

HEALTH CONSULTATION

BRUSH WELLMAN INCORPORATED

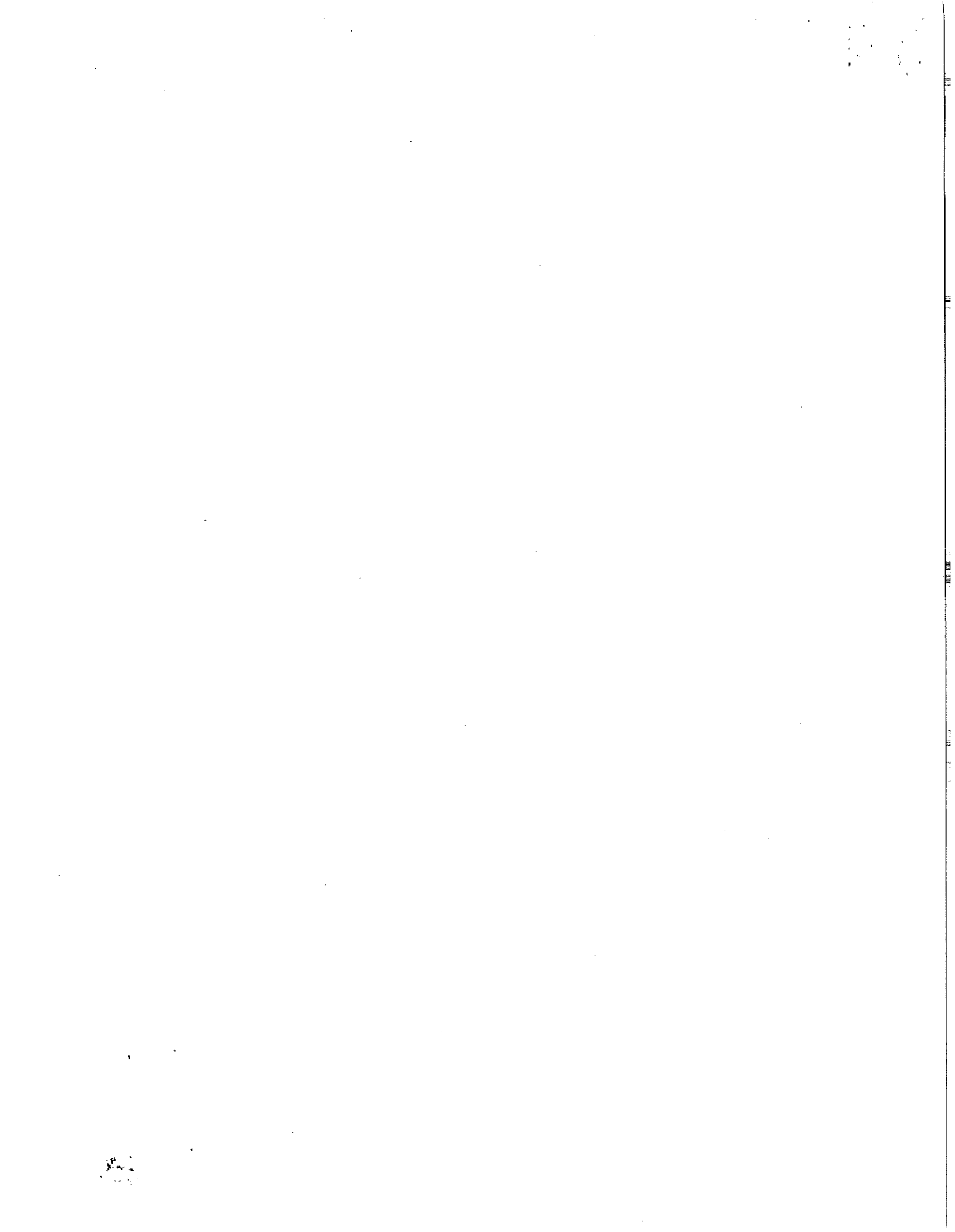
TUCSON, PIMA COUNTY, ARIZONA

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Background and Statement of Issues

The Environmental Protection Agency (EPA) Region 9 requested the Agency for Toxic Substance and Disease Registry (ATSDR) review the methodology and findings of the draft Pima County Health Department document entitled Beryllium/Brush Wellman Investigation, dated November 23, 1999. The purpose of the Pima County Health Department report was to evaluate airborne emissions from the Brush Wellman facility in Tucson Arizona. Brush Wellman has manufactured ceramic beryllium products at its Tucson facility since 1981.

The facility is located in an urban area of Tucson at 6100 South Tucson Boulevard. Vacant lots border the facility to the west, north, and east. Four public schools are located within a one kilometer of the Brush Wellman plant.

Using air modeling, the Arizona Department of Environmental Quality (ADEQ) estimated that average annual ambient beryllium levels adjacent to the plant would be 0.008 micrograms per cubic meter ($\mu\text{g}/\text{M}^3$) [1]. ADEQ also estimated a maximum one hour level of 0.014 $\mu\text{g}/\text{M}^3$. These estimates are based on an emission rate of 4.28 grams per day which is the maximum emissions rate measured during the past 20 years of stack testing and represents a worst case scenario. (The average emission rates for 1998 and 1999 were 0.86 and 0.10 grams per day, respectively. [2, 3]) ADEQ also estimated that maximum deposition of beryllium would occur between 137 to 155 meters distance from the facility, based on particle size, stack height, and local meteorologic conditions. The prevailing wind directions are from the northwest (during the days) and from the southeast (at nights).

In October 1999, the Pima County Health Department and ADEQ collected 30 samples surrounding the Brush Wellman facility to measure the impact of deposition from stack emissions. Four background surface soil samples were collected several miles from the plant. The highest concentrations were found northwest of the facility at the approximate distance predicted by the air models. Beryllium levels ranged from 0.3 to 3.0 milligrams per kilogram of soil (mg/kg) in samples collected near the Brush Wellman plant. The levels of beryllium in background soil samples ranged from 0.4 to 1.4 mg/kg. Samples were collected from within the top two inches of soil [1].

From review of the soil sampling results, the Pima County Health Department concluded that "although soil measurements cannot be used to calculate daily air emissions, the tests results appear to support reported low stack emissions." The Pima County Health Department also stated that ambient air monitoring was not warranted based on these results [1].

Discussion

Breathing beryllium dust causes a serious chronic lung disease called Chronic Beryllium Disease (CBD) for sensitive persons. CBD symptoms include cough, chest pain, shortness of breath, weight loss, weakness, and fatigue. Long-term effects may include loss of lung function, fibrosis, or subsequent secondary effects on the heart with eventual permanent impairment. Chronic beryllium disease is a hypersensitivity or allergic condition in which the tissues of the lungs become inflamed from a cellular nodular reaction [4]. This inflammation restricts the exchange of oxygen between the lungs and the bloodstream. Genetic susceptibility plays a role in the development of CBD. In occupationally exposed workers, the overall prevalence of CBD is two to five percent [5].

EPA has established a reference concentration (RfC) of $0.02 \mu\text{g}/\text{M}^3$. This is based on a lowest observed adverse effect level (LOAEL) of $0.55 \mu\text{g}/\text{M}^3$ for eight hour per day exposures in workers [6]. A study by Essenbud in 1949 estimated a no observed adverse effect level (NOAEL) of 0.01 to $0.1 \mu\text{g}/\text{M}^3$ in air. Essenbud observed cases of CBD in community residents as far as one kilometer from the emission source [6].

CBD continues to occur from exposure in the workplace, including ceramic manufacturing plants, even though the exposures are below the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) of $2 \mu\text{g}/\text{M}^3$ [7]. Researchers are now suggesting that chronic beryllium disease may be associated more with the form and size of beryllium dust, rather than the total mass of beryllium in air [7]. Beryllium oxide, which is used at the Brush Wellman Tucson plant, appears to be the most hazardous form of beryllium because of its insolubility and small particle size. Potential contaminant pathways for the Brush Wellman site are listed in Table 2.

Table 2. Potential exposure pathways for the Brush Wellman site

Media	Exposure Route	Receptor Population
surface soil	ingestion, skin contact	public
air	inhalation	workers/public

Beryllium metal does not cause disease by ingestion, because it is unable to pass through the gastrointestinal tract lining [8]. Some beryllium salts are more soluble, but are still not absorbed well. The maximum level of beryllium detected in surface soil (3.0 mg/kg) is lower than the ATSDR screening values of 4, 100, and 700 mg/kg for pica child, child, and adult, respectively. Because beryllium does not readily cause disease by ingestion, the concentrations of beryllium detected in soil are not expected to pose any hazard to public health.

ATSDR believes the methods used by Pima County Health Department were appropriate for determining the existence of an air emission pathway and validating the air dispersion models. To further evaluate the beryllium air emissions, ATSDR obtained additional background information from the Pima County Department of Environmental Quality (PCDEQ) and the Arizona Department of Environmental Quality (ADEQ). PCDEQ administers the air pollution control program for affected industries within the county. According PCDEQ, Brush Wellman performs annual stack testing to measure its beryllium emissions. The testing is performed using EPA Method 103 for beryllium dust. Pima County environmental engineers have observed the past two stack testings and they report no deficiencies in Brush Wellman's testing methods [6]. Additionally, Pima County environmental officials report that the Brush Wellman facility has not been issued any Notices of Violations (NOV) pertaining to its air permit [6].

ADEQ used two EPA screening models to predict concentrations of beryllium in ambient air. These models used each possible meteorologic condition to select the conditions that gave the highest predicted concentration for each incremental distance from the source. Therefore, the predicted beryllium levels in ambient air near the facility are conservative because they represent the worst-case conditions for both emission rates and meteorologic conditions. The estimated average annual ambient concentration of beryllium ($0.008 \mu\text{g}/\text{M}^3$) and the maximum one hour concentration ($0.014 \mu\text{g}/\text{M}^3$) are below the EPA's reference concentration of $0.02 \mu\text{g}/\text{M}^3$ result of this information, ATSDR concurs with Pima County Health Department's conclusion that air monitoring is not warranted.

ATSDR's Child Health Initiative

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of environmental media. As part of the ATSDR child health initiative, ATSDR health consultations must indicate whether any site-related exposures are of particular concern for children. This site is a particular concern for children because four schools are located close to site. The modeled concentrations represent no apparent health hazard to children.

Conclusions

The levels of beryllium in surface soil near the Brush Wellman Plant represent no public health hazard to the community.

The estimated maximum levels of beryllium in air represent no apparent public health hazard to the community, based on the reported current rate of stack emissions and conservative air modeling methods.

Methods used by the Pima County Health Department were appropriate for determining the existence of an air emission pathway and validating the air dispersion models. ATSDR concurs with the conclusions of the Pima County Health Department report. Soil sampling results support low reported emissions from the Brush Wellman facility and air monitoring is not warranted. ATSDR's conclusions are based on the information contained in the Pima County Health Department report as well as additional background information.

Recommendations

None

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