A Statewide Indicator for Drinking Water

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California Environmental Protection Agency
CalEnviroScreen 3.0
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- Spatial analysis of relative burdens in California communities from pollution and population vulnerability.
- 20 indicators combined into a single ranked score.
- Census tract scale (~8,000).

Available at: http://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30
## CalEnviroScreen 3.0 Indicators

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<td>Hazardous Waste Generators and Facilities</td>
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<td>Unemployment</td>
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### Indicators
- Pollution Burden
- Population Characteristics
- Exposures
- Sensitive Populations
- Socioeconomic Factors
Drinking Water Contaminant Indicator

**Indicator, version 3.0**

- Multi-contaminant index
- Arsenic, cadmium, DBCP, chromium VI, lead, nitrate, perchlorate, THMs, TCE, uranium, tetrachloroethylene (PCE), 1,2,3-trichloropropane (TCP), radium
- MCL Violations and Total Coliform Rule (TCR) Violation data by system incorporated

**Data sources (2005-2013)**

- Water Boundary Tool (CEHTP)
- Water Quality Monitoring (SWRCB)
- Domestic well data (USGS, SWRCB)
DRINKING WATER INDICATOR OVERVIEW

WHAT DOES THE INDICATOR DO?

➢ Combines multiple contaminant data into one index.
  ▪ Water quality varies throughout the state depending on the source and contamination in the area.
➢ Assigns water contaminant data to areas across California
➢ Compares census tracts across California based on delivered drinking water contaminant concentrations.
  ▪ Creates boundaries for areas outside of water system service areas.
  ▪ Converts data that is at the water system service boundary level and areas outside of water systems to the census tract level.

WHAT DOES THE INDICATOR NOT DO?

➢ Not a measure of a water service provider’s current compliance with regulations
➢ Does not indicate whether water is safe to drink
COMMUNITY WATER SYSTEM SERVICE BOUNDARIES [2914 SYSTEMS]

Water Boundary Tool (WBT) [84%]

Census blocks were assigned to the water system that they fall within.

Example of a water system:
East Bay MUD (CA0110005)

Approximated Boundaries [16%]

- Uses location of sample locations (well, treatment plant, etc.) within a system and population served by the system
- Builds up an approximate system boundary

*Includes state small water systems or non-community water systems that serve a retail population
Methodology

1) Clean up WBT boundaries
   ◦ Keep systems that serve residents
   ◦ Most recently uploaded water system boundaries
   ◦ Project: GCS_WGS_1984
   ◦ Run Repair Geometry Tool
   ◦ Run Dissolve Tool on PWSID

2) Remove overlay of multiple boundaries
   ◦ Prioritizes smaller systems and small systems within larger water systems

1. Create a variable = Shape_Area
2. Create individual parts [Union]
3. Sort by shape area variable [Sort]
4. Remove overlaps [Delete Identical]
5. Create system boundaries [Dissolve]
**Areas Outside of Water Systems: Groundwater Boundaries**

- Populated areas not being served by a water system boundary

- Areas are divided into Public Land Survey System townships (6×6 mile grid) which act as “system boundaries”
-Step 3- Combine systems with townships

**Erase** tool creates the holes where systems are supposed to be.

**Merge** tool merges the two layers together.
POPULATION ALLOCATION
INDICATOR ACCOUNTS FOR 99% OF CA POPULATION

- Water Boundary Tool: About 2440 systems
- Approximated Boundaries: About 470 systems
- Areas outside of PWSs (Groundwater)
- Unassigned (Groundwater)

35 Million

1.83 Million

*Population based on 2010 Census residential population (37.25 million)
Geographic boundaries for water systems and groundwater assigned areas.
Step 4) Convert to census blocks

- Intersect tool
- Dissolve tool
Census blocks fit within census tracts
Developing a Drinking Water Contaminant Index

Years of Data: 2005-2013

Contaminants: Arsenic, cadmium, DBCP, chromium VI, lead, nitrate, perchlorate, THMs, TCE, uranium, tetrachloroethylene (PCE), 1,2,3-trichloropropane (TCP), radium + MCL Violations and Total Coliform Rule (TCR) Violations

Methodology:
- Average of contaminant samples to the system or township level
  - For systems, we time-weight by year first
  - Add in raw water samples where there isn’t a treated sample test available
  - Incorporate wholesale systems
- Associate township or system averages to census blocks
Developing a Drinking Water Contaminant Index

Calculate the weighted average for each contaminant or violation measure by census tract

\[
x = \frac{\sum_{i=1}^{n} (x_i \times w_i)}{\sum_{i=1}^{n} w_i}
\]

where:
- \(x\) = contaminant averages by system or township
- \(w\) = population associated with a census block within the system or township

<table>
<thead>
<tr>
<th>Block ID</th>
<th>Tract ID</th>
<th>System or Township ID</th>
<th>Population Associated</th>
<th>Arsenic (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>060014301013004</td>
<td>6001430101</td>
<td>CA0115555</td>
<td>92</td>
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<td>CA0115555</td>
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<td>58002</td>
<td>50</td>
<td>6.0</td>
</tr>
</tbody>
</table>
DEVELOPING A DRINKING WATER CONTAMINANT INDEX

- Rank contaminant averages by census tract and assign percentile scores.
- Sum of the 13 individual contaminant percentiles plus 2 violation indicators to create overall contaminant index score. Each contaminant contributes an equal weight to the overall score.
- Rank and assign percentiles to each census tract based on their overall contaminant index score.
What are drinking water contaminants?

Most drinking water in California meets health standards. However, drinking water sometimes becomes contaminated with chemicals or bacteria above the standards. Both natural and human sources can contaminate drinking water. Natural sources include rocks, soil, wildlife and fires. Human sources include factories, sewage, and runoff from farms.

One common contaminant, arsenic, occurs naturally in some rocks and soil and is often found in groundwater in California. It can cause cancer. Nitrate from fertilizer or manure can leak into groundwater and contaminate wells. Nitrate can cause a blood disorder in infants called blue baby syndrome.

More information can be found in the Drinking Water chapter in the CalEnviroScreen 3.0 report.

Tract in Fresno, CA

Online Map of Drinking Water Indicator

Greater San Diego Area
Next Steps?

- To have a complete set of *accurate* water system boundaries in the Water Boundary Tool (about 15% left)
- To update the water contaminant data from 2005 to 2013 → 2008 to 2016
- “Ground truthing” by regions
- Stay up to date with consolidation efforts and water system updates/closures.
- Research other GIS options for areas outside of water systems (groundwater layer), such as creating a continuous surface.
Thank you!

Contact Information

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