Trace Perchlorate in Ground Waters Within the Northern Rio Grande Basin, New Mexico

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ACKNOWLEDGMENTS

OUTLINE OF PRESENTATION

Why Determine Background?

Analytical Methods

Study Areas

Aquifers Tested

Testing Period and Analyses

Results and Correlations

Perchlorate in Precipitation

Findings and Conclusions

WHY DETERMINE BACKGROUND?

Assess ground-water impacts of known anthropogenic sources.

May help in determining drinking water and cleanup standards, modeling risk/exposure, pathway analysis, tracer, etc.

ANALYTICAL METHODS

Liquid Chromatography/Mass Spectrometry/Mass Spectrometry - SW846: 8321A & 8321A(M)

Method can detect perchlorate to 0.05 μg/L; quantify to about 0.20 μg/L.

Performance evaluation on the method conducted by LANL and NMED in 2003: results favored the method for low-level, sub μg/L concentrations.
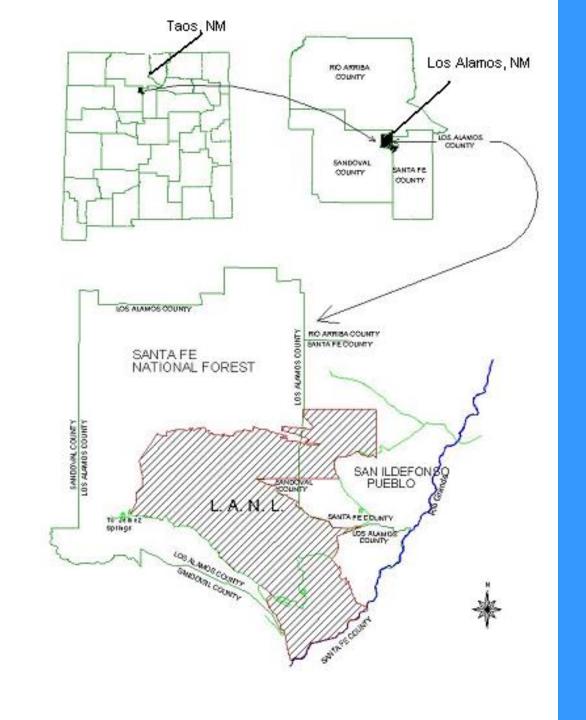
ANALYTICAL METHODS

Ion Chromatography/Mass Spectrometry/ Mass Spectrometry - SW846: 8321A

Method can detect perchlorate to 0.0012 μg/L; quantify to about 0.01 μg/L.

STUDY AREAS

Los Alamos, NM – Springs and wells located in the Sierra de los Valles and Pajarito Plateau

Taos, NM - Springs located along the west and east side of the Rio Grande; basin-aquifer discharge points
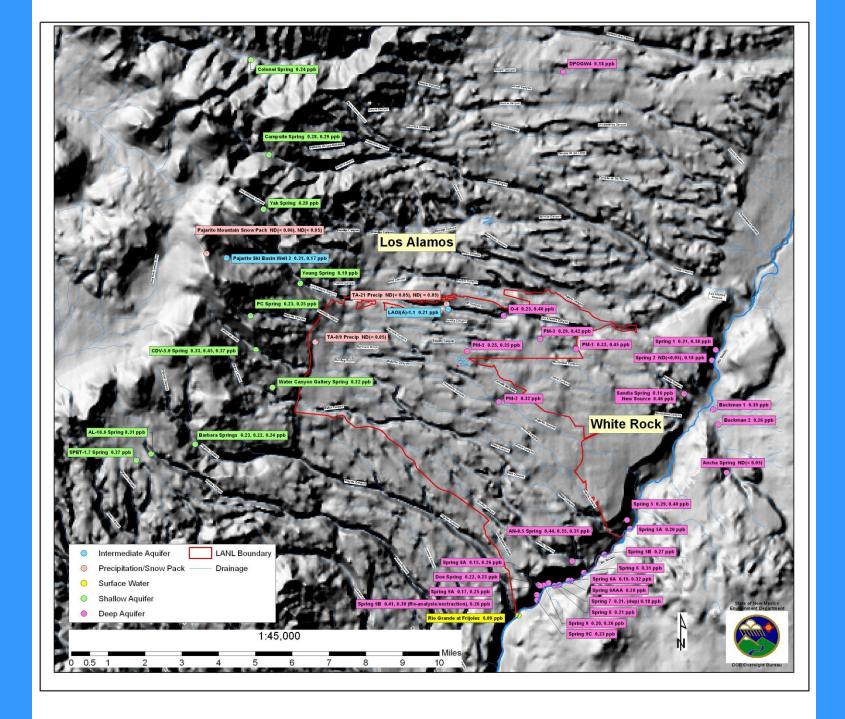
AQUIFERS TESTED

Los Alamos Area

Perched volcanic in mountain block/front and perched beneath the Pajarito Plateau; sub-modern to modern age with short and intermediate flow paths. Twelve stations sampled with 20 results.

Pajarito Plateau regional system; 1000 – 10000+ yrs age or MRT with long flow paths. Twenty-two stations sampled with 45 results.
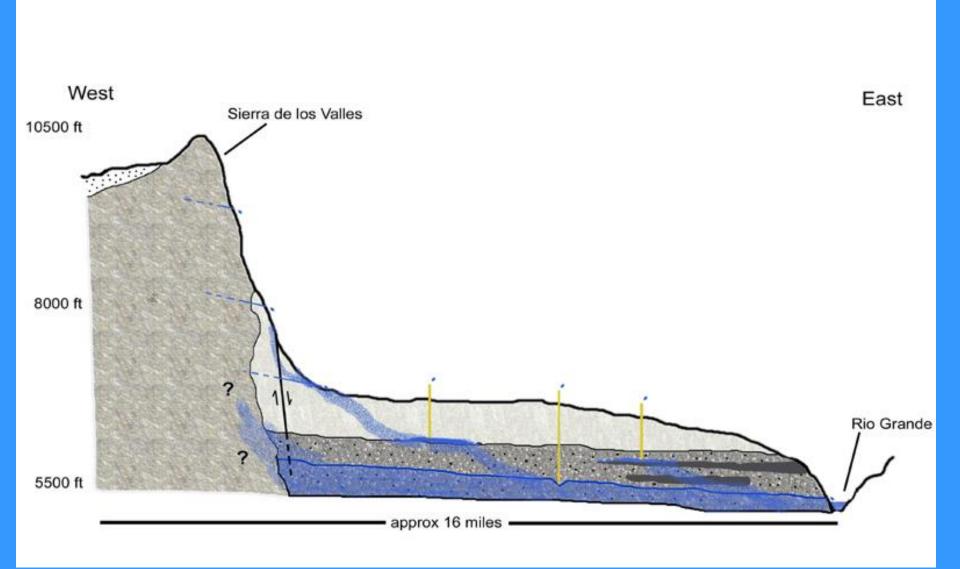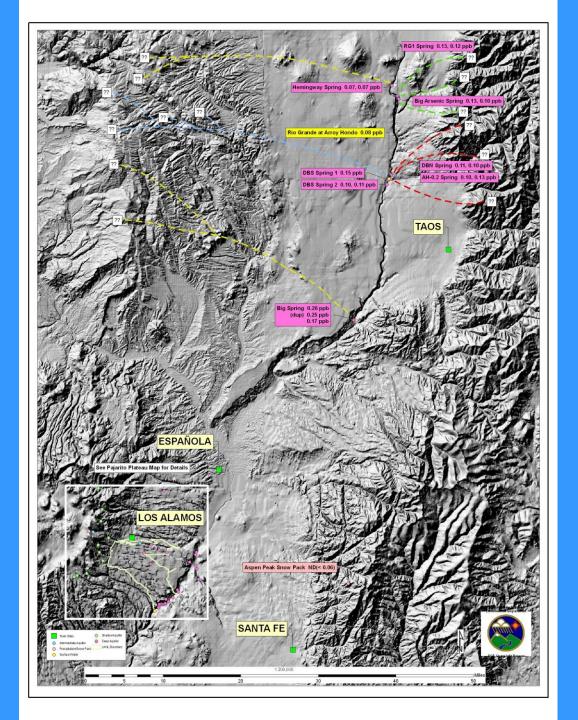
Taos Area

West side Rio Grande north and south of Taos – assumed regional; probably >1000 yrs age with long flow paths. Four stations sampled with nine results. Basin aquifer discharge points.

East side Rio Grande north of Taos – sub-modern to modern age with assumed short and intermediate flow paths. Four stations sampled with 11 results. Basin aquifer discharge points.
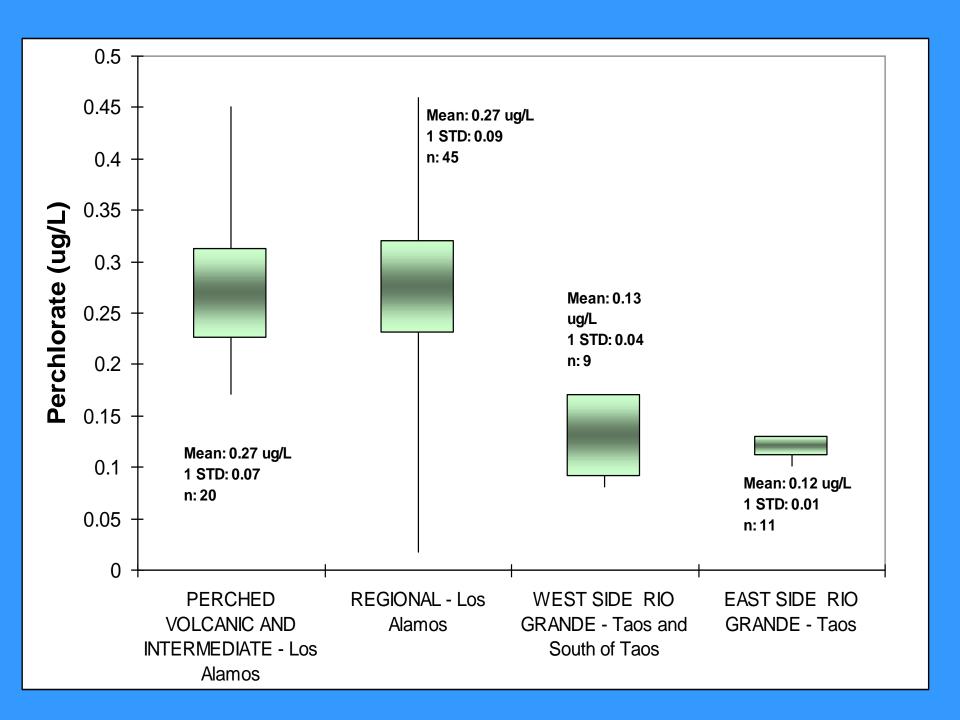
RG1 Spring 0.13, 0.12 ppb

Hemingway Spring 0.07, 0.07 ppb

Big Arsenic Spring 0.13, 0.10 ppb

Rio Grande at Arroy Hondo 0.08 ppb

DBN Spring 0.11, 0.10 ppb
AH-0.2 Spring 0.10, 0.13 ppb

DBS Spring 1 0.15 ppb
DBS Spring 2 0.10, 0.11 ppb

TAOS

Big Spring 0.26 ppb
(dup) 0.25 ppb
       0.17 ppb

ESPAÑOLA

See Pajarito Plateau Map for Details

LOS ALAMOS

Aspen Peak Snow Pack ND(< 0.06)

SANTA FE

Town Sites
Intermediate Aquifer
Precipitation/Snow Pack
Surface Water

Shallow Aquifer
Deep Aquifer
LANL Boundary

1:200,000

0   5   10   20   30   40   50
                                                                        Miles
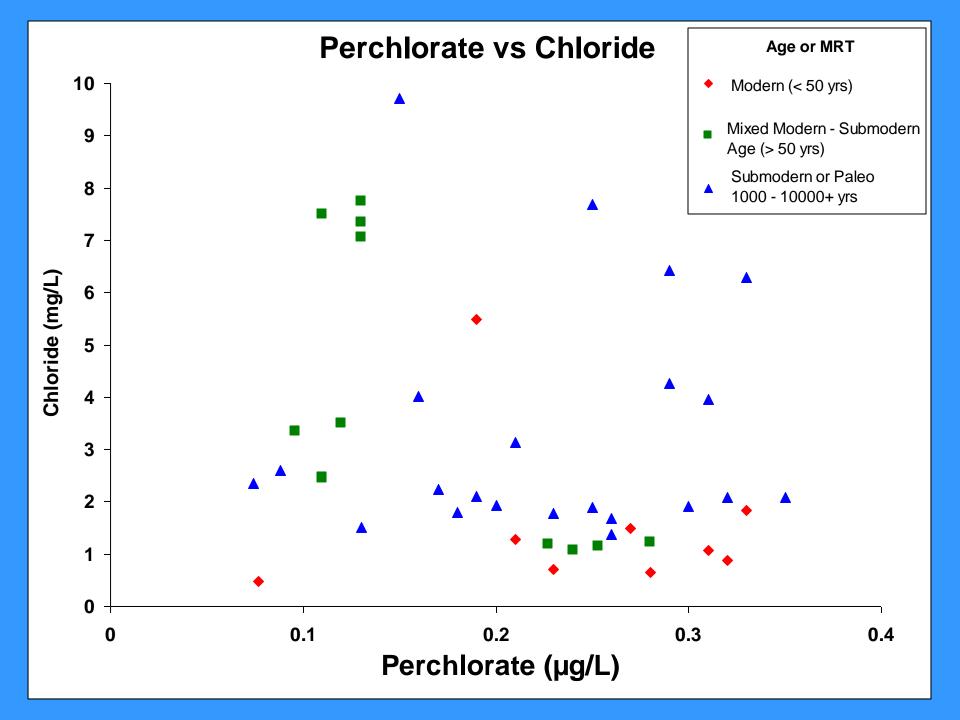
THREE-YEAR TESTING PERIOD

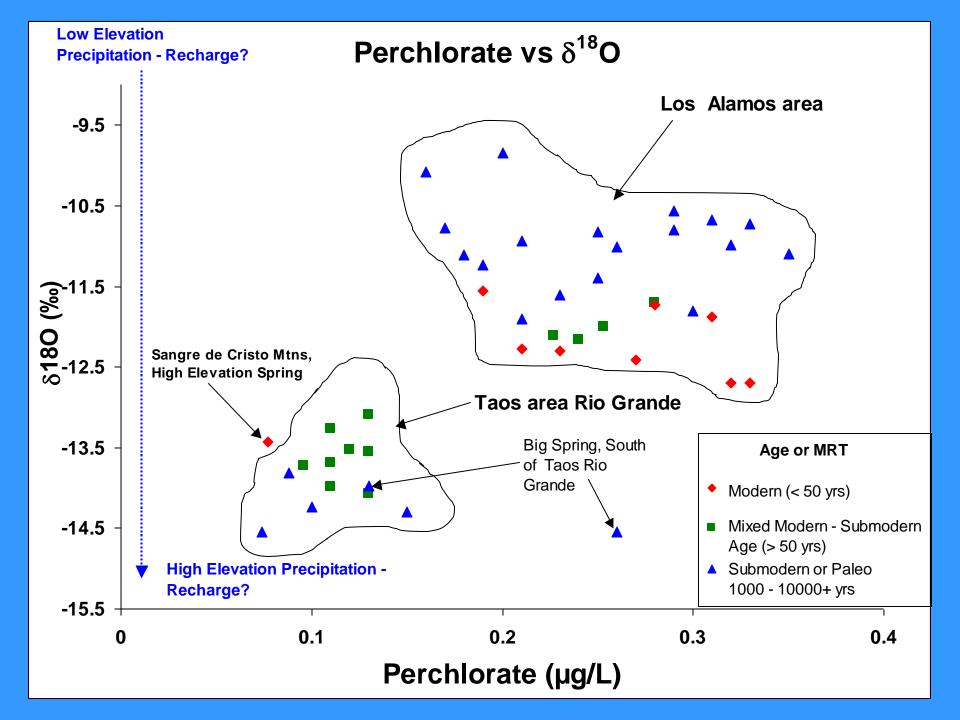**2003 - 2005 (total of 93 results from 49 wells and springs)**

ANALYSES

In addition to perchlorate, samples were analyzed for major ions, trace metals, stable isotopes O, H, and C, low-level ^3H, the noble gases the ^3He, ^4He, Ne, and ^{14}C.

RESULTS

Perchlorate vs Chloride

PERCHLORATE IN LOCAL PRECIPITATION

Four non-filtered snow-pack samples - perchlorate not detected greater than 0.05 – 0.06 μg/L.

Three non-filtered rain samples - perchlorate not detected greater than 0.05 μg/L.

Two non-filtered rain samples contain 0.0099 and 0.021 μg/L using the IC/MS/MS method – detection limit at 0.0012 μg/L; reporting limit at 0.01 μg/L.

IS IT REALLY THERE?

FINDINGS AND CONCLUSIONS

- **Perchlorate is present in background ground waters in the Los Alamos and Taos areas.**

- **Little variability within the Los Alamos/Pajarito Plateau ground-water system. Concentration does not vary along the flow path from recharge to discharge, suggesting that it enters, or is produced, in the system early.**

- **Taos area ground water contains less perchlorate than the Los Alamos ground water.**

- **Concentration inversely correlates with the oxygen isotope composition – more depleted, higher elevation, less perchlorate. This behavior may be due to the variability in evapotranspiration with respect to recharge elevation.**

- **Due to the current threshold of instrument detection limits, it is difficult to determine if perchlorate is present in precipitation.**