Health Consultation

AERO DYNE CORPORATION (AERO DYNE)

DISTRICT 4 LONE BUTTE MEMORIAL AREA

GILA RIVER INDIAN COMMUNITY
MARICOPA COUNTY, ARIZONA

NOVEMBER 16, 2006

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.

You May Contact ATSDR Toll Free at
1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

AERO DYNE CORPORATION (AERO DYNE)

DISTRICT 4 LONE BUTTE MEMORIAL AREA

GILA RIVER INDIAN COMMUNITY
MARICOPA COUNTY, ARIZONA

Prepared By:

Gila River Indian Community
Human Resource Department
Occupational Safety and Health Office
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Table of Contents

Summary and Statement of Issues

The Gila River Indian Community (GRIC), Office of Occupational Safety and Health (OSH), has prepared this health consultation through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). This health consultation addresses health concerns based on the results of the first three phases of the Brownfields Targeted Site Assessment (BTSA) of the abandoned Aero Dyne Corporation (Aero Dyne). The BTSA was completed by Ecology and Environment Incorporated (E. and E.) on behalf of the United States Environmental Protection Agency (USEPA). The USEPA Region IX BTSA's are performed to characterize facilities that have been targeted for redevelopment or reuse.(1) In the past perchlorate and trichloroethylene were found in the soil at Aero Dyne site. This health consultation evaluates contamination and migration of perchlorate and TCE from past site activities, and whether the on-site drinking water well might be impacted.

Background

Site Description and History

Aero Dyne leased the property from the United State Department of Interior, Bureau of Indian Affairs (BIA) from 1984 to 1989. Aero Dyne manufactured and tested solid rocket propellant and rocket motors. The United States Environmental Protection Agency (EPA) has found that ammonium perchlorate, a common component of rocket fuel, contaminated groundwater in a number of locations throughout the United States, including Aero Dyne. Trichloroethlyene (TCE) was also detected in the sampling. The cleaning solvent is associated with cleaning equipment at industrial sites.

The Aero Dyne site is located near the northern boundary of the GRIC in Maricopa County, Arizona. The site is in an undeveloped portion of the GRIC located east of the Lone Butte Industrial Park (LBIP) and near the southern portion of Kyrene Road in Section 3 of Township 2 South, Range 4 East of the Gila and Salt River Baseline and Meridian. A map of the site is located in Appendix B. The site is in desert terrain and is currently vacant, and the drinking water well and remnants of the former buildings' concrete pads are still visible. An aerial view is located in Appendix B.

Site Investigation

As a result of ammonium perchlorate contamination throughout the site, the EPA tested the soil at the Aero Dyne site in May 2000 and discovered ammonium perchlorate in the soil. The waste generated at the site was disposed by open burning or via the on site septic system. Based on Aero Dyne documentation, approximately 200 pounds of waste propellant, 5 drums of other waste and contaminated materials were generated and disposed weekly on the site(2).
In 2000 Ecology and Environmental Inc., completed three phases of investigation for perchlorate.

- Phase I: Collection of groundwater samples from a drinking water well located on the site.
- Phase II: Soil and groundwater testing was completed at the site dated September 27, 2000. (3)

- Phase III: Installation and sampling of five groundwater monitoring at the site dated November 2000(2). An aerial photo is located in Appendix B.

Perchlorate

Soil Sampling

Perchlorate had not been detected in groundwater despite elevated concentrations being reported in the soil at the site as of August 2002. In sampling performed by the DEQ in August 2002, two areas of soil contamination were identified at the Aero Dyne site. Concentrations of perchlorate in soil were reported as high as 82,700 ppb at five feet below land surface (bls) in the northern burn area.(3) In September 2002, under DEQ oversight, the Environmental Response Inc. removed 600 tons of contaminated soil, which was taken to a landfill off the GRIC. The area was then filled with clean soil. According to GRIC DEQ HazWaste Specialist, even though contaminated soil was removed, soil contaminated with perchlorate remains. No sampling has been conducted since 2002.

The type of perchlorate salt that was used at this site, ammonium perchlorate, is extremely soluble in water, absorbs weakly to most soil minerals, and is very persistent over time. GRIC DEQ has indicated that the lack of detectable perchlorate concentration in the groundwater may mean the groundwater monitoring well network is inadequate for monitoring the perchlorate impact based on the direction of groundwater flow. DEQ began installing additional wells at the site to improve the monitoring well network in September 2006.

Monitoring wells sampling

There was no detection of perchlorate in any wells prior to November 2002. The first detection of perchlorate was in the November of 2002 sample results at a concentration of 5.34 µg/L (ppb) in the Aero Dyne-6 monitoring well. Perchlorate was again detected in February of 2003 at 4 µg/L in the Aero Dyne-4 monitoring well. It has been determined through laboratory analysis that the high conductivity of the groundwater may have masked the detection of perchlorate near the practical quatitiation limit (PQL) (4 µg/L); however the contract laboratory has recently reduced its PQL to 2µg/L. Because of this lower PQL, perchlorate that has been intermittently detected in the Aero Dyne-4 monitoring well may be detected in other wells in the future.

Drinking water well sampling

According to the Department of Public Works, in September 2004 perchlorate was detected in the Aero Dyne drinking water well at 3.2 µg/L.(4) The February 2005 levels detected increased in the production well to 7.5 µg/L. Both detections in the drinking water well are below the Arizona's Health-Baseline Guidance Level (HBGL) of 14 µg/L.(5) Quarterly monitoring well and drinking water well sampling results from November 2002 through February 2005 are listed in Table 1.

Table 1
Perchlorate Sampling Results of Aero Dyne-4 (Aero Dyne-6 Duplicate) Monitoring Water Well and Aero Dyne Drinking Water Well (2002 to 2005)

Month sampled	Detection AD-4	Detection AD-6 Duplication	Detection Drinking WW	Exceeds 14ppb? Yes	No
	µg/L (ppb)	µg/L (ppb)	µg/L (ppb)		x
November 2002	ND	5.34	ND		x
March 2003	4.0	ND	ND		x
May 2003	2.8	2.7	ND		x
August 2003	2.84	ND	ND		x
December 2003	2.54	2.7	ND		x
March 2004	2.58	9.5	ND		x
June 2004	4.3	4.1	ND		x
September 2004	<2.0	<2.0	3.2		x
October 2004	Not required	Not required	ND		x
November 2004	Not required	Not required	ND		x
December 2004	2.54	2.71	ND		x
January 2005	Not required	Not required	ND		x
February 2005	1.5	1.6	7.5		x

Duplicate - Aero Dyne-6
ND - Non Detected
µg/L -Micrograms per Liter
ppb-part per billion

Trichloroethylene

Soil Sampling

No other samplings for TCE have been taken since 2002. Even after 600 tons of contaminated soil was removed by the Environmental Response Inc., and was taken to a landfill off the GRIC, TCE still remains in the soil.

Monitoring Well Sampling

The groundwater sampling performed during the time period from August 2001 to January 2002 did not detect any contaminant of concern above their respective maximum contamination levels (MCL 5µg/L) in any well. TCE was detected in Aero Dyne-4 at concentrations of 0.63µg/L and 2.5µg/L during those sampling events, respectively.

The source of TCE detected in the Aero Dyne-4 monitoring well is likely to be the septic system located between the former Aero Dyne Process Plant and the Laboratory. TCE was detected at a

concentration of 72µg/L in a hydropunch groundwater sample collected adjacent to the septic system.(3)

The GRIC DEQ sampled the five groundwater monitoring wells at the Aero Dyne Site in May, August, and November 2002 and February, May, August, and December 2003. However, results of quarterly monitoring well tests in February 2003 indicated concentrations of the TCE in the Aero Dyne-4 monitoring well just above the standard EPA allowance in drinking water of 5 micrograms per liter (µg/L). DEQ found 5.9 µg/L. Refer to the TCE in Aero Dyne-4 monitoring well sampling results in Table 2.

Table 2
The sampling results for TCE in Aero Dyne-4 monitoring well in 2003 to 2005.

		Exceeds MCL 5 µg/L (ppb)?	
Month sampled	**Detection**	**Yes**	**No**
February 2003	5.9 µg/L	x	
May 2003	5.3 µg/L	x	
August 2003	5.5 µg/L	x	
December 2003	6.1 µg/L	x	
March 2004	9.6 µg/L	x	
June 2004	9.8 µg/L	x	
September 2004	10 µg/L	x	
December 2004	3.9 µg/L		x
February 2005	3.0 µg/L		x

µg/L -Micrograms per Liter
ppb-part per billion

Drinking Water Well Sampling

The existing drinking water well at the Aero Dyne Site was tested in May, August, and November 2002 and February, May, August, and December 2003.(6) No TCE was detected in the drinking water well, and it met all federal health standards. The Aero Dyne Drinking Water well will continue to be monitored quarterly as long as no TCE is detected

Demographics

According to data received from the GRIC District Four Project Administrator, the Lone Butte Colony (which is to the northeast of Aero Dyne) consists of approximately 10 households living within one-half mile of the site. In these 10 households there are approximately 31 people, of which 17 are children where 12 are 12 years old and younger. These homes are serviced by the Aero Dyne drinking water well.

Community Health Concerns

Concerns voiced by residents and the GRIC DEQ include:

- Perchlorate and TCE contamination of Aero Dyne on-site drinking water well from contaminated soil and groundwater.
- Over consumption of the drinking well water at seasonally low levels of groundwater.
- Possible increase in the rate of pumping by existing or additional residential hookups to the drinking water well. This high rate of pumping may result in contaminants reaching the drinking water well.
- Potential perchlorate and TCE contamination of the subsequent drinking water wells that are situated at LBIP and across Interstate 10 to the west. These wells are down gradient from the existing Aero Dyne monitoring wells.

Discussion

Exposure Pathway Analysis

ATSDR's pathways analysis determines whether people have contacted contaminants from a site and whether those contacts were substantial enough to cause harm. To determine this, ATSDR identifies exposure pathways or ways in which a chemical can enter a person's body (i.e., ingestion, inhalation, or dermal (skin) contact. An exposure pathway contains five major elements, which are:

1. a source of contamination,
2. transport through an environmental medium,
3. a point of exposure,
4. a route of exposure, and
5. a receptor population.

If an exposure pathway contains all five elements and exists now or existed in the past, or will exist in the future, the pathway is considered complete. Only completed exposure pathways are evaluated to determine whether health effects could occur. If one or more of the five elements is not defined clearly but could exist, the exposure pathway is classified as potential.

Perchlorate

The most significant completed exposure pathway related to the site is the ingestion of contaminated drinking water via the Aero Dyne drinking water well. Perchlorate was detected in the Aero Dyne drinking water well located on site in September 2004 and February 2005. However, detections were below the Arizona Health Based Guidance Level (HBGL) of 14 ppb and are therefore not expected to cause adverse health effects (See Appendix C). GRIC

Department of Public Works (DPW) will monitor drinking water wells each month to ensure there is a safe drinking water supply. Refer to Table 1.

Perchlorate has been detected at varying levels in Aero Dyne monitoring wells since 2002, but detections were below the Arizona HBGL of 14 ppb. DEQ will continue tracking migration of the contaminants in groundwater. Currently exposures to perchlorate through the use of the Aero Dyne drinking water well are below levels of concern.

TCE

Historical monitoring has failed to detect TCE in the Aero Dyne drinking water well. While there is no current exposure pathway at this time, TCE has been detected in nearby monitoring wells and could migrate into the drinking water well in the future.

There is a potential future exposure pathway of TCE in groundwater through migration into the drinking water well. Refer to Table 2. TCE was detected in a monitoring well in September 2001. Results of the February 2003 monitoring well sampling indicated concentrations of the TCE in the Aero Dyne-4 monitoring well just above the EPA maximum contamination level (MCL) of 5 ppb. In September 2004 TCE was detected at 5.0 ppb in the same monitoring well.

Metals

Initially in 2000, the metals arsenic, barium, beryllium, cadmium, chromium, and lead were detected in groundwater monitoring wells above their respective practical quantitation levels. However, the metals were not detected in the Aero Dyne drinking water well at the time of testing in 2000. Currently metal levels are now well below established levels of concern according to Agency for Toxic Substance and Disease Registry drinking water comparison values. No further evaluation of metals will be needed in this health consultation; however, GRIC DEQ and DPW will routinely monitor the metal levels quarterly. Refer to Summary of Laboratory Analytical Results –Metals 3rd Quarter 2002 and 1stQuarter 2002 in Appendix D.

Environmental Contamination

The process by which ATSDR evaluates the possible health impact of contaminants is summarized in the following section.

There are two steps in the evaluation process. The first step involves screening the available data to determine the contaminants of concern (COCs) for each media. As part of the ATSDR screening process, maximum detected concentrations of contaminants are compared with Comparison Values (CVs) to determine which chemicals, if any, require additional evaluation. CVs are concentrations of chemicals in the environment, below which no adverse health effects are expected to occur. In the event that a contaminant concentration exceeds its respective CV, it does not necessarily indicate that health effects are expected to occur. Rather, it is indicated that further evaluation of the particular contaminant and the ways in which individuals might be exposed to it is necessary. It should also be noted that other contaminants may be evaluated further if concerns are received from the community regarding the presence of the particular contaminant(s).

Perchlorate and TCE Soil Contamination

Although contaminated soil was removed, soil contaminated with perchlorate and possibly TCE remain. At the time the hard rock (caliche) was reached during the removal action, it was thought that the contamination stopped at that point. After further sampling it was determined the contamination extended below the caliche. Currently, there is concern that the perchlorate and TCE may enter the drinking water well if increasing amounts of water are drawn from the well if there are additional residential hookups to the drinking water wells. This could increase the likelihood of drawing contaminants toward the well. Additionally, increased usage during seasonal low groundwater levels could potentially increase the amount of contaminants reaching the drinking water supply.

Perchlorate, ClO_4 in Groundwater

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

Since the 1940s, perchlorate salts have been widely used as an oxidizer in solid propellants for rockets and missiles. Perchlorate was periodically exchanged and replaced with a fresh supply in U.S. missiles and rockets because of its short shelf life. At the site, environmental releases occurred due to past open burning and detonation of perchlorate-containing materials. As a result of past practices, soil and groundwater are contaminated near rocket fuel manufacturing and disposal facilities,(7)

Biologically, perchlorate interferes with iodide uptake in the thyroid gland. Iodide is an essential component of thyroid hormones; perchlorate disrupts the thyroid function by interfering with iodide uptake. 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 perchorate 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.(8) Since none of the samples exceeded the Arizona Health Based Guidelines of 14 pp for perchlorate, at this time it is not likely that the levels found will cause the mentioned health effects.

Trichloroethylene, $Cl_2C=CHCl$, in Groundwater

Trichloroethylene (TCE) is a nonflammable, colorless liquid at room temperature with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. TCE is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical. For persons exposed to TCE, the appearance of symptoms and their seriousness is dependent upon how much, how long and by what way you

were exposed. Gender, age, lifestyle and health status may also affect how a person reacts to exposure. Studies have indicated that exposure to low levels of TCE over long periods of time may lead to impaired immune system function and may increase the risk of kidney or liver damage and/ or cancer. Drinking or breathing high levels of TCE may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). The EPA maximum contaminate level (MCL) for TCE is 5 ppb. (9) The samples taken from the Aero Dyne-4 monitoring well exceeded the MCL from February 2003 to Sept 2004. No TCE was detected in drinking water well samples taken in 2002 and 2003.

ATSDR Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

According to the GRIC District Four Service Center, there are 10 households with a total of 31 residents living near the Aero Dyne site. Of the 31 residents, 17 are children. In addition 12 of the child population is 12 years or younger. A child's immune system does not fully develop until about the age of 12 years old. Its unlikely children will suffer any health effects from exposure.

Conclusions

Even though there is a complete pathway of exposure, the low levels of perchlorate found at the Aero Dyne-drinking water well pose no apparent health hazard. The levels are below the Health Based Guidance Levels of 14 µg/L established by the State of Arizona.

Existing monitoring wells are not adequate to quantify the extent of perchlorate and TCE impact based on the direction of groundwater flow. The samples taken from the Aero Dyne-4 monitoring well exceeded the MCL for TCE from February 2003 to Sept 2004. This poses no apparent health hazard at this time, since no one drinks from the monitoring wells.

Soil contaminated with perchlorate on-site poses no apparent public health hazard.

Soil contaminated with trichloroethylene (TCE) on-site poses no apparent public health hazard**.**

Recommendations

- The Gila River Indian Community's Department of Environmental Quality (DEQ) and/or Department of Public Works (DPW) should continue conducting monthly sampling of the Aero Dyne drinking water well for perchlorate and TCE.
- Site assessment should be conducted by the DEQ to determine the full extent of contamination.
- Develop regular communication/information exchange to keep residents informed by GRIC DEQ, OSH and/or DPW of sampling results.
- OSH should follow-up with two separate Lone Butte Industrial Park health consultations to consider impact of perchlorate, and TCE contamination, and appropriate actions to protect public health.

Public Health Action Plan

The OSH has developed a public health action plan to ensure the recommendations are implemented and are meaningful for the affected residents. The public health action plan is described in the following table.

Public Health Action	Who Will Implement the Action	Time Frame for Implementation	Desired Outcome When Implemented	Public Health Impact
Conduct sampling of Aero Dyne drinking water well for perchlorate and TCE	GRIC DEQ/DPW	Monthly for perchlorate and quarterly for TCE	Ensure safe levels of perchlorate in drinking water to residents	Prevent exposure to levels of perchlorate and TCE at levels that could harm health
Site assessment	GRIC DEQ	In progress	Determine full extent of contamination	Fully understand the migration, transport and fate of the contamination
Installation of additional monitoring wells at Aero Dyne	GRIC DEQ	Completed September 2006	Improvement of monitoring well network and knowledge of contamination migration	Fully understand the migration, transport and fate of the contamination
Develop a communication/information exchange with residents serviced by the Aero Dyne drinking water well	GRIC DEQ, OSH and/or DPW	As needed	Residents are informed and many health questions are answered	Affected residents are assured safe drinking water
Follow up with two separate health consultation on Lone Butte Industrial Park site for perchlorate and TCE and action to protect public health.	OSH Environmental Health Assessor	Within FY06	Assess possible perchlorate and TCE contamination, and possible linkage to Aero Dyne site contamination	Fully understand the migration, transport and fate of the contamination of both sites

Authors, Technical Advisors

Report Prepared by
Randall Lange, MBA, CSP
Principal Investigator
Gila River Indian Community
Occupational Safety and Health Office

Eleanor Renteria Vargas, MST
ATSDR Environmental Health Assessor
Gila River Indian Community
Occupational Safety and Health Office

Certification

This Aero Dyne Corporation public health consultation was prepared by the Gila River Indian Community Occupational Safety and Health Office under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

Charisse J. Walcott
Technical Project Officer, CAT, CAPEB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Alan Yarbrough
Team Lead, CAT, CAPEB, DHAC, ATSDR

References

1. Gila River Indian Community Department of Environmental Quality, 2002. Groundwater monitoring report 3rd quarter 2001, and 1st quarter 2002 Aero Dyne Corporation Brownfields Site Gila River Indian Community, May 6.

2. Ecology and Environment, Inc. August 2000a. Aero Dyne Corporation, Gila River Indian Community, Arizona Phase III Brownfields Targeted Site Assessment, Final Report.

3. Ecology and Environment, September 27, 2000b. Brownfields, Targeted Site Assessment, Aero Dyne Corporation, Gila River Indian Community.

4. AeroTech Environmental Laboratories, 2004. Case Narrative and Analysis Report to Mike Daniel, GRIC DEQ Hydrologist, September 30

5. Arizona Department of Health Services. Health based guidance level for Perchlorate. Phoenix, Arizona, May 2000.

6. Gila River Indian Community Department of Environmental Quality, 2002. Groundwater monitoring report 2nd, 3rd, 4th quarter 2002, and 1st quarter 2003 Aero Dyne Corporation Brownfields Site Gila River Indian Community Arizona, May 6.

7. Gila River Indian Community Department of Environmental Quality, 2003. Gila River Indian Community DEQ and USEPA Coordinate on Soil and Groundwater Investigation and Cleanup Project at the Former Aero Dyne Corporation Site, September 30.

8. United States Environmental Protection Agency. Perchlorate environmental contamination. Toxicological review and risk characterization. Washington, DC, 2002.

9. Agency for Toxic Substances and disease Registry. Toxicological Profile for Trichloroethylene, Update. Atlanta: ATSDR, September 1997.

Appendices

Appendix A: Acronyms and Abbreviations

Appendix B: Aero Dyne Site map, Aerial Photo and Monitoring Wells

Appendix C: Arizona Health Bases Guidance Levels Defined

Appendix D: Summary of Laboratory Analytical Results –Metals
3rd Quarter 2002 and 1stQuarter 2002

Appendix A: Acronyms and Abbreviations

Acronyms and Abbreviations

ATSDR	Agency for Toxic Substance and Disease Registry
BTSA	Brownfields Target Site Assessment
bgs	Below Ground Surface
ClO_4	Perchlorate
DEQ	Department of Environmental Quality
DPW	Department of Public Works
E & E	Ecology and Environmental, Inc.
GFW	Gila Floodway Well
GRIC	Gila River Indian Community
HBGL	Health Based Guidance Level
LBIP	Lone Butte Industrial Park
MCL	Maximum Contaminant Level
µg/L	Microgram per liter
ND	Non-Detect
OSH	Occupational Safety & Health
ppb	Parts per billion
PQL	Practical quantitation limit
RfD	Reference Dose
TCE	Trichloroethylene
USEPA	United State Environmental Protection Agency
VOC	Volatile Organic Compounds
WQP	Water Quality Program

Appendix B- Aero Dyne Site Map, Aerial Photo and Monitoring Wells

Figure 1 - Aero Dyne Corporation Site Location Map

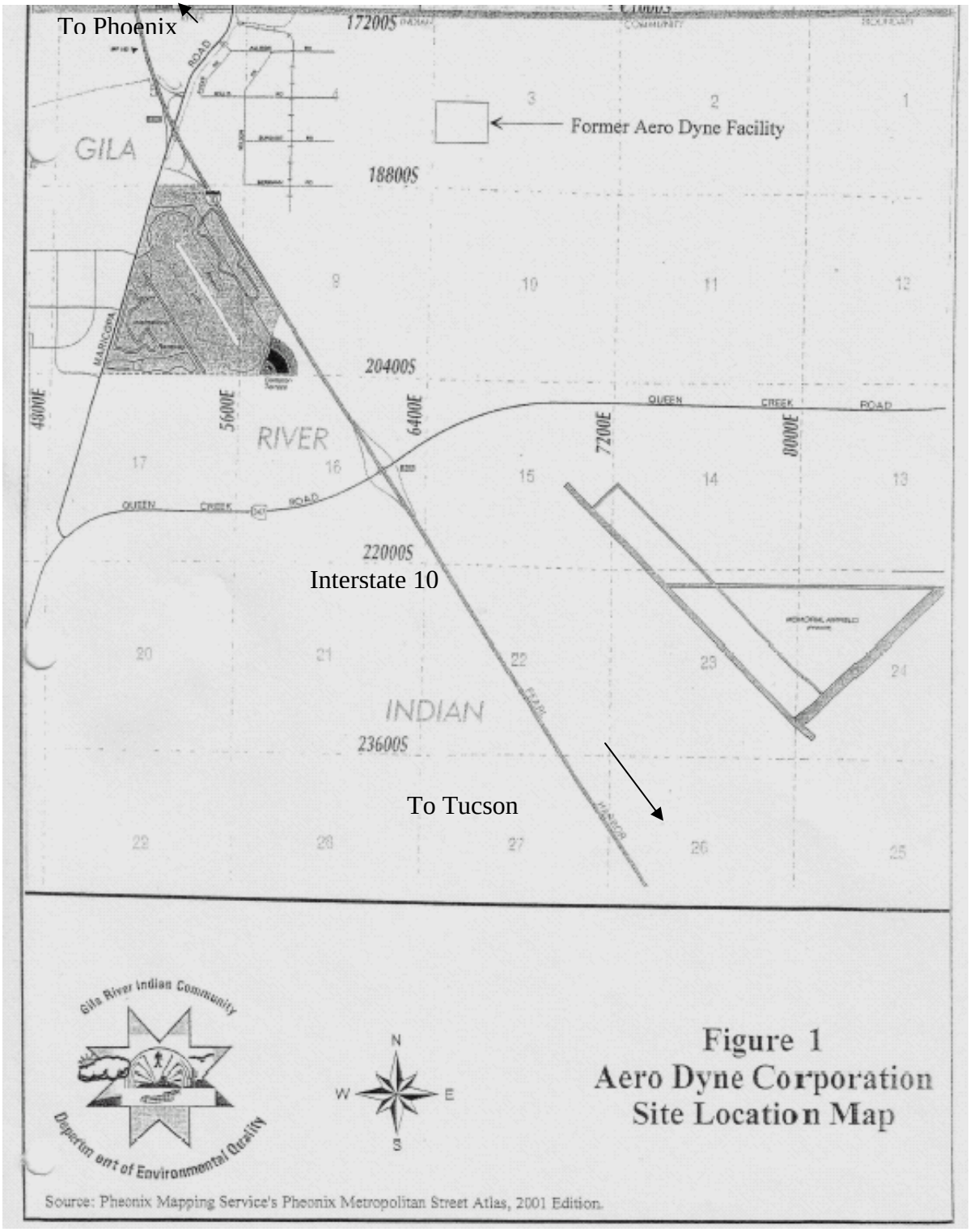
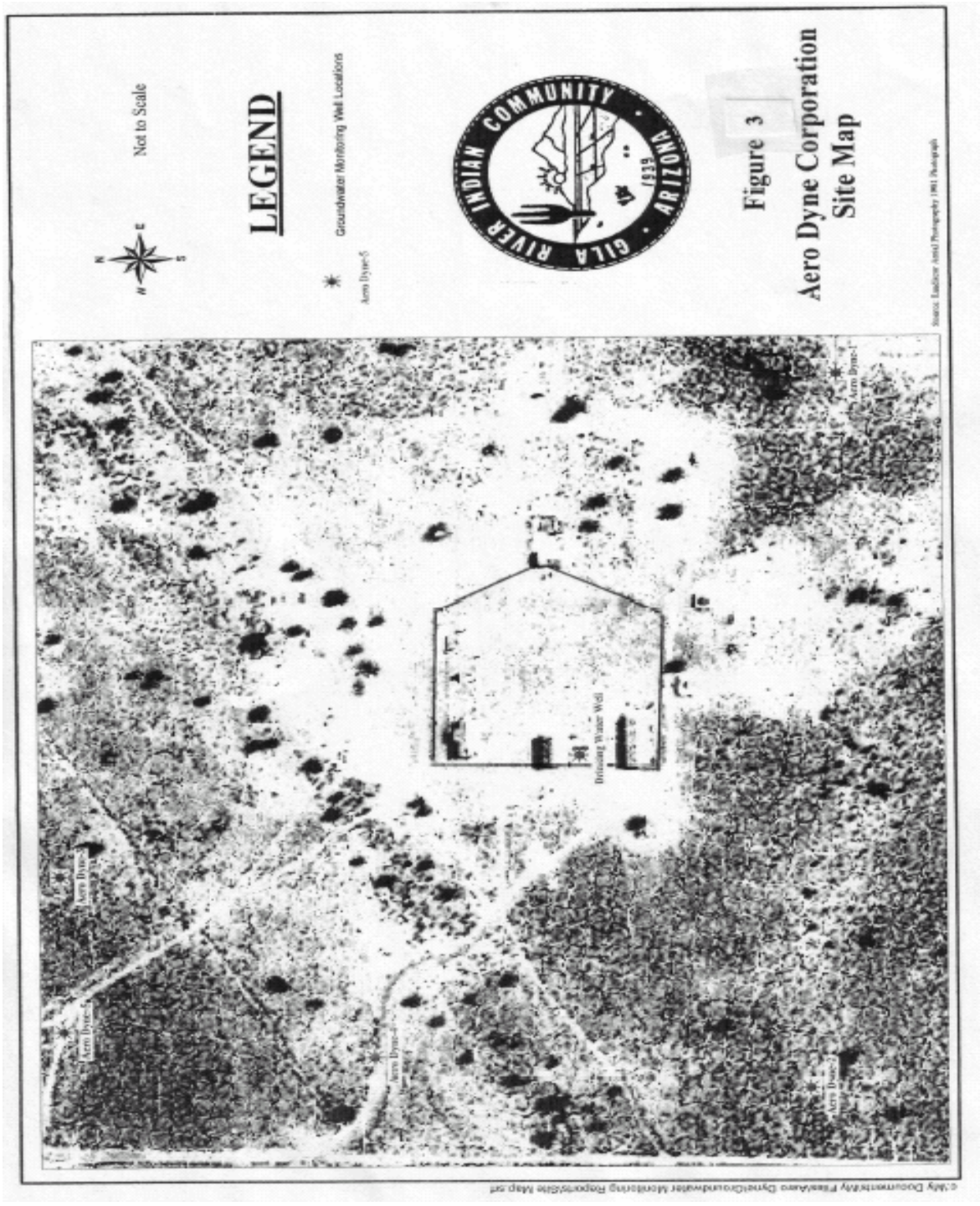


Figure 2 – Aerial Photo of Aero Dyne Corporation and Lone Butte Industrial Park

Figure 3 – Aero Dyne Five Monitoring Groundwater Wells



Appendix C- Arizona's Health-Based Guidance (HBGL) Level for Perchlorate

Arizona's Health-Based Guidance Level for Perchlorate

Arizona's health-based guidance level for drinking water is 14 micrograms per liter (μg/L) for perchlorate (ClO_4) 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.[11]

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.[11]

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.[11] 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. [5]

The health-based guideline has a margin of safety. Concentrations of perchlorate in excess of 14 μg/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 μg/L of perchlorate in drinking water.[11]

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.

Appendix D Summary of Laboratory Analytical Results –Metals 3rd Quarter 2002 and 1stQuarter 2002

Groundwater Monitoring Report
3rd Quarter 2001 and 1st Quarter 2002
Aero Dyne Corporation

Summary of Laboratory Analytical Results - Metals

Sample Location	Sample Date	Analyte Concentration in mg/L												Sample Type
		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Thallium	
Aerodyne-1	9/19/2001	NA	0.017	0.027	NA	<0.001	<0.01	<0.002	<0.0002	NA	<0.005	<0.01	NA	R
Aerodyne-2	8/24/2001	<0.003	0.0054	0.036	<0.001	<0.001	0.031	<0.002	<0.0002	<0.01	<0.005	<0.01	<0.001	R
	9/19/2001	NA	0.0066	0.033	NA	<0.001	<0.01	NA	<0.0002	NA	<0.005	NA	NA	D
Aerodyne-3	9/19/2001	NA	0.006	0.04	NA	<0.001	<0.01	<0.002	<0.0002	NA	<0.005	<0.01	NA	R
Aerodyne-4	9/19/2001	NA	0.0077	0.037	NA	<0.001	<0.01	<0.002	<0.0002	NA	<0.005	<0.01	NA	R
Aerodyne-5	9/19/2001	NA	0.0066	0.044	NA	<0.001	<0.01	<0.002	<0.0002	NA	<0.005	<0.01	NA	R
Drinking Water	1/13/2002	<0.003	<0.005	0.044	<0.001	<0.001	0.024	NA	<0.0002	<0.01	<0.005	NA	<0.001	R

Notes: mg/L - milligram per liter
Drinking Water - Name of sample collected from water well
NA - Not Analyzed
R - Primary Sample
D - Duplicate Sample