

Nitrate Effects on Public Water System Wells

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Public Health Concerns of Nitrate/Nitrite in Drinking Water

- Nitrite can interfere with the ability of red blood cells to carry oxygen to the tissues of the body, a condition called
 - Methemoglobinemia
- Of greatest concern in infants, whose immature stomach environment enables conversion of nitrate to nitrite, which is then absorbed into the blood stream
 - “Blue baby syndrome”
- Considered an acute contaminant; health deteriorates rapidly over a period of days; can lead to death
- High nitrate levels may also effect the oxygen-carrying ability of the blood of pregnant women

Public Water Systems

- A “public water system” is a system for the provision of piped water to the public (does not refer to ownership of the system)
 - Community water systems serve residential communities with 15 or more service connections
 - Noncommunity water systems serve 25 or more people, 60 or more days per year
 - Nontransient = serves the same population daily (schools, places of business)
 - Transient = serves a changing population (campgrounds, restaurants)
- Public water systems are regulated by CDPH and 35 counties
- “State Small Systems” are communities with 5 to 14 service connections; counties regulate these systems
- Doesn’t include agricultural use
- My talk will refer to data from public water system wells



What About Water from Private Wells?

- Most water systems with < 5 service connections are not regulated after permit and installation, though there are some exceptions
- Public water system wells are tested regularly for nitrate and nitrite
- There are no requirements for private wells to be tested
- Some knowledgeable real estate agents and lenders will ask for a water sample as a condition of sale or refinance
- Homeowners are encouraged to sample their wells

Maximum Contaminant Levels for Nitrate/Nitrite in PWS

- The US EPA established a “Maximum Contaminant Level Goal” (MCLG) for nitrate based on health effects; California’s Public Health Goal (PHG) was set at the same level
 - 45 mg/L as NO₃ (10 mg/L as N);
- The MCL for nitrate was established by US EPA and CDPH at the same level as the MCLG/PHG
- The MCLG/PHG and MCL for nitrate + nitrite
 - 10 mg/L as N
- The MCLG/PHG and MCL for nitrite
 - 1 mg/L as N
- Because nitrate tends to increase in concentration in groundwater over time, CDPH has established a “trigger” of ½ the MCL; systems detecting nitrate above this level are required to monitor more frequently

Where Has Nitrate Been Found in Drinking Water in California?

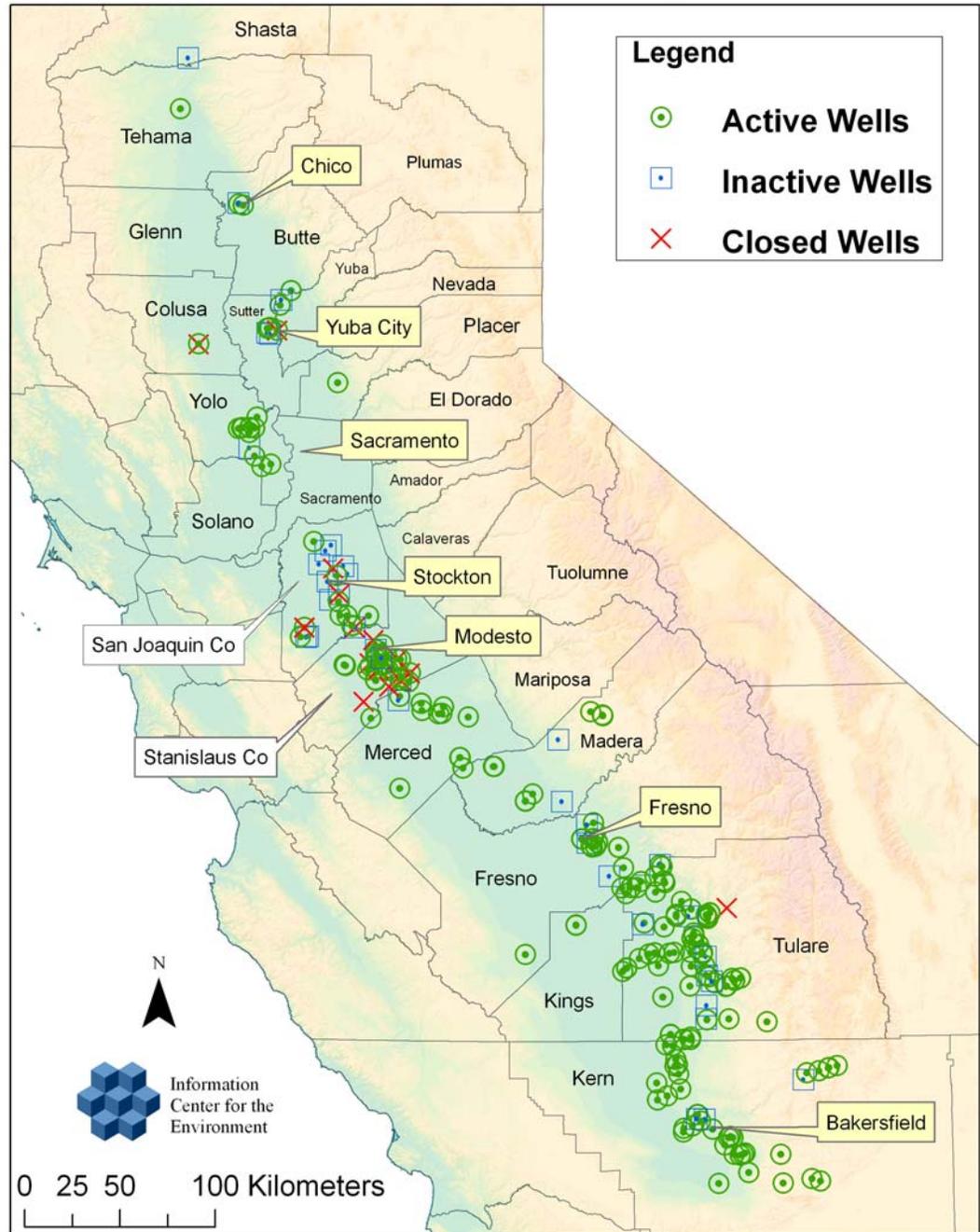
- Remember, as we start to talk about detections of nitrate and nitrite, this refers to detections from a well (“raw water”)
- This does not refer to the water delivered to customers, which may have undergone treatment or blending to reduce concentrations

Where Has Nitrate Been Found in Drinking Water in California?

- Nitrate as NO_3 detected at least once $>$ MCL in 731 sources. Counties with greatest number of detections:
 - Los Angeles (123 sources)
 - San Bernardino (82)
 - Riverside (67)
 - Kern (41)
 - Monterey (30)
- Nitrate + nitrite as N detected at least once $>$ MCL in 169 sources. Counties with greatest number of detections:
 - San Bernardino (38)
 - Los Angeles (36)
 - Riverside (24)
- Nitrite as N detected at least once $>$ MCL in 21 sources. Counties with greatest number of detections:
 - Alameda (7)
 - San Joaquin (5)
 - Kern (4)

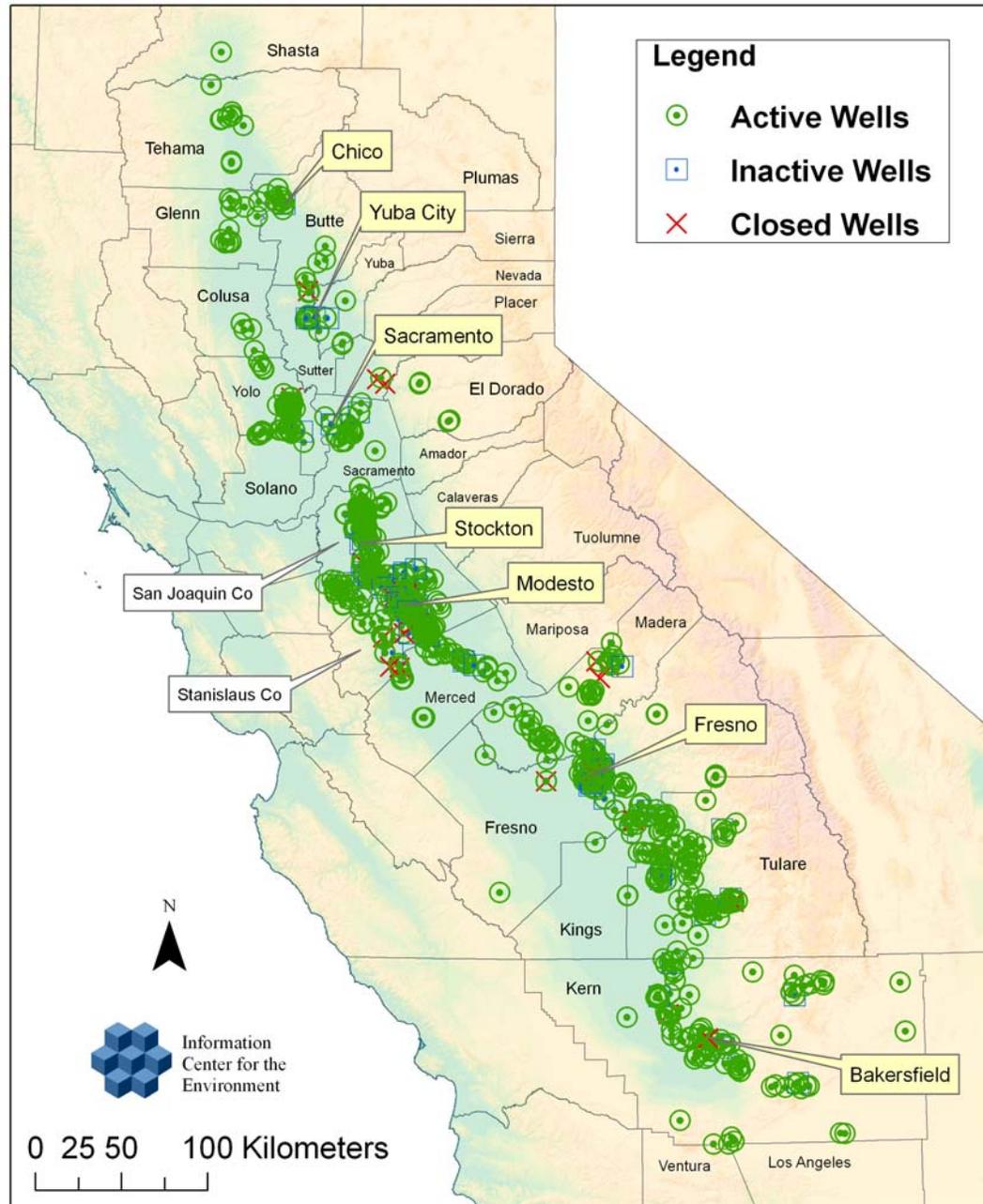
PWS Wells with NO₃ Exceeding MCL

Wells with Nitrates Exceeding MCL



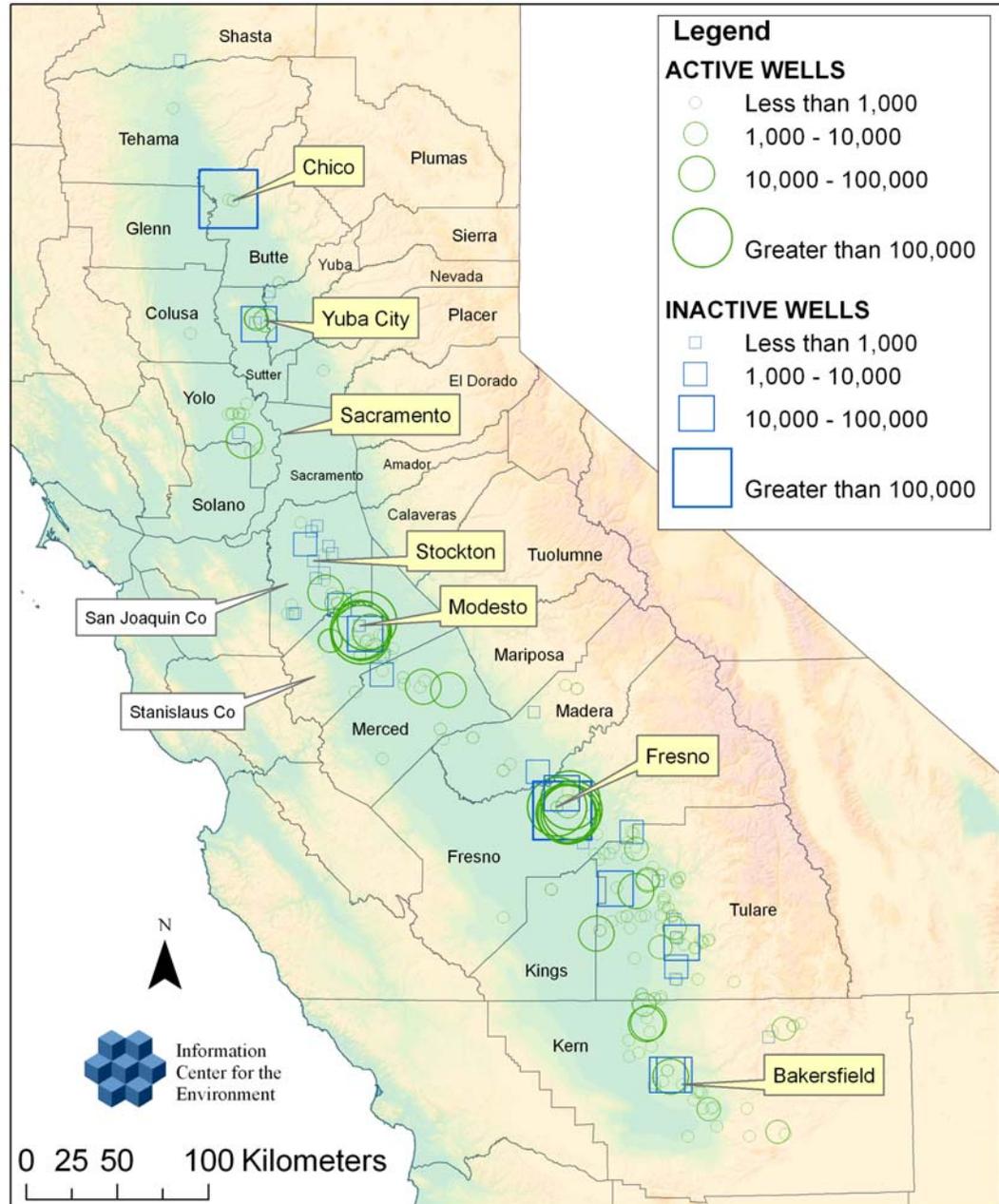
PWS Wells with NO₃ Exceeding 50% MCL

Wells with Nitrates at 50% of MCL



Population Served by Water Systems with Wells Exceeding NO_3 MCL

Population Served by Water Districts with Wells Exceeding MCL of Nitrates





Sources of Nitrate in PWS Wells

- Wells with high nitrates have been found in areas with agricultural activities and, in some cases, in areas with high density of septic systems
- CDPH Drinking Water Source Assessment and Protection Program (DWSAP)
 - 15,000 wells were located and assessed
 - When information was available, detected contaminants were associated with the activities most likely to have caused or released the contaminant
- Detailed review required to determine relationship between activities at the ground surface and detections of nitrate/nitrite in wells

Treatment Options

- Consolidation*
- Bottled water*
- Blending
 - With sources < MCL
 - Treating some portion of the flow and blending with untreated water
- Ion Exchange
 - Small business, annual costs \$20,000
 - Small school, annual costs \$8,500
 - Shafter field station, max population = 32; \$40,000 per year, mostly salt disposal
- Reverse Osmosis
 - Small winery tasting room, 32 gpm, 750 gpd
 - \$15,000 installation, annual costs \$400
- Biological denitrification?

Sources of Funding

- CDPH provides low interest loans and grants through its State Revolving Fund (SRF) program for water system improvements
 - Priority is given to small systems, disadvantaged communities, and consolidation projects
 - Economic Stimulus Funds (ARRA)
 - Upcoming increases in SRF Funding
- Proposition 84
 - Small community infrastructure improvements for chemical and nitrate contaminants (\$180 M)
 - Projects that prevent or reduce contamination of groundwater that serves as a source of drinking water (\$60 M)
 - CDPH to contract with SWRCB to develop pilot projects in the Tulare Lake Basin and the Salinas Valley that focus on nitrate contamination

Sources of Information

○ CDPH website

- Division of Drinking Water and Environmental Management

<http://ww2.cdph.ca.gov/certlic/drinkingwater/Pages/Nitrate.aspx>

- Environmental Health Investigations Branch

<http://www.ehib.org/cma/papers/NitrateFS.pdf>

○ SWRCB website

http://www.waterboards.ca.gov/water_issues/programs/gama/docs/coc_nitrate.pdf

○ US EPA

http://www.epa.gov/safewater/contaminants/dw_contamfs/nitrates.html

○ World Health Organization

http://www.who.int/water_sanitation_health/dwq/chemicals/rnitrates/en/



Questions?
