

UPDATE: Community meeting on February 6, 2003

Cross-sectional Exposure Assessment of Environmental Contaminants in Churchill County, Nevada Centers for Disease Control and Prevention Study Results

Background

February 2001	A statistically significant increase in the number of children diagnosed with acute lymphocytic leukemia (ALL) and acute myelocytic leukemia (AML) was reported in Churchill County, Nevada. By the end of 2001, 15 children had been diagnosed with ALL or AML. An Expert Panel convened by the state recommended conducting a cross-sectional exposure assessment in Churchill County.
March-April	The Centers for Disease Control and Prevention (CDC) met with state health officials and began planning the cross-sectional exposure study of environmental contaminants.
August-October	CDC opened a field clinic in Fallon, Nevada to collect biologic samples and worked with the Nevada Division of Environmental Protection to collect the environmental samples.
February-March 2002	Biologic and environmental sample collection were completed.
August	Preliminary findings of communitywide elevations of tungsten and arsenic in biologic samples were announced at a public meeting in Fallon.
August-December	Laboratory and statistical analyses continued.
February 2003	Results of questionnaire, biologic, and environmental data analyses to be released at a public meeting in Fallon.

Results

- Levels of most chemicals in urine and blood samples from Churchill County study participants were not elevated compared with national estimates reported in CDC's *Second National Report on Human Exposure to Environmental Chemicals*.
- Arsenic levels were elevated in Churchill County participants' urine and tap water samples. Levels in urine were not higher in cases than comparison children and families. Levels of arsenic in tap water do not differ between case and comparison families.
- Tungsten levels were elevated in Churchill County participants' urine samples; however the levels did not differ between case and comparison children or families. Tungsten was detected in all tap water samples; however, no reference level currently exists for tungsten in water.
- Levels of some nonpersistent pesticides in Churchill County participants' urine samples were slightly elevated; however, the levels did not differ between case and comparison children or families. Levels of nonpersistent pesticides in environmental samples were not elevated.
- Levels of DDE (a breakdown product of the pesticide DDT) were elevated in blood samples of Churchill County participants; however, the levels did not differ between case and comparison children or families.
- Case children have slightly older fathers than comparison children.
- No evidence of retrovirus infection or activity was found. No relationship between Epstein-Barr Virus and leukemia was found.

Arsenic

- Exposure to arsenic exceeded health based reference levels in 34% of the Churchill County study population. Exposure levels were not higher among case^a children or families than comparison^b children or families.
- The geometric mean of arsenic in Churchill County urine samples was 34.61 µg/L^c (equivalent to parts per billion).
- 28.6% of Churchill County results were above normal, in the range of 50–200 µg/L.
- 5.4% of Churchill County results were above the arsenic level at which health problems may occur (> 200 µg/L).

Table 1. Arsenic

	Range (µg/L)	Median (µg/L)	Reference Level ^d (µg/L)	Percent Above the Reference Level
Churchill County	<LOD ^e –1180.40	37.40	50	34
Case families	<LOD–186.30	28.70		25
Comparison families	1.80–1180.4	38.2		37

Tungsten

- Exposure to tungsten exceeded the population-based reference level. Exposure levels did not differ between case and comparison children or families.
- Tungsten levels in Churchill County urine samples ranged from <LOD to 53.97 µg/L.

Table 2. Tungsten

	Second National Report^f	Churchill County	Case Families	Comparison Families
Median (µg/L)	0.07	0.97	0.99	0.97
Geometric mean ^g (µg/L)	0.08	1.19	1.15	1.20

Nonpersistent Pesticides and Metabolites

- More than 10% of the Churchill County study participants had urine levels of six nonpersistent pesticides (two organophosphate pesticides (chlorpyrifos shown below), two chlorinated phenol pesticides, a repellent, and a fungicide) were greater than the 95th percentile^h of a national population survey.
- No differences were seen between case and comparison children or families.

Table 3. Organophosphate pesticide: Chlorpyrifos

	Second National Report	Churchill County	Case Families	Comparison Families
Median (µg/L)	1.70	3.39	3.06	3.75
Geometric mean (µg/L)	1.77	2.46	2.22	2.54

Persistent Pesticides and Metabolites

- DDE was the only persistent pesticide found at levels above the reference level. Exposure did not differ between case and comparison children or families.
- Lipid-adjustedⁱ DDE levels in Churchill County blood samples ranged from <LOD–8169.95.
- The 95th percentile for DDE in a national population survey was 1780 ng/g^j lipid. Eight percent of the Churchill County study population had DDE levels greater than the 95th percentile.

Table 4. Organochlorine pesticide metabolite: DDE

	Second National Report	Churchill County	Case Families	Comparison Families
Median (ng/g lipid)	226.0	445.3	393.0	473.0
Geometric mean (ng/g lipid)	260.0	447.1	302.9	501.3

Survey Variables

- An increased risk was associated with paternal age at the study child's birth (OR^k1.14, *P*-value^l 0.03).

Conclusions

- Elevations of some chemicals were identified, but these elevations did not explain the incidence of childhood leukemia in Churchill County.
- Levels of most of the chemicals measured in biologic or environmental samples were no different from reference levels.
- Levels of arsenic were elevated in tap water and urine samples. Levels of tungsten were elevated in urine samples. Tungsten was detected in all tap water samples tested, but there is no standard or regulatory value with which to compare levels.
- Levels of 7 of 43 pesticides measured were elevated in biologic samples but were not elevated in environmental samples.

Recommendations and Next Steps

- Until the new drinking water facility is built, we recommend continuing efforts to educate the community about alternative sources of drinking water to minimize exposure to tungsten and arsenic. Community education is also recommended to help reduce people's exposure to pesticides.
 - The National Toxicology Program of the National Institutes of Health is reviewing existing literature before beginning toxicologic research of tungsten and tungsten compounds to determine their potential link to cancer in humans.
 - Urine and tap water samples from two cities in Nevada will be analyzed to determine whether the levels of tungsten found in the Churchill County community are similar to levels found in other areas of the state.
 - Because elevated levels of some chemicals were found in urine or blood samples from Churchill County study participants, CDC will perform selected tests of genetic differences and genetic sensitivity on stored samples collected from participants in the Churchill County cross-sectional exposure assessment.
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- a A person diagnosed with ALL or AML enrolled in the Churchill County exposure assessment.
 - b A person without leukemia enrolled in the Churchill County exposure assessment.
 - c Micrograms per liter.
 - d The reference level is the level considered clinically abnormal.
 - e Less than the limit of detection. Levels were lower than the lowest level that the instrument could detect.
 - f The *Second National Report on Human Exposure to Environmental Chemicals* (2003) is a national survey of the U.S. population's exposure to 116 chemicals. The report contains reference ranges for these chemicals.
 - g The geometric mean is the measure of the mid-point of a population where the population distribution does not follow a bell-shaped curve.
 - h The level at or below which 95% of a study population measures.
 - i Lipid adjusting accounts for the amount of lipids (fats, like cholesterol) in blood. Because the amount of persistent pesticides in blood depends on the amount of lipids in blood, levels are adjusted to provide a more accurate measure of the amount of these chemicals that are in your body.
 - j Nanogram per lipid
 - k Odds ratio. Measures the strength of the association between two variables.
 - l A measure of the probability that the association suggested by the odds ratio occurred by chance alone.