Trace Perchlorate in Groundwaters of the Pajarito Plateau, Española Basin and the Rio Grande North of Taos, New Mexico

DALE, Michael¹, GRANZOW, Kim¹, LONGMIRE, Patrick², YANICAK, Steve¹, ENGLERT, Dave¹, and COUNCE, Dale²

¹ New Mexico Environment Department, DOE Oversight Bureau, 134 State Road 4, Suite A, White Rock, NM 87544

² Los Alamos National Laboratory, EES-6, MS D469, Los Alamos, NM 87544
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OUTLINE OF PRESENTATION

Why Determine Background?
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WHY DETERMINE BACKGROUND?

Assess groundwater 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 (LC/MS/MS) (EPA SW846 LCMS by 8321A)

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 (IC/MS/MS) (EPA SW846 8321A Perchlorate ICMSMS)

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
AQUIFERS TESTED

**Los Alamos Area**
Perched volcanic in mountain block/front and perched beneath the Pajarito Plateau; submodern to modern age with short flow paths. Twelve stations sampled with 20 results.

Pajarito Plateau regional system; probably >1000 yrs age with long flow paths. Twenty-two stations sampled with 36 results.

**Taos Area**
West side Rio Grande north of Taos – assumed regional; probably >1000 yrs age with long flow paths. Three stations sampled with five results.

East side Rio Grande north of Taos – assumed intermediate; submodern to modern age with short flow paths. Four stations sampled with seven results.

West side Rio Grande south of Taos – assumed regional; probably >1000 yrs age with long flow path. One station sampled with two results.
TWO-YEAR TESTING PERIOD

2003 and 2004 (total of 76 results from 47 wells and springs)

ANALYSES

In addition to perchlorate, samples were analyzed for major ions, trace metals, low-level tritium, and stable isotopes.
RESULTS
PERCHED VOLCANIC AND INTERMEDIATE - Los Alamos

REGIONAL - Los Alamos

WEST SIDE RIO GRANDE - Taos

EAST SIDE RIO GRANDE - Taos

Mean: 0.27
1 STD: 0.07
n: 20

Mean: 0.27
1 STD: 0.09
n: 36

Mean: 0.10
1 STD: 0.03
n: 5

Mean: 0.12
1 STD: 0.01
n: 7
Perchlorate vs $\delta^{18}$O

-15.5
-14.5
-13.5
-12.5
-11.5
-10.5
0 0.1 0.2 0.3 0.4

Perchlorate (µg/L)

$\delta^{18}$O (‰)

Taos area

Los Alamos area

Low Elevation Recharge

High Elevation Recharge

Big Spring, South of Taos
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 groundwaters in the Los Alamos and Taos areas.
- Little variability within the Los Alamos/Pajarito Plateau groundwater 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 groundwater contains less perchlorate than the Los Alamos groundwater.
- 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.