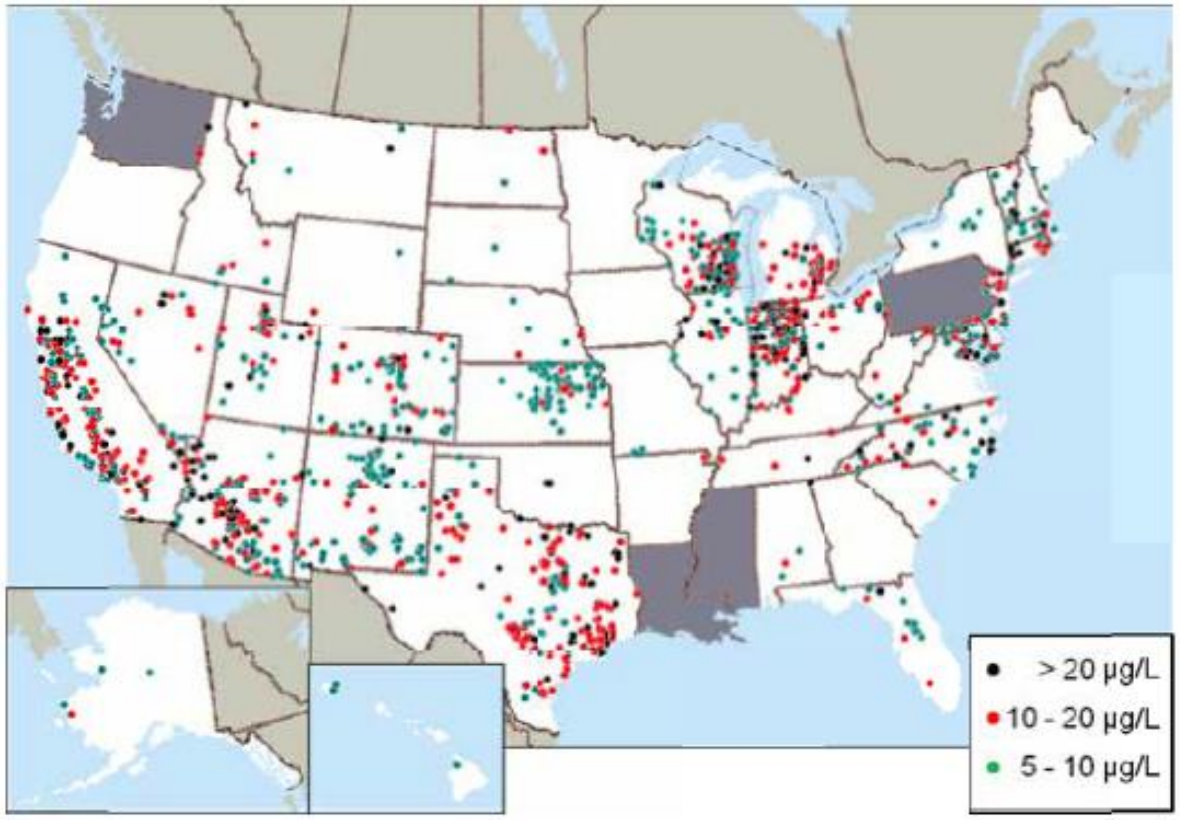
LOCAL OCCURRENCE



OCCURRENCE STATE WIDE



OCCURRENCE IN THE U.S.



MONITORING

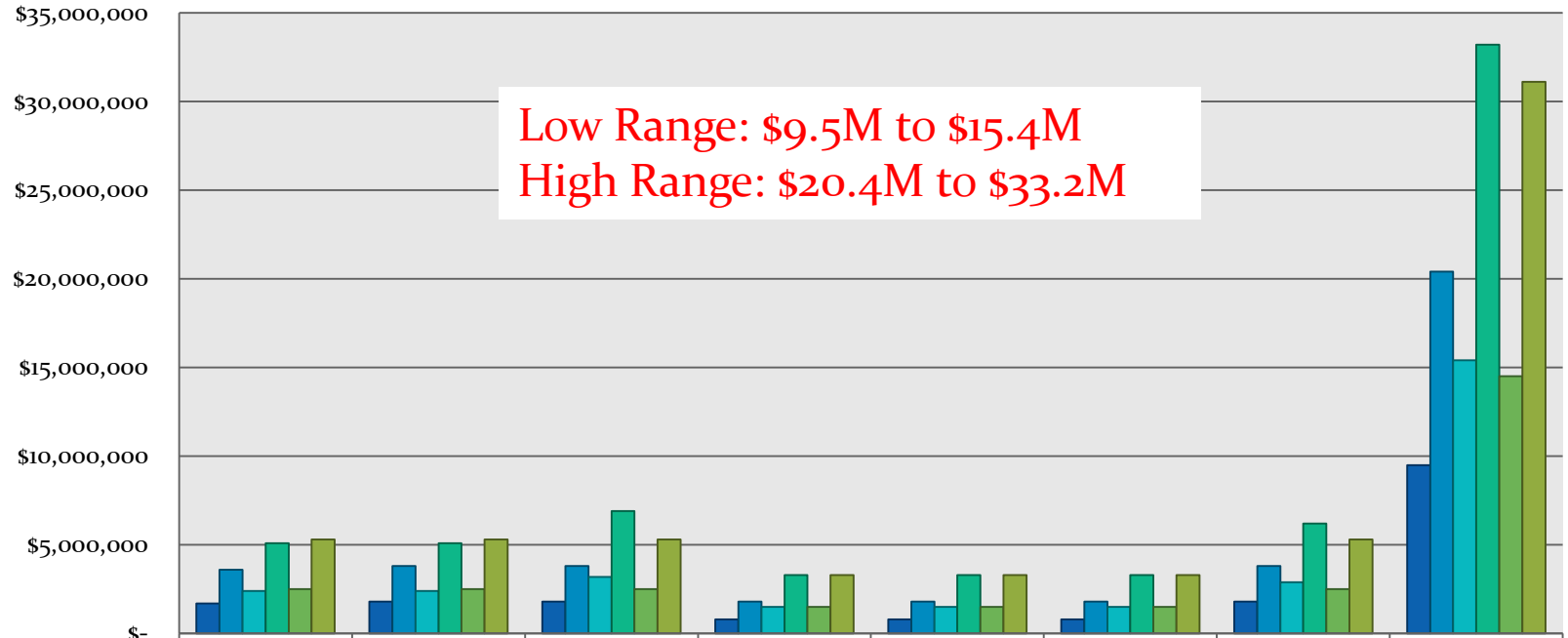
WELLS	3 Quarter Average CrVI (ppb)		AVG PRODUCTION AC-FT/YR (2010-2014)
→ C2	17.0	12.8	143
→ C3	15.7	11.8	660
→ C4	14.3	10.8	530
→ C6	13.3	10.0	463
M10	11.0		158
M11	11.5		420
→ M12	23.0	17.3	236
			Σ = 2,710

- 2010-2014 City Wide Average Production = 8,500 AC-FT/YR

TREATMENT OPTIONS
BEST AVAILABLE TECHNOLOGIES

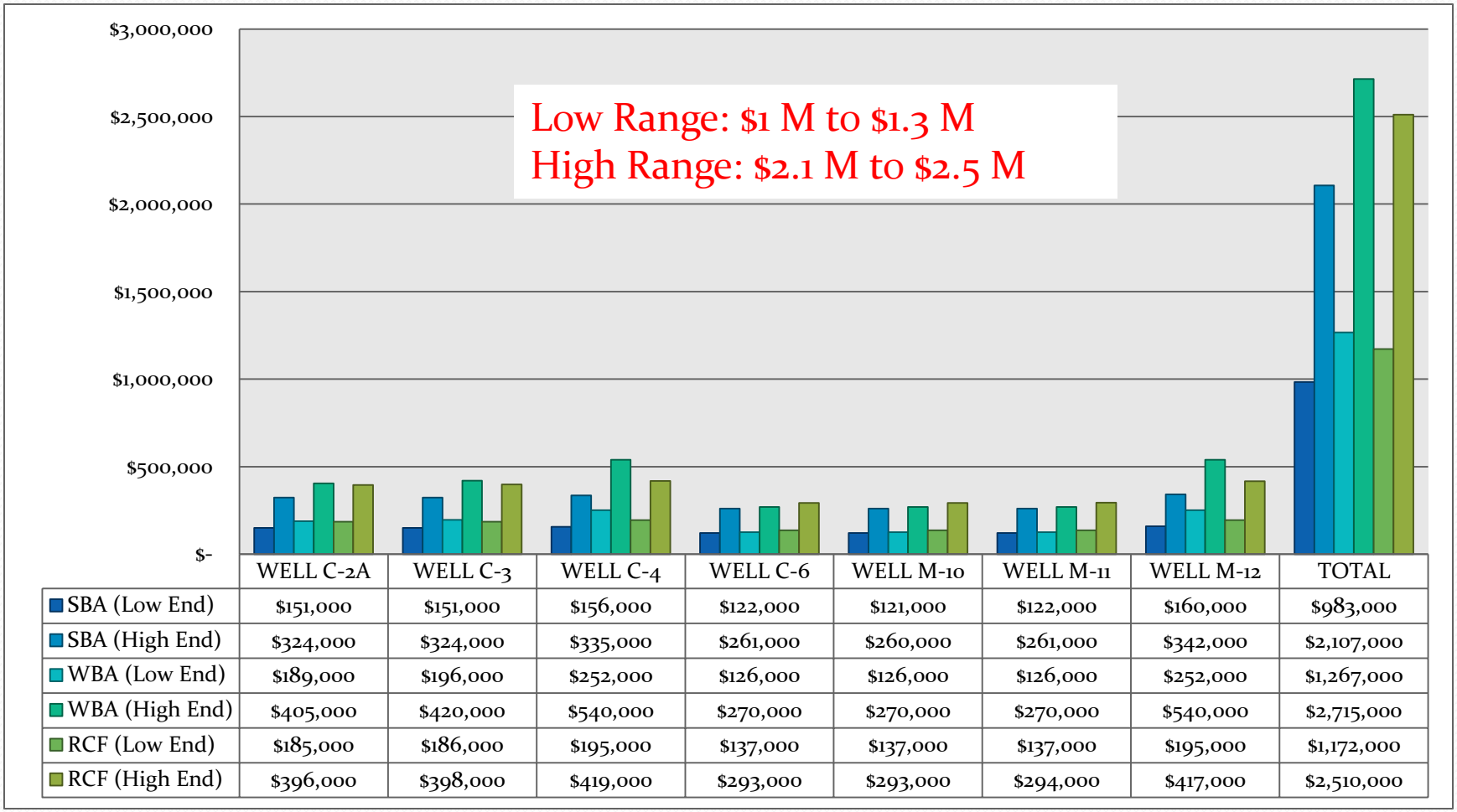
- Weak Base Anion Exchange (WBA)
- Strong Base Anion Exchange (SBA)
- Reduction Coagulation Filtration (RCF)

TREATMENT COSTS (CAPITAL)



	WELL C-2A	WELL C-3	WELL C-4	WELL C-6	WELL M-10	WELL M-11	WELL M-12	TOTAL
SBA (Low End)	$1,700,000	$1,800,000	$1,800,000	$800,000	$800,000	$800,000	$1,800,000	$9,500,000
SBA (High End)	$3,600,000	$3,800,000	$3,800,000	$1,800,000	$1,800,000	$1,800,000	$3,800,000	$20,400,000
WBA (Low End)	$2,400,000	$2,400,000	$3,200,000	$1,500,000	$1,500,000	$1,500,000	$2,900,000	$15,400,000
WBA (High End)	$5,100,000	$5,100,000	$6,900,000	$3,300,000	$3,300,000	$3,300,000	$6,200,000	$33,200,000
RCF (Low End)	$2,500,000	$2,500,000	$2,500,000	$1,500,000	$1,500,000	$1,500,000	$2,500,000	$14,500,000
RCF (High End)	$5,300,000	$5,300,000	$5,300,000	$3,300,000	$3,300,000	$3,300,000	$5,300,000	$31,100,000

TREATMENT COSTS (O&M; $/YEAR)



	WELL C-2A	WELL C-3	WELL C-4	WELL C-6	WELL M-10	WELL M-11	WELL M-12	TOTAL
SBA (Low End)	$151,000	$151,000	$156,000	$122,000	$121,000	$122,000	$160,000	$983,000
SBA (High End)	$324,000	$324,000	$335,000	$261,000	$260,000	$261,000	$342,000	$2,107,000
WBA (Low End)	$189,000	$196,000	$252,000	$126,000	$126,000	$126,000	$252,000	$1,267,000
WBA (High End)	$405,000	$420,000	$540,000	$270,000	$270,000	$270,000	$540,000	$2,715,000
RCF (Low End)	$185,000	$186,000	$195,000	$137,000	$137,000	$137,000	$195,000	$1,172,000
RCF (High End)	$396,000	$398,000	$419,000	$293,000	$293,000	$294,000	$417,000	$2,510,000

NON-TREATMENT OPTION

- Dynamic Well Profiling and CrVI Isolation.
  - Process of determining at which depths the highest levels of CrVI are entering the well.
  - Blank casings to reduce CrVI intrusion.
  - Possible loss of production in the well.
- Profiling cost = $30,000 per well ($210,000)
- Construction cost = $150,000 per well ($1.05 M)

- Converting wells to non-potable wells.

CORRECTIVE ACTION PLAN

- Dynamic Well Profiling
  - November, 2015 – April, 2016
- Modifications to Wells
  - November, 2016 – May, 2017
- Analysis to Determine Treatment Options
  - November, 2016- August, 2017
- Design/Construction of Treatment Facilities
  - December, 2017 – May, 2019

SB-385 (Hueso)

- What it does:
  - Allows a public water system to apply for a limited period of time to achieve compliance.
  - Requires water systems to prepare and submit a compliance plan.
  - Requires that water customers be informed of compliance progress.
- What it doesn't do:
  - The bill does not delay compliance efforts.
  - The bill does not exempt any public water systems from compliance with the MCL.
  - The bill does not modify the MCL of 10 ppb.

QUESTIONS?