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LLNL Beryllium Sensitization/Concern Cases

Descriptive Analysis 1998–2008

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Executive Summary

In 2007 and 2008, the number of beryllium (Be) workers evaluated by the Health Services Department (HSD) at Lawrence Livermore National Laboratory (LLNL) who were determined to be either Be sensitized or on the "concern" list increased when compared to the previous years.

A descriptive analysis of the 38 Be-sensitized/concern cases was conducted to evaluate this increase. Three of the 38 cases were determined to have Chronic Beryllium Disease (CBD). The analysis showed that Be sensitization/concern not only occurred among workers who had direct contact with Be, such as machinists, but also among those individuals who had incidental exposure through an unknown pathway, such as waste handlers, crafts and trades people as well as a custodian and a secretary.

The following items were identified through this analysis as factors potentially contributing to the increase:

- While the largest number of sensitized/concern workers come from previously identified groups such as machinists, other groups, such as waste handlers, crafts and trades, and those with incidental exposure to Be but who were not previously identified as Be workers, were also well represented among the sensitized/concern workers.
- Awareness of sensitized individuals and discussion with line management may have led co-workers who had not been previously identified to seek testing.
- All of the sensitized/concern cases have associated work histories that place these employees working with or around Be at some point in their career.
- In 2006, HSD adopted an additional definition of "concern" in an attempt to increase the margin of safety for workers at LLNL. This new definition ensures that employees with one abnormal and one borderline Lymphocyte Proliferation Test (LPT) are properly protected. This change increased the overall total numbers. Although the change does not account for the total increase, those categorized as "concern" did account for almost 40% of the cases in 2007 and 30% of the cases in 2008.
- Monitoring data for the 38 individuals is limited; however, historical monitoring for identified Be activities and areas at LLNL indicates airborne exposure levels below the action level.

Given the diversity of the population, the areas in which they worked, and the job functions the 38 sensitized/concern workers performed, no clear or apparent common factor would associate the identified increase with a single occupational event or location. A thorough, more in-depth review is therefore necessary to clarify the cause of the increase and to improve worker safety and health via feedback and improvement.

Methods

A descriptive analysis was conducted to identify commonalities among the 38 current workers who were determined to be Be sensitized/concern since 1998. Self-reported work history questionnaires, worker medical records, and reports were used to identify information about each sensitized/concern individual as well as to determine categories of related job

functions. The grouping by job functions resulted in five categories: Machining, Waste Handling, Crafts and Trades, Incidental Direct, and Administration. Although arguments could be made about the appropriateness of which job function falls within each grouping, the following determinations were made by those conducting the observational/descriptive aspect of this study and could be changed by others if necessary:

- **Machining.** Employees who indicated that they conduct(ed) machining, grinding, drilling, sputtering, or any described work activity with obvious risk of generating airborne particulate.
- **Waste Handling.** Employees whose primary activity was handling waste. This category specifically included those who either work(ed) in the Radioactive, Hazardous, Waste Management (RHWM) group or on the Space Action Team conducting building decontamination and decommissioning.
- **Crafts and Trades.** Four employees, including an electrician, a carpenter, a custodian, and an air-conditioning mechanic.
- **Incidental Direct.** All other employees who were considered to be exposed indirectly to Be based on their job functions. These included workers responsible for measuring or repairing machines associated with Be and those in the room when Be work was being conducted or had previously been conducted. However, this group also included many who explicitly stated that they had not actually worked with beryllium.
- **Administrative.** One employee, a secretary who stated that she worked as "machine shop" support. Thus, it is assumed the employee could have frequently been in and out of the shops where Be was being machined and therefore could arguably be placed in the incidental direct group.

Discussion

Beryllium has been used at LLNL since the 1950s. Although solid Be has been shown to pose no health hazard, inhaling Be particulates (such as dust, mists, or welding fumes) has been known to produce acute or chronic lung disease. Additionally, cases of skin irritation have resulted from direct contact with soluble Be compounds. Some concern that individuals may possibly become sensitized to Be by the migration of small particles across the skin is also known. Because of these concerns and to address DOE's efforts to reduce the number of workers exposed to Be, to minimize the levels of Be exposure, and to ensure early detection of Be-related disease, LLNL established their Chronic Beryllium Disease Prevention Program (CBDPP). As of December 31, 2008, 832 current workers have been tested for sensitization using the Be LPT, which DOE established as an accepted Be sensitization screening tool in 1998 for the complex.

Pre-2007 Case Review

From 1998 to 2006, LLNL identified 9 individuals with Be sensitization and one with possible CBD who previously worked as a machinist at Rocky Flats. The sensitization rate among LLNL employees tested from 1998–2006 was 1.36%, and the CBD rate was 0.16%. The

Medical Director and the Industrial Hygiene Subject-Matter Expert reviewed the cases and identified the following:

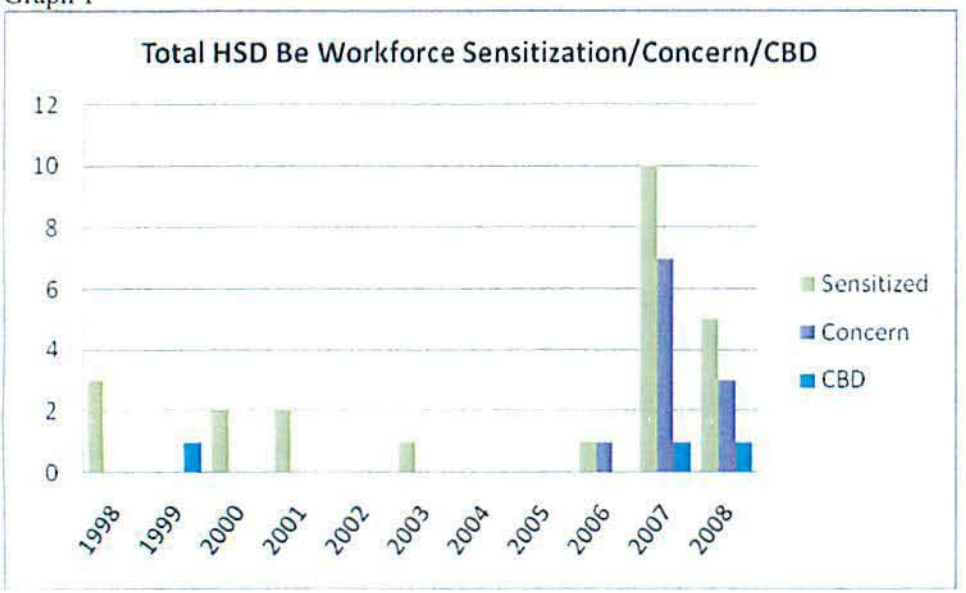
- All individuals had occupational histories that included an activity with clear potential for Be exposure.
- In all but two case, the first potential exposure date was prior to 1990.
- All cases were associated in some way with buildings in which Be use was known, including Buildings 321-C (Machine Shop), 241, and 231.
- Eight cases involved machining or work with machine tools.
- Two of the 10 cases may have resulted from indirect exposure such as working on or in proximity to Be-contaminated equipment.

Although data from the DOE-sponsored Former Worker Beryllium Screening Program indicated that a spectrum of past activities may have caused sensitization, current worker data through 2006 often gave a very different picture of few sensitizations confined to very limited areas.

Review of Combined Cases 1998–2008

In 2007 and 2008, a large increase was seen in the number of sensitized/concern Be workers when compared to the previous years. Almost 75% of the total cases occurring since 1998 were identified in 2007 and 2008 (Graph 1). In 2006, LLNL's HSD created a new "concern" category for workers who did not meet the standard definition of sensitization (two abnormal LPTs), but who had one abnormal and one borderline LPT. The change was made in an attempt to increase the margin of safety for workers at LLNL and to ensure that even those with one abnormal and a borderline LPT were being properly protected. The "concern" category of workers is managed from a medical perspective following the same protocol used for sensitized workers; therefore, these cases are included in this review. Although the change in definition did increase the overall number of cases identified in 2007 and 2008, it alone does not explain the increase.

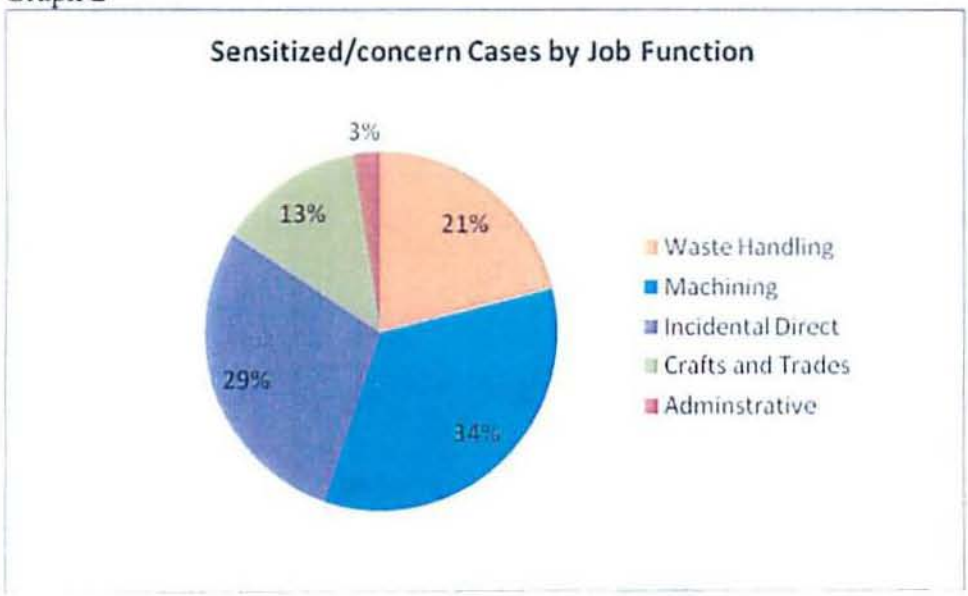
Graph 1



As of December 31, 2008, of the 832 unique individuals tested for Be since 1998, 24 were determined to be "sensitized," 11 were determined to be on the "concern" list, and 3 were determined to have CBD. The sensitization rate among LLNL employees tested from 1998–2008 was 2.88%, and the CBD rate was 0.36%. More of the sensitized/concern cases were men (84%), and the group showed an average number of years worked at the Laboratory of 21. One individual has worked at LLNL for 51 years, and the most recent hire has 5 years of work experience at LLNL. The number of years worked at the Laboratory was determined using the earliest date of hire either by LLNL or by a subcontractor. A few individuals had left the Laboratory and then returned to work here at a later date.

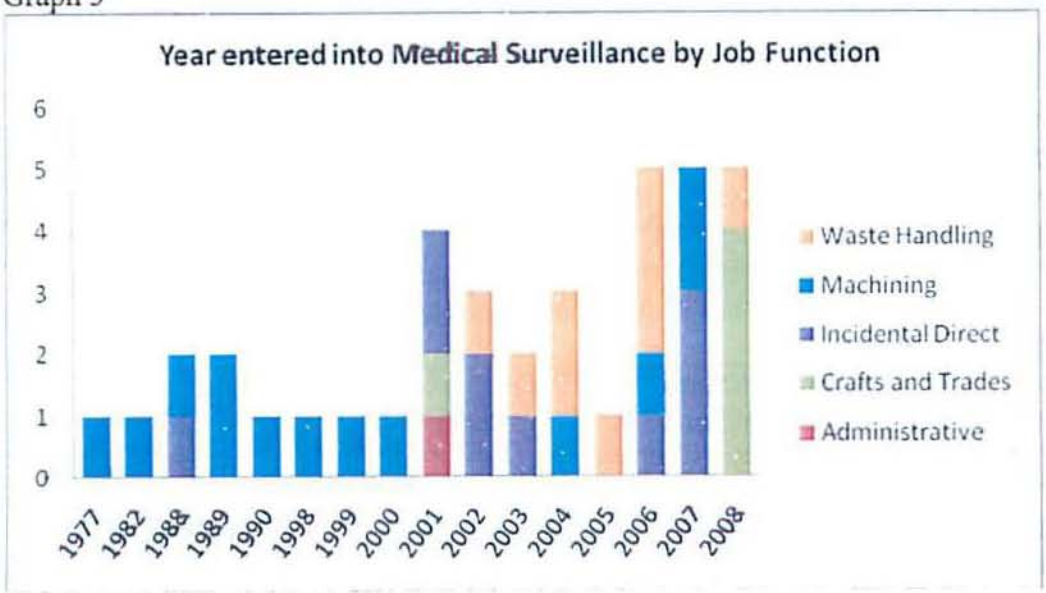
For analysis purposes, the 38 sensitized/concern cases were binned into five groupings based on a combination of described job function and the perceived potential for exposure. The largest group (34%) was Machining, and the smallest group (3%), with only one individual, was Administrative (Graph 2).

Graph 2



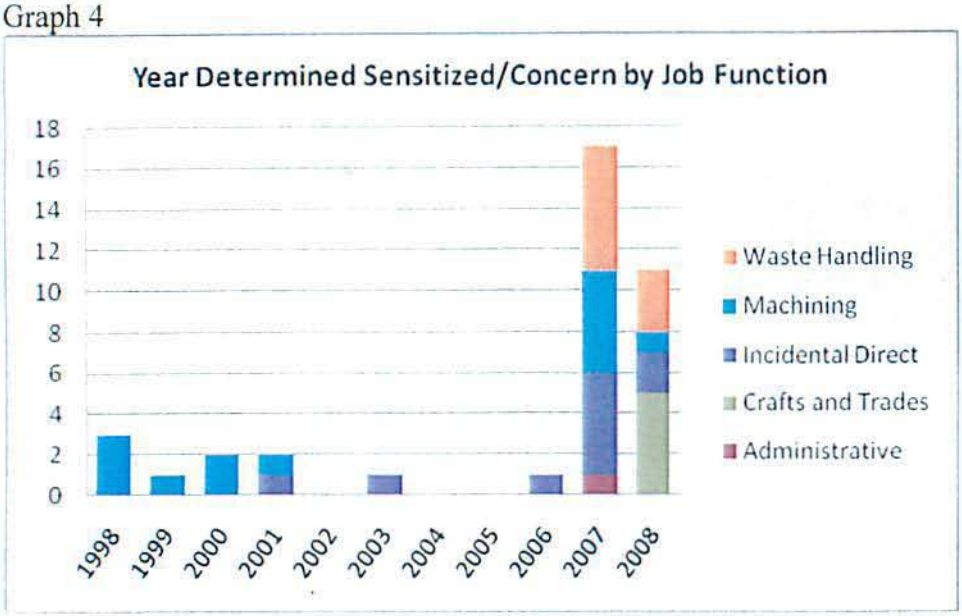
Although the medical surveillance program began using the Be LPT in 1998, some of the sensitized/concern individuals were participating in Be medical evaluations as early as 1977. In 2007 and 2008, other job functions were enrolled into medical surveillance (Graph 3). The Machining group tended to be enrolled much earlier than the other work groups. The majority of the Crafts and Trades group were not enrolled until 2008.

Graph 3



When the grouped categories were compared to the year the employee was determined to be sensitized or on the "concern" list, the review showed that none of the employees in the Crafts and Trade, Administrative, or Waste Handling groups were determined sensitized/concern until 2007 or 2008 (Graph 4).

Graph 4



Approximately half of the sensitized/concern workers were determined to currently work in one of three organizations: the Science and Technology's Engineering Directorate, or the Operations and Business's Nuclear Operations or Facilities and Infrastructure Directorates. However, the exact date of exposure cannot be determined and some of the employees have changed jobs throughout the years, so it is difficult to draw conclusions with regard to organization based on this information alone.

More than 50 different buildings were identified via the questionnaires and medical records as locations in which the 38 sensitized/concern employees had worked: 52% had worked in Building 321 at some point in their LLNL career. Buildings 241, 231, and 131as well as the RHWM facilities and Site 300 were also identified by larger numbers of the sensitized/concern groups. Additional information must be gathered with regard to time spent and activities involved with the work at each building to better understand the effects of building location on sensitization/concern.

Given the diversity of the population, the areas in which they worked, and the job functions the 38 sensitized/concern workers performed, no clear or apparent common factor would associate the identified increase with a single occupational event or location. A thorough, more in-depth review is therefore necessary to clarify the cause of the increase and to improve worker safety and health via feedback and improvement. LLNL has contracted with an internationally recognized Be epidemiologist to conduct this further analysis.