HEALTH CONSULTATION

Public Comment Release

BRUSH WELLMAN ELMORE PLANT
(a/k/a BRUSH WELLMAN INCORPORATED)

ELMORE, OTTAWA COUNTY, OHIO

EPA FACILITY ID: OHD004212999

Prepared by:

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Background and Statement of Issues

The Agency for Toxic Substance and Disease Registry (ATSDR) was requested by Ohio Senator Mike DeWine to investigate community exposure to beryllium from the Brush Wellman plant in Elmore, Ohio. Specifically, ATSDR was asked to determine whether beryllium air emissions from the Brush Wellman plant and the possible off-site tranport of beryllium dust on workers' clothing present a health hazard to the community.

The Brush Wellman facility is located in a semi-rural area between the villages of Elmore and Oak Harbor. (Figure 1 is a map of the area). Approximately 80 persons live within 1 kilometer (0.62 miles) of the plant and approximately 2,000 persons live within 5 km (3 miles) of the plant. Some residences border the plant property; the closest residence is approximately 0.5 km (1/3 of mile) from the plant.

Brush Wellman's Elmore plant produces beryllium powder, beryllium oxide, and beryllium alloys from beryllium hydroxide (Kent 2001). The plant contains 900,000 square feet of floor space within a 470 acre property. The Elmore plant has operated since 1953 and employs approximately 800 workers. The plant operates 24 hours per day, 7 days per week. It is the principle producer of beryllium metal, beryllium alloy, and beryllium in the United States (ATSDR 2000). Currently, the pure beryllium powder extraction operations have been shut down because the plant has been recycling stock piled beryllium.

Beryllium is mined from two ores, beryl and bertrandite. It is also present in small quantities in soil. Beryllium is a rigid, low density metal that contains excellent thermal and physical properties. Because of these properties, beryllium products are used in a number of industries including the following: aerospace, automotive, energy, medical, and electronics industries (Kolanz 2001).

Some persons exposed to beryllium develop a sensitization to the metal, which is similar to an allergy. Some sensitized individuals go on to develop chronic beryllium disease (CBD) in which granulomas form in the lungs. These granulomas can impair lung function (ATSDR 2001). CBD can be debilitating and sometimes fatal. A complete description of CBD is described in Appendix B. In response to Senator DeWine's request, ATSDR conducted a site visit in Elmore, Ohio, on June 27 through June 28, 2001. ATSDR met with representatives from the State of Ohio Environmental Protection Agency (OEPA), Ohio Citizen Action (an environmental group), and Brush Wellman, Inc.

ATSDR also conducted an open house at the Elmore Community Center, on June 27, 2001. The purpose of the meeting was to gather community concerns about beryllium exposure. Fifty-three community members attended the open house. In addition, some community health concerns were received through telephone conversations with local residents and through email and letters written to ATSDR.

The most frequent health–related concerns and comments voiced by the community were:

- the quality of private well water in residences located closest to the plant
- beryllium exposure from air emissions and off-site migration of beryllium on clothes (worker take home)
- request for independent air and wipe sampling
- hygiene, housekeeping, and safety at other companies in the area that work with beryllium containing metals
- requests for blood testing with the blood Beryllium Lymphocyte Proliferation Test (BeLPT) for the community

Some community members voiced a lack of confidence in Brush Wellman. Some also perceived that OEPA regulatory oversight of Brush Wellman was less than rigorous.

These issues are addressed in the main body of the health consultation. Additional community concerns and ATSDR's responses are contained in Appendix A.

In preparation of this health consultation, ATSDR reviewed the following:

- results of well water sampling collected and analyzed by OEPA,
- results of air monitoring performed by Brush Wellman,
- incident reports from OEPA,
- correspondence between Brush Wellman and OEPA,
- wipe sampling information provided by the Ohio Citizen Action, and
- Brush Wellman policies and procedures

Groundwater beneath the Brush Wellman Plant is contaminated with chlorinated solvents including tetrachloroethylene (PCE) and trichloroethylene (TCE). Brush Wellman management indicated that the chlorinated solvent contamination has been limited to the on-site production wells (Brush Wellman 2001a). Since 1999, the plant has obtained its potable and production water from the Ottawa County Regional Water Plant in Oak Harbor (Cox and Colvin 2000). Brush Wellman is conducting a corrective action study to determine whether additional actions are necessary to control the migration of PCE contamination in ground water. This plan must be reviewed and approved by OEPA.

Environmental Data - Well Water Quality

On May 31, 2001, and on July 26, 2001, Brush Wellman and OEPA collected split well water samples from eight residences which border the Brush Wellman Plant. OEPA samples were analyzed for beryllium. No detectable levels of beryllium were found in either set of samples. The limit of detection was 5 micrograms per liter ($\mu g/\ell$) for the samples collected in May 2001, and 0.2 $\mu g/\ell$ for samples collected in July 2001. OEPA inadvertently analyzed the May 2001 well samples using a less sensative method (Inductively Coupled Plasma spectrophotometer). EPA's

Maximum Contaminant Level (MCL) for beryllium is 4 $\mu g/\ell$. (The MCL is the maximum permissible level of a contaminant in allowed in public water systems. This MCL was established by the EPA to protect against illness resulting from ingesting drinking water contaminants.)

The July 2001 samples were analyzed using a more sensitive method of analysis (atomic absorption spectrophotometer) which had a limit of detection of 0.2 $\mu g/\ell$. OEPA notified the affected residents of results of May and July 2001 well water testing in September 2001. Brush Wellman reported that results of the May and July 2001 sampling were also below the MCL (Kolanz 2001b).

On January 11, 1999, OEPA sampled wells of five private residences near the Brush Wellman. The samples were analyzed for volatile organic compounds (VOCs), including chlorinated solvents, and metals, including beryllium. The samples were below detectable levels for VOCs and beryllium. (The detection limit was 0.5$\mu g/\ell$ for VOCs and 0.2 $\mu g/\ell$ for beryllium.) OEPA notified the residents of the well water testing by letter in February of 1999.

Air Monitoring Data

Brush Wellman has performed ambient air monitoring for beryllium outside of its Elmore, Ohio, plant since 1957 (Brush Wellman 2001a). Currently Brush Wellman performs continuous air monitoring for beryllium at nine off-site locations. (Monitoring locations are depicted in Figure 1). Two of the stations, #13 and #19, contain co-located monitors (two monitors located adjacent to each other).

Each air monitor draws air across a fiberglass filter (Whatman type EPM 2000) using an electrically powered pump. The filters are removed weekly and analyzed in the Brush Wellman laboratory using an atomic absorption spectrophotometer. For each 30 day period, the weekly beryllium levels are averaged and reported to the OEPA, as required by EPA.

The weekly and monthly average concentrations of beryllium are reported to OEPA in micrograms per cubic meter ($\mu g/m^3$). Table 1 contains the maximum weekly and monthly average beryllium levels in ambient air for the period January 1999 through May 2001.

Table 1
Levels of Beryllium in Ambient Air
Elmore, Ohio
January 1999 through May 2001
(reported by compass heading from the main stack)

Monitor Number	Direction/Distance from Stacks (degrees/ miles)	Maximum Weekly Concentrations ($\mu g/m^3$) / Date of Maxima	Maximum Monthly Concentrations ($\mu g/m^3$) EPA Limit = 0.01 $\mu g/m^3$
#11	2° / 3.37	0.0008 (1/02- 8/01)	0.0004
#13	44° / 0.57	0.0040 (6/19- 26/00)	0.0019
#15	53° / 0.78	0.0137 (12/20-27/99)	0.0029
#9	71° / 1.28	0.0038 (12/20-27/99)	0.001
#8	115° / 0.69	0.0029 (10/02-09/00)	0.002
#3	204° /0.83	0.0014 (3/8-15/99)	0.0006
to be assigned	≈260° /≈3.7	(started operation in Sept 2001)	not applicable
#12	281 / 0.92	0.0022 (12/28-04/01)	0.0005
#19	330° / 0.33	0.0042 (2/01- 08/99)	0.0008
#18	355° / 0.36	0.0051 (9/18- 25/00)	0.0029

Brush Wellman also operates one air monitoring station in the parking lot north of the plant. This air monitor is not part of their compliance monitoring network because Brush Wellman considers this to be an on-site monitor. EPA's limit for beryllium in ambient air specifies vicinity of the source. Brush Wellman does not consider the onsite location to be within the vicinity.
During the period from January 1999 through May 2001, beryllium levels at the north parking lot monitoring station measured a maximum weekly level of 0.0173 $\mu g/m^3$ (February 1-8 , 1999) and a maximum monthly level of 0.0077 $\mu g/m^3$.

Brush Wellman's quality control methods include chain of custody, use of two co-located monitors, and participation in inter-laboratory quality control programs with the US EPA (Marc Kolanz, personal communication, June 27, 2001). No significant differences were observed in the results of the co-located monitors for the period of January 1999 through May 2001.

In response to congressional interest, EPA conducted a multi-media inspection of Brush Wellman's Elmore Plant during the Summer of 2000. No significant violations of the air, waste or water regulations were observed during this inspection.

ATSDR reviewed the wind rose data for the greater Elmore area. A wind rose describes the direction of the wind blows over time. ATSDR calculated the wind rose using the software program (WRPLOT, Lakes Environmental Software) based on weather data for Toledo Express Airport for years 1990 through 1992. The wind blows from the southwest or west at least 50 percent of the time in the Elmore area. The wind blows from the northwest, north, or northeast approximately 25 percent of the time.

The majority of the air monitoring stations are located north and northeast of the plant (downwind of the plant). The largest angles (from the plant's stack) between air monitors appears on the south and west portions of the site (Figure 1). From the Brush Wellman stack there are approximately 90 degrees difference between air monitoring stations 8 (southeast) and 3 (south), and approximately 77 degrees difference between air monitoring stations 3 (south) and 12 (southwest). (90 degrees represents a quarter of the compass.) Elmore is located between monitoring stations 3 and 12 by compass direction. Oak Harbor is located in-line with monitoring station 9 (Northeast). In September of 2001, Brush Wellman installed an additional air monitoring station on Rice street in Elmore. This action was performed in response to a request Brush Wellman's Community Advisory Panel (CAP). In the first week of operation the beryllium level was measured at 0.0001 $\mu g/m^3$ (Brush Wellman, 2001a).

OEPA staff periodically observes Brush Wellman calibrate air flow rates of the monitoring equipment, and they review air monitoring results provided by Brush Wellman. Several years ago, OEPA staff performed side by side monitoring during the evaluation of air monitoring filter media. However, OEPA staff has not independently performed any periodic or random air monitoring for beryllium outside of the Brush Wellman plant.

OEPA staff has requested that Brush Wellman install an additional air monitoring station for use by the OEPA to verify the quality of the Brush Wellman air monitoring data. This station will be installed at monitoring station 13. OEPA staff will be responsible for calibrating the air monitor, and performing analyses of the air filters. OEPA staff anticipates that this monitor will start operating in the fall of 2001.

Discussion

Well Water

ATSDR does not expect that adverse health effects will occur from ingesting well water containing less than 0.2 $\mu g/\ell$ of beryllium. Beryllium metal is not believed to cause disease by ingestion, because it is unable to easily pass through the gastrointestinal tract lining (ATSDR 2000). Some beryllium salts are more soluble, but are still not absorbed well.

Brush Wellman states that chlorinated solvent contamination has not migrated from the site boundaries. Sampling of private wells of five residences near the Brush Wellman plant indicated the absence of chlorinated solvent contamination in Janaury 1999. The levels of chlorinated solvents in groundwater (and well water samples) may fluctuate with time. ATSDR does not have sufficient information (i.e. analyses of private well water for chlorinated solvents performed within the past six months) to evaluate the potential public health impact on the community.

Ambient Air

To protect communities from chronic beryllium disease, in 1949 the Atomic Energy Commission (AEC) established an ambient air standard for beryllium at 0.01 $\mu g/m^3$, averaged over a 30-day period. EPA adopted this same standard in 1973. Currently, the EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation limits the amount of beryllium that plants can emit into the environment to either 10 grams (g) in a 24-hour period, or to an amount that would result in atmospheric levels of 0.01 micrograms (μg) beryllium per cubic meter (m^3) of air near of the source, averaged over a 30-day period (40 CFR 61.32). Brush Wellman's Elmore plant is regulated under the 0.01 $\mu g/m^3$ limit.

Brush Wellman uses a combination of cyclone separators, bag filters, and high efficiency filters to control beryllium emissions and to achieve compliance with the 0.01 $\mu g/m^3$ limit. For the ten year period from 1990 through 1999, Brush Wellman reported releasing between 720 and 1105 pounds of beryllium per year from stack emissions (TRI 2001). In 1999, Brush Wellman released 720 pounds from stack emissions. If the emissions were constant throughout 1999, approximately 1.9 pounds (860 grams) of beryllium were released each day.

From 1980 to present, Brush Wellman exceeded the EPA's beryllium limit of 0.01 $\mu g/m3$ for a 30 day period on at least three occasions. Monitoring stations 13 and 18 exceeded 0.01 $\mu g/m^3$ during the period of June through August of 1980. In April 1989 and October 1990, monitoring station 18 measured 0.028 $\mu g/m^3$ and 0.015 $\mu g/m^3$. EPA and OEPA issued violations to Brush Wellman for these incidents. The ambient beryllium levels near the Brush Wellman Plant have been below the EPA 0.01 $\mu g/m^3$ limit as measured over 30 day periods at each monitoring station since November of 1990 (OEPA 2001a).

The ambient air levels of beryllium are also below EPA's reference concentration (RfC) of 0.02 $\mu g/m^3$ (IRIS 1998). The reference concentration is defined as the level below which adverse health effects are not likely to occur.

The average ambient air levels of beryllium in the United States is 0.00003 $\mu g/m^3$. The median concentration of beryllium in United States cities in 0.0002 $\mu g/m^3$. (This is about one fiftieth (50^{th}) of the EPA Limit). Coal burning power plants are the largest source of beryllium from man-made activities (ATSDR 2000).

Episodic Air Releases

At approximately 9:00 AM, on February 15, 2001, Brush Wellman personnel observed a visible smoke plume coming from a barrel storage area. Brush Wellman evacuated on-site personnel that were in the path of the plume. Brush Wellman personnel notified the local sheriff's department once it was determined that the plume was migrating off site (OEPA 2001b). The wind was blowing to the southwest (between air monitoring stations 3 and 12) during this event. Brush Wellman is required to notify OEPA if a hazardous chemical is released in excess of its reportable quantity. (The reportable quantity for beryllium is 10 pounds.) The Harris-Elmore Fire Department closed State Road 590 southwest of the plant and evacuated seven homes by door to door notification. Harris-Elmore Fire Department response personnel drove through the plume twice to notify the residents of the evacuation. Brush Wellman personnel collected an air sample in the pathway of the plume at State Road 590. The concentration of beryllium in the three hour air sample was 0.64 $\mu g/m^3$. This value is below the American Industrial Hygiene Association's Emergency Response Planning Guideline level two (ERPG-2) of 25 $\mu g/m^3$. ERPG-2 is defined as "the maximum airborne concentration below which it is believed that nearly all persons could be exposed for up to one hour without experiencing or developing life threatening health effects or symptoms that could impair an individual's ability to take protective action" (AIHA 2001). While no air monitoring station was directly in the path of the plume, Brush Wellman personnel removed and analyzed the filters from the closest air monitoring stations located downwind of the plant after the release. Both samples contained less than 0.01 $\mu g/m^3$ of beryllium. (These samples had been collected over a two-day period.) Residents were allowed to return to their homes at 3:30 PM after the source of the plume was controlled and the results of the air sampling were obtained and reviewed.

OEPA emergency response personnel were not allowed to enter the Brush Wellman Plant to investigate the release because Brush Wellman management stated they lacked the specific training required to enter the facility. OEPA maintains that their personnel have the necessary training and authority to enter the Brush Wellman regardless of Brush Wellman's policy. Fifteen OEPA personnel received the Brush Wellman training required to enter the Elmore Plant after this incident.

Some past and current workers expressed concern about another incident where particulate emissions settled on their vehicles following an upset in the plant's air pollution control system. Brush Wellman staff washed the employees' vehicles after this incident.

Two additional episodes occurred in 2001 that required the evacuation of workers from portions of the plant in order to prevent or reduce employee exposure to beryllium dust (Henry 2001; Funk 2001). Two days after the February 15, 2001, air release, a furnace leak resulted in a small fire. Brush Wellman notified the Harris-Elmore sheriff but not the OEPA. On July 11, 2001, a small leak occurred in the cast shop furnace. Brush Wellman notified OEPA. OEPA did not respond to either incident because they were informed that no off-site releases had occurred.

Overhead exhaust fans are used to remove air contaminants, including beryllium dust, from the work areas during these beryllium incidents according to Brush Wellman Policy. These are general exhaust ventilation fans which are used for cooling and they do not contain any air cleaning devices.

The public health implications of a brief exposure to 0.64 $\mu g/m^3$ are difficult to assess. It is theoretically possible for the community to be exposed to levels of beryllium that approach 1 $\mu g/m^3$ for brief periods (less than four hours) during plant upsets while maintaining the 30 day average below the EPA limit of 0.01 $\mu g/m^3$. During the February 15, 2001, incident community members could have been exposed to 0.64 $\mu g/m^3$ levels of beryllium for three hours had there been no evacuation. It is not known whether this exposure may be sufficient to sensitize a susceptible person or initiate the onset of disease in a sensitized person. Two workers at a beryllium ceramics plant were sensitized to beryllium following less than 24 months of exposure to levels averaging less than 0.1 $\mu g/m^3$ (Henneberger 2001). These workers may have been exposed through inhalation and skin contact. Because of the lack of understanding of CBD, prudent public health policy calls for minimizing or eliminating non-occupational exposure to processed beryllium dust where feasible.

ATSDR does not have sufficient information to draw public health conclusions about the levels of beryllium in ambient air during short-term (eight hours or less) adverse plant conditions (e.g., breach of bag house filters).

Potential Off-site Migration of Beryllium Dust on Workers and Equipment

Many community members voiced their concern about possible exposure to beryllium as a result of worker take home (beryllium dust on workers' clothing and shoes.)

In 1999, the National Institute for Occupational Safety and Health (NIOSH) found beryllium contamination in the personal vehicles of beryllium machine shop workers in Alabama. The geometric mean level of beryllium found on the drivers side of vehicle floors was 2.0 μg per 100 cm^2 ($\mu g/100\ cm^2$) of surface area. Workers at this facility were allowed to wear their work shoes outside of the machine shop (Sanderson et al. 1999).

On September 2, 1999, the Occupational Safety and Health Administration (OSHA) issued a hazard information bulletin warning employees of the risk of chronic beryllium disease and encouraging hygiene controls, including shower and separate work clothes (Appendix C). However, OSHA does not currently require companies to have their beryllium exposed workers shower or change clothes. OSHA is developing a proposed beryllium regulation that will effect the Brush Wellman's operations and other companies that work with beryllium. This regulation may take several years to be promulgated.

In late 2000, Ohio Citizen Action collected wipe and dust samples from the property of 12 community members including nearby residents, four current, and two former workers. Samples were collected from house surfaces, automobiles and vacuum cleaner dust collection bags. Dust samples from eight household vacuum cleaners contained from less than 0.8 μg to 2.4 μg of beryllium. (These levels were not reported in concentration units, e.g., beryllium mass per total mass). Wipe samples collected from ceiling fans and exterior surfaces of four residences contained no detectable amount of beryllium. (The limit of detection was 0.8 μg per sample). Wipe samples collected from the inside of the automobiles of three Brush Wellman workers contained 0.4 μg per 100 cm^2 to 1.0 $\mu g/100\ cm^2$ of beryllium. A wipe sample collected from the hood of the car from a nearby resident contained 0.03 $\mu g/100\ cm^2$. In July 2001, Ohio Citizen Action conducted wipe and dust sampling on the property of non-Brush Wellman beryllium alloy workers who work with beryllium metal and found beryllium in some of the samples (Amy Ryder, Ohio Public Citizen, personal communication, Aug 22, 2001). Ohio Citizen Action indicated that the levels of beryllium in wipe samples ranged from 0.08 $\mu g/100\ cm^2$ on a truck cab floor to 3.0 $\mu g/100 cm^2$ on the floor of a (non-Brush Wellman) worker's residence. A wipe sample collected from the boots of a (non-Brush Wellman) worker contained 100 $\mu g/100\ cm^2$.

For several years, Brush Wellman has required its production employees to wear company issued clothing and to shower at the end of the work shift. Based on discussions with former and current workers, this policy has been largely self-regulated. Until recently this policy may not have been strictly or uniformly enforced. Employees who perform extremely dusty jobs are required to wear disposable coveralls as well. Within the past three years, the policy has been extended to include visitors into production areas. Non-production workers are no longer allowed to eat in the plant cafeteria. Workers are allowed to eat in their work clothes without first showering. Workers wearing outer coveralls must remove them prior to entering the lunch room. Brush Wellman has installed "air showers" to remove loose dust from plant workers' clothing. An air shower is a chamber containing a uniform flow of air. Prior to leaving certain production areas, workers are required to take an "air shower" while wearing respiratory protection. Failure to comply with workplace hygiene controls could result in the off-site migration of beryllium on personal items such as lunch boxes.

Several studies have documented cases of chronic beryllium disease occurring in the spouses of beryllium workers (Knishkowy and Baker 1986). Shaking beryllium-contaminated work clothes can produce 0.3 $\mu g/m^3$ of beryllium (Cohen and Positano 1984). In 1980, a spouse of a Brush Wellman Elmore Plant worker was diagnosed with chronic beryllium disease (Roe 1999). The nature of her beryllium exposure was not clear but she did launder contaminated clothing at home after her husband was injured at the plant and she toured the Elmore plant.

Based on ATSDR's limited observations (from outside the plant), there appear to be no clear or distinct boundaries between zones of contamination or between personal protective equipment used at the Brush Wellman Elmore Plant that are similar to those found in asbestos abatement, hazardous waste operations or radiological work. In common areas of the plant, vendors were observed delivering supplies wearing street clothes, while workers who pass-by wear respirators

and company work clothes. One employee indicated that Brush Wellman workers are required to pick up their clean clothing in the laundry room at the beginning of the shift. Employees pick up clothing in an area where the laundry room workers clean contaminated work clothing wearing respiratory protection. Brush Wellman requires that injured employees be decontaminated before entering an ambulance. The Elmore-Harris Fire Department responders have observed that decontamination is less likely to occur on 2nd and 3rd shifts (M. Czeczele, personal communication, June 27, 2001).

There are no health-based standards that define safe levels of beryllium for surface contamination or household vacuum cleaner dust. The potential for exposure to beryllium from surface contamination may be a function of several factors including the total amount of dust on the surface, the form and size of the beryllium particles, and the location and physical characteristics of the surface. It is not possible to accurately evaluate the potential risk posed by beryllium surface contamination because of a number of factors may effect potential exposure and our current lack of understanding of chronic beryllium disease.

Wipe sampling is not an efficient method for removing surface contamination. Researchers who repeated wipe sampling of the same surfaces found that the second wipe samples contained on average 55 percent of the initial wipe concentration (Lichtenwalner 1992). In the same study, the range of second wipe samples varied from 35 to 92 percent. Also, the lack of a standardized wipe sampling methodology may increase the variability of wipe sampling results and the uncertainty of the meaning of the data.

Background levels of beryllium in soil could account for some of the beryllium detected in wipe samples. The geometric mean level of beryllium in 322 surface soil samples, collected from seven of the 88 Ohio counties, was 0.38 milligrams per kilogram (mg/kg) (Cox - Colvin 1996).

Brush Wellman operated another beryllium processing plant in Luckey, Ohio, for the Atomic Energy Commission (the predecessor of the Department Of Energy) from 1949 through 1959. Investigators determined that the background beryllium level in soil for the site was 1.1 milligrams per kilogram (mg/kg) (US Army Corps of Engineers 1999). The Luckey Plant is located approximately 16 kilometers (10 miles) west of Elmore in Wood County, Ohio.

In response to cases of chronic beryllium disease occurring at Department of Energy (DOE) facilities, DOE promulgated a Chronic Beryllium Disease Prevention regulation (10 CFR Part 850). As part of this program, DOE established surface contamination limits. Removable, i.e. loose, beryllium contamination must not exceed 3μg/100 cm^2 during non-operation periods. The requirement is intended to limit the spread of beryllium contamination and to assess the adequacy of housekeeping measures. Prior to releasing any equipment from designated beryllium work areas, the levels of removable beryllium must be below 0.1 μg/100 cm^2.

The DOE's Chronic Beryllium Disease Prevention Program does not apply to Brush Wellman's Elmore plant because it is not a DOE facility. Brush Wellman does not perform routine wipe sampling on equipment/vehicles leaving the facility. Instead, Brush Wellman uses visual inspections to ensure that there is no visible contamination on equipment that is leaving the site.

Because of the uncertainty associated with assessing the risk of beryllium surface contamination, and the reports of chronic beryllium disease among family contacts, prudent public health practice calls for preventing the spread of beryllium dust through the use of hygiene, housekeeping, work practice and engineering controls.

At present, ATSDR does not have adequate information to assess whether the community has been exposed to beryllium through off-site transport from Brush Wellman workers.

Biological Testing

ATSDR has received many requests from the Elmore community to provide screening for community members, including former Brush Wellman contractors and vendors, using the beryllium blood lymphocyte proliferation test (BeLPT). The BeLPT was developed as a screening tool to identify sensitization to beryllium, that is, to determine if the immune system has learned to "recognize" beryllium. Persons identified as sensitized can then be clinically evaluated for chronic beryllium disease. The test has been a useful tool in detecting chronic beryllium disease in workers without clinical symptoms of disease. At present, there are no effective routine biological tests to identify if community members have ever been exposed to beryllium.

There is considerable debate among experts as to whether the BeLPT would be an effective screening tool for use in a community setting. All screening tests have some error, where some who truly have a condition are missed and others who truly don't have a condition are mistakenly identified. The specificity of the BeLPT, or the likelihood that it would correctly identify a person as not sensitized, is unknown (Maier 2001). If the specificity of the BeLPT is poor, some community members may be identified as sensitized when they are not. To date, the test has only been used to screen current and former beryllium workers. It has never been used in a non-occupational environment where exposure to beryllium, and thus prevalence of sensitization, would be expected to be much lower.

Based on ATSDR's observations at the community meeting, some residents may be unclear about symptoms and nature of chronic beryllium disease.

Community Information Issues

Some community members voiced a lack of confidence in Brush Wellman. This lack of trust may be attributed, in part, to ineffective dialogue between Brush Wellman and the community regarding beryllium and other environmental health issues. For example, residents who allow

Brush Wellman to maintain air monitoring stations on their property and other community members have not been formally notified of the results of the air monitoring.

Brush Wellman recently established a Community Advisory Panel (CAP) to improve dialog with the community. The CAP meeting minutes are sent to the Harris-Elmore Public Library but no newsletter or fact sheet is produced that summarizes CAP activities. The community has not been notified of CAP meetings in advance nor has OEPA been allowed to participate in the CAP.

Based on observations during ATSDR's June 2001 public meeting, community members were not aware of OEPA's recent environmental sampling efforts, such as recent well water sampling for beryllium or plans for ambient monitoring for beryllium until these actions were announced by OEPA personnel at the public meeting.

OEPA has notified the affected residences of the results of private well water sampling in 1999 and 2001. However, these results may be of interest to others who reside near the Brush Wellman plant.

Off-site Machining of Brush Wellman-owned Beryllium Parts and Downstream Users of Beryllium

Brush Wellman hires some off-site machine shops in the Elmore area to machine Brush Wellman-owned beryllium containing components. During the June 2001 public meeting, some workers at these machine shops reported a lack of adequate air monitoring, personal protective equipment and ventilation. Workers also reported unsafe practices, including using high-pressure air to remove dust from ones clothing, sweeping, and smoking in work areas. Some of the workers are also concerned about the migration of beryllium dust from these shops on workers' clothing.

In July 2001, Ohio Citizen Action conducted wipe and dust sampling on the property of non-Brush Wellman beryllium alloy workers who work with beryllium metal and found beryllium in some of the samples (Amy Ryder, Ohio Public Citizen, personal communication, Aug 22, 2001). Ohio Citizen Action indicated that the levels of beryllium in wipe samples ranged from 0.08 $\mu g/100cm^2$ on a truck cab floor to 3.0 $\mu g/100cm^2$ on the floor of a (non-Brush Wellman) worker's residence. A wipe sample collected from the boots of a (non-Brush Wellman) worker contained 100 $\mu g/100cm^2$.

As part of its product stewardship program, Brush Wellman trains industrial hygiene consultants on methods for evaluating and controlling beryllium exposure in the workplace, and they offer these consultants to Brush Wellman customers. In addition, Brush Wellman management indicated that they offer to inspect and perform air monitoring of Elmore area machine shops that perform work for Brush Wellman (Marc Kolanz, Brush Wellman, personal communication, June 27 2001).

ATSDR does not have the authority to investigate occupational health and safety issues at operating facilities. OSHA has initiated a study of down stream users of beryllium as part of its rule making process. Downstream users are employers who purchase beryllium containing materials from producers, such as Brush Wellman, and further machine or modify the beryllium containing material.

Until recently researchers have believed that chronic beryllium disease occurs primarily in persons exposed to beryllium metal and beryllium oxides. There is now some evidence indicating that chronic beryllium disease may occur in workers who are exposed to beryllium copper alloys containing 2 per cent beryllium (Balkissoon 1999). This finding is significant because of the potentially large number of downstream beryllium workers who may be exposed to copper beryllium alloys and the current lack of an OSHA regulation for beryllium.

Workers who may be exposed to beryllium are encouraged to share the content of OSHA's hazard information bulletin (Appendix C) with their employers and follow the guidance provided on beryllium products' material safety data sheets. Workers may also contact NIOSH or OSHA for on-site assistance.

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 there are residences close to the site. Children are believed to be more sensitive to exposure to hazardous contaminants than adults.

Conclusions

ATSDR cannot fully evaluate possible environmental pathways for beryllium exposure because of the following data gaps:

- levels of beryllium dust in homes and personal vehicles of Brush Wellman workers and the members of the community
- levels of beryllium in ambient air during short-term incidents (e.g. furnace fires, air pollution control system upsets)

Levels of beryllium in ambient air near the Brush Wellman Plant are below the EPA limit of 0.01 $\mu g/m^3$ for 30 day periods. This limit may not adequately protect the public from repeated short-term exposure to releases of beryllium during plant upset conditions.

Brush Wellman may not have communicated effectively with the community regarding the results of past environmental sampling and planned activities.

The levels of beryllium in well water samples collected from eight private residences near the Brush Wellman Plant in July 2001 were below detectable limits and less than EPA's maximum contaminant level.

The levels of volatile organic compound in well waters samples collected from five private residences near the Brush Wellman Plant in January 1999 were less that detectable limits.

Door to door notification for evacuation is an inefficient means of communicating emergencies. The Ottawa County Emergency Management Agency is installing a 911 call back system. This system will allow affected residents to be notified of emergencies by telephone.

Downstream beryllium workers may not have adequate hygiene and workplace controls to prevent the spread to beryllium dust from their work places.

Some community members may not understand the symptoms and nature of chronic beryllium disease.

Recommendations

ATSDR should:

- conduct an exposure investigation to determine whether community members have been exposed to beryllium from possible off-site transport of dust on Brush Wellman workers's clothing.
- evaluate the possible use of biological testing based on the results of the Exposure Investigation.
- use air dispersion modeling to review the air monitoring site locations and determine the possible geographic distribution of beryllium levels.
- develop and distribute health education materials for residents and for health care providers that explain (a) what is known about the relationship between exposure and chronic beryllium disease, and (b) the importance of differentiating chronic beryllium disease from sarcoidosis and other forms of chronic granulomatous lung disease.

Brush Wellman should:

- notify the community of the CAP meetings in advance, summarize CAP findings and actions in a newsletter or a fact sheet or other effective methods, and allow OEPA to participate in the CAP.
- notify the community of the results of environmental monitoring and results from air monitoring sampling.
- report any release of visible dust emissions to the OEPA, regardless if the estimated quantity is less than 10 pounds.
- continue to conduct short-term air sampling downwind of any potential off-site release of beryllium (e.g., February 15, 2001), report the incidents and sampling results to OEPA and the community.
- review proper decontamination procedures for injured personal with affected onsite responders.
- continue to monitor the potential migration of ground water contamination to ensure that it does not impact nearby private wells.

OEPA should:

- establish ongoing dialogue with the Elmore community through regularly scheduled public meetings or other effective means.
- conduct additional well water sampling for the residences adjacent to the Brush Wellman Plant for volatile organic compounds, including PCE and TCE.
- perform periodic ambient air monitoring to verify the Brush Wellman data.
- notify community of the results of any environmental sampling.
- respond to all potential off-site air releases of beryllium from Brush Wellman Elmore Plant.

Downstream beryllium workers should consider:

Requesting a Health Hazard Evaluation from the National Institute for Occupational Safety and Health online at http://www.cdc.gov/niosh/hheform.html or by calling or 1-800-356-4674. A Health Hazard Investigation is an investigation conducted by NIOSH to find out whether there is a health hazard to employees caused by exposure to hazardous materials in the workplace.

Or contact the local Occupational Safety and Health Administration (OSHA) Office:

The OSHA office for Elmore area workers is:

Toledo Area Office
Ohio Building
420 Madison Avenue, Suite 600
Toledo, Ohio 43604
(419) 259-7542

Community members

Persons who believe that they have been exposed to beryllium in the past and are experiencing symptoms of shortness of breath, fatigue, weight loss, chest and joint pains, cough, and skin rashes should consider consulting an occupational/environmental medicine specialist to determine whether testing for beryllium sensitivity is appropriate.

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