

## **Naturally occurring radionuclide contamination in diverse aquifers tapped by domestic wells in the Santa Fe, New Mexico area.**

Meghan Hodgins, Jay Lazarus, Crystal Mitchem, Glorieta Geoscience, Inc.,  
P.O. Box 5727, Santa Fe, NM 87502

Through the course of conducting more than 50 geohydrologic studies for land development near Santa Fe, New Mexico, we have found that nearly all of the aquifers tapped by domestic (individual and shared) wells have regions of elevated radionuclides concentrations, some in excess of the EPA drinking water standards. Rural population growth has resulted in people living in more mountainous areas without central water supplies. Therefore, more domestic wells are being drilled into aquifers with high concentrations of radionuclides. The shallow alluvial aquifers are generally no longer used due to nitrate contamination from domestic septic systems and declining water levels. The main aquifers in the Santa Fe area, which range in age from Miocene to Precambrian, are the unconsolidated, alluvial, Miocene Tesuque Formation; volcanoclastic, Oligocene Espinazo Formation; clastic sedimentary, Eocene Galisteo Formation; clastic sedimentary, Permian Sangre de Cristo Formation; primarily limestone Pennsylvanian Madera Formation; and fractured granitic, gneiss, and amphibolite Precambrian crystalline rock. Within each of the aquifers the radionuclide concentrations appear to be related to either granitic material (i.e. granite or granitic clasts) or black, organic shale. Domestic well owners in granitic aquifers and aquifers that contain organic-rich shale layers should analyze for gross alpha, radium 226/228, and elemental uranium.

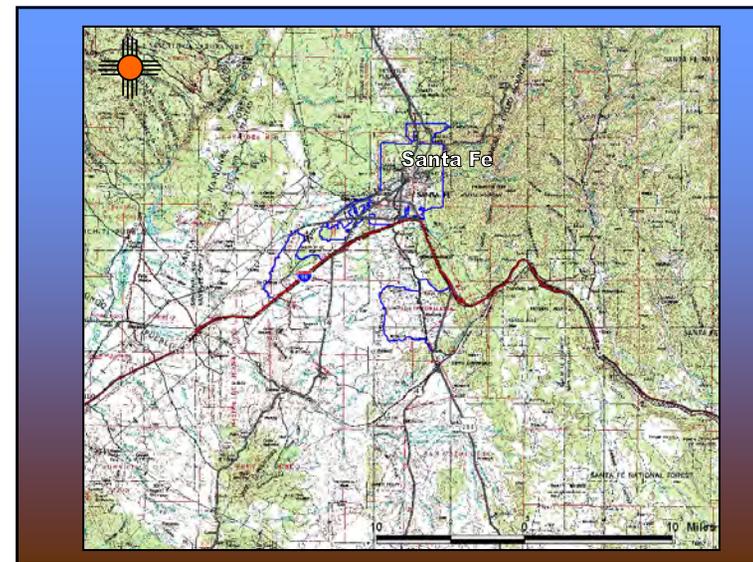
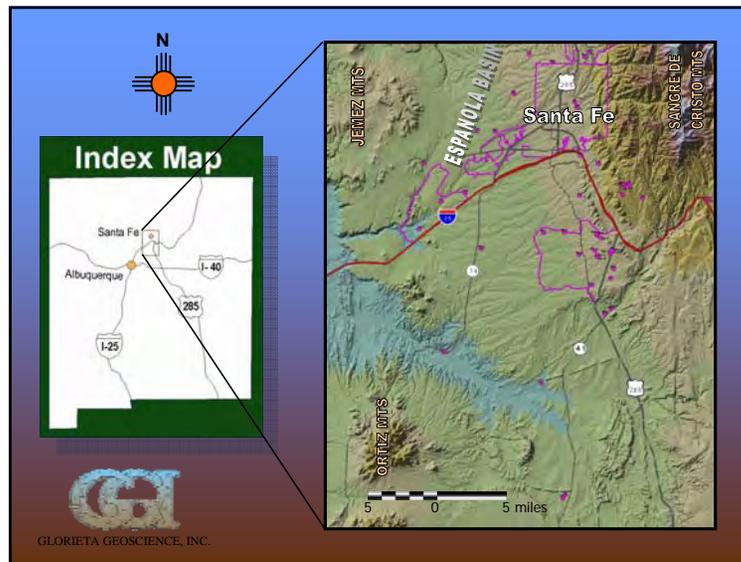
# Naturally occurring radionuclide contamination in diverse aquifers tapped by domestic wells in the Santa Fe, New Mexico area

Meghan Hodgins, Jay Lazarus, and Crystal Mitchem  
Glorieta Geoscience, Inc., P.O. Box 5727, Santa Fe, NM 87502

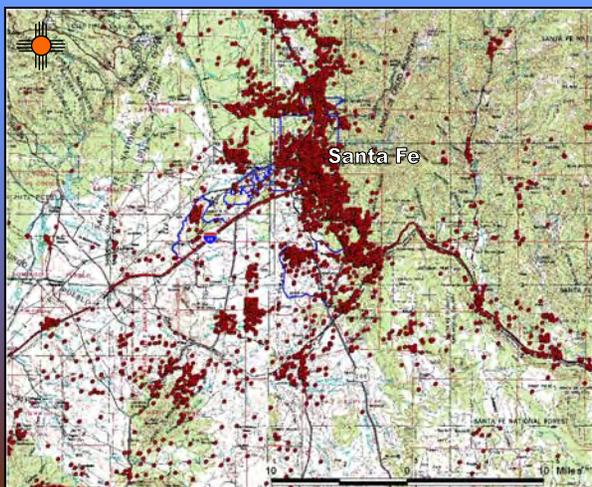


## Focus of Study

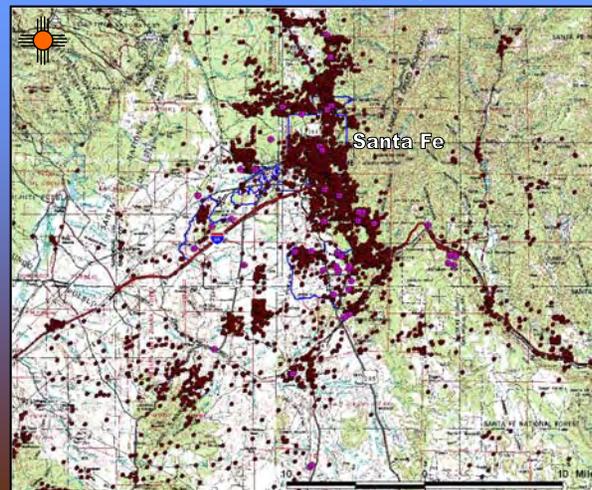
- Concern over domestic well drinking water quality as more individual domestic wells are drilled outside of community system areas
- Compilation of radionuclide water quality data
  - Gross  $\alpha$ , Gross B, Radium 226+228, Uranium
- Compare radionuclide concentrations in various aquifers
- Encourage sampling groundwater for radionuclides
- Propose possible mitigation by well design



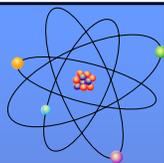
## Wells in the Santa Fe Area



## Water Quality Sampling Wells



## EPA Regulated Radionuclides

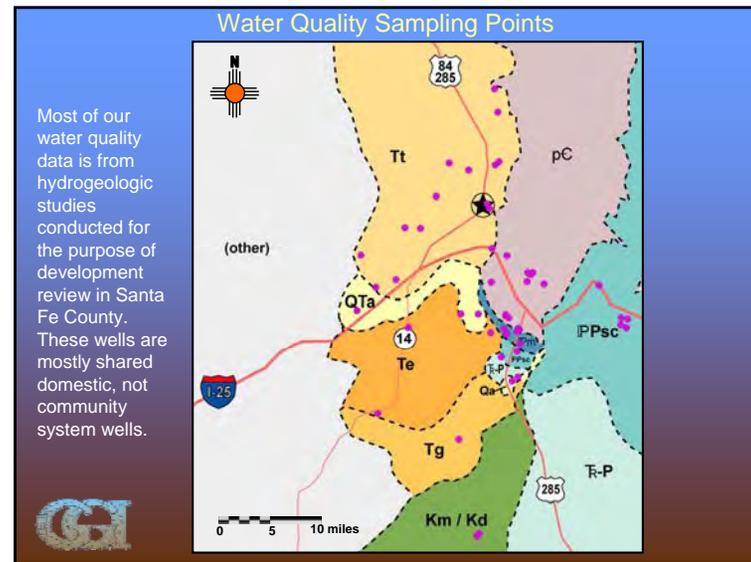
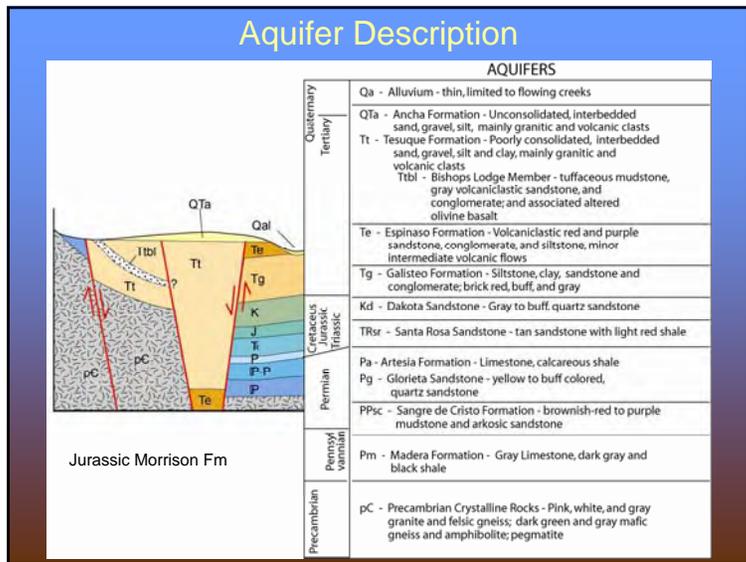
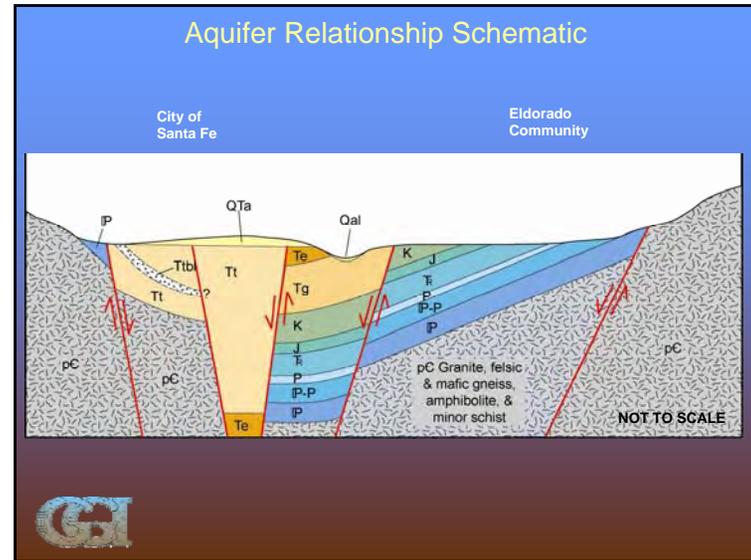
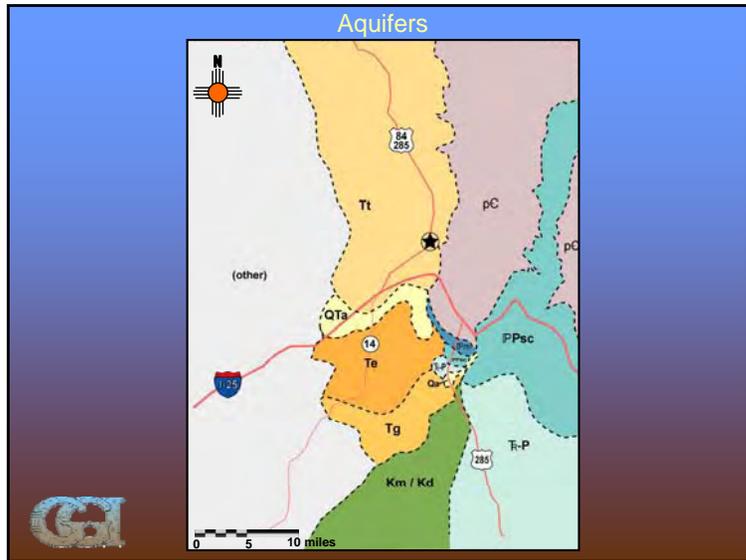


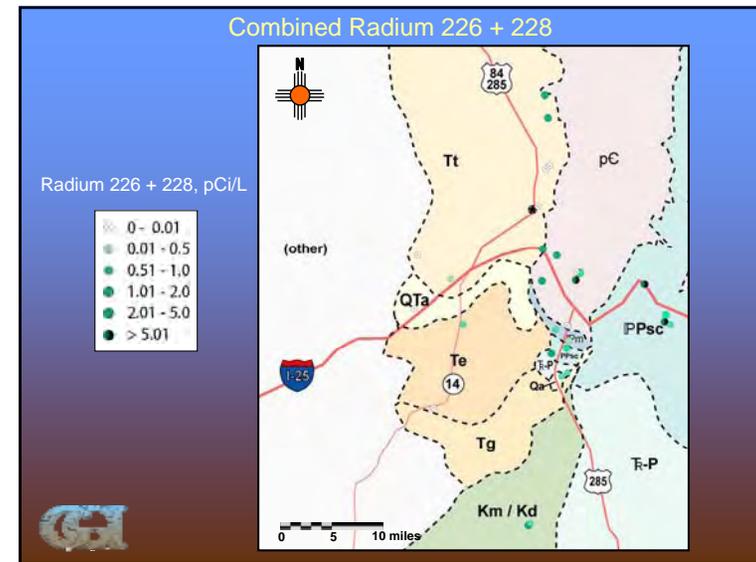
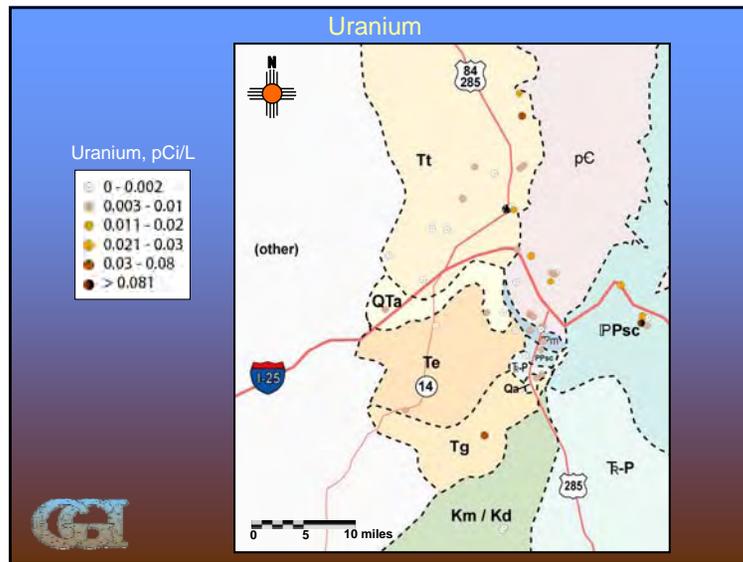
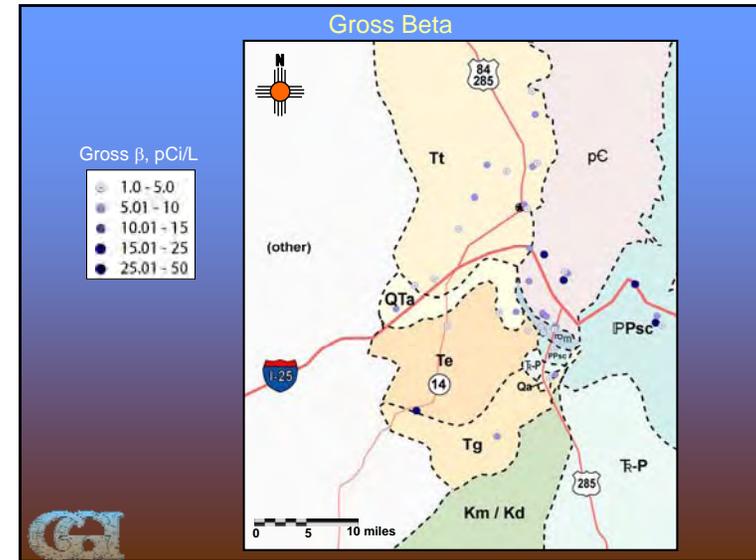
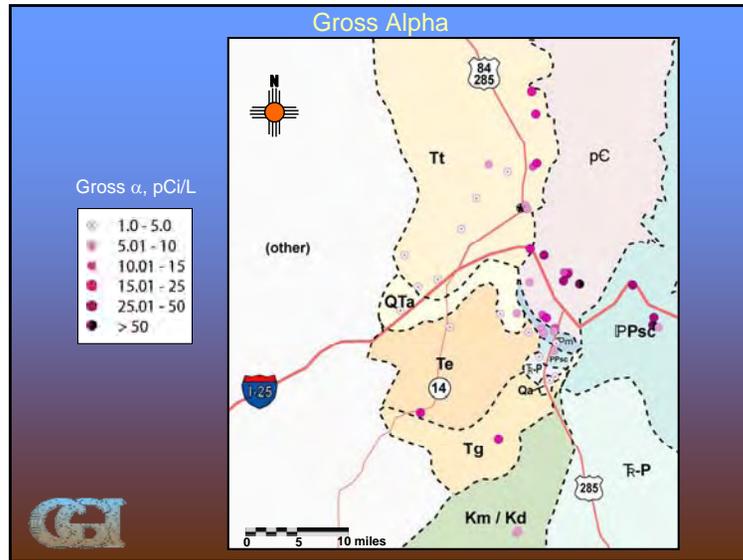
Regulated Radionuclide	MCL	MCLG
Beta/photon emitters	4 mrem/yr $\approx$ 50pCi/L	0
Gross alpha particle	15 pCi/L	0
Combined radium-226/228	5 pCi/L	0
Uranium	30 $\mu$ g/L	0



## Geology of the Santa Fe Area

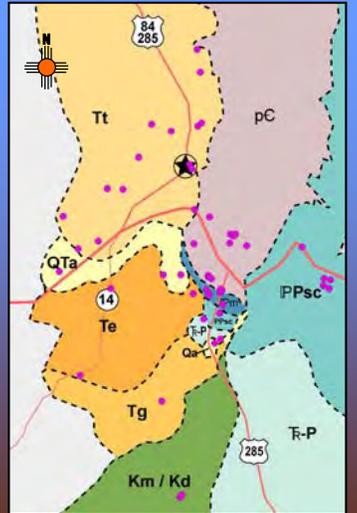






## Results

- Highest Radionuclide concentrations were found in the Permian Sangre de Cristo Formation
- The Precambrian fractured granite aquifer consistently has high gross alpha
- Many of the samples have high gross alpha, but low uranium and radium – possibly radon or other daughter products?
- The Tertiary Galisteo Formation may have higher radionuclide concentrations near the base of the formation
- The Quaternary-Tertiary Tesuque and Ancha Formations generally have low to moderate concentrations of radionuclides, but also contains known high uranium zones that appear to be located near the mountain front at the base of the formation

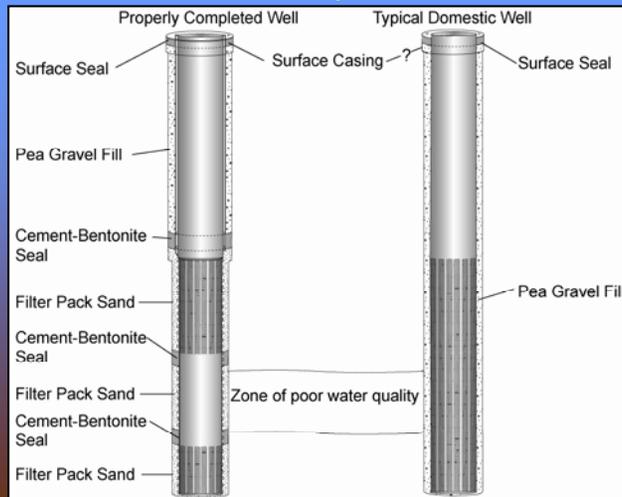


## Possible Mitigation?

- All domestic wells in the Precambrian granite aquifer should be tested for gross alpha and uranium, at a minimum.
- Most wells in the granite aquifer will require some water treatment – unavoidable
- Wells in the sedimentary aquifers can be designed to avoid known or possible contamination zones
  - Geophysical logging of borehole using gamma log may help determine potential contaminant zones
  - Existing water quality data and geologic correlation to contamination can be used to avoid known problem zones
  - Suspicious looking strata can be sealed off



## Well Completion



## Recommendations

- Domestic well owners and potential buyers need to be informed of possible water quality issues
- Domestic wells in potentially contaminated aquifers should be tested for gross alpha at a minimum
- Well drilling companies need to be aware of potential contaminant zones and design wells to seal off, if possible
- Geophysical logging using gamma log may help determine potential contaminant zones

