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**" PERCHLORATE IN DRINKING WATER - A CASE
STUDY FROM NORTHERN CHILE"**

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ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY



1550 EAST PRINCE ROAD
TUCSON, ARIZONA 85719 (520) 881-4912

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**“Perchlorate in Drinking Water -
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An important technical study titled “Does perchlorate in drinking water affect thyroid function in newborns or school-age children” was published in the June 2000 issue of *The Journal of Occupational Environmental Medicine*. This study provides needed information to address public concerns about exposure to perchlorate in drinking water and for establishment of exposure guidelines. Study results indicate that perchlorate in drinking water at concentrations of 100 to 120 parts per billion (about 10 times concentrations in Lake Mead) had no observed adverse health effects on newborns or on school-age children. Results of the technical study are summarized here.

Public Concern

In 1997, the capability of chemical laboratories to detect extremely small amounts of perchlorate was greatly improved. Shortly after, the compound was detected in water at various locations in the United States. Detection of perchlorate in water has raised a number of questions regarding possible impacts on human health. Studies to identify and monitor potential human health effects began soon after detection of perchlorate. Exhaustive studies for all aspects of effects of perchlorate on human health have not been completed. However, information from initial studies has provided direction to policy makers who are charged with establishing exposure guidelines to protect public health. Discussion is currently underway in the United States to establish safe exposure guidelines for perchlorate.

Known Effects of Perchlorate

Perchlorate has been used medicinally at doses of as much as 0.9 grams per day. Physicians prescribed these doses to reduce uptake of iodine in patients with overactive thyroid glands. Proper thyroid function is critical for infants to grow and develop normally, thus there is concern that perchlorate in drinking water may affect growth and development among the very young. In California and Nevada, studies were conducted to determine if there were any detectable effects of perchlorate on thyroid hormone levels in newborn babies. These studies



did not detect any negative effects on thyroid function. Occupational health investigations for adults were conducted in 1997 and 1998 to study possible effects of exposure to airborne particles during manufacture of ammonium perchlorate. These studies found no indication of any thyroid or other negative health effects in adults with perchlorate exposure as high as 0.034 grams per day, (roughly equal to 700 times the amount of perchlorate in one gallon of Lake Mead water). Results of recently completed studies in the Atacama Desert of northern Chile indicate no effects on thyroid health among infants and young children from perchlorate in drinking water at concentrations significantly higher than most areas where it has been detected in the United States.

Perchlorate in Northern Chile

Extensive nitrate deposits occur in the Atacama Desert of northern Chile. These deposits contain amounts of naturally-occurring perchlorate ranging from 5,000 to 60,000 parts per billion. In 1998 and 1999, hydrologic field investigations were conducted in Chile to answer two questions: can perchlorate be found in groundwater in the region of nitrate deposits, and is groundwater containing perchlorate used as drinking water for cities in northern Chile? Results of the field investigations indicated that naturally-occurring perchlorate is widespread in groundwater in the region of nitrate deposits. For more than 30 years, groundwater wells in the region have provided municipal drinking water containing 100 to 120 parts per billion perchlorate to the City of Taltal, Chile. This concentration is also roughly 4 to 8 times larger than exposure guidelines recently adopted by states in the southwest.

Three Chilean cities were chosen to be included in studies of effects of perchlorate on human health. Taltal was selected as the primary study city. Antofagasta was selected as a control city because the municipal water supply, derived from springs at the margin of the Andes mountains, contained no detectable perchlorate. Chañaral was selected as a third study city because it is near Taltal, it has a similar size and economy to Taltal, and because perchlorate concentrations in drinking water are about 7 parts per billion, similar to those in Lake Mead. Lifelong residents of the Chilean study cities have been exposed to these concentrations of perchlorate throughout their lifetimes.



Studies conducted in northern Chile investigated possible effects of perchlorate exposure on newborns and on school-age children. In 1992, the Chilean Ministry of Health initiated a mandatory thyroid health screening program for all newborns throughout the country. During the recent study, these screening records were examined for babies born between February 1996 and January 1999 in Taltal, Antofagasta and Chañaral. Additionally, public schools were visited in each city where first and second grade children were evaluated. The children were examined by a team of Chilean physicians (endocrinologists), nurses and technicians. Laboratory tests were conducted on blood and urine samples from each child to check thyroid, liver, kidney and bone marrow function. For each child, questionnaires were used to obtain background information, current health status and family history of thyroid disease. During the same time period, water quality samples were obtained from the children's various drinking water sources to measure perchlorate concentrations.

Although concentrations of perchlorate were different for each city, thyroid hormone levels among newborns and school-age children were similar in the three cities. Additionally, the school-age children showed no difference in height, weight, liver function, kidney function or bone marrow function between the three cities.

Parents in Taltal were more likely to self-report thyroid disease among older family members than those in Antofagasta or Chañaral. These reported findings have not yet been investigated. Larger perchlorate concentrations in drinking water due to environmental factors prior to 1970, and lack of dietary iodine supplementation prior to 1982, make comparisons across time difficult. The children and infants in the recent study were exposed to relatively constant perchlorate concentrations in drinking water and had adequate dietary iodine throughout their development.

In summary, newborns and school-age children in northern Chile were examined for potential negative effects of perchlorate in drinking water at concentrations up to 110 parts per billion. No evidence was found that perchlorate in drinking water at these concentrations affected thyroid function among newborns or school-age children.



Future Investigations

The hydrogeology of northern Chile and naturally-occurring concentrations of perchlorate in the environment provide an excellent on-going opportunity to study effects of perchlorate on human populations. Scientists should take advantage of this opportunity to verify results of the recent study and to increase understanding of relationships between perchlorate and human health.



A copy of the full technical study is available from the principal author, Casey Crump, MD, PhD. Address correspondence to:

*Casey Crump, MD, PhD, MPH
5307 Ravenna Place NE, #3
Seattle, WA 98105 USA
kccrump@u.washington.edu
Tel: (206) 985-8615*

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Authors:

*Casey Crump, M.D., Ph.D., Patricio Michaud, M.D., Rafael Téllez, M.D.,
Carlos Reyes, M.D., Gilberto Gonzalez, M.D., Errol L. Montgomery, Ph.D.,
Kenny S. Crump, Ph.D., Gabriel Lobo, M.D., Carlos Becerra, M.D., John P. Gibbs, M.D.*

*From ICF Consulting, Seattle, Wash. USA (Dr. C Crump); Sótero del Río Hospital and
Medicine Faculty, Pontifical Catholic University, Santiago, Chile (Dr. Michaud, Dr. Téllez,
Dr. Reyes, Dr. Gonzalez); Errol L. Montgomery & Associates, Tucson, Ariz. USA (Dr.
Montgomery); ICF Consulting, Ruston, La. USA (Dr. K S Crump); San Juan de Dios Hospital,
Santiago, Chile (Dr. Lobo), Ministry of Health, Santiago, Chile (Dr. Becerra), and the Kerr-
McGee Corporation, Oklahoma City, Okla. USA (Dr. Gibbs).*



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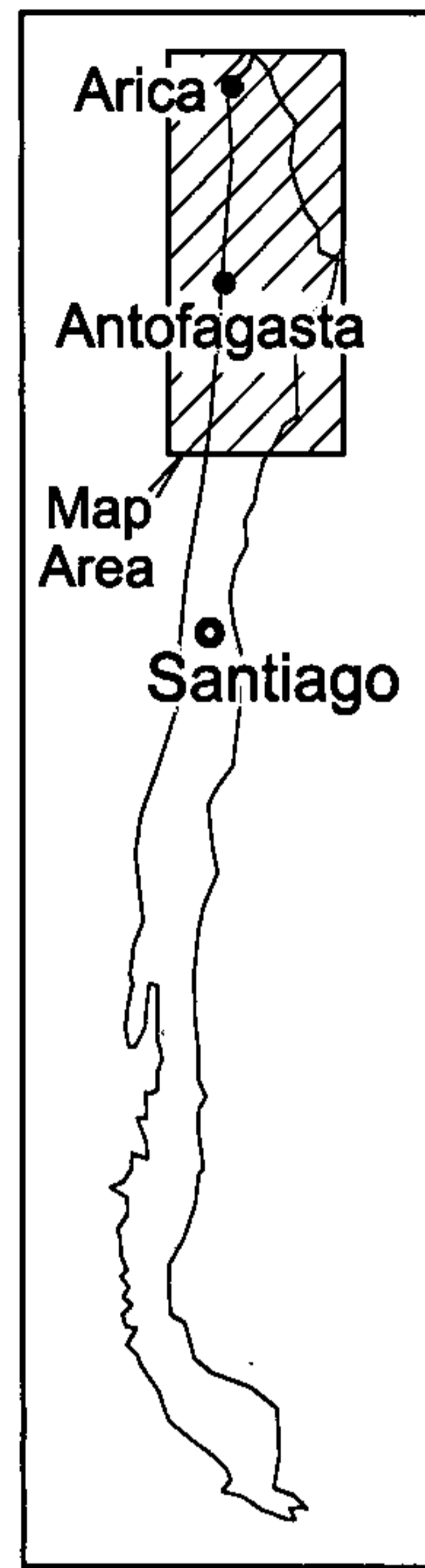
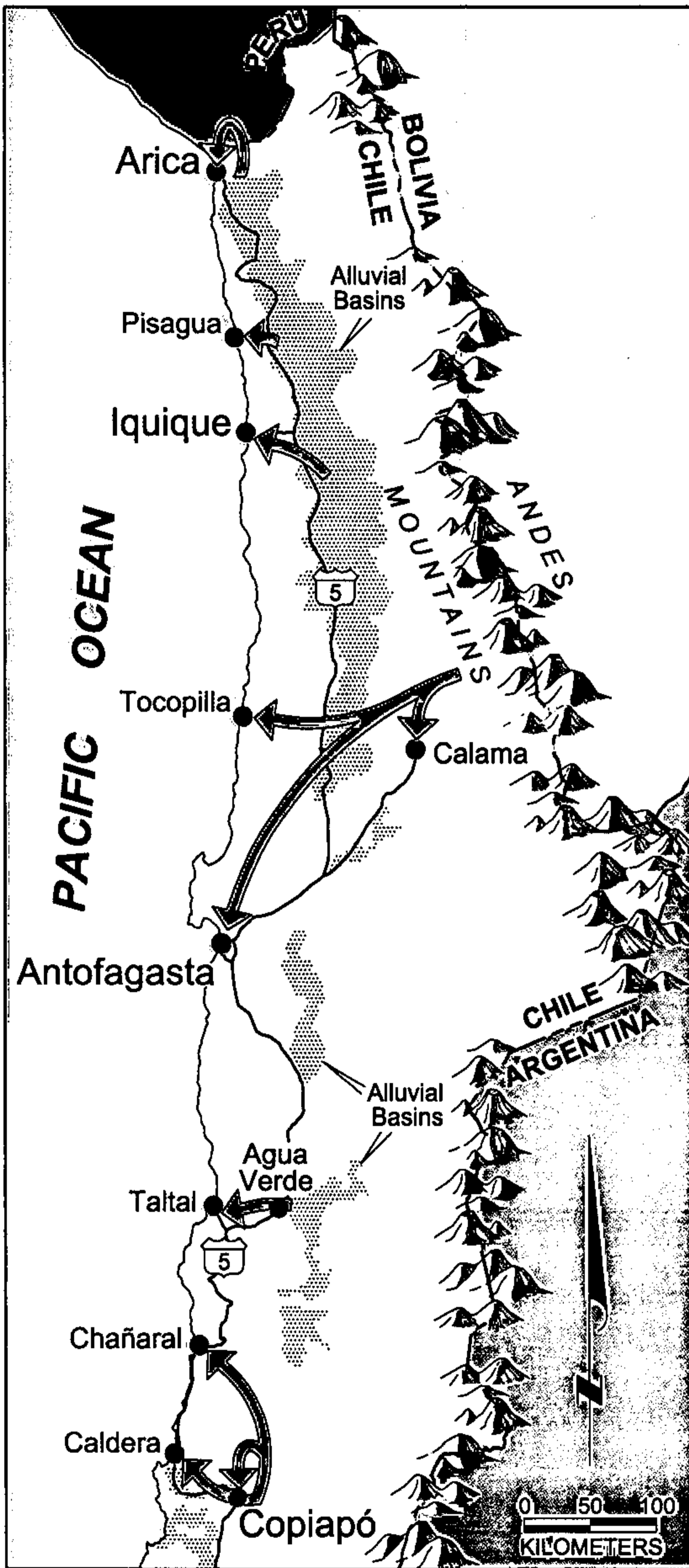
PERCHLORATE IN DRINKING WATER

Leilani Bew and Errol L. Montgomery¹

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¹ Hydrochemist and Hydrogeologist, respectively, Errol L. Montgomery & Associates, Inc., 1550 East Prince Road, Tucson, AZ 85719 (520/881-4912), FAX (520/881-1609), e-mail lbew@elmontgomery.com and emontgomery@elmontgomery.com, respectively.



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