BERYLLIUM RESEARCH
NIOSH
HIGHLIGHTS

July
2005

An update about NIOSH's ongoing beryllium research findings

ISSUE 2

Welcome To Our Second Newsletter

This issue provides an update of the ongoing beryllium research findings at the National Institute for Occupational Safety and Health (NIOSH). We have tried to present this technical information in a manner that is easy to understand and still be scientifically correct. **If you have questions about any of this information, please call 1-800-447-8305.**

Christine Schuler, Ph.D.
Beryllium Program Leader
Field Studies Branch, NIOSH

SOME OF THE TOPICS THAT ARE ADDRESSED IN THIS ISSUE INCLUDE:

- **Studies of skin exposure to beryllium.**
- **Ways in which employees in the Tucson, Reading, and Elmore plants apply NIOSH research findings to everyday work practices.**
- **Do employees in a plant that handles mostly copper-beryllium alloy, with relatively low air levels of beryllium have the same risk of sensitization and CBD as other beryllium production plants?**
- **How to obtain genetic results.**
- **Follow-up of Tucson ceramics plant workers who participated in 1992 survey.**
- **Influence of genetics on your risk of developing beryllium sensitization and disease.**

UPDATED CONTACT INFORMATION FOR BERYLLIUM COMPENSATION ACT

In 2001, a law, called the Energy Employees Occupational Illness Compensation Program (EEOICP) Act, was passed that provides medical and monetary benefits to some current and former workers with beryllium sensitization and CBD.

The EEOICP National Call Center provides nationwide toll-free assistance to customers with questions regarding EEOICP Occupational Illness claims. In addition to answering general information, the Call Center will relay any specific inquiry to the proper office.

To receive any benefits to which you may be entitled, you must file a claim with the Department of Labor. We encourage you to obtain more information from the Department of Labor. You can also call the EEOICP Call Center toll-free number: 1-866-888-3322. Information about the act can be found at http://www.dol.gov/esa/regs/compliance/owcp/eeoicp/main.htm

NIOSH is ***not*** involved in this beryllium compensation program. We are providing you with some general information, so you can decide whether you want to learn more.

CONTENTS

CDC Workplace Safety and Health

NIOSH SKIN STUDIES

STUDIES OF SKIN EXPOSURE TO BERYLLIUM

Efforts to prevent beryllium sensitization have focused on controlling inhalation exposures for many years, but sensitization continues to occur. This suggests that other exposure pathways, such as skin wound contamination and direct contamination to the breathing zone by hand-to-face contact, may be important.

We do not definitely know that skin exposure to beryllium contributes to sensitization, but knowing whether beryllium is on the skin and, if so, at what level will help us make better decisions in developing future studies. It is important to understand that there is currently no standard for skin exposure.

TUCSON

As part of the protection program at the Tucson ceramics facility, employees wear gloves in production areas. We wanted to see if beryllium was still getting on hands, despite the use of gloves. In May 2001, *wipe samples* were collected from the hands of 122 glove-wearing employees.

Results showed measurable levels of beryllium in nearly all of the samples. The levels of beryllium were higher on the hands of production employees (example: press operator) when compared to production support employees (example: office administration).

These results, and other evaluations of glove use, led to improvements in the personal protection program. For example, the decision was made to first put gloves on before handling work shoes and other personal protective equipment. Further work showed that gloves often broke during normal work activities, such as when contacting kiln brick, sharp edges on tooling, or adhesive tape. This finding led to the practice of double gloving and allowed the use a heavier nitrile glove to reduce frequency of glove breakage.

READING

We wanted to learn which jobs at the Reading copper-beryllium alloy facility had the greatest potential for skin exposure. In June 2003, we selected 27 employees who worked in a variety of jobs. We asked each of them to wear thin cotton gloves over their nitrile gloves. The cotton gloves were then analyzed for beryllium. Skin wipe samples were also collected from the necks and faces of the same employees to check for beryllium. In addition, we took wipe samples from work surfaces that might be touched by those same employees to measure the level of beryllium on those surfaces. Finally, we compared the level of beryllium found on work surfaces to the level of beryllium found on cotton gloves, necks, and faces.

Results showed measurable beryllium on all sampled work surfaces in production areas and on all cotton gloves worn by employees in production-areas. Results also showed beryllium on most of the necks and faces of employees in production areas. In contrast, although beryllium was also found on most sampled surfaces in office areas and on most of the cotton gloves worn by employees in office areas, no beryllium was found on the necks and faces of the employees in office areas. Finally, results showed that the level of beryllium on surfaces was positively related to the level of beryllium on the gloves, necks, and faces of all employees.

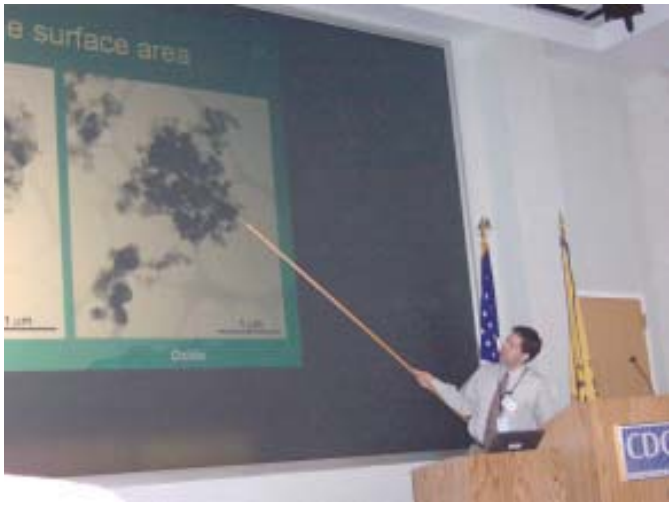
These results showed, as was also the case in Tucson, that office employees experienced lower skin exposures than did production employees. The results also provided a better understanding of migration pathways for beryllium and will facilitate future efforts to improve control.

THE 2004 ANNUAL MEETING

The annual NIOSH/Brush Wellman Program Leadership Team (PLT) meeting was held November 3 & 4, 2004 in Morgantown, WV. This meeting provided an opportunity for Brush Wellman Inc and NIOSH to exchange information and discuss the latest research findings. Representatives from NIOSH, Brush Wellman, the Department of Energy (DOE), and the Agency for Toxic Substances and Disease Registry (ATSDR) attended.

Employee representatives from the Reading, Tucson, and Elmore plants gave presentations showing how research findings are being communicated to their peers and put into practice at each of their facilities.

The presentations from the employee representatives were very motivating to NIOSH scientists who could see that their research was understood and being used by employees to decrease their health risks related to beryllium.



HIGHER-RISK PROCESSES AT THE READING PLANT

In 2000, NIOSH and BWI surveyed the employees at the Reading copper-beryllium alloy strip and wire finishing plant. This was the first time a plant that handled mostly copper-beryllium alloys, which are generally less than 2% beryllium, was studied. We found that about 7% of the participating employees (10 of 144) were sensitized to beryllium, and 4% (6 of 144) also had CBD.

When we looked at the types of jobs that might be linked to higher risk, the strongest relationships were all in the rod and wire production area. In this area, coils and rods of copper-beryllium alloy are annealed, pickled, drawn, straightened, pointed and chamfered, and milled. Within the rod and wire area, the highest-risk jobs were in wire annealing and pickling, wire drawing, and point and chamfer.

Our next question was: were the beryllium air levels also higher at the higher-risk jobs? We were able to locate air sampling records from the mid-1970s through 2000. Almost 6,000 sample records were found: 4,524 general area samples, 815 short-duration high-volume breathing zone task samples, and 650 full-shift personal lapel samples. The personal lapel samples are summarized in the table below:

This table shows that the highest beryllium sample results were found in the rod and wire area (red).

Work Area	Number of Personal Lapel Samples	Sample Results		
		Lowest	Midpoint	Highest
Rod and Wire	210	Less than 0.01 µg/m^3	0.06 µg/m^3	7.80 µg/m^3
Strip Metal	320	Less than 0.01 µg/m^3	0.02 µg/m^3	0.72 µg/m^3
Production Support	52	Less than 0.01 µg/m^3	0.02 µg/m^3	0.33 µg/m^3
Administration	68	Less than 0.01 µg/m^3	0.02 µg/m^3	0.11 µg/m^3

Schuler CR, Kent MS, Deubner D, Berakis MT, McCawley M, Henneberger PK, Rossman MD, Kreiss K. Process-related risk of beryllium sensitization and disease in a copper-beryllium alloy facility. AJIM. 2005 Mar; 47:195-205.

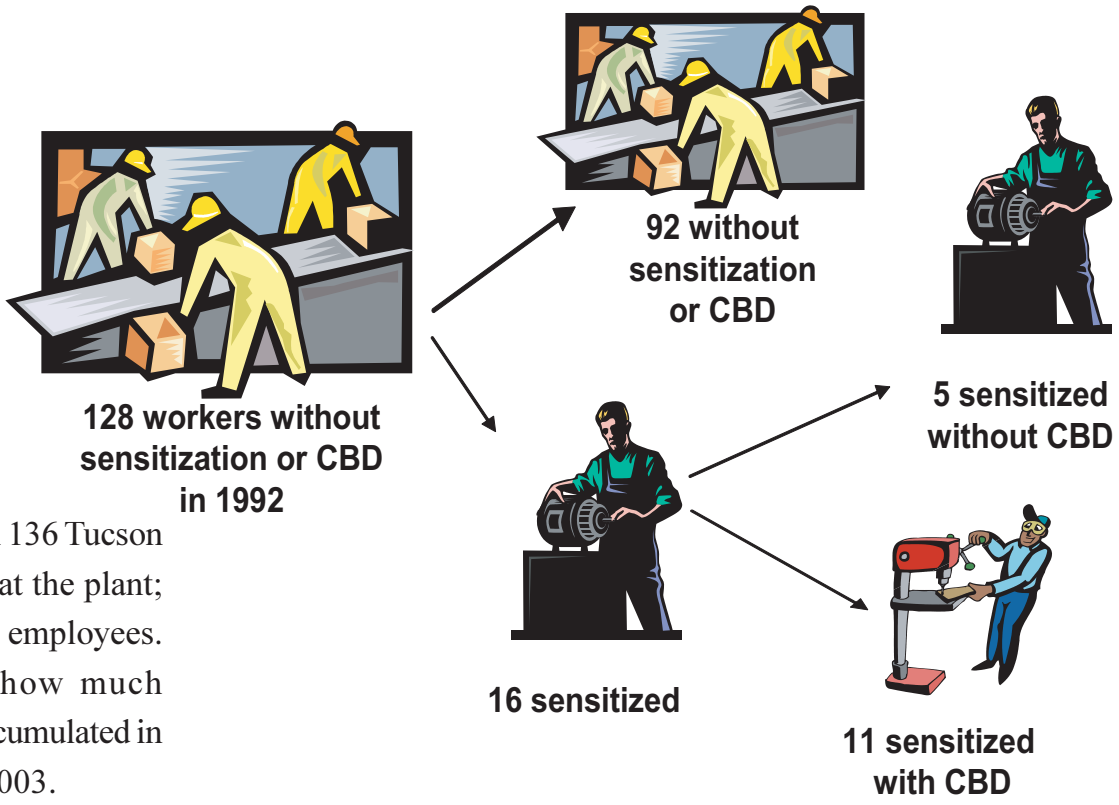
The table shows that the rod and wire area had the highest sample results and the highest midpoint (red). (If you lined up all the samples from highest to lowest, the midpoint would be the sample result exactly in the middle.) If you compare the rod and wire numbers to information from the strip metal area, production support work, and administration, you can see that these other areas were lower. Within the rod and wire area, most of the high measurements were from the wire annealing and pickling operation, which was one of the highest-risk jobs and was also located close to other higher-risk jobs. Samples from the wire annealing and pickling operation were most likely to exceed two occupational exposure limits: the OSHA permissible exposure limit of 2.0 μg/m^3, where 6% (about 1 of every 16 samples) may have exceeded this limit, and the Department of Energy action level of 0.2 μg/m^3, where 54% (more than half of all samples) may have exceeded this limit. No other operation exceeded the 2.0 μg/m^3 limit.

We concluded that the wire annealing and pickling operation was the most likely source of exposures related to sensitization and CBD at this plant. Since the survey ended, Brush Wellman has enclosed the wire annealing and pickling operation under negative pressure, so that if the door is opened air gets pulled inward and not blown out toward other operations. Also, anyone who works in the wire annealing and pickling area wears a respirator, protective clothing and gloves.

TUCSON CERAMICS FACILITY – THEN AND NOW

In 1992, Dr. Kay Kreiss and colleagues surveyed 136 employees at the ceramics facility in Tucson. At that time, 128 employees had no evidence of sensitization or chronic beryllium disease and 8 (6%) were sensitized. Of the 8 sensitized, 6 employees (4%) had chronic beryllium disease, while the other 2 had sensitization only.

2003 Population: Eleven Years Later



By 2003, only 41 of the original 136 Tucson employees were still working at the plant; the other 95 were now former employees. We wanted to understand how much sensitization and disease had accumulated in this group between 1992 and 2003.

Among the 128 employees who were not sensitized in 1992, 16 (13%) were now sensitized and 11 of the sensitized (9%) also had chronic beryllium disease. We combined this information with information from the 1992 survey. By 2003, a total of 24 (18%) of the original 136 employees in the 1992 Tucson study group were known to be sensitized to beryllium, and 17 of the sensitized (13%) had chronic beryllium disease.

Some of the new cases were found in former workers. It is important that former employees seek expert medical attention for beryllium disease if they develop chest symptoms.

In this group over an eleven-year period, the amount of sensitization was 13% and the amount of chronic beryllium disease that was identified was 9%.

NIOSH plans to continue to follow the 1992 group, and compare them to newly hired employees currently working under lower exposure conditions. In the mid-to-late 1990s, multiple engineering controls were installed and a strict personal protective equipment program (including respirators) was begun at Tucson. Comparing the two groups will help assess the effectiveness of changes in the facility and in workplace practices in lowering the likelihood of sensitization and chronic beryllium disease.

HOW TO OBTAIN YOUR GENETIC RESULT

NIOSH began the beryllium genetic study in the fall of 1998. The purpose of the study is to understand the role of genetics in the development of beryllium sensitization and CBD.

The first genetic blood samples were taken by NIOSH in July 1999. Since that time we have collected over 1,100 samples from current and former Brush Wellman employees for analysis.

We do not automatically send study participants their personal genetic analyses. Participants may contact us for their results.

Obtaining your genetic result from the NIOSH beryllium research program is a two-step process:

Step 1 is to call **1-800-447-8305**. You will provide your name, Social Security number, complete mailing address, and home and/or work phone numbers. If you leave a voice mail message, please spell any names or words that may be unclear. We will check our records to confirm that you gave blood for the genetic research study. If you did participate, we will mail you a letter that explains the risks and benefits of receiving your genetic result, a consent form, and a stamped return envelope. (If our records show you did *not* participate, we will call you to explain how you can do so.)

Step 2 is to read the letter explaining the risks and benefits of receiving your genetic result. You will then decide if you want to get your result. If you want your result, sign the consent form and return it to us in the stamped return envelope. We will then mail you your genetic result. If you decide that you do not want your result, keep the letter. You may decide that you want your result in the future.

FORMER WORKER SURVEYS

Is the risk of becoming sensitized or of developing beryllium disease lower after exposure ends?

As part of our continuing effort to answer this question, NIOSH conducts surveys of former Brush Wellman workers who were first tested when they still worked at Brush Wellman. With the passage of time and increased worker participation, we will be able to answer this question.

Who's eligible for NIOSH former worker surveys?

Those who took part in current worker surveys (at Tucson in 1992 or 1998, at Elmore in 1993-94 or 1999, or in Reading in 2000), but who have since left Brush Wellman are eligible.

What does NIOSH do?

We conduct medical and work history interviews, and offer blood tests for the BeLPT and genetic analysis free of charge.

We are currently conducting another survey of former workers from the Elmore facility in which we are offering blood tests for the BeLPT and conducting medical and work history interviews.

We would like to thank everyone who participated in the former worker surveys. If you have not been contacted and would like to participate, please give us a call at 1-800-447-8305.

HOW GENETICS MAY INFLUENCE THE RISK OF CHRONIC BERYLLIUM DISEASE

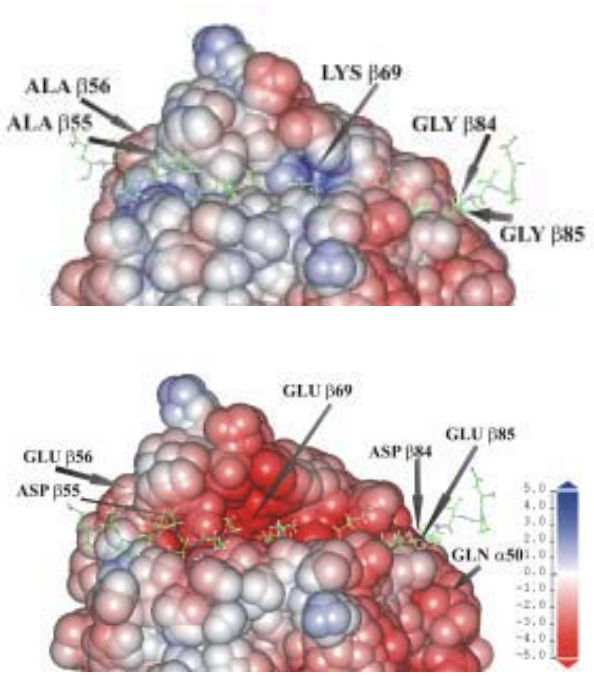


FIGURE 1: The protein that has the Glu69 marker (bottom picture) has a strong negative charge (red) in the groove where a positively charged beryllium ion would fit (positive and negative attract). The protein without the Glu69 marker (top picture) does not have this charge, which makes it less likely that a beryllium ion might fit into the groove.

Have you ever wondered *how* genetics influences risk? Many of you have taken part in the genetics research that NIOSH has been conducting at Dr. Ainsley Weston's lab. Some genetic markers for beryllium sensitization and chronic beryllium disease (CBD) have been identified, by researchers at NIOSH and others, and the risks of sensitization and CBD associated with those markers have been reported. One marker in particular, called *HLA-DPβ1*^{Glu69}, is well-known.

Proteins are "chemical machines" that make all living things work. Genes are the recipe that tells our body what type of proteins to make. The Human Leukocyte Antigen (HLA) genes are the instructions for a network of immune-system proteins found on the surface of human cells.

How beryllium interacts with proteins created by these genes is not well understood. Some research from the Health Effects Laboratory Division's Computational Biology Team may help us to understand this relationship. Dr. Jim Snyder and coworkers published an article in the November 2003 issue of *Environmental Health Perspectives — Toxicogenomics,* in which they used state-of-the-art technologies in molecular modeling to investigate how beryllium may interact with the HLA proteins. An example of this work is the three-dimensional model of HLA illustrated in Figure 1.

IF YOU MOVE…

Please contact us with your new address and phone number so that we can keep you up to date on all of our research findings. You can send your change of address and/or phone number to the attention of the Beryllium Research Program NIOSH, 1095 Willowdale Road MS H2800, Morgantown, WV 26505, or call us at 1-800-447-8305 and we will be glad to take your new address and/or phone information.

FOR FURTHER INFORMATION…

If you would like further information on any of the topics in this newsletter or if you have questions regarding our Beryllium Research Program please contact us at the Beryllium Research Program NIOSH, 1095 Willowdale Road MS H2800, Morgantown, WV 26505, or call us at 1-800-447-8305.

WEB: http://www.cdc.gov/niosh **PHONE:** 1-800-447-8305 **FAX:** 1-304-285-5820

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
1095 Willowdale Road M/S H2800
Morgantown, WV 26505-2888

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