

# Health Consultation

A Review of Well Sampling Results and Perchlorate

UNIVERSAL PROPULSION COMPANY

PHOENIX, MARICOPA COUNTY, ARIZONA

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Agency for Toxic Substances and Disease Registry  
Division of Health Assessment and Consultation  
Atlanta, Georgia 30333

## **Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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# HEALTH CONSULTATION

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UNIVERSAL PROPULSION COMPANY

PHOENIX, MARICOPA COUNTY, ARIZONA

Prepared by:

Arizona Department of Health Services  
Division of Health Assessment and Consultation  
Agency for Toxic Substances and Disease Registry

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## Purpose

The Arizona Department of Health Services (ADHS), under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), is conducting public health assessment activities on the Universal Propulsion Company in Phoenix, Arizona. These activities are at the request of members of the Goodrich Watch Committee, which is comprised of residents who own property near the facility. The residents are concerned about possible exposure to perchlorate and the quality of drinking water from their private wells.

This health consultation focuses on residents' drinking-water wells and groundwater information from Universal Propulsion's production and monitoring wells. In the spring of 2004, the Arizona Department of Environmental Quality and the Universal Propulsion Company sampled local private wells for perchlorate. In addition, the company's production and monitoring wells were sampled for perchlorate. Perchlorate was detected in recently installed monitoring wells located on the company property.

This health consultation is one of several that will be performed as part of the ATSDR public health assessment process at this site. During this process, data on the release and public health impact of perchlorate and any other hazardous substances will be evaluated. The site is currently under review by the Arizona Department of Environmental Quality, and the on-site soil, groundwater, and air emissions from open-burn operations have yet to be fully characterized.

## Introduction

### Universal Propulsion Company

The Universal Propulsion Company (UPCO), a B.F. Goodrich Aerospace Company, is located at 25401 North Central Avenue in far north Phoenix, Arizona. The property is on state trust land that is leased by the Goodrich Corporation from the State of Arizona.<sup>1</sup> The City of Phoenix annexed this area in 2002. The company is currently seeking zoning changes from the City of Phoenix to conform to city land-use plans.<sup>2</sup>



The site covers 160 acres and employs over 250 people. The facility has operated under several different owners since 1972. The city does not supply either municipal water or sewer to the company property or the nearby residences. A production well and eleven septic tank systems are located on the property. Two monitoring wells were installed on the property in 2003.<sup>2</sup> The closest private drinking water well is less than 1/8<sup>th</sup> of a mile north of the facility.<sup>3</sup>

The facility manufactures military aircraft ejection seats, solid propellants, solid propellant operated devices, and related components for the Department of Defense. The facility provides pyrotechnic devices for NASA and produces automotive air bags and products such as stun grenades for military and police agencies. The facility uses bunkers to store, test, and detonate explosives. Two of the manufacturing areas are capable of producing 3,500 pounds of propellant per day. Another area produces 750 pounds of propellant per day. The facility stores an average of 28,373 pounds of ammonium perchlorate daily.<sup>1,2</sup>

### Known Perchlorate Releases

The Arizona Department of Environmental Quality has documented numerous violations at the site for waste treatment units' noncompliance with tank or impoundment regulations. Solid propellant-containing perchlorate is removed from rocket motors by the use of a high-pressure stream of water; and the resulting wastewater is discharged into containment tanks. Prior to 1988, the water generated during this activity was discharged to lined pits.<sup>4</sup> A 1986 report describes the release of perchlorate to a dry wash that crosses the property. Other spills or releases of perchlorate are documented over the years from various locations throughout the facility.<sup>2</sup>

The waste treatment units are known as water bore out units. These units are used to remove propellant from waste rocket parts using water under high pressure. The wet propellant is accumulated in tanks and allowed to dry into sludge that is then burned on-site. The Arizona Department of Environmental Quality classifies the dry sludge from the manufacturing and processing of explosives as hazardous waste.<sup>5</sup>

Company soil investigation reports from July 1999 to March 2001 describe sampling for perchlorate contamination (Table 1). The company has not remediated the perchlorate since enforceable federal or state regulatory clean-up levels do not exist at this time.<sup>2</sup>

**Table 1. Perchlorate Soil Sampling from Water Bore Out Area, 1999-2001.**

Year	Sample Depth (feet)	Perchlorate (milligram per kilogram – mg/kg)	Arizona Health Based Guidance Level (HBGL) for Residential Soil <sup>1</sup>	Exceeds HBGL?
1999	1	1,800	38	Yes
2000	30	255	59	Yes
2001	59	5	59	No
2001	67	0.10	59	No

<sup>1</sup>In 2000, the Arizona Department of Health Services revised the health based guidance level for residential soil from 38 mg/kg to 59 mg/kg.

### The Community

Approximately 3,600 people and 1,700 homes and business reside within a three-mile radius of the plant.<sup>7</sup> The area, while within the City of Phoenix city limits, is rural in nature and is adjacent to state desert preserve land.

The Happy Valley Neighborhood Association serves the homes located north of the facility. This association formed the Goodrich Watch Committee, comprised of approximately 200 residents. This committee has voiced concerns over the possibility that perchlorate will reach their drinking-water wells. This group is participating in a series of meetings with the City of Phoenix and state agencies to provide community input into the company's zoning change application. The Central Arizona Canal is located approximately ½ mile south of the facility. This canal supplies drinking and irrigation water to central and southern Arizona. City of Phoenix drinking-water wells are located directly south and downgradient of the site.<sup>8</sup>

The groundwater flow in this area is from the northeast to the southwest. While the general groundwater flow is away from the private wells located north of the facility, complex local geology may allow the groundwater to migrate in other undetermined directions. The City of Phoenix has not identified a timeline as to when the community will be supplied with municipal water and sewer.<sup>9</sup>

## **Well Sampling Results**

### Residential and Local Business Drinking-Water Wells

The Arizona Department of Environmental Quality collected 44 well-water samples from 41 wells (37 residential wells and 4 business wells). The Universal Propulsion Company collected 22 samples from 21 wells. Water samples obtained by both entities were taken from homes north and south of the facility. The ADEQ also sampled 16 of the 21 wells sampled by the Universal Propulsion Company. A total of 46 wells were sampled by the ADEQ and Universal Propulsion Company, for a total of 66 samples. Perchlorate was not detected in any of these samples.<sup>10</sup>

At the time of the sampling, perchlorate was not detected in any of the residential or business drinking-water wells and, therefore, posed **no public health hazard**.

### Universal Propulsion Company Production Well

The Universal Propulsion Company has one on-site production well that supplies water for the facility and employees. The well is located on the southwest section of the property. Technical consultants for the Universal Propulsion Company estimated the depth to groundwater at 208.5 ft in 2003. The company performs monthly sampling of the production well for perchlorate.<sup>6</sup>

In January 2004, 2 micrograms per liter of water (ug/L) of perchlorate were detected in the production well. Additional sampling results from this well were non-detectable to 1.8 micrograms per liter of water (ug/L).<sup>11</sup> These levels are well below the Arizona health-based guidance level of 14 ppb for perchlorate and **pose no apparent public health hazard**.

### Universal Propulsion Company Monitor Wells

In 2003, two monitoring wells were installed in the southern portion of the site. In February 2004, the Universal Propulsion Company sampled the wells (Table 2). Detected levels of perchlorate ranged from 47 to 130 micrograms per liter of water (ug/L) in these two wells. The monitoring wells tap the same aquifer as the production well. However, the production well on the property is approximately 170 feet deeper than the monitoring wells.<sup>11</sup> Monitoring well #1 has a depth to groundwater of approximately 206 feet. Monitoring well #2 has a depth to groundwater of 217 feet.<sup>4</sup>

**Table 2. 2004 Perchlorate well sampling results.**

Well	Depth to groundwater (feet)	Perchlorate (micrograms per liter) (ug/L)	Exceeds Arizona HBGL for Perchlorate in Drinking Water? (14 micrograms per Liter) (ug/L)	Well water used for drinking water?
Production Well	208	0 to 2	No	Yes
Monitor Well #1	206	47	Yes	No
Monitor Well #2	217	130	Yes	No

The wells are used only for monitoring purposes and **pose no apparent public health hazard.**

### Discussion

Human contact or exposures to chemical contaminants drive the ATSDR public health assessment process. The release or disposal of chemical contaminants into the environment does not always result in exposure or contact. Chemicals only have the potential to cause adverse health effects if people come into contact with them. People may be exposed to chemicals by breathing, eating, or drinking a substance containing the contaminant or by skin (dermal) contact with a substance containing the contaminant.

When people are exposed to chemicals, the exposure does not always result in adverse health effects. The type and severity of health effects depend on the toxicologic properties of the contaminants, how much of the contaminant to which an individual is exposed, how often and or how long an individual is exposed. Once exposure occurs, characteristics such as age, sex, nutritional status, genetics, life style and health status of the exposed individual influence how the individual absorbs, distributes, metabolizes, and excretes the contaminant. These factors influence whether exposure to a contaminant result in adverse health effects.

Residents living near the Universal Propulsion Company are not currently being exposed to perchlorate in drinking water. Levels of perchlorate in the production well located on company property are well below the Arizona health-based guidance level for perchlorate of 14 ppb. Private well owners should continue to monitor their drinking-water wells for perchlorate and other naturally occurring elements and biological factors to ensure safe drinking water supplies.

### Perchlorate

Perchlorate is a white or colorless powder found naturally in the environment in South America or as a manufactured product. Perchlorate is a component of solid fuel propellant for rockets and missiles and is used in the manufacture of some fireworks. It is also used to make rubber, electronic tubes, lubricating oils, matches, fertilizers, paints, and enamels. It is often a component in electroplating and aluminum refining.

Perchlorate salts have been widely used as an oxidizer in solid propellants for rockets and missiles since the 1940's. Because of its finite shelf life, propellant-containing perchlorate has been periodically washed out of U.S. missile and rocket inventory to be replaced with a fresh supply. Environmental releases occurred because of past open burning and open detonation of perchlorate-containing material. As a result of past practices, soil and groundwater are contaminated near rocket fuel manufacturing and disposal facilities.



Drinking water sources have become contaminated with perchlorate because of soil pollution in areas where solid fuel has been used or disposed. Perchlorate salts are soluble in water and once dissolved, perchlorate ions can persist in surface and ground water for several decades.<sup>12</sup>

Perchlorate interferes with iodide uptake into the thyroid gland. Because iodide is an essential component of thyroid hormones, perchlorate disrupts thyroid function. In adults, the thyroid helps to regulate metabolism. In children, the thyroid plays a major role in proper development and metabolism. Impairment of the thyroid function in expectant mothers may impact the fetus and newborn and result in behavior changes, delayed development, and decreased learning capability. Changes in thyroid hormone levels may also result in thyroid tumors. The disruption of iodide uptake by perchlorate is the key event leading to changes in development or tumor formation. Perchlorate is currently not classified by the U. S. Environmental Protection Agency (EPA) as a carcinogen.<sup>13</sup>

#### Arizona's Health-Based Guideline for Perchlorate

Arizona's health-based guidance level (HGBL) for drinking water is 14 micrograms per liter (ug/L) for perchlorate (ClO<sub>4</sub>) and is specifically protective of childhood exposure. Health-based guidelines are developed by the Arizona Department of Health Services and represent concentrations of contaminants in drinking water that are protective of public health during long-term exposure.

The Arizona Department of Health Services uses health-based methodologies and assumptions that are consistent with risk assessment principles recommended by the EPA to develop health-based guidelines.

The health-based guideline developed for perchlorate is specifically protective of childhood ingestion exposure. Exposure assumptions reflect childhood contact rates and body weight. The focus on children is protective of the higher daily intake rates by children and their lower body weight. The exposure duration was assumed at 350 days/year for 6 years.<sup>14</sup>

The provisional reference dose (RfD) of 0.009 mg/kg-day published by the EPA in December 1998 was used to develop the health-based guideline.<sup>14</sup> The RfD is based on the assumption that a threshold exists for certain toxic effects and that threshold may not exist for other carcinogenic effects. Thus, if the critical toxic effect is prevented, then all toxic effects are prevented. The RfD is an estimate of a daily oral exposure to the human population that includes sensitive subpopulations that is unlikely to cause adverse health effects during a lifetime. The oral RfD is expressed in units of milligrams per kilogram per day.<sup>12</sup>

The health-based guideline has a margin of safety. Concentrations of perchlorate in excess of 14 ug/L should not be considered a health threat. Rather, a more detailed analysis would be necessary in order to evaluate health risks from exposure to more than 14 ug/L of perchlorate in drinking water.<sup>14</sup>

The Arizona Department of Health Services will re-evaluate this health based guidance level after the National Academy of Sciences completes their review of the draft USEPA perchlorate toxicity assessment.

### **Child Health Concerns**

According to the 2000 U.S. Census, 34% of the population within a 3-mile radius of the Universal Propulsion property is less than 17 years of age. Five percent of the population is less than 5 years of age.

Exposure to perchlorate can affect how the thyroid gland functions. In children, the thyroid plays a major role in proper development, including the development of brain cells. Thyroid disorders in expectant mothers may result in effects to the developing fetus and newborn. Effects may include abnormal motor activity, decreased learning capability and other behavioral differences that can be tested and observed in animals.

The Arizona health-based guideline developed for perchlorate is specifically protective of childhood ingestion exposure. Exposure assumptions reflect childhood contact rates and body weight. The focus on children is protective of the higher daily intake rates by children and their lower body weight.

### **Conclusions**

Perchlorate has been detected in groundwater at the site. As of March 2004, site contaminants have not been detected in adjacent private drinking-water wells. The use of these wells **poses no public health hazard** at this time.

The Universal Propulsion Company is monitoring their production well monthly to ensure safe drinking-water supplies for their employees. The use of the production well **poses no apparent public health hazard** at this time.

The Arizona Department of Health Services will conduct additional health assessment activities for this site as more complete data becomes available for groundwater, soil, and air emissions originating from the Universal Propulsion Company.

### **Recommendations**

The Arizona Department of Health Services encourages private-well owners who live adjacent to the site to regularly test their well water for perchlorate until such time that the site is fully characterized and remediation, if required, is completed.

Private-well owners are responsible for making sure that the water is safe for domestic use. Private wells should be tested annually for nitrates, coliform bacteria, and naturally occurring elements to detect contamination problems early. Wells should be tested more frequently if a problem is suspected. More information for private well owners is available at <http://www.epa.gov/safewater/faq/faq.html>.

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## **PREPARERS OF THE REPORT**

### **Arizona Department of Health Services, Office of Environmental Health**

Kristina Schaller, Office of Environmental Health

Don Herrington, Chief, Office of Environmental Health, Principal Investigator

### **ATSDR Regional Representative**

Gwendolyn Eng

Office of Regional Operations, Region IX

Office of the Assistant Administrator

### **ATSDR Technical Project Officer**

Allen Robison

Division of Health Assessment and Consultation

Superfund Site Assessment Branch

State Programs Section

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## CERTIFICATION

The Arizona Department of Health Services, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), prepared this lead in schools health consultation. It was prepared in accordance with approved methodology and procedures existing at the time.



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Allen Robison  
Technical Project Officer  
Superfund and Program Assessment Branch  
Division of Health Assessment and Consultation

The Division of Health Assessment and Consultation has reviewed this health consultation and concurs with its findings.



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Bobbi Erlwein  
Team Leader, Cooperative Agreement Team  
Superfund and Program Assessment Branch  
Division of Health Assessment and Consultation  
ATSDR