Health Consultation

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

ELMORE, OTTAWA COUNTY, OHIO

EPA FACILITY ID: OHD004212999

ORIGINAL RELEASE: JULY 25, 2002

REVISED: DECEMBER 1, 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.

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Prepared by:

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Background and Statement of Issues

Ohio Senator Mike DeWine asked the Agency for Toxic Substance and Disease Registry (ATSDR) to investigate the potential for beryllium exposures from the Brush Wellman plant in Elmore, Ohio. Specifically, Senator DeWine asked ATSDR whether beryllium air emissions from the plant and the possible off-site transport of beryllium dust on workers' clothing constitute a health hazard to area residents.

The Brush Wellman plant is located on 470 acres in a semi-rural area between the villages of Elmore and Oak Harbor (Figure 1). Approximately 80 persons live within 1 kilometer (0.62 miles) of the plant and approximately 2,000 persons live within 5 km (3 miles). Some residences border the plant property; the closest is approximately 0.5 km (0.3 miles) from the plant.

The plant is the principal producer of beryllium, beryllium alloy, and beryllium oxide in the United States (ATSDR 2000). The Elmore plant has operated since 1953 and employs approximately 600 workers on a 24-hour per day, 7-day per week schedule. Currently, the pure beryllium metal smelting operations have been shut down because the plant has been recycling stockpiled beryllium metal.

Beryllium is extracted from two ores, beryl and bertrandite. It is also present in soil and rocks in small quantities. Beryllium is a rigid, low-density metal with excellent thermal and physical properties. Because of these properties, beryllium products are used in a number of industries including aerospace, automobile, energy, medicine, and electronics (Kolanz 2001).

Upon exposure, susceptible individuals can become sensitized to beryllium and can eventually develop chronic beryllium disease (CBD), a sometimes progressive, granulomatous, lung disease. The symptoms associated with clinical disease include dry cough, shortness of breath, fatigue, and chest pain (Maier and Newman 1998). CBD can be debilitating and is sometimes fatal. A detailed description of CBD is contained in Appendix A.

In late 2000, Ohio Citizen Action collected wipe and dust samples from the property of 12 community members including residents who live near the plant, four current workers, 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 mircograms μg) to 2.4 μg of beryllium. 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 to 1.0 μg of beryllium per 100 square centimeters (cm^2) of surface area. A wipe sample collected from the hood of a nearby resident's car contained 0.03 μg/100 cm^2. In July 2001, Ohio Citizen Action conducted wipe and dust sampling on the property of non-Brush Wellman beryllium alloy workers and found beryllium in some of the samples (Amy Ryder, Ohio Citizen Action, personal communication, Aug 22, 2001). Ohio Citizen Action reported that the levels of beryllium in wipe samples ranged from 0.08 μg/100 cm^2 on a truck cab floor to 3.0 μg/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 μg/100 cm^2. ATSDR was not

provided specific sampling procedures and other quality control information. As a result, ATSDR has not attempted to interpret the meaning of these data.

From June 27 through June 28, 2001 ATSDR conducted a site visit in Elmore, Ohio. ATSDR met with representatives from the Ohio Environmental Protection Agency (OEPA), Ohio Citizen Action, and Brush Wellman, Inc (ATSDR 2001).

Also, on June 27, 2001, ATSDR conducted an open house at the Elmore Community Center. 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 written correspondence to ATSDR.

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

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

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

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.

Public comments to the October 10, 2001, Public Comment Health Consultation are contained in Appendix C together with ATSDR's responses to those comments.

Environmental Data – Residential Well and Groundwater Quality

Dissolved beryllium has been detected in groundwater at 262 of 4,177 sites (6.6 percent) throughout the United States with an average concentration of 13 µg/L (USEPA 2000). On May 31, 2001, and on July 26, 2001, Brush Wellman and OEPA collected split well water samples from eight residences bordering the plant. OEPA samples were analyzed for beryllium. Beryllium was

not found in either set of samples. The limit of detection was 5 micrograms per liter (µg/L) for the samples collected in May 2001, and 0.2 µg/L for samples collected in July 2001. OEPA inadvertently analyzed the May 2001 well samples using a less sensitive method (Inductively Coupled Plasma spectrophotometer). The Maximum Contaminant Level (MCL) for beryllium established by the USEPA to protect against potential illness resulting from ingesting contaminated drinking water is 4 µg/L.

In September 2001 OEPA notified the property owners of the results of the May through July 2001 well water testing. Brush Wellman also reported that results of the May through July 2001 sampling were below the MCL (Kolanz 2001b). Brush Wellman's environmental consultant conducted additional rounds of sampling in August 2001 through April 2002. Beryllium was not detected in these samples.

Some of the groundwater beneath the Brush Wellman plant is contaminated with chlorinated solvents including tetrachloroethylene (PCE) and trichloroethylene (TCE). Brush Wellman reported that the chlorinated solvent contamination has been detected in some of the on-site monitoring wells (Brush Wellman 2001a). Since 1999, the plant has obtained potable and production water from the Ottawa County Regional Water Plant in Oak Harbor. Brush Wellman is conducting a corrective action study to determine whether additional actions are necessary to control the migration of PCE groundwater contamination. This plan will be reviewed by and subject to the approval of OEPA.

No VOCs have been detected in private well water samples collected from residences adjacent to the plant. On January 11, 1999, OEPA sampled the wells of five private residences near the Brush Wellman plant to assess whether Brush Wellman's groundwater contamination was affecting private well water. 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 0.5µg/L for VOCs and 0.2 µg/L for beryllium.) In February of 1999 OEPA notified the residents of their well water testing results by letter. In April 2002 Brush Wellman's environmental consultant sampled the wells of 10 private residences near the Brush Wellman Plant for VOCs. No VOCs were detected in these samples.

Air Sampling Data

Brush Wellman has performed ambient air sampling for beryllium outside of its Elmore, Ohio, plant since 1958 (Brush Wellman 2001b). The United States Atomic Energy Commission required Brush Wellman to operate an ambient air sampling network from 1958 to 1962. For 11 years, from 1962 until 1973, Brush Wellman voluntarily operated the ambient air sampling network. In 1973, USEPA adopted an ambient air standard for beryllium. In 1974 Brush Wellman's sampling network was redesigned in consultation with, and approved by, USEPA Region 5. Currently, Brush Wellman performs continuous air sampling for beryllium at ten off-site locations (Figure 1). Two of the stations, #13 and #19, contain co-located samplers for quality control purposes. The stations are operated continually; sampling filters are collected weekly and are reported to the OEPA monthly.

Each air sampler draws air through 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. As required by USEPA, for each 30-day period, the weekly beryllium levels are averaged and reported to the OEPA. Based on a 30-day average, the USEPA standard for the airborne concentration of beryllium is 0.01 micrograms per cubic meter of air ($\mu g/m^3$).

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 1997 through April 2002. ATSDR also reviewed the weekly sampling results over this 5-year period.

Table 1
Levels of Beryllium in Ambient Air
Elmore, Ohio
January 1997 through April 2002
(reported by compass heading from the main stack)

Monitor Number	Direction/Distance from Stacks * (degrees/ km)	Maximum Weekly Average Concentration ($\mu g/m^3$) / (period of maxima)	Maximum Monthly Average Concentration ($\mu g/m^3$) EPA Limit = 0.01 $\mu g/m^3$
#11	2 º / 5.4	0.0012 (3/23- 3/30/98)	0.0004
#13	44 º / 0.91	0.0040 (6/19- 26/00)	0.0019
#15	53 º / 1.25	0.0137 (12/20-27/99)	0.0029
#9	71 º / 2.05	0.0038 (12/20-27/99)	0.0011
#8	115 º / 1.1	0.0029 (10/02-09/00)	0.002
#3	204 º / 1.33	0.0028 (2/2/98-2/9/98)	0.0009
to be assigned	260 º / 5.9	(started operation in Sept 2001)	not applicable
#12	281 º / 1.47	0.0022 (12/28-04/01)	0.0005
#19	330 º / 0.53	0.0042 (2/01- 08/99)	0.0010
#18	355 º / 0.58	0.0056 (10/26- 11/02/98)	0.0029

* a zero degree heading (0º) is north

Brush Wellman also operates one air sampling station in the parking lot north of the plant. This air sampler is not part of their compliance sampling network—Brush Wellman considers this to be an on-site sampler. During the January 1999 – May 2001 monitoring period, levels at the north parking lot monitoring station measured a maximum weekly level of 0.0173 $\mu g/m^3$ on 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 samplers, and participation in inter-laboratory quality control programs with the USEPA (Marc Kolanz, Brush Wellman Vice President of Environmental Health and Safety, personal communication, June 27, 2001). No significant differences were observed in the results of the co-located samplers.

In response to Congressional interest, USEPA conducted a multi-media inspection of the plant during the summer of 2000. No significant air or waste violations 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 over time. ATSDR calculated the wind rose using WRPLOT, Lakes Environmental software based on weather data for the Toledo Express airport for the following years: 1985, 1986, 1987, 1990 and 1991. In the Elmore area, the winds are from the southwest or west at least 50% of the time, and from the northwest, north, or northeast approximately 25% of the time. For dispersion modeling purposes, ATSDR has determined that the meteorology conditions at the Toledo Express Airport are similar to those in Elmore Ohio.

The majority of the air sampling stations are north and northeast, i.e., downwind of the plant. The largest angle (from the plant's stack) between air samplers appears on the south and west portions of the site (Figure 1). From the Brush Wellman stack there is an approximate 90-degree difference between air sampler stations 8 (southeast) and 3 (south), and an approximate 77-degree difference between air sampling stations 3 (south) and 12 (southwest). By compass direction, Elmore is located between sampling stations 3 and 12. Oak Harbor is in-line with monitoring station 9 (Northeast). In September of 2001, Brush Wellman installed an additional air sampling station on Rice Street in Elmore. Brush Wellman proposed this action to the Community Advisory Panel (CAP). The CAP accepted Brush Wellman's proposal. In the first week of operation the beryllium level was measured at 0.0001 $\mu g/m^3$ (Brush Wellman 2001a).

ATSDR performed dispersion air modeling to review the location of the air sampling stations using a USEPA-approved air model (ISCT-3) and meteorology data the years 1985, 1986, 1987, 1990, and 1991, from the Toledo Express airport. Input parameters for the source in the model were obtained from the Elmore Plant's Title V air pollution permit application. The modeling results show that the highest airborne beryllium concentrations, measured as 30-day averages, are found in the area immediately northeast of the plant. Two sampling stations are located in this area. Therefore, the air sampling stations (13 and 15) are positioned to measure the highest levels of beryllium in ambient air that result from the Brush Wellman plant emissions during normal operations.

Until recently, OEPA staff has not independently performed any periodic or random air sampling for beryllium outside of the Brush Wellman plant. In 2001, OEPA staff requested that Brush Wellman split some of Brush Wellman's sample filters with the agency (each analyzing ½ a filter) for analysis by the OEPA to verify the quality of the Brush Wellman air sampling data. As an alternative, Brush Wellman suggested that an additional air sample station be installed—at Brush Wellman's expense—to permit the OEPA to independently collect its own samples. OEPA

accepted Brush Wellman's offer. OEPA completely controls the sampler while Brush Wellman pays for the electricity. This station has been installed at air sampling station 13. OEPA staff is responsible for calibrating the air monitor, and collecting and analyzing the air filters. OEPA staff initiated this sampling in January 2002. ATSDR reviewed the OEPA results for January and February 2002. Both OEPA and Brush Wellman's results were well below the USEPA's National Emission Standard for Hazardous Air Pollutant (NESHAP) standard of 0.01 µg/m3 of beryllium, based on 30-day averages.

Discussion

Well Water

Beryllium has not been detected in the private well water of residences near the Brush Wellman plant. Beryllium is not known to cause disease by ingestion, because it is unable to easily pass through the gastrointestinal tract lining (ATSDR 2000).

Brush Wellman reported that chlorinated solvent contamination has not migrated from the site boundaries (Marc Kolanz, Brush Wellman, personal communication, June 28, 2001). Chlorinated solvents were not detected in well water samples collected in January 1999 or April 2002 from residences near the Brush Wellman plant. The levels of chlorinated solvents in groundwater (and well-water samples) can change with time. Periodic VOC sampling of nearby residential wells is necessary to verify the absence of contamination.

Ambient Air

Beryllium in the ambient air occurs from natural sources, such as wind-blown soil, and from human activity, such as the burning of coal. Coal-burning power plants are the largest source of beryllium in the environment from human activity (ATSDR 2000). The annual average ambient air level of beryllium in the United States is 0.00003 µg/m^3. The annual median concentration of beryllium in United States cities is 0.0002 µg/m^3. This is about one-fiftieth (50^{th}) of the USEPA Limit of 0.01 µg/m^3 averaged over a 30-day period.

To protect communities from chronic beryllium disease, in 1949 the Atomic Energy Commission (AEC) recommended an ambient air standard for beryllium of 0.01 µg/m^3, averaged over a 30-day period. This standard was based on an epidemiologic study in Lorain, Ohio, in the late 1940s. Ten non-occupational cases of chronic beryllium disease were attributed to ambient air pollution from a nearby beryllium plant. The farthest case lived ¾ mile from the beryllium plant. Researchers concluded that the lowest exposure that produced disease was greater than 0.01 µg/m^3 but probably less than 0.1 µg/m^3 (Eisenbud 1982).

In 1973 USEPA adopted the Atomic Energy Commission Standard of 0.01 µg/m^3 averaged over a 30-day period. Currently, USEPA limits the amount of beryllium that plants can emit into the environment to either 10 grams in a 24-hour period, or to an amount that would result in atmospheric levels of 0.01 (µg/m^3) of air near the source, averaged over a 30-day period (National Emission Standards for Hazardous Air Pollutants, 40 CFR 61.32). The Elmore plant is regulated

under the 0.01 μg/m^3 limit. The USEPA determined through dispersion modeling that a 10-gram limit would prevent 30-day average ambient concentrations from exceeding 0.01 μg/m^3.

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 μg/m^3 limit. For the 10-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 327 kilograms (720 pounds) from stack emissions. If the emissions were constant throughout 1999, approximately 0.86 kilograms (1.9 pounds) of beryllium were released each day. The plant contains approximately 80 emission units (sources) for beryllium. Brush Wellman's TRI data reporting are emission estimates based on a combination of stack emissions, permit limit data, and best professional judgment. In 2000, because the plant ceased beryllium metal extraction operations, Brush Wellman's air emissions dropped to less than 200 pounds of beryllium.

From 1980 to the present, Brush Wellman exceeded USEPA's beryllium limit of 0.01 μg/m^3 for a 30-day period on at least three occasions. Sampling stations 13 and 18 exceeded 0.01 μg/m^3 during the period of June through August of 1980. During this 3-month period, monthly average beryllium concentrations were 0.0041 to 0.0871 μg/m^3 at station 13, and 0.0100 to 0.0351 μg/m^3 at station 18. In April 1989 and October 1990, sampling station 18 measured 0.028 μg/m^3 and 0.015 μg/m^3. USEPA and OEPA issued citations to Brush Wellman for these violations. The public health implications of these violations are discussed in the Public Health Implications section of this report.

Since November of 1990 the ambient beryllium levels near the Brush Wellman's Elmore Plant have been below the 0.01 μg/m^3 limit (OEPA 2001a). The ambient air levels of beryllium are also below USEPA's reference concentration (RfC) of 0.02 μg/m^3 (IRIS 1998). The reference concentration is defined as the level below which adverse health effects are not likely to occur. ATSDR does not anticipate that adverse health effects will occur from these levels of beryllium, measured as monthly averages.

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. On-site personnel who were in the path of the plume were evacuated. The local sheriff's department was notified once it was determined that the plume was migrating off site (OEPA 2001b). Brush Wellman is also required to notify OEPA if more that 10 pounds of beryllium are released during an incident. The wind was from the northeast during this event. State Road 590 southwest of the plant was closed and seven homes were evacuated by door-to-door notification. Brush Wellman personnel collected an air sample in the pathway of the plume at State Road 590. The beryllium concentration in the 3-hour air sample was 0.64 μg/m^3. This value is below the maximum airborne concentration at which, it is believed, 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 sampling station was directly in the path of the plume, Brush Wellman personnel removed and analyzed the filters from the closest air sampling stations located

downwind of the plant after the release. Both samples contained less than 0.01 μg/m^3 of beryllium. These samples had been collected over a 2-day period starting on February 12, 2001. 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.

After the incident, OEPA personal collected five surface samples from areas in or near the location of the plume. Samples were collected from surfaces on a camper, mailbox, decorative rock and two birdhouses. These samples contained less than detectable amount of beryllium (less than 0.5 μg/g).

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 the OEPA. OEPA did not respond to either incident because Brush Wellman informed them that no off-site releases occurred. The levels of beryllium measured at the closest downwind stations were less than the USEPA limit of 0.01 μg/m^3 for the 30-day period during these incidents.

Because the USEPA's beryllium limit for air is based on a 30-day period, short-term releases can approach 1 μg/m^3 for brief periods (less than 4 hours) without exceeding the monthly USEPA standard of 0.01 μg/m^3. In December of 1999 the monthly concentration of beryllium measured at Station 15 was 0.0029 μg/m^3. Within this period the level of beryllium from December 20th through 27th was measured at 0.0137 μg/m^3. Within the past 5 years this is the only weekly sample result that exceeded 0.01μg/m^3.

The plant's overhead exhaust fans were used to remove air contaminants—including beryllium dust—from the work areas during beryllium incidents (Brush Wellman 1984). These are general area exhaust ventilation fans that do not contain any air cleaning devices. Brush Wellman states that their current policy prohibits the use of general area exhaust fans until the visible plume is cleared through the use of the filtered exhaust ventilation system.

Public Health Implications – Intermittent Short-Term Exposures

The public health implications of intermittent short-term exposure to beryllium are unknown. Researchers still do not have a clear understanding of the exposure and disease relationship. Chronic beryllium disease outside the beryllium industry workforce is very rare. Furthermore, the risk of developing chronic beryllium disease from this type of exposure is believed to be low.

There is some evidence that workers can be sensitized to beryllium within a few months of exposure to levels below 0.5 μg/m^3 (Newman et al. 2001). A threshold below which no chronic beryllium disease will occur has not been clearly established (Maier and Newman 1998). While the scientific literature attributes no recent case of chronic beryllium disease to ambient air exposure, physicians might not always correctly identify or report chronic beryllium disease (Newman and Kreiss 1992). Therefore, there is insufficient scientific information from which draw public health

conclusions about the levels of beryllium in ambient air during intermittent short-term peak exposure events.

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

Some community members were concerned about possible worker take-home exposure to beryllium (i.e., beryllium dust on workers' clothing and shoes).

Since the 1950s, Brush Wellman has required its production employees to wear company issued clothing and to shower at the end of the work shift. Until recently this policy has been self-monitored. Brush Wellman informs its workers about the possibility of exposing their families and friends to beryllium if they fail to adhere to the hygiene requirements. Employees who perform extremely dusty jobs are required to wear disposable coveralls. Visitors going to production areas where the potential for exposure is believed to be high are required to change into Brush Wellman-supplied work clothing and to shower before they leave. Visitors to other beryllium control areas must wear a full-length lab coat and knee-high booties over their personal clothing. In addition, visitors are limited to no more than 2 hours in the plant and are not permitted into areas where respiratory protection is required. Non-production workers are no longer allowed to eat in the plant cafeteria. 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.

One employee indicated that Brush Wellman workers were required to pick up their clean clothing in the laundry room at the beginning of the shift. Employees picked up clothing in an area where workers laundered contaminated work clothing while wearing respiratory protection. This information was included in the Public Comment Health Consultation released on October 10, 2001. Since the 2001 public comment Health Consultation, Brush Wellman reports that the procedure has changed and employees no longer enter the laundry room to pick up their clean work clothes at the start of the shift (Marc Kolanz, Brush Wellman Vice President of Environmental Health and Safety, personal communication, June 18, 2001).

Brush Wellman requires that injured employees be decontaminated before entering an ambulance unless the injuries are life threatening. The Elmore-Harris Fire Department responders previously observed that decontamination was less likely to occur on 2nd and 3rd shifts (M. Czeczele, personal communication, June 27, 2001). Following the release of the Public Comment Health Consultation, Brush Wellman and Elmore-Harris Fire Department have met to review the procedures from handling injured workers (Marc Kolanz, Brush Wellman Vice President for Environmental Health and Safety, personal communication, March 26, 2002).
In the late 1940s, Eisenbud (1949) estimated a daily inhalation exposure of 17 µg of beryllium from hand-laundering the clothes of a beryllium worker. Shaking beryllium-contaminated work clothes can produce up to 0.3 µg/m^3 of beryllium (Cohen and Positano 1984). Numerous cases of chronic beryllium disease have been documented among the spouses of beryllium workers, but most of these cases occurred prior to the 1960s (Hardy et al 1967; Knishkowy and Baker 1986). In 1980, the spouse of a Brush Wellman worker at the Elmore Plant developed chronic beryllium

disease (Newman and Kreiss 1992). The spouse might have been exposed when she laundered contaminated clothing at home after her husband was injured at work, or possibly during a tour of the Elmore plant (Newman and Kreiss 1992).

No health-based standards define safe levels of beryllium for surface contamination or household vacuum cleaner dust. The potential for exposure to beryllium from surface contamination can be a function of several factors, including the total amount of dust on the surface, the form and size of the beryllium particles, the location and physical characteristics of the surfaces, and the types of activities performed in the space.

Wipe sampling is neither an efficient method for removing surface contamination nor a reliable method for measuring surface contamination. Researchers who repeated wipe sampling of the same surfaces found that the second wipe samples contained on average 55% of the initial wipe concentration (Lichtenwalner 1992). In the same study, the range of second wipe samples varied from 35 to 92%. Also, the lack of a standardized wipe sampling methodology increases the variability of wipe sampling results.

In response to chronic beryllium disease among Department of Energy (DOE) workers, in 1999 DOE promulgated a Chronic Beryllium Disease Prevention regulation (Federal Register 1999). As part of this program, DOE established surface contamination limits. Removable (i.e., loose) beryllium contamination in work areas must not exceed 3µg/100 cm^2 during non-operation periods. Also, prior to releasing any equipment from designated beryllium work areas, the removable surface contamination must not exceed the higher of 0.2 µg/l00 cm^2 or the concentration level of beryllium in soil at the point of release, whichever is greater. It should be noted here that the DOE limits are not based on health considerations, but are intended to limit the spread of beryllium contamination and to assess the adequacy of housekeeping measures.

Because it is not a DOE facility, the DOE's Chronic Beryllium Disease Prevention Program does not apply to Brush Wellman's Elmore plant (Federal Register 1999). Brush Wellman does not perform routine wipe sampling on equipment or vehicles leaving the facility. Instead, Brush Wellman uses visual inspections to ensure that there is no visible contamination on equipment leaving the site (Marc Kolanz, Brush Wellman Vice President of Environmental Health and Safety, personal communication, June 28, 2001).

Background levels of beryllium in soil could account for some of the beryllium detected in wipe samples. The beryllium levels in uncontaminated soils in the northeastern United States range from less than 1 to 7 µg/g (ATSDR 2001). The geometric mean level of beryllium in 322 surface soil samples, collected from seven of the 88 Ohio counties, was 0.38 µg/g (Cox and Colvin 1996). The background beryllium level in soil near a former beryllium processing site in Luckey, Ohio, was 1.1 µg/g (US Army Corps of Engineers 1999). The Luckey Plant is located approximately 16 kilometers (10 miles) west of Elmore in Wood County, Ohio. The Brush Wellman plant and Luckey, Ohio are both within the Portage River Basin—a region containing the same general soil classification type (i.e., Hoytville-Nappanee-Paulding-Toledo). Therefore, the background beryllium levels in soil in the Elmore area are expected to be similar to those collected at the Luckey site.

Public Health Implications of Worker-Take-Home Exposure – the Brush Wellman Elmore Plant

The public health implications of potential worker-take-home exposure cannot be accurately assessed. Scientific studies and case reports indicate the family members can develop CBD from worker-take-home exposure. The amount, duration and nature of the exposure required to result in CBD is unknown. As noted previously, researchers have not developed a reliable exposure method for predicting chronic beryllium disease in the workplace.

Brush Wellman adopted hygiene controls following the realization that worker-take-home exposure can result in CBD. Although a spouse of a plant worker developed chronic beryllium disease in 1980, Brush Wellman's hygiene controls have reduced the likelihood of additional cases of CBD from occurring among family members of Brush Wellman workers.

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 components containing beryllium. During the June 2001 public meeting, some workers at these machine shops reported a lack of adequate air sampling, personal protective equipment and ventilation. Workers also reported unsafe practices, including using high-pressure air to remove dust from clothing, sweeping, and smoking in work areas. Some of the workers are also concerned about the migration of beryllium dust by the worker-take-home pathway.

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 (Sanderson et al.1999). The geometric mean level of beryllium found on the drivers' side of vehicle floors was 2.0 µg per 100 cm^2 (µg/100 cm^2) of surface area. These workers were not required to shower or change out of their work clothes and shoes prior to leaving the machine shop (Sanderson et al.1999).

The Occupational Safety and Health Administration (OSHA) issued a hazard information bulletin in 1999 warning employees of the risk of CBD and encouraged hygiene controls, including showering and separate work clothes (Appendix D). However, OSHA does not currently require that beryllium workers shower or change clothes. OSHA states that it will issue a Request for Information in 2002 with the intent to eventually develop a beryllium standard (Federal Register 2001).

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 Citizen Action, personal communication, Aug 22, 2001).

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 beryllium health and safety assistance is offered to customers and vendors. This includes the Elmore-area machine shops that perform work for Brush Wellman (Marc Kolanz, Brush Wellman Vice President of Environmental Health and Safety, personal communication, June, 27 2001).

Downstream users are employers who purchase beryllium-containing materials from producers, such as Brush Wellman, and further machine or modify the beryllium-containing material. OSHA has initiated a study of downstream users of beryllium as part of its rule making process.

CBD can occur in workers who are exposed to low content beryllium copper alloys (Lieben et al. 1964; Balkissoon 1999; Tarlo 2001; Schuler 2001). This finding could be significant because of the potentially large number of downstream beryllium workers who might be exposed to beryllium copper alloys and the current lack of a comprehensive OSHA regulation for beryllium.

Workers who might be exposed to beryllium are encouraged to share the content of OSHA's hazard information bulletin (Appendix D) with their employers and follow the guidance provided on beryllium products material safety data sheets (MSDSs). Workers can also contact NIOSH at 1-800-232-2114) or OSHA for on-site assistance. Brush Wellman can be contacted for MSDSs and product safety information at www.brushwellman.com or 1-800-862-4118.

Biological Testing

ATSDR has received some requests to screen Elmore community members with the blood beryllium lymphocyte proliferation test (BeLPT). The BeLPT was developed as a screening tool to identify beryllium sensitization; that is, to identify exposed individuals who could be at risk for developing chronic beryllium disease. The test has been useful in identifying sensitized workers, but it has not been used for screening community groups, where exposure levels and the prevalence of sensitization are expected to be much lower. This is important because the utility of a screening test is related to the prevalence of the condition or disease in the group tested. All screening tests are imperfect, missing some individuals who truly have a condition and mistakenly identifying others who truly do not have the condition. The specificity of the BeLPT, or the likelihood that it would correctly identify as "not sensitized" a person who is truly "not sensitized" is not well established (Maier 2001).

All laboratory tests, including the BeLPT, have some degree of inaccuracy and unreliability. Given that the test is imperfect and the condition either rare or absent in the community, harm could be done if some community members are identified as "sensitized" to beryllium when they truly are "not sensitized." For example, more invasive testing (i.e., bronchoscopy) with attendant risks often follows a positive BeLPT. Before considering such screening for apparently healthy community members, environmental levels and the potential for exposure must be better characterized. These comments relate to healthy community members; they are not relevant to screening employees exposed to beryllium at work or for evaluating patients who have a granulomatous lung disease.

Community Information Issues

ATSDR observed a lack of effective dialogue between Brush Wellman and the community regarding beryllium and other environmental health issues. For example, residents who allow Brush Wellman to maintain air-sampling stations on their property and other community members have not been formally notified of the results of the air sampling. In 1999 Brush Wellman 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 not otherwise announced. Also, community members were not aware of OEPA's recent environmental sampling efforts, such as recent well-water sampling for beryllium or OEPA's plans for ambient sampling for beryllium. In 1999 and 2001 OEPA notified the affected residences of the results of private well-water sampling. These results, however, might be of interest to others who reside near the Brush Wellman plant. Since the October 2001 release of the Public Comment Health Consultation, Brush Wellman has initiated efforts to improve communications with the community through circulation of a community newsletter.

Some of the observations contained in this health consultation were based on interviews with former workers and concerned citizens who attended the ATSDR's community meetings or who provided comments to the agency. ATSDR did not administer a questionnaire to randomly selected Elmore community members. Nevertheless, ATSDR believes that comments received from community members represent that portion of the community's concerns.

ATSDR's Child Health Initiative

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis, especially 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 residences are close to the site. In general, children are believed to be more sensitive to exposure to hazardous contaminants than adults. And specifically, children can develop chronic beryllium disease. Prior to 1960, case reports indicate that at least two children developed chronic beryllium disease that was attributed to worker-take-home or ambient air exposure (NIOSH 1995). Approximately 2000 children were included in the community investigation in Lorain, Ohio in the 1940s. Although no cases of chronic beryllium disease were observed among the children (Eisenbud 1949), the radiographic methods used to detect chronic beryllium disease were less sensitive than those used today (Kreiss et al. 1989).

Conclusions

Air

Beryllium emissions from the Brush Wellman-Elmore Plant, measured as 30-day averages over years of exposure, are below levels expected to cause adverse health effects and do not pose a public health hazard

Short-term beryllium release episodes and past violations of the USEPA standard in 1980, 1989, and 1990 present an indeterminate public health hazard to residents immediately north and northeast of the Brush Wellman's Elmore facility.

Worker Take Home – Brush Wellman Plant and Other Beryllium Workers in Elmore

At present, ATSDR does not have adequate information to assess whether the community could be exposed to beryllium through possible off-site transport of dust from Elmore-area beryllium workers. Therefore, ATSDR classifies the potential worker-take-home pathway from beryllium workers in Elmore as an indeterminate public health hazard.

Well Water of Private Residences

The levels of beryllium in well-water samples collected from private residences near the Elmore Brush Wellman plant present no public health hazard to the residents.

The levels of volatile organic compounds in well-water samples collected from private residences near the Elmore Brush Wellman Plant in January 1999 and April 2002 present no public health hazard to the residents.

Recommendations

ATSDR:

1. Determine whether community members might have been exposed to beryllium from off-site dust transport of dust on Elmore-area beryllium workers' clothing or from past deposition of air emissions from the Brush Wellman plant.

   ATSDR proposes to address this recommendation by completing two environmental sampling investigations. In the first investigation, ATSDR proposes to collect environmental samples from residences of Brush Wellman workers and others living near the Elmore plant. In the second investigation, ATSDR proposes to collect environmental samples from the residences of other area beryllium workers.

   These investigations will not completely answer whether a health hazard exists because there are no health-based guidance values for beryllium surface contamination. Still, the results of the investigations will assess the adequacy of exposure control efforts and guide what additional public health actions are necessary.

2. Identify community health education needs related to beryllium exposure.

Brush Wellman:

1. Continue to develop a two-way dialogue with the community regarding plant-related environmental health issues.

2. Notify the community of the CAP meetings in advance, and summarize CAP findings and actions in a newsletter, fact sheet, or other effective methods.

3. Continue to notify the community of the results of all environmental sampling.

4. Report any release of visible dust emissions to the OEPA, regardless of whether the estimated quantity is less than 10 pounds.

5. Continue to conduct short-term air sampling downwind of any potential off-site release of beryllium, and report the incidents and sampling results to OEPA and the community.

6. Continue to monitor the potential migration of groundwater contamination to ensure that it does not impact nearby private wells.

OEPA:

1. Establish ongoing dialogue with the Elmore community through regularly scheduled public meetings or other effective means.

2. Conduct periodic well-water sampling for the residences adjacent to the Brush Wellman plant for volatile organic compounds, including PCE and TCE.

3. Perform periodic ambient air sampling to verify the Brush Wellman data.

4. Notify community of the results of any environmental sampling.

5. Respond to all potential off-site air releases of beryllium from Brush Wellman's Elmore Plant.

Downstream beryllium facilities in Elmore:

1. Prevent the spread of beryllium dust through the use of hygiene, housekeeping, work practices and engineering controls.

Downstream beryllium workers should consider:

1. Requesting a Health Hazard Evaluation from the National Institute for Occupational Safety and Health on-line at http://www.cdc.gov/niosh/hheform.html or by calling or 1-800-232-2114. 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

Downstream beryllium workers can contact Brush Wellman's Product Stewardship Department at:

Brush Wellman
17876 St. Clair Avenue
Cleveland, OH 44110
Phone: (800) 862-4118
Fax: (216) 383-4091

Community members

1. Individuals concerned with past beryllium exposure should talk with their personal physician. The individual and their physician might consider consulting a pulmonary disease specialist knowledgeable in the area of chronic beryllium disease.

Prepared by

Peter J. Kowalski, MPH, CIH
Environmental Health Scientist
Division of Health Assessment and Consultation

Amanda Gonzalez
Exposure Investigations and Consultations Branch
Division of Health Assessment and Consultation

Robert Johnson, MD
Medical Officer
Division of Health Assessment and Consultation

Lynn Wilder, Ms Hyg, CIH
Environmental Health Scientist
Division of Health Assessment and Consultation

Jason Sautner
Environmental Health Scientist
Division of Health Assessment and Consultation

Brian Kaplan, MS
Environmental Health Scientist
Division of Health Assessment and Consultation

Loretta Bush
Community Involvement Specialist
Division of Health Assessment and Consultation

Dan Middleton, MD, MPH
Medical Epidemiologist
Division of Health Studies

Lauren Swirsky, MPH, CHES
Health Education Specialist
Division of Health Education and Promotion

John Doyle
Health Communication Specialist
Division of Health Education and Promotion

Reviewed by

John E. Abraham, PhD. MPH
Chief, Exposure Investigations and Consultations Branch
Division of Health Assessment and Consultation

Susan Moore
Chief, Consultations Section
Exposure Investigations and Consultations Branch
Division of Health Assessment and Consultation

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Appendix A

Chronic beryllium disease (CBD) is a hypersensitivity lung disorder first identified in 1946 in fluorescent industry workers (Eisenbud 1998). In 1947 the first community cases were observed in the neighborhood around a Lorain, Ohio plant. The community cases were originally thought to be a result of ambient air contamination. It is possible, however, that these cases resulted from worker take-home contamination. Industrial hygiene measures were implemented and in 1949 the first exposure limits were proposed at a 2.0 $\mu g/m^3$ daily weighted average (DWA) for workers and 0.01 $\mu g/m^3$ for ambient air (Eisenbud 1998). Few new cases were seen following the introduction of these exposure limits, and it was assumed that the limits were preventing new cases of disease. Nevertheless, in the 1980s a number of new cases were diagnosed in former workers and the exposure limits began to be reevaluated. Talk of changing the exposure limit has led to extensive debate and new research. It is not clear whether a more stringent exposure limit would prevent new cases or if other factors such as genetic predisposition, particle size and chemical form are more accurate indicators of risk. Part of the problem in assessing the influence of these factors is the lack of an observable dose-response relationship.

Only a portion of those individuals exposed to beryllium (Be) become sensitized and even fewer progress to a diseased state. This has made it difficult to understand fully CBD etiology. It has also led to the consideration of multiple factors influencing disease development. Particle size, chemical form of Be, genetic susceptibility, and the role of skin sensitization are all under consideration. In cross-sectional surveys of individuals exposed to Be in the workplace, approximately 2-18% became sensitized and between 1-11% had CBD (Bartell 2000; Eisenbud 1983; Henneberger 2001; McGavran 1999, Stange 1996, Newman 1996). One study reported that approximately 10% of sensitized individuals progress to a diseased state (Maier 2001). The disease is fatal for 5-38% of CBD cases (Newman 1996).

CBD primarily affects the lungs, and is a result of a cell-mediated immune response (Newman 1996; Eisenbud 1983). In CBD, beryllium particles are inhaled and deposited in the lungs. Beryllium particles then stimulate an immune response. Large numbers of lymphocytes and macrophages (white blood cells) surround and isolate the Be particles in the lungs. An accumulation of a large number of these immune cells clustering in the lung tissue decreases the gas-exchange process. Patients with clinical symptoms of disease often have shortness of breath, difficulty breathing, coughing, digital clubbing and anorexia.

An immune response to Be is not, however, limited to lung exposure. Skin reactions have been observed in workers who had direct contact with beryllium compounds (ATSDR 2000). NIOSH is studying how skin sensitization might contribute to CBD and the possibility that some Be could penetrate the skin and induce a cell-immune response (McCawley 2001).

The chemical form and particle size of beryllium are also possible factors influencing Be sensitization and disease onset. Beryllium in its metallic form, and beryllium oxide, have been associated with higher incidence of disease in some studies—perhaps due to their increased solubility in the body (Paustenbach 2001; Kreiss 1993). Particles smaller than 0.5 μm in diameter have a greater likelihood of deposition in the lungs and take longer for the body to clear. They also have a higher surface-area-to-size ratio, increasing the area in contact with lung tissue and the opportunity for immune response. Ultra-fine particles (0.1 μm) have been associated with

increased risk for disease in some studies (McCawley 2001; Kent 2001).

Genetics also appear to play a role in the onset of disease. Research has identified one possible marker, Glu-69, in 75% of CBD cases (Richeldi 1997). Further research into genetic predisposition could identify other markers that influence individual susceptibility.

Appendix B

Community Comments/Concerns

The following comments and concerns were provided to ATSDR through telephone calls, e-mail correspondence, and interviews during the June 27, 2001, public meeting.

Community Comment/Concern

Air sampling methods may not adequately capture all beryllium present in the air. Beryllium exists in particles too small to be efficiently caught by the paper in the sampling devices and also the respirators.

ATSDR Response

In the workplace, the Occupational Safety and Health Administration (OSHA) requires that beryllium exposure be measured as total mass of beryllium per cubic meter of air. Current OSHA and NIOSH air sampling methods require sampling filters with a 0.8-micrometer (µM) pore size. While some beryllium particles are smaller than 0.8 µM, this NIOSH method captures smaller particles through the process of diffusion and interception. The National Institute for Occupational Safety and Health (NIOSH) is conducting studies to determine whether smaller beryllium particles are a better predictor of chronic beryllium disease. If this is the case, OSHA could adopt air sample methods that reflect measurement of smaller particles.

NIOSH uses 0.3-µM particles for testing the efficiency of respirators. The 0.3-µM-diameter particle size is the most penetrating particle size through particulate filters. (Although it seems contrary to expectation, smaller particles do not penetrate through filters as readily as 0.3-micrometer particles.) Therefore, NIOSH-approved respirators will filter all other particle sizes as well.

Community Comment/Concern

Are Brush Wellman air-sampling locations appropriate?

ATSDR Response

ATSDR has determined that the air sampling stations are located in the appropriate locations to measure the maximum beryllium levels from Brush Wellman plant emissions. The locations of air samplers are based on factors such as modeling, willingness of property owners to have a sampler on their property, availability of power (cannot be plowing up power lines in a farm field), and year-round access to the site.

Community Comment/Concern

Roof ventilation fans are used in many areas to exhaust air to the atmosphere. These fans are exhausting unfiltered air from areas where workers are required to wear respirators. These fans are turned on in the summer to help cool hot areas around furnaces and any area where workers are exposed to high temperatures. They are also turned on as a first step in exhausting high levels of beryllium dust from areas that have had furnace leakages, powder spills or other causes of high

levels of airborne dust.

ATDSR Response

ATSDR believes it is important to measure the beryllium levels in ambient air during plant-upset conditions. Prudent public health policy calls for minimizing or eliminating non-occupational exposure to beryllium dust where feasible through the use of appropriate work practices and engineering controls. This comment has also been forwarded to OEPA and Brush Wellman. Brush Wellman's policy is to operate the filtered ventilation system in the area until the air has all been cleared out prior to using unfiltered roof fans.

Community Comment/Concern

Several years ago, residents had problems with particle deposition damaging the finish of their cars.

ATSDR Response

Brush Wellman indicated that there have been one or more incidents when caustic aerosol from a malfunctioning air pollution control device, was deposited on workers' vehicles in the employee parking lot. This resulted in the damage to the finish on some vehicles. Brush Wellman paid for refinishing the affected cars.

Community Comment/Concern

Why did Brush Wellman purchase the residential/horse farm property at the intersection of 105 and 590, and move the home further south on 590?

ATSDR Response

Brush Wellman management indicated that, on occasion, they have purchased property adjacent to the plant to increase their buffer zone. Well water sampling on this property has indicated the absence of beryllium contamination.

Community Comment/Concern

In the past, emissions from the tall stack used to be yellow, now they're white. Is the company using urea to cover the yellow color?

ATSDR Response

Brush Wellman indicates the urea is added to the acid baths in the pickling operation to reduce acid emissions. These operations, however, are not connected to the tall stack.

Community Comment/Concern

Until at least 1990, changing bags in the bag house resulted in air releases. Bags were changed frequently. Dust from the bag house change outs would end up in the shower area.

ATSDR Response

Brush Wellman management acknowledged that air releases occurred during bag changes. Since 1990, Brush Wellman has implemented new procedures for changing bags to prevent such air releases. Brush Wellman has also established improved work practices to reduce significantly the potential for worker-take-home of beryllium dust from the dirty side of the locker room.

Community Comment/Concern

The safety practices are poor at Brush Wellman's plant.

ATSDR Response

Employees should address specific safety concerns with their management. Employees can contact the Occupational Safety and Health Administration if they believe that their concerns are not adequately addressed by Brush Wellman management. Workers can contact the area OSHA office at (419) 259-7542. NIOSH can be contacted at 800-232-2114.

Community Comment/Concern

A former Brush Wellman temporary worker was never required to shower at the end of the work shift and was not supplied with company clothing. Brush Wellman informed this person on his last day of employment that he should have been wearing company shoes/underwear and taking showers before leaving the plant.

ATSDR Response

All plant workers, including temporary workers working in the factory areas, are required to change into Brush Wellman clothing. In the past, persons working solely in in-plant office areas were allowed to wear a Brush Wellman-supplied lab coat over their personal clothing and were not required to change clothing. But within the past 3 years Brush Wellman management indicated that they have increased the personal protective equipment and hygiene requirements for contractors and visitors (Marc Kolanz, Brush Wellman Vice President of Environmental Health and Safety, personal communication, June 18, 2001). Thus it is possible that this employee was leaving the Brush Wellman workforce during a period when new requirements were being implemented.

Community Comment/Concern

Within the last 5 years, a new building was constructed at the Brush Wellman facility. Subcontractors who worked on the building have since been diagnosed with chronic beryllium disease.

ATSDR Response

Employees should attempt to resolve ongoing safety and health concerns with the management of their company and Brush Wellman. Employees can call OSHA or NIOSH for assistance as well.

Community Comment/Concern

There was a fish kill a few months ago.

ATSDR Response

ATSDR did not examine the water quality for sport fishing as part of this health consultation. If you witness a fish kill, report it immediately to:

The Ohio Division of Wildlife - District 1
1500 Dublin Rd.
Columbus, OH 43215
1-800-WILDLIFE or 614-644-3925
Or contact your district wildlife officer.

Fish kills sometimes occur in the Portage river from natural causes. The most common cause is a rapid change in water temperature such as during a spring rain storm where warm water flows into a cold river. Such an event tends to affect selected species of fish more than others (such as shad). Brush Wellman operations were associated with a fish kill in the Portage River in the 1960s (Marc Kolanz, Brush Wellman Vice President of Environmental Safety and Health, personal communication, June 18, 2001).

Community Comment/Concern

Some residents voiced concern about the degradation in the Portage River water quality for sport fishing.

ATSDR Response

ATSDR did not investigate the water quality trends for sport fishing as part of this health consultation. The Ohio Department of Natural Resource reports that the fishing outlook for the Portage River is good to excellent for most sport fish. Brush Wellman funded a study of the river in 1990, and OEPA conducted another study in 1995. These reports are available at the Harris -

Elmore Library.

Community Comment/Concern

A resident who lives approximately ½ mile NW of the plant has concerns about the quality of their private well water, their pond water, and the pond fish they consume. They have never seen any data from the air monitor on their property.

ATSDR Response

Private well quality is addressed in the health consultation. Beryllium has not been detected in private well water samples collected from residences near the plant. Beryllium is a naturally occurring element in soil. As a result, small amounts of beryllium are found in food, including fish (ATSDR 2000). Ingesting food containing small amounts of beryllium is not known to cause chronic beryllium disease. ATSDR is recommending that Brush Wellman and OEPA notify the community of the results of any environmental sampling.

Community Comment/Concern

How accurate are the results of beryllium lymphocyte proliferation screening test (BeLPT)?

ATSDR Response

BeLPT is a useful tool for identifying workers who could develop chronic beryllium disease, particularly when the test is repeated (Newman et al. 2001). There are occasions when the test results in false positives, or results cannot be interpreted because of the inherent difficulty of the method, i.e., culturing cells (Maier 2001). Also, BeLPT has resulted in false negative results when administered to known cases of chronic beryllium disease.

Community Comment/Concern

Residents have difficulty distinguishing between the evacuation alarms for the Davis Bessie nuclear plant and the Brush Wellman Plant.

ATSDR Response

Ottawa County Emergency Management Agency is implementing a 911 call-back within the next several months. The system will allow the emergency management officials to notify residents in selected areas by phone, and give them specific instructions on precautions or required actions.

Community Comment/Concern

Is there arsenic in private wells?

ATSDR Response

Arsenic is a naturally occurring ground water contaminant in many areas of the United States, including northwest Ohio. The levels of arsenic in private well water samples collected from the five residences near the Brush Wellman plant in January 1999 ranged from 2 to 4 µg per liter. These values are below USEPA's proposed maximum contaminant level (MCL) for arsenic of 10 µg per liter, and are not of public health concern.

Community Comment/Concern

There are a lot of cancers in the community (e.g., breast, throat, skin).

ATSDR Response

Chronic beryllium disease is the primary health outcome addressed in this health consultation. ATSDR has not investigated the cancer rates as part of this health consultation. The National Toxicity Program classifies beryllium as *reasonably anticipated to be a human carcinogen, i.e., cancer causing agent.* (NTP 2000) Excess lung cancer was observed in beryllium workers but smoking and other occupational air contaminants could confuse this association.

Community Comment/Concern

The Lucky, Ohio site should be investigated. Was the facility decontaminated?

ATSDR Response

The Army Corps of Engineers conducted an extensive investigation of the Luckey site over the past few years. Public meetings have been held periodically to update the community on the progress of the investigation. Information about the Luckey site contamination and clean-up can be obtained from the US Army Corp of Engineers Web site at http://www.lrb.usace.army.mil/fusrap/luckey/index.htm**.**

ATSDR was not asked to investigate the Luckey site. If community members are concerned about the Luckey site, they can request ATSDR's involvement. Procedures for petitioning ATSDR are found at http://www.atsdr.cdc.gov/HAC/petition.html**.**

Following Comments and Concerns have been referred to Brush Wellman:

Workers don't change shoes between exiting the whiting furnace and entering the cafeteria. Brush

Wellman responded that a change of clothes is not required between these two areas.

Some production areas have not had process ventilation systems upgraded in over 30 years. Brush Wellman responded that they have spent over $10 million dollars per year on health and safety related improvements.

Residents expressed concern that the Community Advisory Panel (CAP) was composed of only those persons who favored the company. Please see Brush Wellman's comments regarding the CAP.

Workers arriving for work are required to pick up work clothes in the laundry area, where laundry workers are in contaminated clothes and are at times required to wear respirators. Brush Wellman has addressed this concern.

Following Comments and Concerns have been referred to OEPA:

Roof ventilation fans are used in many areas to exhaust air to the atmosphere. These fans are exhausting unfiltered air from areas where workers are required to wear respirators. These fans are turned on in the summer to help cool hot areas around furnaces and any area where workers are exposed to high temperatures. They are also turned on as a first step in exhausting high levels of beryllium dust from areas that have had furnace leakage, powder spills or other causes of high levels of airborne dust. OEPA will investigate this issue as part of their Title V air pollution permitting process.

The facility is notified of upcoming OEPA inspections—they clean up the facility before inspectors arrive (e.g, adding new gravel over areas where beryllium dust has accumulated). OEPA responded that they do not announce hazardous waste inspections.

Dross is sitting outside in rusting drums. OEPA indicates the solidified dross should not become airborne.

Community Comment/Concern

There appears to be a high rate of esophagus cancer in the area.

ATSDR Response

ATSDR reviewed the 1994 – 1998 mortality rates for esophagus cancer for Ottawa County and the State of Ohio. For the period from 1994 through 1998, the mortality rate of esophagus cancer for Ottawa County residents (combined male and female) was 5.2 cases 100,000 per year. The State-wide mortality rate for esophagus cancer for this period was 3.9 cases 100,000 per year. The county rate is not statistically distinguishable from the state rate.

Appendix C

The following are written comments to the Public Comment Health Consultation of October 17, 2001, and ATSDR's responses.

Comment:

Please change "Ohio Public Citizen" to "Ohio Citizen Action."

ATSDR Response: The text has been changed.

Comment:

ATSDR recommends to itself that it "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' clothing." OCA strongly supports this recommendation and urges the agency to turn this investigation into a pilot project by creating a community panel to oversee the investigation. The panel would decide on the process and the timeline of the investigation, monitor the testing, choose the lab which will do the analysis, and review the analysis results. The panel should be made up of members of the community, ATSDR staff, Ohio Citizen Action, and technical experts, appointed by the community and paid for by the ATSDR. A process of public involvement is critical to the success of the exposure investigation for two reasons:

The community is skeptical because this is the first time in over four decades that any government agency has looked into the health and safety of the community, because Brush Wellman has been permitted to police their own emissions for so long, and because the Ohio EPA is under strict scrutiny by the US EPA for lack of environmental enforcement. This skepticism was clearly displayed at the agency's public meeting held on October 24. In order for this investigation to be thorough and credible to those who will benefit from it, members of the community need to not only be made aware of the process, they need to be involved in the decisions of what the process is, how long it will take, and who will conduct and analyze the testing. The community will likely trust the results of the investigation if they create and are a part of the process 100%.

ATSDR Response

ATSDR will release the exposure investigation as a public comment draft similar to the public comment health consultation. The follow-up report of the investigation will also be published as a draft for public comment. ATSDR will allow a 30-day comment period, and ATSDR will hold public meeting both prior to and following the exposure investigations.

Comment

Since the Brush Wellman plant has been operating, members of the community have been forced to rely on Brush Wellman and the Ohio EPA for information. Unfortunately, neither Brush nor the Ohio EPA have done much to establish a level of trust or lines of open communication to lead the public to believe that the information they put forth is trustworthy. Clearly one of the biggest

problems in this community is poor communication between these two institutions and members of the community. The ATSDR addresses this problem in its recommendations to Brush Wellman and the Ohio EPA. This problem must also be addressed in the exposure investigation. The most effective way to do this is for the Agency to provide the financial resources to the community to hire its own technical expert(s) whose sole responsibility is to answer to members of the community. These experts will act in an advisory capacity to assure that the investigation process agreed upon and carried out is thorough and will achieve the intended results.

ATSDR Comment

ATSDR does not have funding for communities to hire their own technical advisors.

Comment

We ask that the agency include, as part of its exposure investigation, soil sampling on the properties neighboring the Elmore plant. Because the facility has been operating for over four decades, it is reasonable to believe that beryllium could be accumulating in the soil, posing severe health risks for children. Since the ATSDR recognizes that, “the unique vulnerabilities of infants and children demand special emphasis in communities faces with contamination of environmental media,” and that “this site is a particular concern for children because there are residences close to the site,” it is critical to know if this highly toxic heavy metal is accumulating in the ground where children spend a great deal of their time.

ATSDR Response:

ATSDR plans on including soil sampling as part of its investigation.

Comment

ATSDR recommends that Brush Wellman, “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.” We ask that this recommendation be amended to actually opening the CAP to all members of the community. A CAP which operates behind closed doors is not an effective way to open lines of communication or establish a level of trust between the company and its neighbors. Members of the community should not only know in advance when the meetings are taking place, but should also feel welcome to attend and participate in the meetings.

ATSDR Response

ATSDR believes that Brush Wellman should maintain an effective dialog within the community through appropriate methods.

Comment

In several places in the report the ATSDR provided statements or information which detoured well beyond the scope of Senator Mike DeWine's request. Brush Wellman has identified those instances and in general recommends that those sections be removed from the final document to be consistent with the original request of Senator DeWine. The scope of the draft report is unclear and is broader than ATSDR's Congressional charge.

ATSDR Response

Generally, ATSDR has broad authority under section 104(d) and (i) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA or Superfund, 42 U.S.C. 9604(d) and (i)) to address the public health implications of releases or threatened releases of hazardous substances in the environment. We believe this document is consistent with our authority. When conducting an investigation it is standard public health practice to identify all of the community's public health concerns.

Comment

Brush Wellman understands that the subjects discussed in the draft report are reflective of ATSDR's meetings with individuals, but it does not believe that responding to all these subjects are within the ATSDR's expertise and/or its Congressional charge. Indeed, Brush Wellman believes that it would be prudent for ATSDR to focus its resources and attention on those subjects within its Congressional charge and its expertise.

ATSDR Response

As public health agency, ATSDR is obligated to develop a dialog with the community and identify health concerns. Addressing the community's site-related environmental health concerns is consistent with ATSDR's mission and its Public Health Assessment Guidance Manual.

Comment

As a scientific agency, the ATSDR should establish some minimum criteria for acceptance of data or information from sources used to develop their report. Parts of the document contain data which was generated with little or no scientific quality control or statements which were unsubstantiated or hearsay. An equal standard of acceptability should be applied to all sources of information in the interest of accuracy, clarity, fairness and scientific rigor. Unsubstantiated information or data should either not be used, be adequately researched to substantiate the data or information, or at minimum the scientific confidence in the data should be clearly qualified.

ATSDR has not critically evaluated the wipe and dust samples collected by Ohio Citizen Action. Although the draft report does note the unreliability of wipe samples in general, the absence of a recognized and reliable protocol for taking wipe samples, and the fact that dust levels on surfaces and in vacuum cleaners are not the subject of health-based standards, the ATSDR has not performed any scientific evaluation of the Ohio Citizen Action samples. For example, it has not

obtained the quality assurance/quality control documentation for those samples as one would normally do in any scientific review. Despite not having scrutinized these data, the draft report presents these data in an unqualified fashion. Presenting these data in an unqualified fashion makes the report misleading as well as incomplete. Since these data are reported along with data from peer-reviewed journals, the general reader is invited to give the Ohio Citizen Action's data the same weight as data in peer-reviewed publications and to draw comparisons between these different data sets. ATSDR should either critically review the Ohio Citizen Action's data or, if they are not worth reviewing, it should so state and not present these data for the purposes of information and general comparison with other data whose quality has been assured by publications in a peer-reviewed journal or by a review of quality control/quality assurance documentation.

ATSDR Response

The Ohio Citizen Action information has been moved to the background section on page 1. ATSDR has not reviewed quality control information for this data, and therefore has not attempted to interpret it.

Comment

ATSDR's draft recommendation to conduct an exposure investigation of the potential for off-site transport of beryllium from workers clothing is not likely to lead to information which can be analyzed for potential health implications because of the absence of information linking health effects or airborne concentrations of beryllium to surface levels of beryllium. The ATSDR itself has noted the above problems in the draft report along with technical problems associated with the absence of a standard and reproducible surface sampling methodology.

ATSDR Response

Despite its limitations, ATSDR believes that conducting an exposure investigation is an appropriate course of action. The results of the exposure investigation will help determine whether a completed exposure pathway exists for Elmore-area beryllium workers who could bring beryllium dust home on the clothing. This issue will be addressed in more detail in the public comment exposure investigation protocol.

Comment

ATSDR's draft recommendation to evaluate the use of biological testing based on the results of the exposure investigation is unfounded. Like the exposure investigation, biological testing is fraught with technical problems and conflicting results. In addition, biological testing in and of itself cannot diagnose any beryllium related health effect.

ATSDR Response

ATSDR believes that ruling out any public health actions prior to reviewing the results of the exposure investigation is premature.

Comment

As a respected scientific agency it is inappropriate for ATSDR to include a discussion of health concerns based on "theoretically possible" or "could have been exposed" types of statements regarding episodic air releases. The ATSDR has provided no reasonable scientific basis to challenge the USEPA's risk based beryllium health exposure limit for the general public based upon episodic air releases.

ATSDR Response

ATSDR has revised the sentence (page 9) as follows: Because the USEPA's beryllium limit for air is based on a 30-day period, short-term releases can approach 1 $\mu g/m^3$ for brief periods (less than 4 hours) without exceeding the monthly USEPA standard of 0.01 $\mu g/m^3$. In addition, ATSDR also added a Public Health Implications of Intermittent Short-Term Exposures section on page 9.

Comment

Throughout the document, the ATSDR is critical of both Brush Wellman and the Ohio EPA regarding their communications to the public. Though Brush Wellman believes it certainly has room to improve, the ATSDR did not perform their investigative review using scientific methods of surveying or questionnaires in a random data gathering process. The ATSDR should carry out all of their data gathering efforts in a manner which incorporates scientific principles of data gathering to ensure that bias is not introduced into the process.

ATSDR Response

The statements were based on interviews with persons who attended the community meeting and from telephone calls and e-mails from concerned citizens. ATSDR believes that these comments reflect the views of the community members who attended the meeting. ATSDR did not attempt to quantify responses. Therefore statistically based methods are not relevant.

Background and Statement of Issues Section

Comment

Paragraph 3, first sentence - remove the word "powder" (...plant produces beryllium ~~powder,~~ beryllium oxide,) In the fifth sentence, insert "oxide" between the words "beryllium" and "in." Change the last sentence to read "Currently, the ~~pure~~ beryllium ~~powder~~ extraction operations..."

ATSDR Response The text has been changed as requested.

Comment

Paragraph 4, sentence 1 & 2 - change the first two sentences as follows. "Beryllium is extracted ~~mined~~ from two ores, beryl and bertrandite. It is also present ~~in small quantities~~ in soil and rocks."

Note: Beryllium concentration in soil throughout the United States is typically found at levels of 1-2 ppm. This concentration is the same as 1-2 milligrams beryllium per kilogram of soil. A practical example representing the concentration of beryllium in typical soil is as follows. A shovel full of soil from a typical back yard can weigh about two pounds. Two pounds of typical soil will contain about 1000 to 2000 micrograms of beryllium. Considering the circumstances of this health consultation, it is not established that this amount of beryllium in typical soil would be considered a small quantity by most people.

ATSDR Response - The text has been changed as noted.

Comment

Paragraph 5 should more clearly define the potential outcomes from exposure to beryllium. We recommend the paragraph be rewritten as follows.

"Some persons exposed to beryllium develop a sensitization to the metal, ~~which is similar to an allergy~~. Some sensitized individuals go on to develop sub-clinical (no symptoms) chronic beryllium disease (CBD) in which granulomatous inflammation forms in the lungs. When these ~~These~~ granulomas ~~can~~ impair lung function, and begin to cause symptoms such as dry cough or shortness of breath, the person is said to have clinical (with symptoms) CBD (ATSDR 2001). CBD can be debilitating and sometimes fatal. A ~~complete~~ description of CBD is ~~described~~ in Appendix A."

The above reference to allergy should be removed because it is misleading to the public's understanding of the potential health effects associated with beryllium. Today, the term "sensitization" has become strictly associated with the Beryllium Lymphocyte Proliferation Test (BeLPT) as measured by testing blood or lung fluid. Sensitization, as it is defined today, is not similar to an allergic response nor is it a health effect. The term "allergy" denotes a health effect. The original use of the term "sensitization" refers to the inflammatory response in the lungs (health effect) which was originally associated with clinical CBD and can now be detected by cutting samples from inside the lung using an in-hospital procedure called bronchoscopy. This surgical procedure also allows for the identification of sub-clinical CBD.

ATSDR Response

The text as been modified as follows:

“Some persons exposed to beryllium develop a sensitization to the metal. Some sensitized individuals go on to develop sub-clinical (no symptoms) chronic beryllium disease (CBD) in which granulomatous inflammation forms in the lungs. Over time, areas of fibrosis surround the granulomas (Maier and Newman 1998). Common symptoms reported by persons with clinical Chronic Beryllium Disease include dry cough, shortness of breath, fatigue, and chest pain. (Maier and Newman 1998). CBD can be debilitating and sometimes fatal. A detailed description of CBD is contained in Appendix A.”

Comment

Paragraph 7 refers to the open house conducted by ATSDR. ATSDR states that the purpose of the meeting was to gather community concerns about beryllium exposure. An open house is not a scientifically valid way to identify and assess “community” concerns. Truly representative community concerns are properly evaluated using a valid random sampling method, such as random interviews or survey questionnaires. What the ATSDR did was gather “individual” concerns of an admittedly unrepresentative sample of the community within a public setting. In addition, the audience at the open house was not randomly selected but included persons who work for Brush Wellman, who favor Brush Wellman, and persons who are, or have been, actively pursuing legal action against Brush Wellman. All of these potential biases should be included in the health consultation report in a section describing the limitations of the methods used to gather community concerns.

ATSDR Response

ATSDR’s public availability sessions are an effective method of listening to the concerns of community members who attend these meetings. These public availability sessions are the efficient means of establishing a dialog with a community. ATSDR does recognize and has noted the limitations of the data collection in this section.

Comment

The last paragraph in this background section (paragraph 12) is beyond the scope of Senator Mike DeWine's request. In addition, the paragraph is misleading to the public and contains incorrect statements regarding groundwater contamination on Brush Wellman's property. Brush Wellman's on-site production wells have been used for both drinking water and as make-up water for production operations. Our on-site production wells are **NOT** contaminated with chlorinated solvents, PCE or TCE. These chlorinated solvents have been detected in about a dozen of the more than 70 groundwater monitoring wells that Brush Wellman has installed in or around old or existing solid waste disposal areas and holding ponds. These wells are placed to determine the potential migration of contamination in groundwater beneath the plant. In no case has ground water contamination been detected near Brush Wellman's property borders. In addition, all samples of neighbor wells have shown no contamination associated with Brush Wellman operations.

ATSDR Response

The reference to on-site production wells has been removed. The following sentence has been added: “No VOCs have been detected in well water samples collected from residences adjacent to the plant.”

Environmental Data - Well Water Quality Section

This section is beyond the scope of Senator Mike DeWine's request, and should, therefore, be removed. Nonetheless, Brush Wellman offers the following comments on this section.

Paragraph 1 - Even though no beryllium was detected in the residential wells, the public deserves throughout the United States. We recommend the last sentence of the first paragraph be modified as follows.

"EPA's Maximum Contaminant Level (MCL) for beryllium is 4 µg/l. ~~(~~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.~~)~~ Beryllium is naturally occurring in around water and surface water. Beryllium has been measured in surface water at an average concentration of 23.8 µg/l(EPA 2000). Beryllium has been measured in ground water at an average concentration of 13.6 µg/l (EPA 2000)."

ATSDR Response

The following sentence as been added to the text: Dissolved beryllium has been detected in groundwater at 262 of 4,177 sites (6.6 percent) throughout the United States with an average concentration of 13 µg/L (EPA 2000).

Comment

Brush Wellman recommends that the first paragraph be rewritten as follows to provide the public a more accurate and complete description of Brush Wellman's ambient air sampling network.

"Brush Wellman has performed ambient air monitoring for beryllium outside of its Elmore, Ohio, plant since ~~1957~~ 1958 (Brush Wellman 2001a). The United States Atomic Energy Commission required Brush Wellman to operate an ambient air monitoring network from 1958 to 1962. For 11 years, from 1962 until 1973, Brush Wellman voluntarily operated the ambient air monitoring network. During this period, it was not required by any government agency. On July 24, 1973, the USEPA adopted an ambient air standard for beryllium. Brush Wellman's monitoring network was redesigned in consultation with, and approved by, the USEPA Region V in 1974. Brush's monitoring data from this network have been verified by USEPA Region V. USEPA employed a contractor which for a full year operated an independent set of monitors next to Brush Wellman's monitors. The contractor's independent data confirmed Brush Wellman's data. 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 collocated ~~co-located~~ monitors (two monitors located adjacent to each other for quality control purposes). The stations are operated continually; monitoring data is collected weekly and is reported to the Ohio EPA monthly."

Paragraph 2 - ATSDR should correct this paragraph to state that air is drawn through a fiberglass filter, not across the filter. We recommend that the following sentence be added to improve the understanding of the general public.

"The USEPA standard for the airborne concentration of beryllium is 0.01 micrograms per cubic meter of air ($\mu g/m^3$) based on a 30-day average."

ATSDR Response

ATSDR has revised the text as follows:

Brush Wellman has performed ambient air sampling for beryllium outside of its Elmore, Ohio, plant since 1958 (Brush Wellman 2001a). The United States Atomic Energy Commission required Brush Wellman to operate an ambient air sampling network from 1958 to 1962. For 11 years, from 1962 until 1973, Brush Wellman voluntarily operated the ambient air sampling network. In 1973, USEPA adopted an ambient air standard for beryllium. In 1974 Brush Wellman's sampling network was redesigned in consultation with, and approved by, USEPA Region 5. Currently, Brush Wellman performs continuous air sampling for beryllium at nine off-site locations (Figure 1). Two of the stations, #13 and #19, contain co-located samplers for quality control purposes. The stations are operated continually; sampling filters are collected weekly and are reported to the OEPA monthly.

Each air sampler draws air through 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. As required by USEPA, for each 30-day period, the weekly beryllium levels are averaged and reported to the OEPA. Based on a 30-day average, the USEPA standard for the airborne concentration of beryllium is 0.01 micrograms per cubic meter of air ($\mu g/m^3$).

Comment

The ATSDR should not be reporting weekly concentration limits for beryllium in Table 1 or in the text of this section because there is no comparative scientific or health basis to justify its inclusion. Providing data for which there is no means of providing a health-based comparison does a disservice to the public and is scientifically misleading (see additional Brush Wellman comments relevant to this topic in the conclusions section).

ATSDR Response

ATSDR disagrees with this comment and reports the weekly values to illustrate how a peak weekly value is averaged with a monthly period.

Comment

In paragraph 7, ATSDR infers that the wind patterns measured at the Toledo Express airport are the same as those in the greater Elmore area. Such a conclusion should be verified to be a scientifically supportable statement in light of the facts that the airport is at least 25 miles away and Elmore is in closer proximity to Lake Erie. If it cannot be verified, the wording should be clarified as shown below for the last three sentences. Brush Wellman did provide recent wind pattern data specific to the Elmore facility which the ATSDR can use for either comparison purpose or as a more accurate representation of wind patterns surrounding the Elmore plant.

"At the airport, the ~~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. "

ATSDR Response:

Metcalf Field is the closest location to Brush Wellman Plant that has some limited meteorology data in an electronic format. Metcalf Field is approximately 12 miles northwest of the Brush Wellman Plant and is similar to the Brush Wellman Plant in distance and direction from Lake Erie. The Toledo Express airport, approximately 25 miles west of the Brush Wellman Plant, has more extensive meteorology data in an electronic format that is suitable for modeling. ATSDR has compared meteorology data collected at the Toledo Express Airport (west of Toledo) and Metcalf Field (east of Toledo) for an identical timeframe and has determined that surface wind patterns are similar at those two airports. Brush Wellman collects limited meteorology data at its Elmore Plant, e.g., wind direction data are collected by visual observation of a wind sock. These data are not suitable for modeling.

Comments

The second to last sentence in paragraph 8 is partially inaccurate and should be reworded as follows.

"This action was proposed ~~performed in response~~ to ~~a request~~ Brush Wellman's Community Advisory Panel (CAP) by Brush Wellman. The CAP accepted Brush Wellman's proposal."

The first sentence in the last paragraph in this section is partially inaccurate and should be replaced as follows.

"OEPA staff ~~has~~ requested that Brush Wellman split some of Brush Wellman's sample filters with the agency (each analyzing one-half of a filter) ~~install an additional air monitoring station~~ for

analysis ~~use~~ by the OEPA to verify the quality of the Brush Wellman air monitoring data. Alternatively, Brush Wellman suggested that an additional air sample station be installed, at Brush Wellman's expense, to permit the OEPA to independently collect its own samples. The OEPA would completely control the sampler. Brush Wellman would pay for the electricity. The OEPA accepted Brush Wellman's alternative proposal and, in addition, may occasionally split samples with Brush Wellman."

ATSDR Response:

ATSDR has modified the text on page 6 as follows.

In 2001, OEPA staff requested that Brush Wellman split some of Brush Wellman's sample filters with the agency (each analyzing ½ a filter) for analysis by the OEPA to verify the quality of the Brush Wellman air sampling data. As an alternative, Brush Wellman suggested that an additional air sample station be installed—at Brush Wellman's expense—to permit the OEPA to independently collect its own samples. OPEA accepted Brush Wellman's offer. OEPA completely controls the sampler while Brush Wellman pays for the electricity. This station has been installed at air sampling station 13. OEPA staff is responsible for calibrating the air monitor, and collecting and analyzing the air filters. OEPA staff initiated this sampling in January 2002. ATSDR reviewed the OEPA results for January and February 2002. Both OEPA and Brush Wellman's results were well below the USEPA's National Emission Standard for Hazardous Air Pollutant (NESHAP) standard of 0.01 µg/m3 of beryllium, based on 30-day averages.

Discussion – Well-Water Section

Comment

Paragraph 1 - Brush Wellman believes that in the first sentence ATSDR mistakenly used the level of 0.2 µg/l instead of the drinking water standard of 4 µg/l. There would be no scientific basis upon which to use a level of 0.2 µg/l. At the end of this paragraph, the ATSDR states that it "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." This evaluative statement is beyond the scope of Senator Mike DeWine's request. Notwithstanding, Brush Wellman believes that sufficient information and data is available to the ATSDR to evaluate the potential public health impact of chlorinated solvents on the community. Brush Wellman has provided to the ATSDR groundwater study data and additional data is available from either Brush Wellman or the OEPA.

ATSDR Comment

ATSDR changed the 0.2 µg/L to 4.0.µg/L. ATSDR has removed the following statement: "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" and concludes that "the levels of beryllium in well water samples collected from private residences near the Brush Wellman Plant present no public health hazard to the residents."

Discussion - Ambient Air Section

Comment -

Paragraph 1 - The Atomic Energy Commission "recommended" an ambient air standard in 1949. The standard was not "established" (adopted) by the AEC until several years later.

ATSDR Response

ATSDR has changed “established” to “recommended.”

Comment

Paragraph 2 - Though the TRI release values stated in this paragraph are as reported by Brush Wellman, the public needs to understand that these numbers are primarily generated by emission estimates. Brush Wellman has about 80 air emission units. Emission estimates are calculated in three ways.

Stack data represents the most accurate source of data because it uses the actual hours of operation during the year and multiplies it times the result of a stack sample of the operation during maximum throughput of material. This type of data is most often an overestimation of the actual emission because it uses data representative of the maximum rate of emission, not the average rate.

Permit limit data uses the actual hours of operation multiplied times the allowable emission limit for the permitted source. Again in this instance, the emission limit would be based on a calculation of using the maximum throughput of material. This type of data is most often an overestimation of the actual emission because it uses data representative of the maximum rate of emission, not the average rate.

Some emission estimates are based on best professional judgment regarding the operation of a ventilation and air cleaning system. These types of estimates are usually used for non-routine sources and are usually not production type sources. For example, a laboratory ventilation hood used to occasionally handle beryllium powder would be estimated to lose 1% of the material being handled to the ventilation system during normal handling. This is an infrequent operation where the hours of operation have to be roughly estimated by the operators. In the end, a calculation is made by taking the estimated hours of operation times the estimated losses to the air cleaning system times the efficiency of the air cleaning filtration system. This type of estimate can overestimate or underestimate the average emission.

The above conditions tend to arise because the data being used is generated for an individual discharge permit, which, by design, tends to include a bias towards higher emission estimates. This bias is then magnified by multiplying the higher estimate for 80 emission sources by the number of days of operation during each year. The fact remains that a community ambient air monitoring network represents the most accurate measure of potential exposure to a community.

ATSDR Response

The following statements have been added: “Brush Wellman’s Elmore plant contained 80 emission units. The TRI data are based on a combination of stack emissions, permit limit data, and best professional judgment.”

Comment

Brush Wellman believes the ATSDR should inform the public of the following information regarding the establishment of the ambient air standard for beryllium.

1. The current ambient air standard incorporated a 20-fold safety factor (Eisenbud 1998)
2. In adopting the 10 gram per 24-hour standard, the USEPA stated, "This level was determined through dispersion estimates as the level which would protect against the occurrence of 30-day average ambient concentrations exceeding 0.01 µg/m^3.” 38 CFR 8823 (April 6, 1973). The dispersion model used was reviewed and approved by two advisory committees.

ATSDR Response

ATSDR has adopted the following statement. “This level was determined through dispersion estimates as the level which would protect against the occurrence of 30-day average ambient concentrations exceeding 0.01 µg/m^3.”

ATSDR has also added the following text on page 7:

“This standard was based on an epidemiology study in Lorain, Ohio, in the late 1940s. Ten non-occupational cases of chronic beryllium disease were attributed to ambient air pollution from a nearby beryllium plant. The farthest case lived ¾ mile from the beryllium plant. Researchers concluded that lowest exposure that produced disease was greater than 0.01 µg/m^3 but probably less than 0.1 µg/$m^{3"}$ (Eisenbud 1982).”

Comment

Brush Wellman believes the first two sentences in the last paragraph in this section would be correct if rewritten as follows.

"The annual average ambient air level of beryllium in the United States is 0.00003 µg/m^3. The median annual concentration of beryllium in United States cities is 0.0002 µg/m^3."

Brush Wellman believes it would be informative for the public to add the following sentence ahead of the last sentence in the last paragraph.

"Beryllium in the ambient air occurs from both natural sources, such as wind blown soil, and from man-made activities, such as the burning of coal."

ATSDR Response: ATSDR has made the changes as noted.

Comment - Episodic Air Releases Section

Paragraph 2 - This paragraph regarding the February 15, 2001 smoking barrel incident needs to be expounded upon to convey the entire event and underlying circumstances to the public. Brush Wellman did not prohibit the single OEPA emergency response person from entering our site. We instructed the person that it would not be a good idea to enter the site without training on the associated potential hazards. In addition, we advised the person that they would not be permitted to wear Brush Wellman supplied clothing, over garments or respiratory protective gear without going through Brush Wellman's training. The United States Occupational Safety & Health Administration (OSHA) regulations require Brush Wellman demand written certification from a medical authority that a person is medically fit to wear our respiratory protective equipment.

The ATSDR report states that the OEPA maintains that their personnel have the necessary authority and training to enter Brush Wellman. Brush Wellman understands the authority of OEPA both then and now. The individual who came to the Elmore site that day did not state that he had the appropriate training or that he had brought with him the proper protective gear. This individual was not barred from entry; he chose not to enter our site.

ATSDR Response

Brush Wellman and Ohio EPA provide different perspectives of this event. ASTDR has deleted this paragraph because it does not directly relate to the community's health concerns.

Comment

Paragraph 3 - As written, this paragraph regarding particulate emissions settling on vehicles is vague. ATSDR should either seek out an accurate accounting of the alleged episode or remove this paragraph. Brush Wellman is willing to provide all documentation regarding any historical episodic release. Additional information may also be available from the Ottawa County Emergency Management Agency or the Ohio EPA.

ATSDR Response

ATSDR has removed this paragraph from the consultation because no additional information was available about the incident.

Comment

Paragraph 4 relates to a production related accident which has no bearing on public health and should be removed. Any discussion of these events must be considered in the context that the ambient air monitoring network measures any emission episodes from the Elmore plant, and the monitoring results collected during the sampling periods that included these episodes demonstrated attainment of the standard. Brush Wellman has now established with the OEPA that any time it

makes a report to the Ottawa County Emergency Management Agency, it will also notify the OEPA, regardless of its legal requirement.

ATSDR Response

ATSDR has added the following statement. “The levels of beryllium measured at the closest down wind stations were less than the USEPA standard of 0.01 µg/m^3 during these incidents.”

Comment

Paragraph 5 should be removed in its entirety. This discussion is speculative, misleading and inaccurate. First, it is speculative to discuss the standards for assessing a three-hour potential exposure to 0.64 µg/m^3 because no such exposure occurred due to the evacuation as well as for other reasons, such as dilution of the plume between where it was measured and the location of residents. Second, it is misleading because it confuses any "brief" exposures occurring during the February 15 incident with exposures of three hours or longer. It is also misleading because it fails to compare any short-term exposure with the AIHA 25 µg/m^3 guideline for one-hour exposure which is discussed a few paragraphs earlier in the text. Lastly, it is inaccurate because the inclusion of the Henneberger reference as a comparison to an episodic release level is scientifically wrong. The Henneberger reference is for average exposure data taken over a 24-month period from inside of a beryllium oxide production facility. Average exposure data is not comparable to a hypothetical short-term episodic community exposure. Taken altogether, these errors show that it is wholly unjustified for ATSDR to engage in theorizing as to the relationship of a potential three-hour exposure to the EPA standard and one paper. Brush Wellman knows of no basis for ATSDR's statement of prudent public health policy. Brush Wellman agrees with the concept of reducing exposure to airborne beryllium to levels as low as reasonably achievable and it has adopted policies and procedures that seek to do just that. However, the USEPA ambient air standard is not based on "eliminating non-occupational exposure to processed beryllium dust where feasible" as an acceptable policy. The USEPA has established a health-based beryllium ambient air exposure limit for the general public under the authority of the 1973 National Emission Standard for Hazardous Air Pollutants.

ATSDR Response

As previously indicated, ATSDR has added a Public Health Implications of Intermittent Short-Term Exposures section on page 9 in lieu of this paragraph.

Comment

Paragraph 6 - Brush Wellman contends that the ATSDR has available to it more than 50 years of beryllium ambient air studies and data and thus can draw public health conclusions about the levels of beryllium in the ambient air under most conditions, including "short-term (eight hours or less) adverse plant conditions.)" In addition, the episodic releases which have in the past occurred at Brush Wellman have been measured using the ambient air monitoring network which is located in the community. The network operates 24 hours per day, 7 days per week and 52 weeks per year.

Indeed, Brush Wellman would be surprised if there is a more comprehensive database anywhere with respect to the ambient air impacts of the emissions of one air pollutant from a manufacturing plant. Recognizing the stringency of the 0.01 μg/m^3 standard and the fact that Brush has almost invariably been operating well under that standard for decades, we think that the claimed lack of "sufficient information" rings hollow. The ATSDR should either eliminate this paragraph or revise it to reflect that it has not reviewed the available data in sufficient detail to draw conclusions regarding the public health hazards of short-term upsets. Brush Wellman provides additional analysis of this issue in the conclusions section of these comments.

ATSDR Response

ATSDR has reworded the paragraph as follows: “There is insufficient scientific information to draw public health conclusions about the levels of beryllium in ambient air during these short-term events.”

Potential Off-Site Migration of Beryllium Dust on Workers and Equipment Section

Comment

In the first paragraph, the ATSDR describes that “many” community members voiced concern about this topic. Being a scientific agency, the ATSDR should provide a more accurate accounting of the community response and the scientific and random method used to make such an accounting. Left unchanged or unquantified, this sentence could mislead the public into believing the respondents were properly representative of the community.

ATSDR Comment:

ATSDR has removed “many.”

Comment

It is misleading to the public to include the findings of the Sanderson study. Marc Kolanz, Brush Wellman's Vice President of Environmental Health and Safety, was a scientific reviewer of this paper at the request of the author. Marc Kolanz has been to and reviewed the industrial hygiene practices used at this facility. This first paragraph is not representative of a beryllium facility using beryllium control practices with production workers similar to the conditions at the Elmore facility and is, therefore, misleading to the public.

Below is a comparison of the key work practices of the Elmore facility versus the Speedring facility at the time of the Sanderson study.

Work Practice	**Speedring**	**BWI**
Wear work clothing in personal car	Yes	No
Wear work shoes in Personal car	Yes	No
Required to take showers at end of work day	No	Yes
Split locker room design (clean side/dirty side)	No	Yes

For the above reasons, this paragraph is misleading to the public and the data is irrelevant to the Elmore facility operations and should be removed in its entirety. In addition, this summary is beyond the scope of Senator Mike DeWine's request.

ATSDR Response

ATSDR has been moved this paragraph to the “Off-site Machining of Brush Wellman-own Beryllium Parts and Downstream Users of Beryllium” on page 10.

Comment

In the paragraph describing the OSHA bulletin, the ATSDR refers to the fact that OSHA does not currently require showering or a clothing change. The relevance of this discussion of the OSHA standard is unclear. Brush Wellman does have long-established and well-defined practices regarding showering and changes of clothing. What OSHA has not required in the past or will require in the future really is not relevant to assessing potential off-site migration potential in light of Brush's work practices. In any event, if ATSDR feels constrained to summarize and offer a prognosis on OSHA's work practices standards, it should not do so in a misleading manner. In this instance, the public needs to understand that the ways which beryllium containing products are handled by companies can vary tremendously from foundry and hot work operations to assembly of parts. Likewise the need for showering or company provided clothing can vary by type of operation and the controls used. For example, the Atomic Weapons Facility in Cardiff, United Kingdom handled metallic beryllium in both powder and solid forms. This facility has had only one case of clinical CBD in over 35 years of operation. The operation was well controlled and very clean. Work clothing was required; however, showers were not required. Also in this paragraph, ATSDR makes comment that "OSHA is developing a proposed beryllium regulation that will affect Brush Wellman's operations". Since no such proposal has been published, even in draft form, it is both premature and inappropriate for ATSDR to guess whether Brush Wellman's operations will need to be changed to comply with a new beryllium regulation.

ATSDR Response

This paragraph has been moved to the Off-Site Machining of Brush Wellman Part and Downstream Users of Beryllium Section.

Comment

The ATSDR's inclusion of wipe sample data and dust samples taken by Ohio Citizen Action (OCA) is inappropriate and grossly unfair to the public. It is Brush Wellman's understanding that the ATSDR did not request of the OCA their written sampling methodology, the analytical method used, quality control procedures or inquire as to the qualifications of the persons taking the samples. This is evidenced in the data itself where several samples were not reported in units indicating a concentration. This contradiction in the application of scientific rigor is remarkable and alarming since in providing outplant air sample data to the ATSDR, Brush Wellman was requested to include the following information.

1. Ambient air monitoring and laboratory procedures for beryllium including quality control and quality assurance practices.
2. Plant procedures for wipe sampling surfaces to determine beryllium surface loading.

The inconsistent standard for acceptance of data, indeed the apparent lack of a standard for acceptance of OCA data, is inappropriate, especially when data from various sources are presented and comparisons made without any qualifications.

In addition, the ATSDR should make note that the OCA itself adds a qualifier regarding their data which states that there is no way to determine if their results are background levels of beryllium or beryllium from the Brush Wellman plant. If the ATSDR insists on including the OCA data in the final report, the above qualifications should be included in the written summary.

ATSDR Response

ATSDR has moved the Ohio Citizen Action data discussion to the Background Section and noted the limitations of this data.

Comment

The first sentence of paragraph 5 is inaccurate and should be corrected as follows.

"Since the 1950s ~~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."

ATSDR Response

The text has been changed as noted.

Comment

The second sentence of this paragraph states: "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." This description leaves the reader open to interpretations which can unfairly characterize Brush Wellman's workers' compliance with Brush Wellman's requirement for workers to shower before leaving work. At the Elmore plant, each new employee's first day of employment includes instruction on the locker room procedure, including the requirement to take a shower before leaving work. This practice has been in place since the 1950s. The public needs to understand that though more emphasis has been placed recently on compliance with the requirement to take showers, compliance with this requirement has always been at a high level. To any extent that the policy has been self-regulated, it must be understood that the "regulators" are adult workers who have been trained as to the importance of complying faithfully with work practices so as not to unnecessarily expose their families, friends and other persons to beryllium. ATSDR should better characterize their finding to reflect the above.

ATSDR Response

ATSDR has revised the text as follows:

Until recently this policy has been self-monitored. Brush Wellman informs its workers about the possibility of exposing their families and friends to beryllium if they fail to adhere to the hygiene requirements.

Comment

The fifth sentence in paragraph 5 is incorrect. Visitors going to select production areas, where the potential risk of exposure is believed to be greater, are required to change into Brush Wellman supplied work clothing and to shower before they leave. Visitors to other beryllium control areas must wear a full-length lab coat and knee-high booties over their personal clothing.

In addition, visitors are limited to no more than two hours in the plant, are not permitted into areas where respiratory protection is required; they must stay on main aisle ways and avoid getting close to active production activities. The ATSDR should correct their statement. The remainder of paragraph 5 has nothing to do with a potential risk to the public, is beyond the scope of Senator Mike DeWine's request and should, therefore, be removed.

ATSDR Response

ATSDR has revised this section to reflect the above comments.

Comment

Notwithstanding, Brush Wellman offers the following additional clarification. In this paragraph, the ATSDR also states that, "Workers are allowed to eat in their work clothes without first showering." The purpose of including this sentence is unclear. If the sentence is retained, it would be appropriate to help the public's understanding by including the fact that beryllium is not believed or known to pose any human health risk via ingestion.

ATSDR Response

ATSDR has removed this sentence because it is related to worker safety and health.

Comment

In paragraph 6, the ATSDR should clarify that the vast majority of cases of CBD among worker family members occurred in the 1950s. There have been few cases in the last 40 years. In the second sentence of this same paragraph, the ATSDR describes a research study reporting a single air sample result while shaking clothing which had been worn in a beryllium production operation. This data is not comparable or relevant to the community, is beyond the scope of Senator Mike

DeWine's request and, therefore, should be removed. Notwithstanding, it is misleading to the public to give a single example of an airborne concentration while shaking beryllium-contaminated clothing. The Cohen study was sponsored by Brush Wellman and performed at the Elmore plant. The study included testing of clothing worn by workers in the production areas of the factory. The air sample results taken during those tests varied. The public should not be indirectly led to believe that such a study would have single data point precision. Sentence 3 of this paragraph uses a newspaper article as a factual reference. Such a reference is highly inappropriate in a scientific investigation. The reference should be removed.

ATSDR Response

ATSDR states on page 11 that the majority of CBD cases associated with workers take occurred before the 1960s. ATSDR believes that the Cohen and Positano article provides relevant background information on this subject. The newspaper reference has been replaced by the scientific case report (Newman and Kreiss 1992).

Comment

Paragraph 7 refers to ATSDRs limited observations of zoning practices at the Elmore plant. First, it is totally inappropriate for a scientific agency to try to interpret observations made during ATSDR visitors' 100-foot walk from the security control center to the administration building or while looking out the window of a conference room in the administration building. Second, the ATSDR made no inquiry of Brush Wellman to try to confirm their perceptions. Third, this paragraph states observations and interpretations of those observations which are both wrong and highly misleading to the public. In this instance, stating that the observations are limited does not justify the absence of good scientific investigative practice. In sentence 1, the ATSDR incorrectly makes the assumption that the Elmore facility should be operated like an asbestos removal operation, or hazardous waste cleanup operation, or a nuclear facility. The ATSDR has no scientific basis for making such an assumption and these comparisons are inappropriate. In asbestos abatement, workers are removing materials that literally fall on them while performing their work. Such abatement areas are totally sealed off. In hazardous waste operations, the health and physical hazards of the wastes are often not known and explosions can potentially occur. In radiology, the work is very different. Radiation affects 100% of the population and can result in acute health effects. The ATSDR has never toured the Elmore facility to seek to understand how operations are conducted. Brush Wellman did offer for the ATSDR to tour the facility. Sentence 1 is both vague and highly misleading to the public and should be removed.

Sentence 2 of paragraph 7 refers to vendors in personal clothing walking near workers in common areas of the plant. This sentence is both vague and misleading. The observation made by the ATSDR took place at the entrance to the plant at the security control center. First, the entire plant production area is contained within an eight-foot high barbed wire topped fence. Access to the plant by visitors or vendors can only occur through the security control center which is manned 24 hours per day. Visitors and vendors have a business need to enter the site. Before entering the plant site, visitors and vendors are informed of the potentially hazardous nature of site operations. Vendors who routinely provide services on the site attend Brush Wellman's beryllium orientation

program and are subject to the protective clothing requirements to access the facility. The ATSDR's description of the "common areas" on the plant site make it appear that they are numerous. There is only one common area: the approximately 100 feet long walkway between the security control center and the east administration building. This area is outdoors, not indoors. Persons in Brush supplied work clothing are allowed to walk through this outdoor area as are visitors or vendors. Persons in Brush supplied work clothing are not permitted in the east administration building and vendors and visitors are not permitted beyond areas demarcated on the pavement. The ATSDR and the public need to understand that people in Brush work clothing at times need to talk in person to either a vendor or visitor. They don't come into physical contact with one another and it is not a frequent event. A reasonable means of communicating with the outside world is a business necessity. The fact that some of the workers keep their respirators on when walking through this area is simply a matter of convenience.

ATSDR Response

This paragraph has been removed from the document because the observation related primarily to workplace safety and health.

Comment

Sentence 3 & 4 of paragraph 7 refers to a practice of allowing incoming workers to pass through the laundry area to pick up their cleaned work clothes before they enter the locker room. Brush Wellman agrees that this is a practice that could be improved and is in the process of determining if there is adequate space inside the men's locker room to store the cleaned clothing. The public does need to understand that though dirty clothing is washed in the laundry room and that the workers in the laundry room wear company supplied clothing and respirators while they load dirty clothing. The dirty clothing has been pre-wetted to suppress dust before it is brought into the laundry room.

ATSDR Response

The following statement has been added “Brush Wellman employees no longer enter the laundry room to pick up their clean work clothes at the start of the shift (Marc Kolanz, Brush Wellman Vice President of Environmental Health and Safety, personal communication, March 26, 2002).”

Comment

The last two sentences of paragraph 7 refer to decontamination practices during emergencies. Brush Wellman's emergency response personnel took offense to the notion that "decontamination is less likely on 2nd and 3rd shifts," as implied by the authors of the report. Brush Wellman does not understand the basis for such a statement nor was the validity of the statement ever confirmed with Brush Wellman. Brush Wellman's emergency response personnel make every effort to change the person's clothing and, if necessary, cut off contaminated clothing from a worker prior to their being transported. The ATSDR and the public need to understand that in a life-threatening circumstance, such as a severe injury or heart attack when a delay in treatment may make the

difference between life and death, we appropriately choose life. In addition, written medical procedures requiring decontamination of the individual exist and have been in place for many years (copy of procedures from 1991 and 1998 are attached).

ATSDR Response

ATSDR has revised this statement as follows:

Brush Wellman requires that injured employees be decontaminated before entering an ambulance unless the injuries are life threatening.

Comment

In paragraph of this section, ATSDR refers to mean (average) levels of beryllium found in soil in Ohio. ATSDR should also provide the public the range of results found in Ohio, which was 0.10 mg/kg to 3.15 mg/kg. In addition, it would help the public to better understand the data if it were converted into units they have some familiarity with such as micrograms per pound (microgram is used throughout this report and most people understand a pound). For example, 0.38 milligrams per kilogram would be about 172 micrograms per pound. The upper value of the range (3.15 mg/kg) would be about 1425 micrograms per pound.

ATSDR Response

ATSDR has changed the soil concentration units from mg/kg to µg/g for consistency throughout the document.

Comment

Paragraph 12 refers to the surface contamination limits established by the Department of Energy (DOE). The ATSDR correctly identifies that the DOE limits do not apply to Brush Wellman. In addition, the DOE has made it eminently clear that the DOE's surface contamination limits are not health-based values and that they were simply set at levels they believed could be achieved by the DOE sites (the DOE beryllium operations are smaller than Elmore and are engaged in less complex production operations). In addition, the DOE states:

"As recognized by DOE in the reopening notice, surface or wipe sampling is not an adequate means of characterizing potential exposure risk."

ATSDR Response

ATSDR clearly states on page 11 that the DOE limits are not based on health. They are intended to limit the spread of beryllium contamination and to assess the adequacy of housekeeping measures rather than evaluate the potential health impact of beryllium exposure.

Comment

In paragraphs 8 and 9 of this same section, the ATSDR has recognized the absence of a health-based standard and the problems associated with surface sampling methods. Because the DOE values have no scientific health basis, it is misleading to the public to include them and it is clearly beyond the scope of Senator Mike DeWine's request. Reference to the DOE surface contamination limits should be removed from this paragraph. Notwithstanding, the last sentence in this paragraph contains an incorrect value and is incomplete. DOE rule Section 850.31 (b) (1) states:

> "The removable contamination level of equipment or item surfaces does not exceed the higher of 0.2 µg/l 00 cm^2 or the concentration level of beryllium in soil at the point of release, whichever is greater;"

ATSDR Response

ATSDR believes that this is relevant information and should be included in the consultation. ATSDR has, however, corrected the definition of removable contamination.

Biological Testing Section

In the first sentence of paragraph 1, the ATSDR should precisely define the number of requests for BeLPT screening received by the ATSDR. The second to last sentence in this paragraph incorrectly states, "The test has been a useful tool in detecting chronic beryllium disease in workers without clinical symptoms of disease." The sentence is incorrect because the BeLPT does not detect CBD. To help the public better understand the BeLPT test, the ATSDR should discuss readily available scientific information regarding the reliability of the blood BeLPT test. For example, laboratories which detect a positive result on a first blood test will get a negative result 30% of the time on a second blood test on the same person. When two different labs (Labs A&B) test the same blood sample, Lab A will miss 30% of Lab B positive results and Lab B will miss 30% of Lab A positive results. In one recent survey at the Elmore plant, 18 persons who had tested confirmed positive blood BeLPT (2 positive tests) in the early 1990s were retested in 1999. The retest found 10 of the 18 to test negative based on testing two blood samples each. Brush Wellman has now completed blood BeLPT testing of over 300 new workers before they started working in a beryllium plant. Brush has found that 1-2% of these workers test positive to beryllium before they ever begin working. The public needs to understand that the BeLPT is not diagnostic and a positive BeLPT test does not indicate any health effect or the presence of CBD. Making a determination of sub clinical CBD or clinical CBD requires surgery to obtain samples of lung tissue. Such surgery has its own associated health risks, such as a collapsed lung. The ATSDR should revise this section to provide the public more complete information and easier to understand examples of the benefits, risks and reliability of the BeLPT test. The third paragraph in this section has nothing to do with biological testing and should either be deleted or moved.

ATSDR Response

ATSDR has rewritten the Biological Testing Section as follows:

ATSDR has received some requests to screen Elmore community members with the blood beryllium lymphocyte proliferation test (BeLPT). The BeLPT was developed as a screening tool to identify beryllium sensitization; that is, to identify exposed individuals who could be at risk for developing chronic beryllium disease. The test has been useful in identifying sensitized workers, but it has not been used for screening community groups, where exposure levels and the prevalence of sensitization are expected to be much lower. This is important because the utility of a screening test is related to the prevalence of the condition or disease in the group tested. All screening tests are imperfect, missing some individuals who truly have a condition and mistakenly identifying others who truly do not have the condition. The specificity of the BeLPT, or the likelihood that it would correctly identify as “not sensitized” a person who is truly “not sensitized” is not well established (Maier 2001).

All laboratory tests, including the BeLPT, have some degree of inaccuracy and unreliability. Given that the test is imperfect and the condition either rare or absent in the community, harm could be done if some community members are identified as “sensitized” to beryllium when they truly are “not sensitized.” For example, more invasive testing (i.e., bronchoscopy) with attendant risks often follows a positive BeLPT. Before considering such screening for apparently healthy community members, environmental levels and the potential for exposure must be better characterized. These comments relate to healthy community members; they are not relevant to screening employees exposed to beryllium at work or for evaluating patients who have a granulomatous lung disease.

Comment

ATSDR's review of the topic of this section is beyond the scope of Senator DeWine's request and, therefore, should not be included. That notwithstanding, Brush Wellman offers the following comments and clarifications.

Paragraph 2 - ATSDR's understanding of the function of Brush Wellman's Community Advisory Panel (CAP) is erroneous. The CAP was never designed to serve as a community meeting, but instead a group of invited community members, convened by the company, to advise it on issues and concerns pertaining to the plant and its relationship with the community. The CAP includes a wide range of local citizens from retirees, to business owners and clergy, to public officials and local homeowners. It is inappropriate for the ATSDR to infer that the CAP should somehow be transformed into a platform for large-scale public dialogue with Brush Wellman via the public meeting format. For that reason, CAP meetings are scheduled based on the availability of those on the advisory panel, and invited guests.

The CAP is not a substitute for Brush Wellman's direct, two-way communications with the broader local public. The ATSDR comment inferring that OEPA should be allowed to participate as a member of the CAP is inappropriate because the OEPA is a regulator and not a representative member of the local community. However, the OEPA was never told they were not allowed to attend; indeed, the OEPA has been invited to come and make presentations to the CAP.

ATSDR Response

ATSDR believes that Brush Wellman should maintain some effective means of two-way communication with the community. ATSDR has not asked Brush Wellman to transform the CAP into an open community meeting forum. Nevertheless, for the CAP to be effective, community members should know who participates on the CAP, what issues are discussed, when the issues are discussed and resolved, and how to contact a CAP member or Brush Wellman for questions.

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

Comment

Paragraph 3 - Sentence 2 should be reworded as follows.

"in addition, Brush Wellman management indicated that they offer beryllium health and safety assistance to customers and vendors which includes the ~~to inspect and perform air monitoring~~ of Elmore area machine shops that perform work for Brush Wellman (Marc Kolanz, Brush Wellman Vice President of Environmental Health and Safety, personal communication, June, 27 2001).

ATSDR Response

The text has been revised as requested.

Comment

Paragraph 5 is totally erroneous due to ATSDR's use of a reference paper which is in error. The statement made in Balkissoon 1999 is simply wrong. Researchers have known for years that exposure to airborne beryllium from processing of alloys containing less than 2% beryllium can result in CBD. For example, the 1983 paper by Eisenbud, referenced in Appendix B of the draft ATSDR report, identifies 11 cases of CBD from the cold working of copper beryllium. A paper by Lieben, et al., published in 1964, describes 16 cases of CBD attributable to alloys containing beryllium going back as early as 1955. ATSDR should remove all reference to the Balkissoon paper due to its erroneous statement and resulting lack of validity.

ATSDR Comment

The text has been revised to include the (Lieben et al. 1964) reference.

Comment

In the last sentence of paragraph 5, the ATSDR refers to a lack of an OSHA regulation for beryllium. This sentence is misleading in that OSHA established Permissible Exposure Limits for airborne beryllium in 1972 and to this day, these limits are among the most stringent ever established by OSHA for any substance. OSHA also has a regulation section specific to welding of materials containing beryllium. This welding requirement can be found in 29CFR 1910.252.

ATSDR Response

The word “comprehensive” was added before the word “regulation.”

Comment

Paragraph 6 - ATSDR relates sources of information regarding potential health hazards of beryllium in this paragraph. Brush Wellman is also a good source of health and safety information regarding beryllium. We can provide information in both hard copy and via the internet. We request that Brush Wellman be included in this paragraph as a source for such information. Brush Wellman can be contacted in the following ways.

Web site: www.brushwellman.com
Address: Brush Wellman Inc.
Product Stewardship Department
17876 St. Clair Ave.
Cleveland, Ohio 44110
Telephone: 1-800-862-4118

ATSDR Response

Brush Wellman has been added as an information resource.

ATSDR's Child Health Initiative Section

Comment

In this section, ATSDR makes the statement that the Elmore site is of particular concern for children because there are residences close to the site and that children are believed to be more sensitive to exposure to hazardous contaminants than adults. This statement of belief appears to be a "boilerplate" statement required by ATSDR's policy to appear in any health consultation where there may be an exposure of a chemical to children from an industrial plant or other source. In this instance, however, data does exist regarding the potential risk to children. A x-ray health survey was conducted in 1948 in the neighborhood surrounding a beryllium manufacturing facility in Lorain, Ohio. Approximately 10,000 persons were surveyed (20% of the population in the survey area). Nine thousand satisfactory films were obtained. Of those films, 2000 were of children. The report of this study did not identify any cases of clinical CBD among the children x-rayed in the

survey. The report describes one case of CBD in a seven-year old child identified by the local medical community. The report identifies a second possible case in a child which was not confirmed as CBD by the treating and reviewing physicians. The public would probably like to know that children were a major part of the population (indeed they were over 20% of that population) studied in establishing the 0.01 $\mu g/m^3$ standard. They would presumably also like to know that this population was exposed to levels of beryllium well above the current standard which has been set using safety factors. For example, in 1948 the levels of airborne beryllium within one-quarter mile of the Lorain plant averaged about 1 $\mu g/m^3$ and in some instances exceeded 2 $\mu g/m^3$. Eisenbud estimated that ambient air levels of beryllium during the 10 years preceding 1948 were determined to likely be no more than 8 times higher than the 1948 levels. The ATSDR should incorporate the above information into this section.

ATSDR Response

ATSDR uses standardized language in the Child Health Initiative when there is a lack of information about environmental contaminant's effect on children. ATSDR appreciates Brush Wellman's observation that children were included in the Lorain epidemiology study. As a result, ATSDR has revised the child health as initiative as follows:

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis, especially 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 residences are close to the site. In general, children are believed to be more sensitive to exposure to hazardous contaminants than adults. And specifically, children can develop chronic beryllium disease. Prior to 1960, case reports indicate that at least two children developed chronic beryllium disease that was attributed to worker-take-home or ambient air exposure (NIOSH 1995). Approximately 2000 children were included in the community investigation in Lorain, Ohio in the 1940s. Although no cases of chronic beryllium disease were observed among the children (Eisenbud 1949), the radiographic methods used to detect chronic beryllium disease were less sensitive than those used today (Maier and Newman 1998).

Conclusions Section

Comment

The ATSDR concludes that the following data gaps are why they cannot fully evaluate possible environmental pathways for beryllium exposure.

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

This conclusion is inappropriate in several respects. First, as stated, the conclusion is simply wrong. There is no doubt that it is possible for Brush Wellman workers or for emissions due to

routine or certain short-term events to be "possible pathways" for exposure to beryllium by persons who live in the community. These possibilities are well recognized and measures are thus taken to prevent or to minimize such exposures. Hence, additional data are not necessary to identify these exposures as possibilities. Second, acquiring meaningful scientific data about the levels of potential exposures may not be possible. Data obtained by currently available surface sampling methods will not provide the ATSDR with the capability to evaluate the significance of the exposures via these environmental pathways for several reasons including those stated by the ATSDR in the section titled, *Potential Off-site Migration of Beryllium Dust on Workers and Equipment*. The reasons cited by ASTDR are:

1. There are no health-based standards that define safe levels of beryllium for surface contamination or household dust.
2. 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 chemical form and size of the beryllium particles and the location and physical characteristics of the surface.
3. It is not possible to accurately evaluate the potential risk posed by beryllium surface contamination because of a number of factors may affect potential exposure and our current lack of understanding of chronic beryllium disease.
4. 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.
5. 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.
6. Background levels of beryllium in soil could account for some of the beryllium detected in wipe samples.

In addition to the above list, the time period material has accumulated and cleaning frequencies will have a bearing on the accuracy of results and their usefulness in evaluating environmental pathways as they relate to potential health effects.

As is clearly noted by the ATSDR draft report, a sample obtained using a surface sampling method is not quantifiable, is not repeatable and has no direct relationship to airborne levels of beryllium or health risks associated with beryllium exposure. Wipe sampling cannot be used to create a distinct line between safe and unsafe conditions. Given these facts, Brush Wellman cannot comprehend how the ATSDR can scientifically determine if off-site transport of beryllium dust presents a health hazard to the community. Quite frankly, ATSDR's recommendation to fill this "data gap" at this time does not appear to be based on scientific merit.

ATSDR Response

Despite the limitations noted above, ATSDR believes that absence of surface sample results for beryllium in this community represents a data gap. ATSDR believes that there was merit to the NIOSH investigation of worker-take-home in Alabama, despite similar limitations. Worker-take-home of beryllium dust can result in exposure to household contacts. More than 40 persons have

developed chronic beryllium disease from non-occupational contact with contaminated clothing over the past 50 years. The levels of beryllium in homes can be measured through environmental sampling. The results of environmental sampling can be used to evaluate the effectiveness of existing controls and provide information to guide additional public health actions.

Comment

The levels of beryllium in ambient air during short-term incidents do not constitute a data gap. As previously noted, the Elmore plant's ambient air network has captured samples of emissions from past short-term incidents. Moreover, the ATSDR has no scientific basis to indicate that any plausible short-term incidents are not captured within the current framework of the existing 30-day ambient air standard and that this standard is not protective.

ATSDR has not identified any repeated short-term incidents that give rise to its conclusion that the NESHAPs standard "may not adequately protect the public from repeated short-term exposures". As noted previously, the existence of health risks attributable to such exposures, in the past or in the future, is a matter of speculation given the ambient air monitoring network data. In addition, short-term incidents at the Elmore plant are not the appropriate metric to be looking at for determining a public health risk to beryllium. The beryllium emitted from a factory has never been associated with Acute Beryllium Disease (ABD) in the general public, even at the high levels emitted during the 1940s when some beryllium plants were located less than 100 feet away from people living in a city neighborhood and community levels exceeded 2 $\mu g/m^3$. The potential for risk to the community surrounding the Elmore plant due to beryllium has to do with CBD not ABD. In over 45 years of operation of the Elmore plant, there has never been a release which has resulted in an acute health effect in the community surrounding the Elmore plant. Brush Wellman is at a loss to understand why the ATSDR cannot make an evaluation of an environmental pathway via the air by review of over 9000 air sample data points over the last 20 years.

ATSDR Response

ATSDR believes that the lack of knowledge on the effects of short-term beryllium exposure constitute a knowledge gap. As a result, ATSDR classifies short-term beryllium release episodes and past violations of the USEPA standard in1980, 1989, and 1990 as an indeterminate public health hazard.

ATSDR has concluded that beryllium emissions from the Brush Wellman-Elmore Plant, measured as 30-day averages over years of exposure, are below levels expected to cause adverse health effects and do not pose a public health hazard.”

Comment

The ATSDR indicates that Brush Wellman may not have communicated effectively with the community "regarding the results of past environmental sampling and planned activities." This charge is vague and overbroad in Brush Wellman's judgment. Though Brush Wellman does not contend that on all occasions in the past that there was no room for improvement in our

communications to the community, it must note that the ATSDR's conclusions in this regard are not the result of a scientific evaluation. Whatever the level of Brush Wellman's communication efforts to date on such subjects, it is our intention to do better in the future.

ATSDR Response

ATSDR has limited the conclusions in the final health consultation to health-related issues. As a result, this conclusion was removed from the document.

Comment

The ATSDR concludes that door-to-door notification for evacuation is an inefficient means of communicating emergencies. The ATSDR again provides no standard or scientific methodology for arriving at this conclusion. When it comes to communicating emergencies, effectiveness, rather than efficiency, is the primary objective. Door-to-door notification has been in use across the United States for decades, is the most common form of communicating emergencies and has been the method of choice as defined by the Ottawa County Emergency Management Agency. New technologies, such as the 911 call-back system mentioned by the ATSDR, are being installed by the Ottawa County Emergency Management Agency to augment door-to-door notification. The ATSDR should also note that it is Brush Wellman's Elmore plant which is providing the funding to install the 911 call-back system in Ottawa County. The ATSDR needs to factor in that people using the phone cannot be reached unless they have call waiting. Depending on the time of day, some people may let the answering machine or voice mail pick up the call to avoid telemarketers. Because of these pitfalls, door-to-door notification should not be disregarded as being inefficient. Brush Wellman believes the ATSDR should re-evaluate the merits of its conclusion.

ATSDR Response

ATSDR has limited the conclusions in the final health consultation to health-related issues. As a result, this conclusion was removed from the document.

Comment

Regarding the list of recommendations the ATSDR has made to itself, Brush Wellman offers the following comments.

An exposure investigation of whether community members have been exposed to beryllium from workers' clothing is not likely to lead to information which can be analyzed for potential health implications because of the absence of information linking health effects or airborne concentrations of beryllium to surface levels of beryllium. Basically, the gathering of surface sample data will be uninterpretable in terms of whether or not it is a community health hazard for the previously stated reasons and, therefore, should not be performed on the basis of good scientific practice.

ATSDR Response

As previously noted the results of environmental sampling can be used to evaluate the effectiveness of existing controls and provide information to guide additional public health actions.

Comment

ATSDR recommendation to evaluate the use of biological testing based on the results of the exposure investigation is not well considered. Biological testing (BeLPT) is fraught with problems of reliability and in and of itself cannot diagnose any beryllium related health effect. Moreover, there is no baseline for interpreting the results of BLPT testing of persons without occupational exposure to beryllium. Before any such testing can be considered, the ATSDR would need to perform a statistically valid study in the general population to determine the naturally occurring rate of sensitization in the general population. Brush Wellman has explored having such a study performed and has received rough estimates ranging from $500,000 to $1,000,000. In addition, based solely on the current known rate of detection of positive BeLPT's in the unexposed general population, one could expect a sensitization rate of 20 to 40 people within the 2000 people living within three miles of the Elmore plant even if the Elmore plant never existed. Finally, before undertaking any such study, one must ask what is the medical benefit to the community. Stephen H. Woolf, MD, has served as science advisor to the U.S. Preventive Services Task Force which is an expert panel established by the U.S. Department of Health and Human Services to evaluate the scientific evidence of screening tests and other preventive services. As an expert on public health screening Dr. Woolf has stated, "if medical screening for CBD were to be evaluated for effectiveness by medical organizations in a non-judicial setting, it would fall short of the accepted criteria for effectiveness and would not be recommended for population screening."

ATSDR Response

ATSDR appreciates Brush Wellman’s comments regarding biological testing of community members. Although this statement has been removed, it did not imply the need for, or recommend a community wide screening program. ATSDR is keeping all potential public health actions open at this time.

Comment

Brush Wellman welcomes the ATSDRs review of the air modeling data as it relates to monitoring site locations providing that ATSDR uses wind pattern data relative to the plant. The ATSDR should coordinate their review with the OEPA who is responsible for approving any changes in Brush Wellman's ambient air monitoring program and who has reviewed and requested changes to that program in the past.

ATSDR Response

All suggestions will be provided to Ohio EPA and Brush Wellman.

Comment

Brush Wellman has no objection to the development and distribution of health education materials to residents and health care providers and indeed it would be willing to work cooperatively with the ATSDR in the development of any community health education materials. However, the only reference in the report to the need for such materials is the statement that based upon what ATSDR observed at the June 27 community meeting, "some residents may be unclear about symptoms and nature of chronic beryllium disease." It is unclear from this statement what has caused this possible lack of clarity. The ATSDR may want to understand Brush Wellman's and others' past efforts to educate local health care providers before pursuing the development and distribution of new health education materials.

ATSDR Response

ATSDR will meet with the community and Brush Wellman to discuss health education issues.

Comment

Brush Wellman appreciates that the ATSDR finds the CAP to be valuable and the intention of its recommendations to make it more effective. Brush Wellman will continue to support a CAP based on the explanation provided earlier in these comments.

Brush Wellman agrees that communications with the community should be improved. However, ATSDR probably does not appreciate the tremendous volume and range of "environmental monitoring" that Brush Wellman conducts. Hence, ATSDR's recommendation concerning community notification seems overly broad and impractical. Nevertheless, Brush Wellman is actively pursuing the most effective ways to communicate environmental monitoring and air monitoring results to the community and plans to implement a program to make the communications.

ATSDR Comment

ATSDR supports Brush Wellman’s efforts to communicate environmental sampling information to the public.

Comment

Though there is no regulatory basis to do so, Brush Wellman has volunteered to notify the OEPA the same way that it notifies the Ottawa County Emergency Management Agency of any release. Brush Wellman has always attempted to obtain downwind samples during an accidental release of beryllium which may travel off-site.

ATSDR Response

ATSDR supports Brush Wellman's efforts to voluntarily notify the OEPA of any release, regardless of size, and attempt to obtain downwind samples following an accidental release.

Comment

Brush Wellman plans to explore the alleged concerns of emergency response personnel and would appreciate if the ATSDR would identify the original source of the concern so Brush Wellman can conduct an appropriate and thorough investigation. Recent meetings between Brush Wellman personnel and local emergency medical services personnel have not identified this as an issue.

ATSDR Response

The conclusion was removed from the text.

Comment

Brush Wellman has been and plans to continue monitoring for the potential migration of groundwater contamination to neighbor wells.

ATSDR Response

Comment noted.

Comment

ATSDR recommendations for downstream beryllium users should include Brush Wellman as an appropriate source of information.

ATSDR Response

ATSDR has included Brush Wellman as an information resource.

Comment

The ATSDR recommendation for community members is vague, over-broad and inappropriate. There is not a person on this planet who has not been exposed to beryllium since it is a naturally occurring substance. The potential symptoms listed by the ATSDR could have hundreds of different causes. It is inappropriate for the ATSDR to encourage the use of the BeLPT for persons experiencing symptoms which could have hundreds of known causes. ATSDR should not endorse BeLPT testing by encouraging persons to determine whether BeLPT is appropriate by consulting with their physicians. The decision to recommend such testing should be left to the medical practitioner and should not be biased by an ATSDR endorsement or apparent endorsement.

ATSDR Response

The recommendation has been changed to the following: “Persons who believe they have had beryllium exposure in the past should talk with their personal physician. The individual and their physician might consider consulting an occupational /environmental medicine specialist who is knowledgeable in the area of chronic beryllium disease.”

Appendix D

OSHA Hazard Information Bulletins
Preventing Adverse Health Effects From Exposure to Beryllium on the Job.

U. S. Department of Labor
Occupational Safety and Health Administration
Directorate of Science, Technology and Medicine
Office of Science and Technology Assessment

Preventing Adverse Health Effects From Exposure to Beryllium on the Job

Hazard Information Bulletin

WARNING!
INHALING BERYLLIUM DUST OR FUMES MAY CAUSE SERIOUS,
CHRONIC LUNG DISEASE AMONG EXPOSED WORKERS;
THIS LUNG DISEASE CAN BE FATAL.
BERYLLIUM CAN ALSO CAUSE LUNG CANCER.

The Occupational Safety and Health Administration (OSHA) has recently obtained information suggesting that OSHA's current 2 micrograms per cubic meter of air (micrograms/m^3) eight-hour time-weighted average (TWA) permissible exposure limit (PEL) for beryllium in the workplace may not be adequate to prevent the occurrence of chronic beryllium disease (CBD), a disabling and often fatal lung disease, among exposed workers.

OSHA is publishing this Hazard Information Bulletin to alert employees working with beryllium about the hazards associated with their work. It describes engineering controls, work practices, and personal protective equipment recommended for controlling exposures to beryllium through inhalation and skin contact. It also suggests health surveillance methods to identify workers who may have become sensitized to beryllium, or who may have CBD.

Background

Beryllium is a metal that is found in nature, especially in beryl and bertrandite rock. It is extremely lightweight and hard, is a good conductor of electricity and heat, and is non-magnetic. These properties make beryllium suitable for many industrial uses, including: *metal working* (pure beryllium, copper and aluminum alloys, jet brake pads, aerospace components); *ceramic manufacturing* (semi-conductor chips, ignition modules, crucibles, jet engine blades, rocket covers); *electronic applications* (transistors, heat sinks, x-ray windows); *atomic energy applications* (heat shields, nuclear reactors, nuclear weapons); *laboratory work* (research and development, metallurgy, chemistry); *extraction* (ore and scrap metal); and *dental alloys* (crowns, bridges, dental plates); and *sporting goods* (golf clubs, bicycle frames).

Current Exposure Limits

The current OSHA PELs for beryllium are 2 micrograms/m^3 as an 8-hour TWA, 5 micrograms/m^3as a ceiling not to be exceeded for more than 30 minutes at a time, and 25 micrograms/m^3as a peak exposure never to be exceeded. The OSHA limits have been in place for nearly 30 years and have not been revised in that time. The American Conference of Governmental Industrial Hygienists (ACGIH) has recently published a Notice of Intended Change for its Threshold Limit Value (TLV) for beryllium that would lower the TLV from the current level of 2 micrograms/m^3 to 0.2 micrograms/m^3averaged over an 8-hour work shift.

Potential Adverse Health Effects From Beryllium Exposure

Chronic Beryllium Disease

Chronic beryllium disease (CBD) primarily affects the lungs. CBD may occur among people who are exposed to the dust or fumes from beryllium metal, metal oxides, alloys, ceramics or salts. It occurs when people inhale beryllium in these forms. CBD usually has a very slow onset, and even very small amounts of exposure to beryllium can cause the disease in some people. In some cases, CBD develops while workers are still on the job, but in others it may not develop until many years after a person has stopped working in the beryllium industry, or has been transferred to a job that does not involve beryllium exposure. The amount or length of exposure to beryllium necessary to cause a specific individual to develop CBD is not known, but recent information suggests that exposure below

OSHA's 2 micrograms/m^3 TWA PEL over a very short time (weeks or months) can lead to CBD in some workers.

Signs and Symptoms of Chronic Beryllium Disease

Workers with advanced CBD may have one or more of the following symptoms: unexplained cough; shortness of breath, especially with activity; fatigue; weight loss or loss of appetite; fever; or night sweats. However, because the disease may develop slowly over a period of many years, workers may have the disease for a long time without knowing it.

Beryllium Sensitization

CBD only develops in workers who have become sensitized to beryllium. A sensitized worker is one who has developed an allergic reaction to beryllium. A worker may become sensitized at any point during job exposure, or in some cases may not become sensitized until after leaving a job where there has been beryllium exposure. Beryllium sensitization can be detected through the use of a blood test called the BeLPT, which stands for beryllium lymphocyte proliferation test. This test measures how specific white blood cells called lymphocytes react to beryllium. A positive test result means that a worker is sensitized.

Acute Beryllium Disease

Acute beryllium disease usually has a quick onset and has symptoms that resemble those of pneumonia or bronchitis. The acute form of the disease is believed to occur as a result of exposures well above the current PEL. This form of beryllium disease is now rare.

Cancer

Studies of workers exposed to beryllium have demonstrated significantly elevated risks of lung cancer. The International Agency for Research on Cancer (IARC), the expert cancer agency of the World Health Organization, has concluded that exposure to beryllium can cause lung cancer in humans.

Skin disease

A skin disease, which is characterized by poor wound healing and a rash or wart-like bumps, can occur as a result of the skin being exposed to beryllium dust.

Recommendations

OSHA recommends the following measures to reduce exposure to beryllium in the workplace and to determine whether workers have beryllium sensitization or CBD.

1. Engineering Controls

Employers should use appropriate engineering controls and work practices to ensure that worker exposures to beryllium are maintained below the current OSHA PELs to the extent feasible. The following engineering controls and practices should be used by employers:

- enclose processes;
- design and install appropriate local exhaust ventilation;
- use vacuum systems in machining operations;
- use pellets instead of powders wherever possible;
- use product substitution where possible;
- minimize the number of workers who have access to areas where there is a potential for beryllium exposure;
- monitor employee exposures to airborne beryllium dust and fume, using personal sampling techniques, on a regular basis to ensure that exposures are below the PELs and that proper respiratory protection is being used where necessary.

2. Work Practices to reduce beryllium exposure

Employers should ensure that employees use the following safe practices to reduce their exposure to beryllium:

- use high-efficiency particulate air (HEPA) vacuums to clean equipment and the floor around their work areas;
- do not leave a film of dust on the floor after the water dries if a wet mop is used to clean;
- do not use long vacuum hoses and do not loop the hoses that are used;
- do not disconnect or disable the vacuum system during any machining operation;
- never use compressed air to clean parts or working surfaces;
- avoid prolonged skin contact with beryllium particulate; and
- do not allow workers to eat, drink, smoke, or apply cosmetics at their work stations.

3. Hygiene and Personal Protective Clothing

OSHA is aware of CBD cases that have occurred among family members of beryllium-exposed workers. To reduce "carry-home" exposures, employers should provide showers, clean work clothes, and clean areas for storing street clothes**.** Protective clothing should be provided to employees who work in areas where beryllium-containing powders are used and where there is a potential for spills. In addition, employers should ensure that employees:

- change into work uniforms before entering their work area;

- place their uniforms in a labeled bin with a cover at the end of the work shift;
- shower and change into street clothes prior to leaving the facility;
- wash their face, hands, and forearms before eating, smoking, or applying cosmetics;
- keep their work clothes as clean as possible during the workshift;
- wipe off their shoes before leaving the work area; and
- do not wear their work uniform (including their work shoes) outside of the facility.

4. Respiratory Protection

Recent data suggest that exposures to beryllium even at levels below the 2 micrograms/m^3 PEL may have caused CBD in some workers. Therefore, employers should consider providing their beryllium-exposed workers with air-purifying respirators equipped with 100-series filters (either N-, P-, or R-type) or, where appropriate, powered air-purifying respirators equipped with HEPA filters, particularly in areas where material containing beryllium can become airborne.

5. Training

Employers should give employees exposed to beryllium training and information about the following items:

- material safety data sheets (MSDSs) for beryllium;
- the fatal lung disease that may occur as a result of exposure;
- the availability of the BeLPT blood test to determine whether an exposed worker has become sensitized to beryllium;
- the potential for developing lung cancer as a result of exposure;
- the importance of avoiding skin contact;
- the engineering controls the employer is using to reduce worker exposures to beryllium;
- specific work practices that can be used to reduce exposure to beryllium;
- the use of appropriate protective equipment, including the use of respirators;
- the results of any industrial hygiene sampling for levels of beryllium in the workplace; and
- a copy of this Hazard Information Bulletin.

6. Health screening methods for beryllium sensitization and chronic beryllium disease

To the Employer:

Employers should consider sending beryllium-exposed employees to a physician or other licensed health care professional to be evaluated for beryllium sensitization or the presence of CBD. The screening examination for CBD usually begins with a chest x-ray and a blood test for beryllium sensitization, namely, the BeLPT, plus any further evaluation considered appropriate by the health care professional. The blood test can detect an adverse health response to beryllium exposure earlier than breathing tests or chest x-rays can. The BeLPT is not routinely done in most medical laboratories; however, the health care professional may order this test from any laboratory that has overnight courier service to one of the Medical Research Centers listed below. If a worker is sent to a health care professional for health screening, a copy of this Hazard Information Bulletin should accompany the employee.

To the Employee:

If you work in a place where beryllium is used and have developed any of the symptoms listed below, you should inform your health care professional of your past beryllium exposure, or seek information from a health care professional who specializes in occupational lung diseases to determine whether you may have developed CBD:

- unexplained cough,
- shortness of breath,
- fatigue,
- weight loss or loss of appetite,
- fevers, and/or
- skin rash.

If you do not have any of the above symptoms but are concerned that you may have become sensitized to beryllium, you should inform your health care professional that you would like to be tested with the blood BeLPT. Take a copy of this Hazard Information Bulletin with you.

Blood testing for beryllium sensitization

Only the three medical research centers and the one laboratory listed below currently offer the blood test to identify beryllium-sensitized workers as indicated by a positive blood BeLPT. As other research centers and laboratories develop the capacity to screen workers for beryllium sensitization, they will be added to the list.

Medical Research Centers

Cleveland Clinic Foundation
9500 Euclid Avenue, L-15
Cleveland, Ohio 44195
phone: (800) 628-6816

Division of Environmental and Occupational Health Sciences

National Jewish Medical and Research Center
Denver, Colorado 80206
phone: (303) 398-1722

Pulmonary Immunology Laboratory
Hospital of the University of Pennsylvania
421 Curie Blvd.
844 BRB II/III
Phliadelphia, Pennsylvania 19104
phone: (215) 573-9875

Testing Laboratory

Specialty Laboratories, Inc.
2211 Michigan Avenue
Santa Monica, California 90404-3900
phone: (800) 421-4449

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Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210