Natural Uranium in Ground Water in the Espanola Basin

Dennis McQuillan[1], Patrick Longmire[2], Peggy Johnson[3], Jerzy Kulis[1], Fernando Martinez[1], Dale Counce[2], Elizabeth Keating[2]

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1 **New Mexico Environment Department**

2 Los Alamos NATIONAL LABORATORY

3 The New Mexico Bureau of Geology & Mineral Resources
A Division of New Mexico Tech

Uranium Deposits

- Small, laterally discontinuous, roll-front deposits in Tesuque Formation
- Grain coatings of carnotite and other uranyl minerals
- Potential sources of uranium origination include devitrification of volcanic ash and weathering of crystalline Precambrian rocks

Volcanic Ash

Ash Devitrification

- Volcanic ash (glass) reacts with ground water
- Ash devitrifies to clay minerals, including smectite
- Metals including uranium(VI) are released into solution

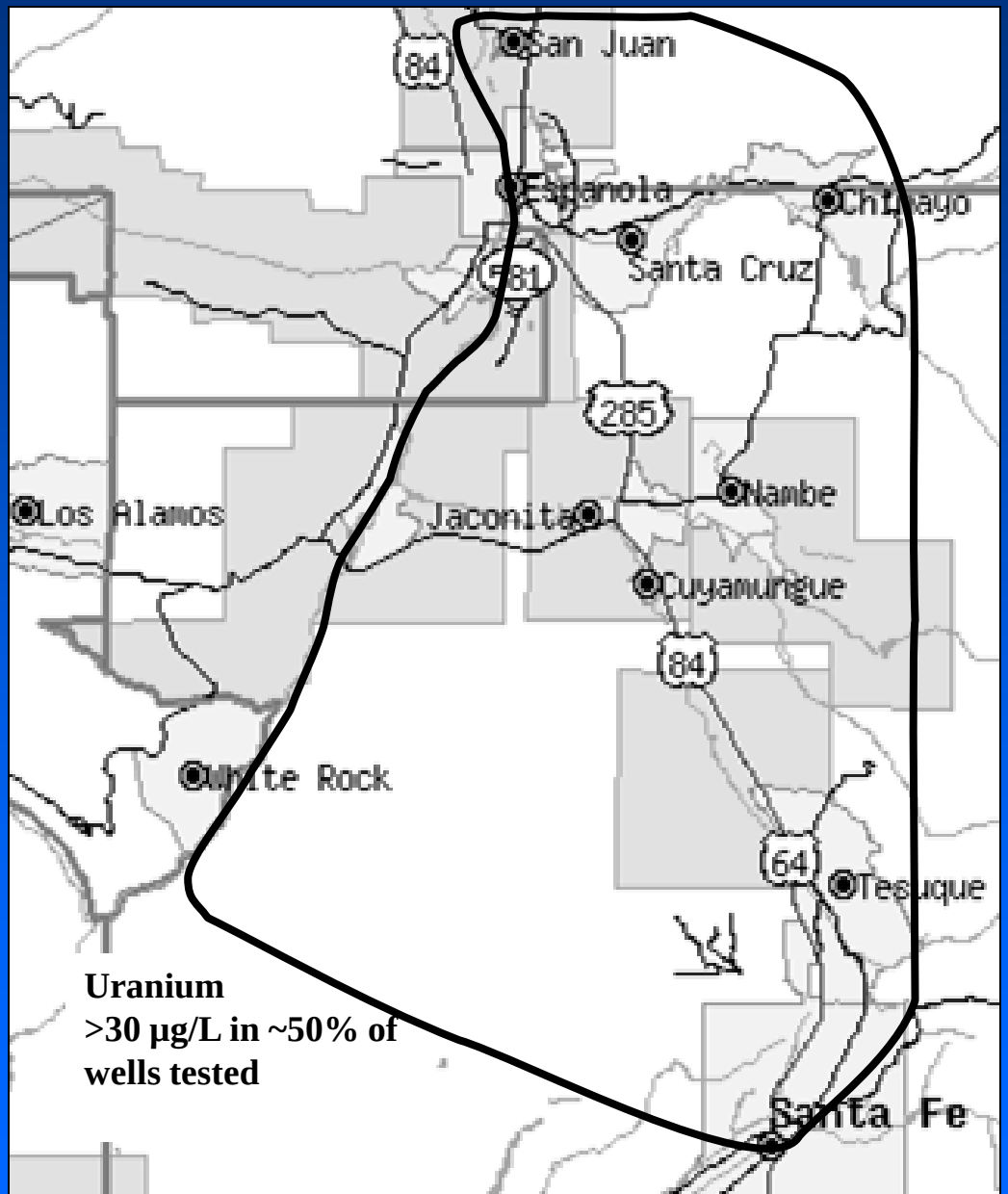
Aqueous Uranium

- **Uranium has a high affinity for oxygen and forms the uranyl ion UO_2^{2+} (stable at pH<5)**
- **Uranyl carbonates are the most common species in natural water**
  - **$UO_2(CO_3)^0$ (pH 5-6.5)**
  - **$UO_2(CO_3)_2^{2-}$ (neutral pH)**
  - **$UO_2(CO_3)_3^{4-}$ (alkaline pH)**

Uranium in Well Water

- 50 % of wells tested have U > 30 µg/L
- East of Rio Grande, from northern Santa Fe into Espanola
- 27 wells serving public systems, 209 private wells
- Levels range from < 1 to 1820 µg/L
- Isotopic signature is natural, not depleted or enriched by anthropogenic activity

Uranium in Well Water



Uranium
>30 µg/L in ~50% of wells tested

Drinking-Water Treatment

- Reverse Osmosis
- Ion Exchange

Reverse Osmosis

- **Removes dissolved solids by passing water thru a semi-permeable membrane**
- **Cost is about $250 for 25 gpd unit**
- **Pretreatment needed if water has high chloride, iron, manganese, sulfides, or TDS**

Reverse Osmosis

Ion Exchange

- Works like a water softener, except with proprietary resins that exchange uranyl carbonates with chloride
- Regenerate with brine backwash (NaCl or KCl)
- Mixed resins (anion & cation) can be used if radium is present

Pojoaque Mobile Home Park Ion Exchange System

- 9,000 to 14,000 gpd from two wells
- ~100 µg/L uranium in raw water reduced to < 5 µg/L
- $15,000 total capital cost (2 units)
- $200/year operation and maintenance

Pojoaque Ion Exchange

Treatment Wastes

- Currently discharged to on-site septic tanks in this area
- Waste disposal from large treatment systems will be a permit issue as drinking water standard for U will be enforced in 2007
- Pojoaque ion exchange generates 500 gal, four times/year, of 200,000 µg/L U waste