

Indoor-Surveys, Radon Potential Maps and Their Impacts on Radon Awareness in California

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Introduction

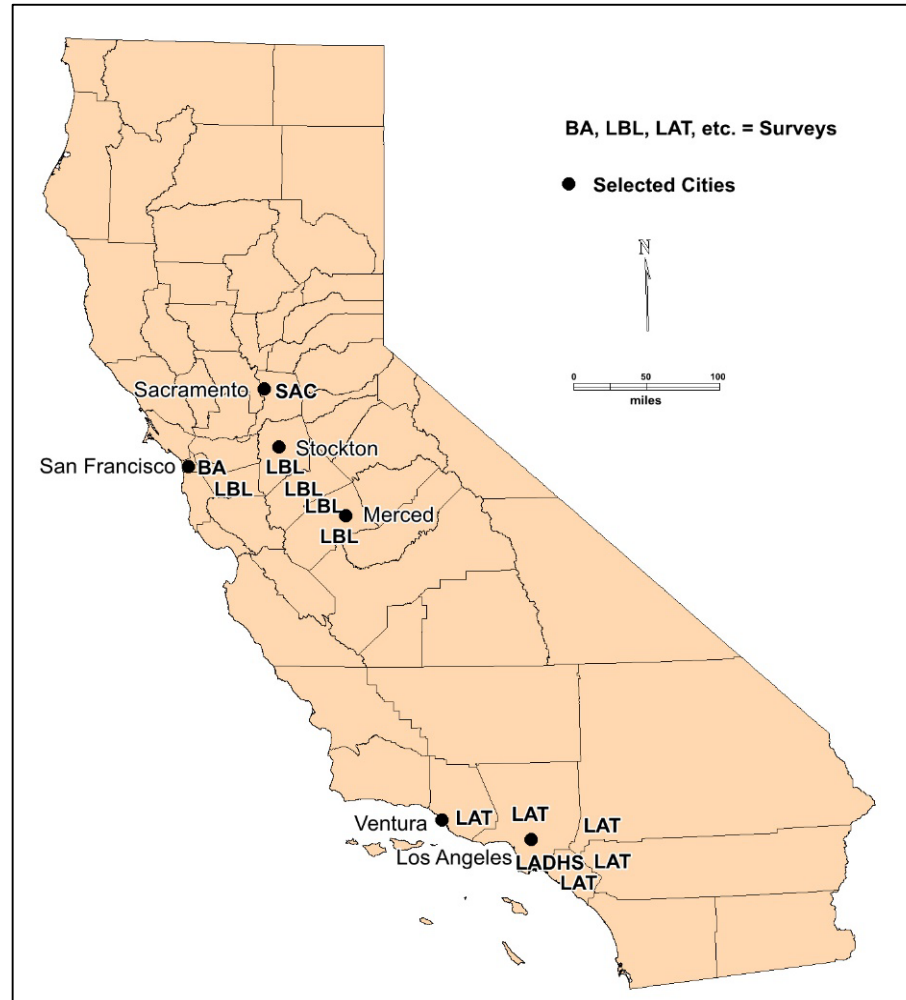
Presentation will discuss:

- **Origins and accuracy of the perspective “California does not have significant radon problems”**
- **Current California Geological Survey (CGS) and California Department of Public Health (CDPH) work to identify anomalous radon areas**
- **CGS radon potential map use by consultants**
- **The CGS online interactive radon map**

1980s and 1990s Influences on the California Radon Perspective

- Early small random home radon surveys find few or no >4 pCi/L homes
- Radon authorities' media comments
 - radon is not a major problem here compared to other states
 - disagreements about whether everyone should test their home
- The DHS 1988-1989 statewide yearlong radon survey of 310 homes (Liu and others, 1990)
- EPA and LBL radon map limitations

Early Radon Surveys in California—1979 to 1988



Radon Authorities' Media Comments

“While we certainly agree with EPA that radon is a significant potential health problem, we do not believe at this time that every home in California should be tested for radon.” Radon is far less prevalent in California homes than in northeastern states with high-uranium soils because much of California enjoys a mild climate and its houses are well ventilated and built over crawlspaces rather than basements. (Santa Cruz Sentinel, September 14, 1988)

In general most people shouldn't be concerned about radon in California, but they should start to do something when any particular area has higher-than average concentrations. (LA Times March 29, 1990)

“Recommending that everyone worry about radon is causing people who shouldn't be concerned about it to worry about it.” “Most of the houses (with problems) are clustered...we need a focused effort finding places with high numbers.” (LA Times June 13, 1990)

California Statewide Radon Study 1989-1990*

Yearlong measurements from 310 homes throughout California

- Geometric mean radon = 0.85 pCi/L; Geometric standard deviation = 1.91 pCi/L
- 0.8 % of state's population in residences with ≥ 4.0 pCi/L radon
- Radon variability—Sierra Nevada foothills and Ventura County highest, coastal areas lowest
- Higher radon residences: rarely opened windows/doors, concrete slab foundations, single family homes and new residences

Study qualifications (summarized):

- Finding only a small percentage of California residences with annual radon concentrations > 4 pCi/L does not imply there are no radon problems in the state.
- In general a survey of this size using population-based sampling would not be expected to identify even a moderately-sized elevated radon region unless it had a sufficiently high population.

* (Liu and others, 1990)

Other Radon Perspective Influences

The LA (San Fernando) – Ventura Zip Code radon study*

- 1989-1990 yearlong random radon survey
- 862 yearlong residential measurements in 49 Zip Code areas
- High (14%), Moderate (8%) and Low (1%) > 4pCi/L Zip Codes

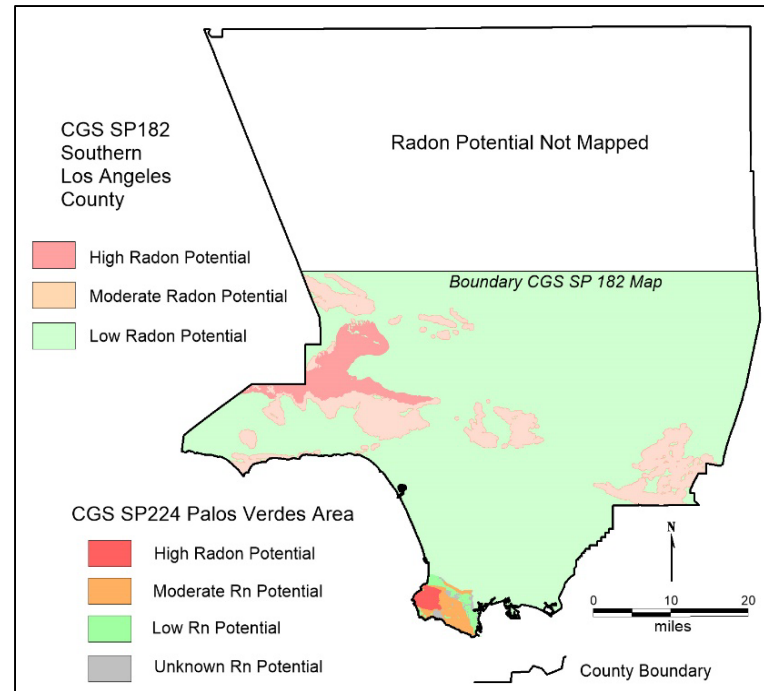
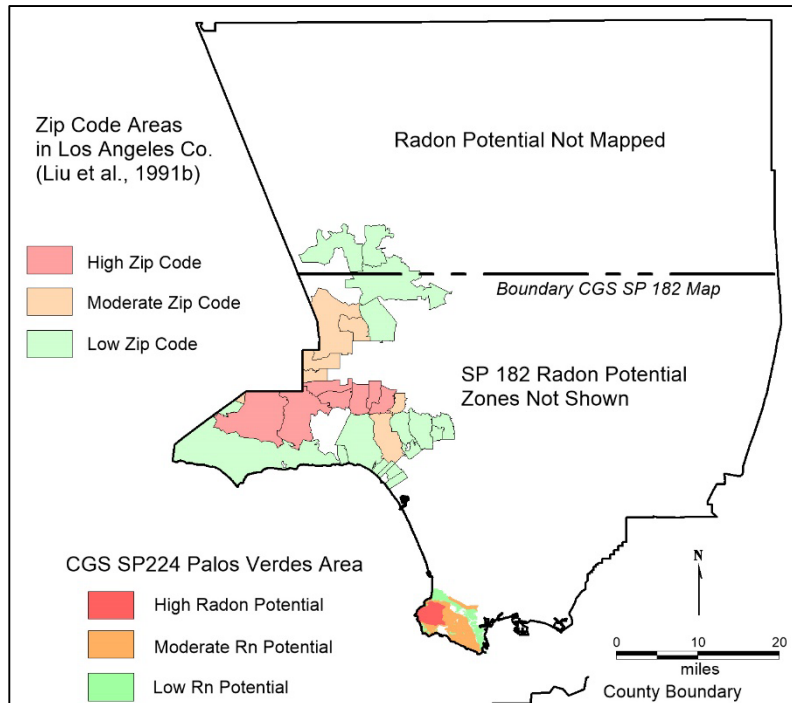
1991—The Santa Barbara radon hot spot**

- Missed by “low density” random radon surveys
- Found by targeted sampling of a areas underlain by geologic unit likely to cause indoor-radon problems

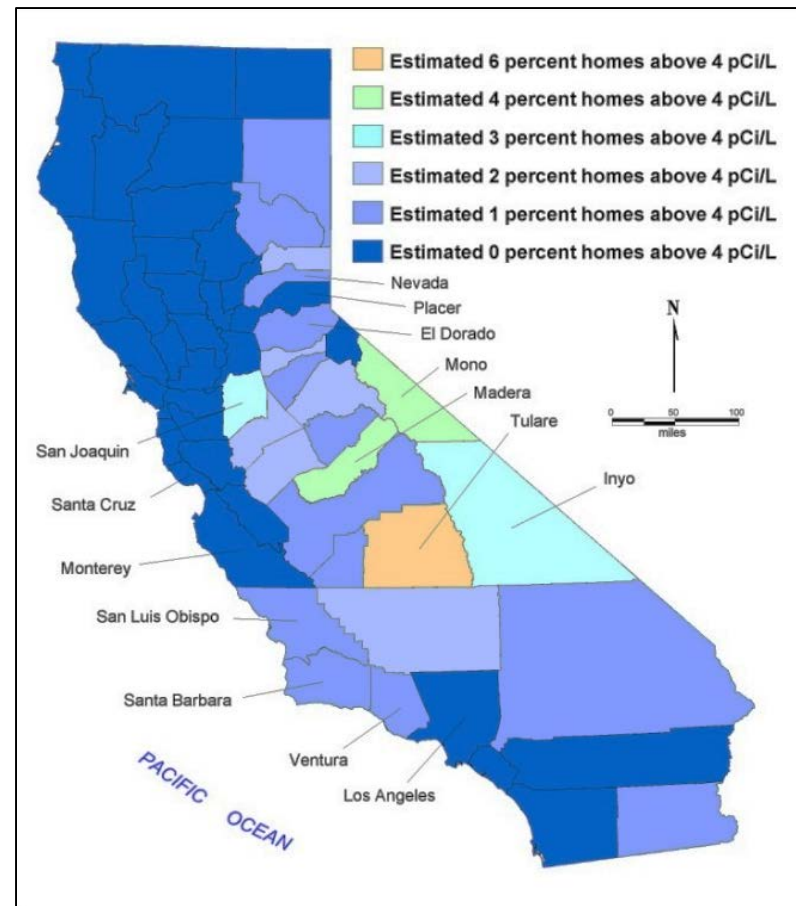
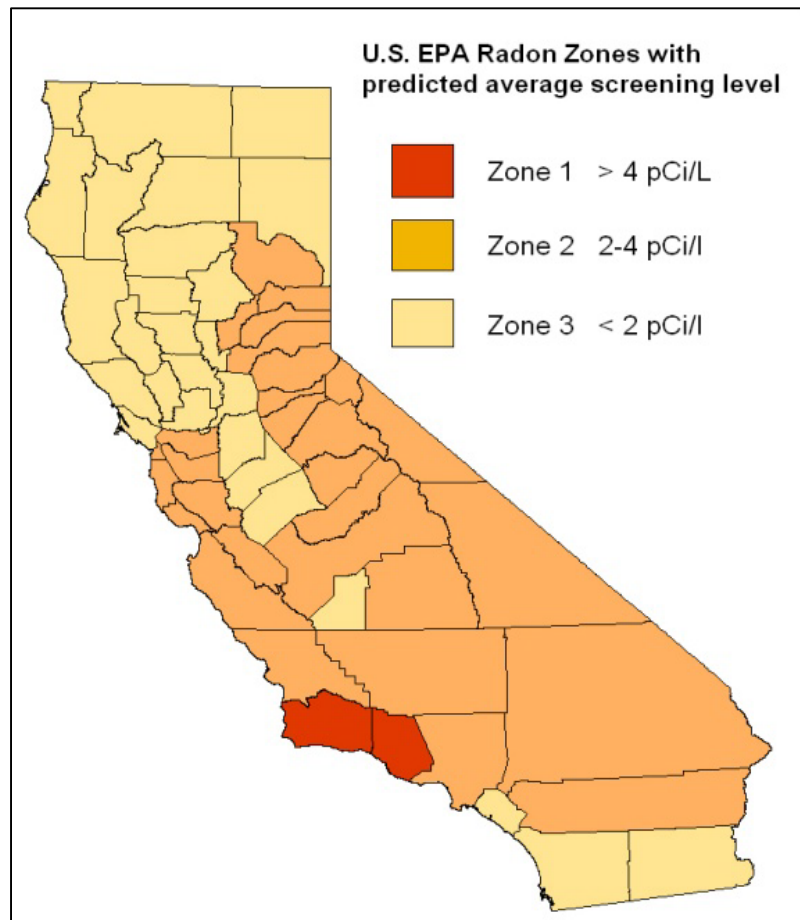
*Liu and others (1991)

**Carlisle and Azzouz (1993); Hobbs and Maeda (1995)

Liu and others (1991) Zip Code Radon Potentials and CGS Radon Potentials for Los Angeles County



U.S. EPA and LBL High Radon Project Radon Potential Maps



1990s Radon Maps

Both EPA and LBL maps reinforce the “radon is not a significant problem in California” perspective

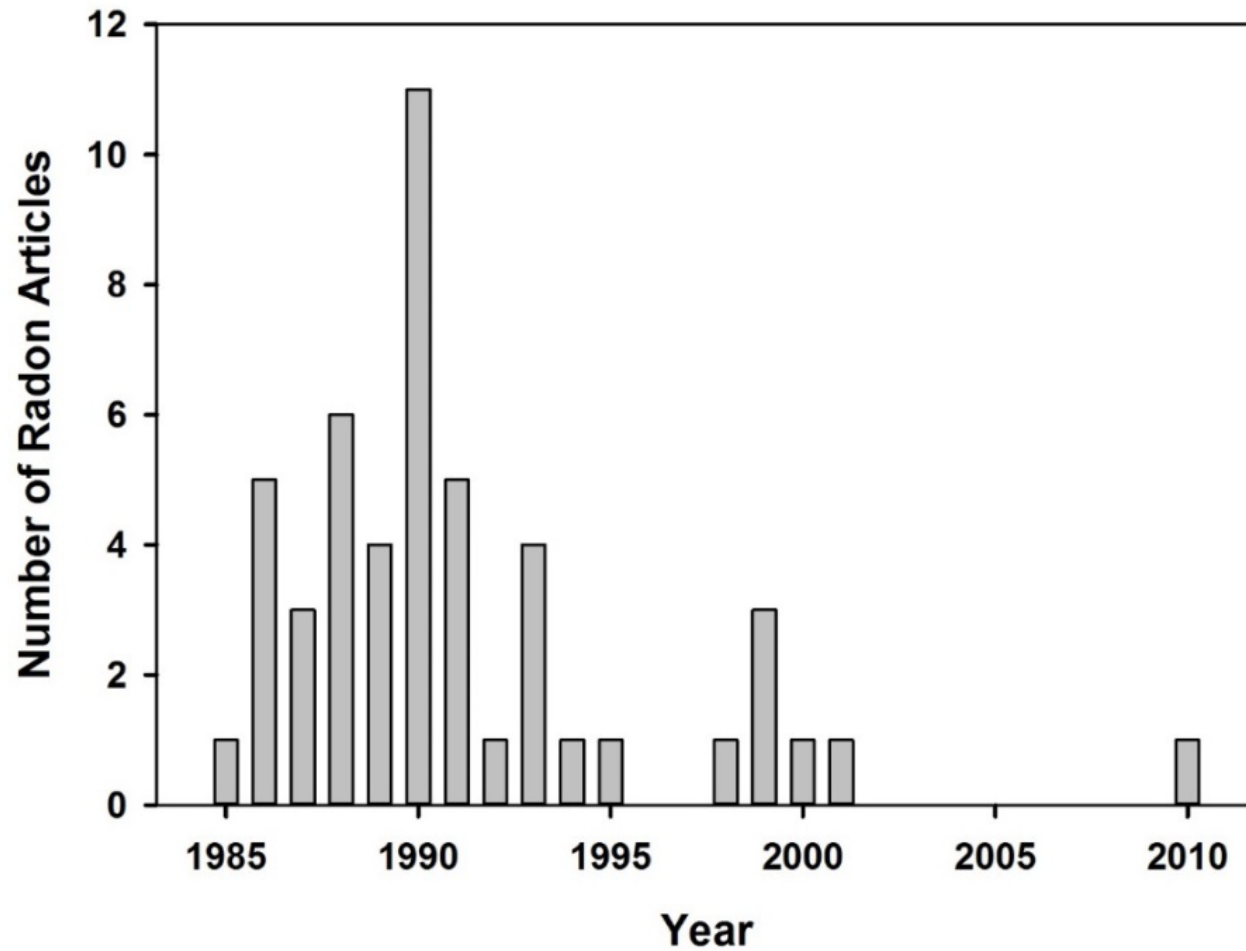
EPA map shortcomings

- California anomalous radon areas not indicated
- Zone definitions often misinterpreted

LBL(LBNL) High-radon map shortcomings

- California anomalous radon areas not indicated
- Underestimates some county radon potentials
 - 33 counties estimated to have no > 4 pCi/L homes
 - “Zero county” Los Angeles has >38,900 residents in > 4 pCi/L homes just in Liu and others (1991) high and moderate Zip Code areas

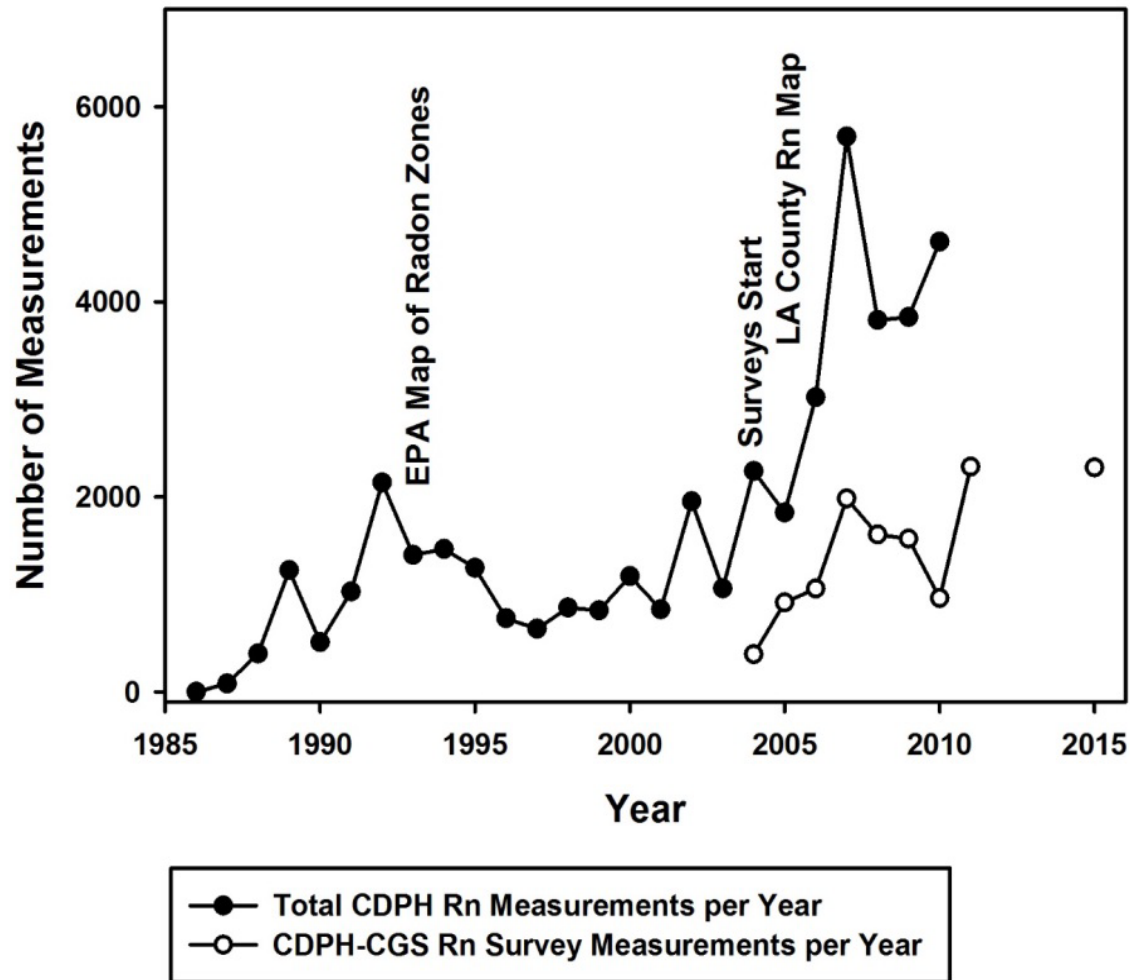
Los Angeles Times Radon Articles by Year 1985 to 2010



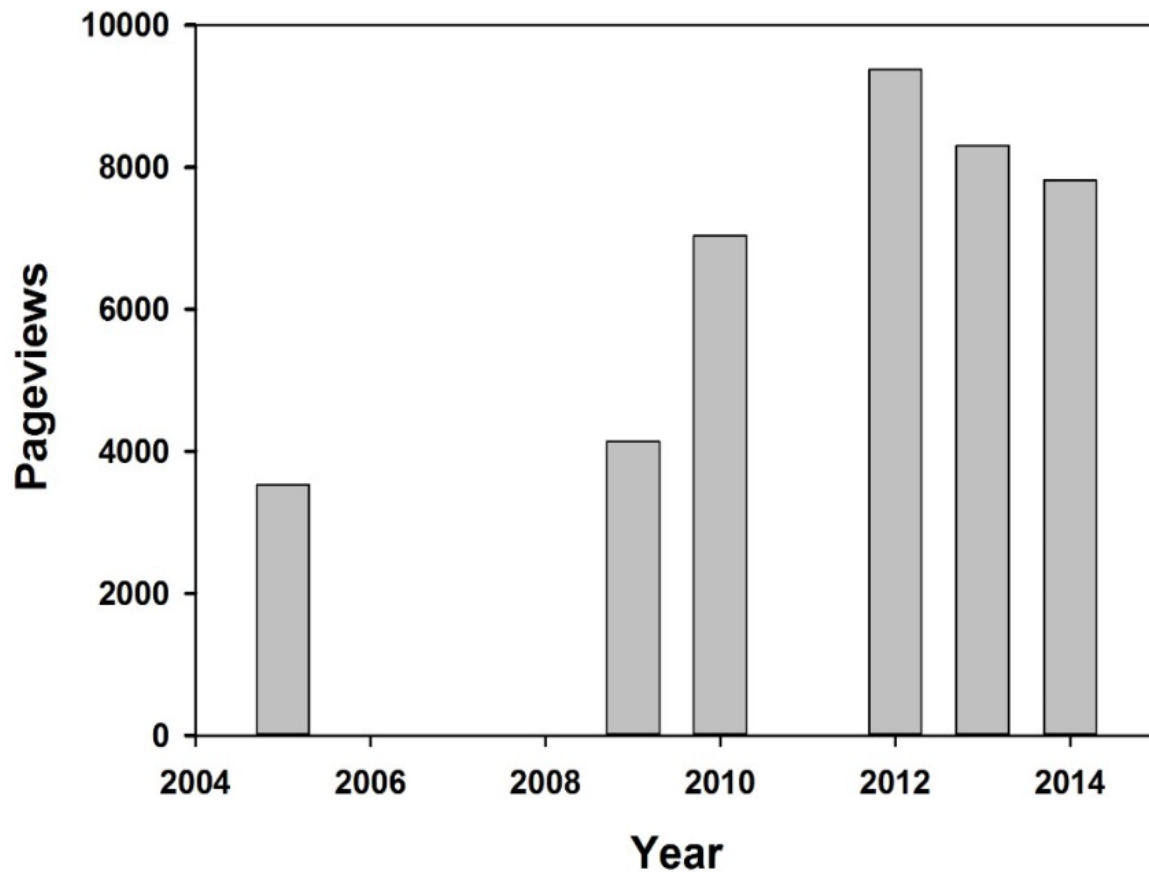
Increasing Radon Awareness in California since 2003

- CDPH and CGS radon websites
- CDPH online radon Zip Code database
- CDPH—CGS cooperative radon surveys (all or parts of 20 counties)
- CGS geology based radon potential maps (10 maps completed since 2005—available online)
- Recent requirements to address radon in some Phase 1 environmental reviews in California
- CGS 2016 online interactive radon potential map

CDPH Radon Database and CDPH-CGS Radon Survey Measurements by Year

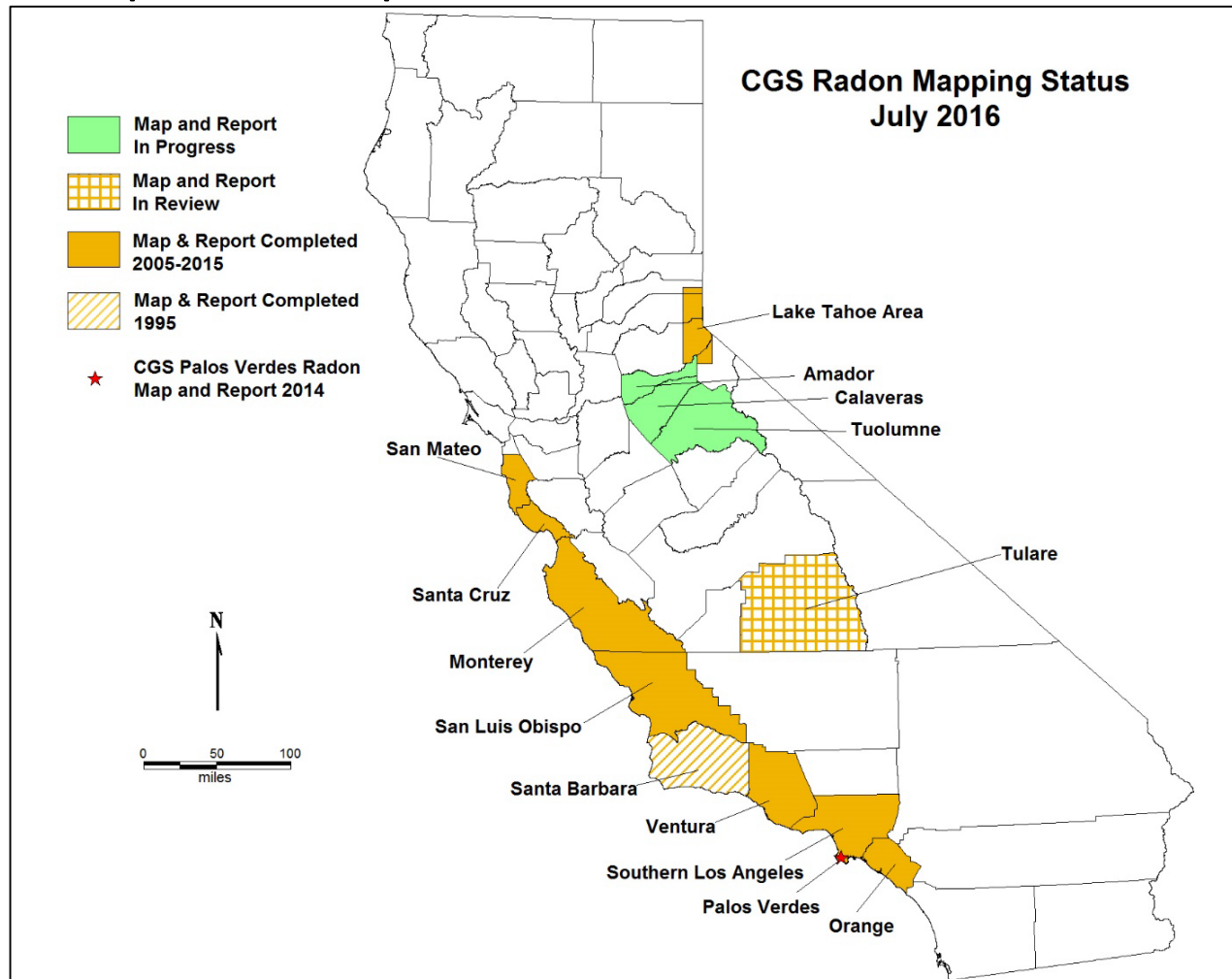


CGS Radon Website Pageviews by Year

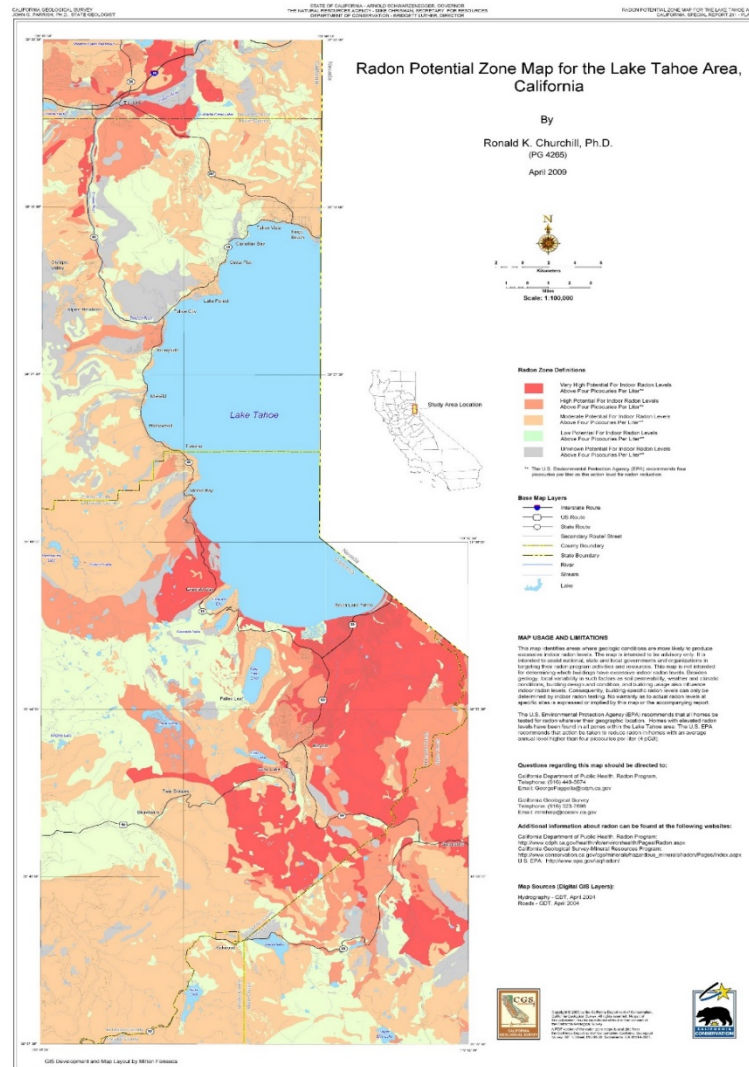


CGS Radon Mapping Status—July 2016

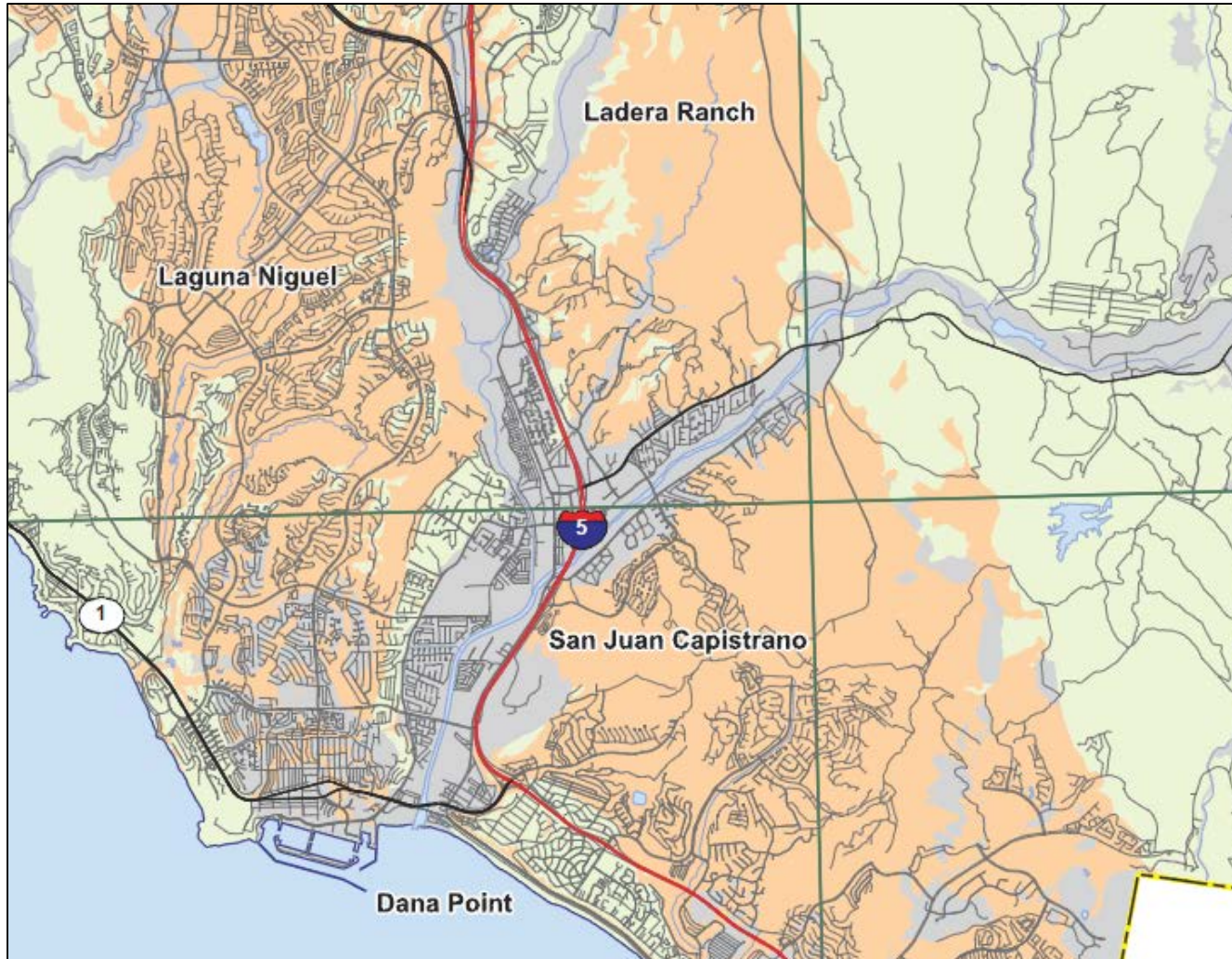
Completed map areas have > 15 million residents



CGS Radon Potential Map Example 1



CGS Radon Potential Map Example 2



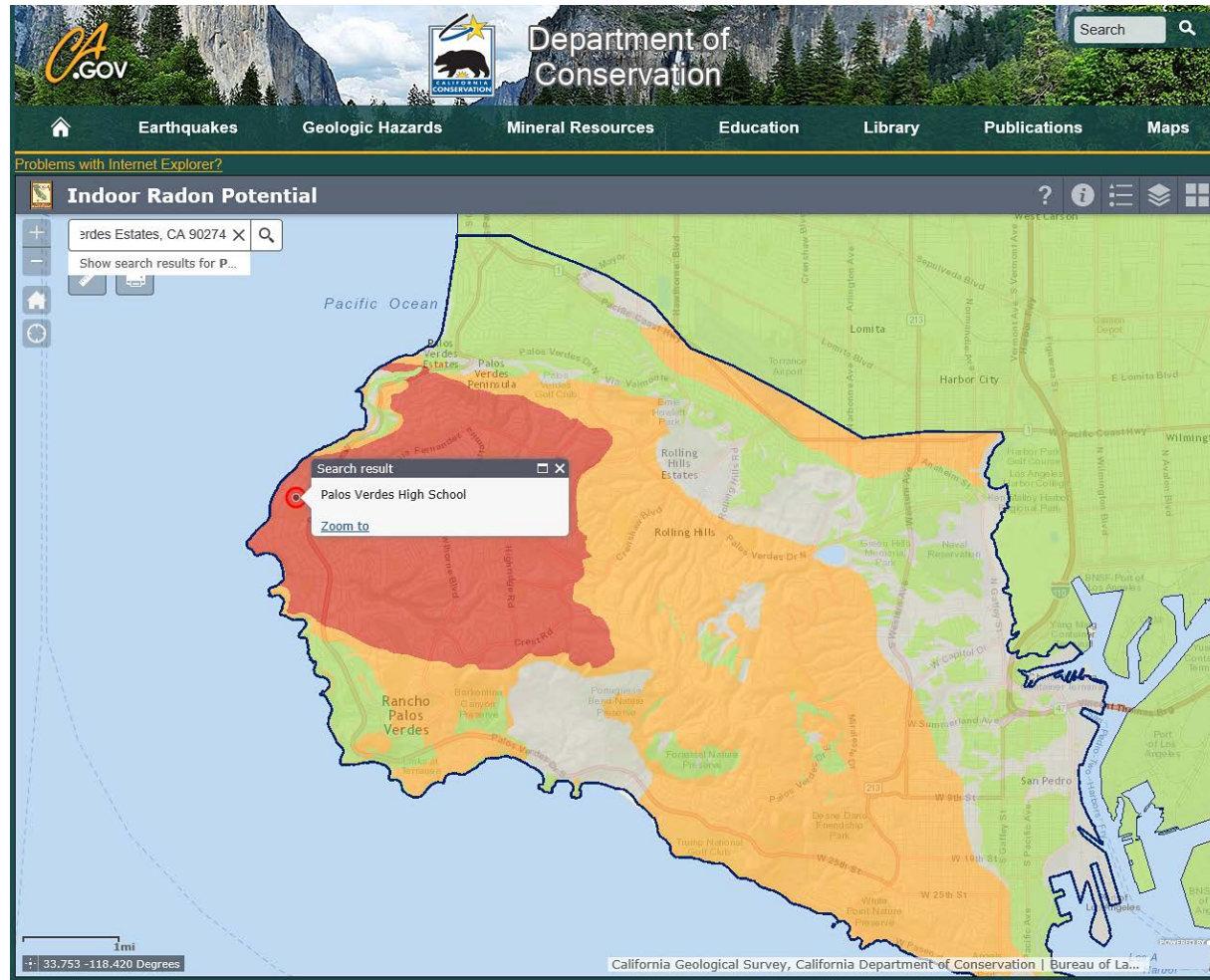
Phase 1 Environmental Reviews

Radon review required in engineering geologists reports for:

- **Construction projects for:** schools, hospitals, skilled nursing facilities and essential services buildings construction projects—CGS Note 48 (2013)
 - 10 reports for school construction address Rn (Jan. to June 2016)
- **San Luis Obispo County:** Guidelines for Engineering Geology Reports (October 2013)—Item 25 “Radon and other hazardous gasses”
 - Cal Fire commitment to RRNC at a new fire station

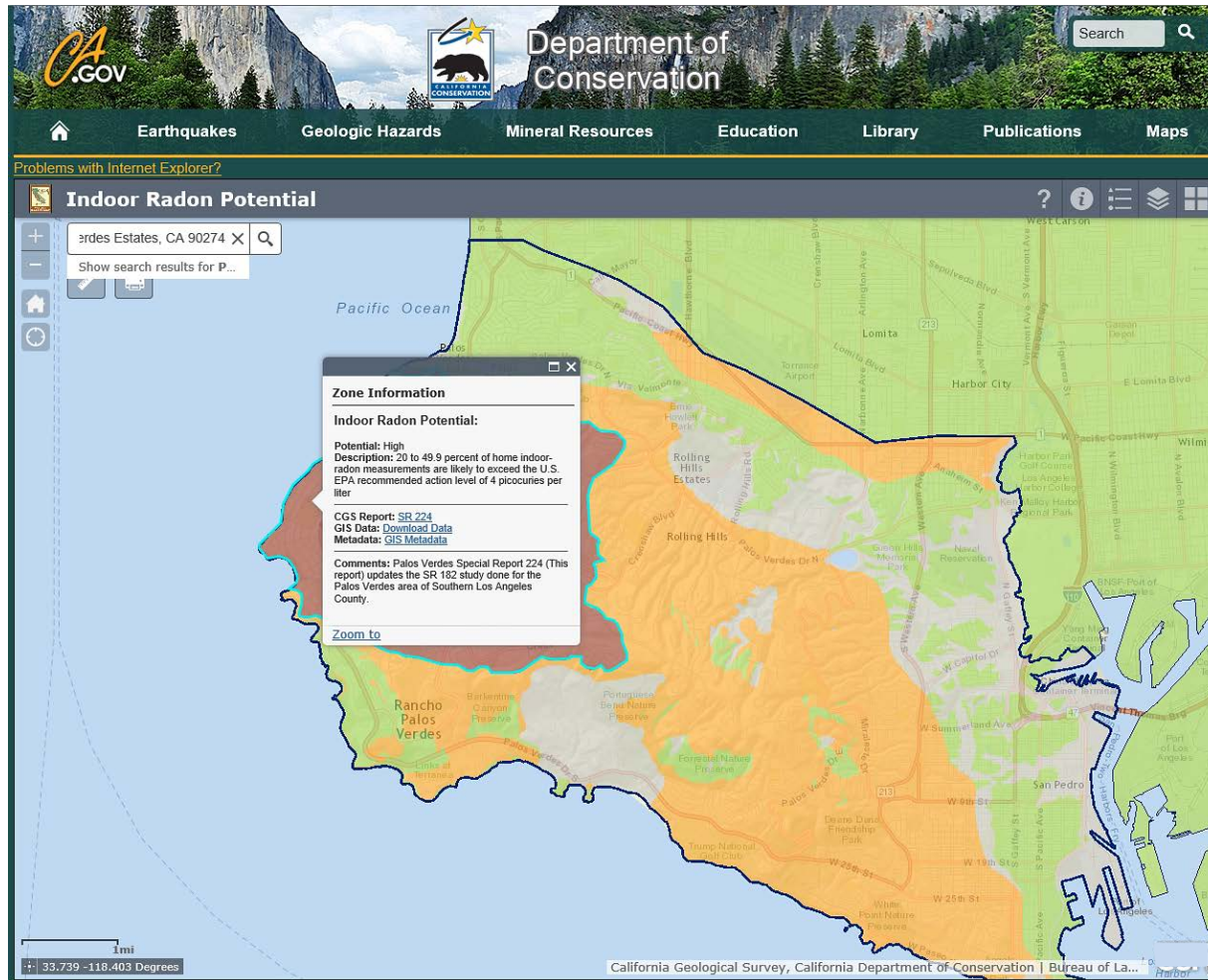
CGS Interactive Radon Potential Map July 14, 2016

Location of Interest View



CGS Interactive Radon Potential Map

Site Indoor Radon Potential Pop-up



Summary

Historic contributors to the perception that radon is not a significant problem in California 1980s-1990s

- Small random radon surveys with limited ability to identify typical anomalous radon areas
- Radon authorities repeated statements that radon is only a problem in small isolated areas
- Lack of more detailed studies to identify such areas
- Disagreements between experts on who should test
- EPA and LBL radon potential map shortcomings

Summary continued

Activities demonstrating that California has some significant anomalous radon areas

- CDPH—CGS geology targeted radon surveys and CGS geology based radon potential maps

Activities increasing radon awareness

- CDPH and CGS radon websites since 2003
- Recent requirements to address radon in engineering geology reports for construction projects
- Easy access to radon potential information via the CGS online interactive radon map

End

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