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NIOSH Comments to DOL

COMMENTS OF THE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
TO THE
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
REGARDING THE UPDATE OF THE NIOSH CRITERIA DOCUMENT
ON BERYLLIUM

U.S. Department of Health, Education, and Welfare
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

December 10, 1975

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16. Abstract (Limit: 200 words) This testimony concerns the development of a standard for controlling occupational exposures to beryllium (7440417). Attention was given to the entire issue of beryllium's carcinogenic potential. The testimony was a follow-up to earlier communication and supplied information requested. The information included a review of not only new information, but also a gathering of older information to put into more proper perspective the entire issue of the carcinogenic potential of the element. Analysis of the information available indicated that beryllium does pose a carcinogenic risk to man, so that occupational exposures should be reduced to a minimum through engineering and/or personal protective controls. An evaluation was also attached of the currently available sampling and analytical methods. A question was raised over the correctness of results of analysis of volatile beryllium compounds due to possible sampling errors. While it was not felt that this concern at present was serious enough to delay the institution of the standard, NIOSH will provide additional information on this problem as it becomes available.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Author, NIOSH-Testimony, Beryllium-compounds, Air-quality-monitoring, Analytical-methods, Personal-protective-equipment, Control-methods, Occupational-exposure

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ATTENTION

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NIOSH Comments to DOL

Horton Corn, Ph.D
Assistant Secretary for Occupational
Safety and Health
U.S. Department of Labor

Director, National Institute for
Occupational Safety and Health

Update of NIOSH Criteria Document on Beryllium

As a follow-up to my communication of September 29, 1975, to Mr. Marshall Miller, the attached information is submitted to your office in the hope that it will be useful in development of a standard for controlling occupational exposures to beryllium.

The information submitted involves a review of not only new information, but also puts into more proper perspective the entire issue of beryllium's carcinogenic potential. Based on our analysis of the available information, we are of the opinion that beryllium poses a carcinogenic risk to man. Occupational exposures should, therefore, be reduced to a minimum through the use of appropriate engineering and/or personal protective controls.

Evaluation of currently available sampling and analytical methods is also attached. It should be noted that a question has been raised regarding the sampling method. If the concern over volative beryllium compounds is correct, the sampling procedure might, in some cases, give results lower than that to which the worker is actually exposed. At the present time, we don't feel this is a serious enough problem to warrant delay of the standard. NIOSH will evaluate the significance of this potential problem and will provide information as it becomes available.

/s/ John F. Finklea, M.D.

John F. Finklea, M.D.

Attachments

MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

TO : Director, DLCD
Through: Chief, P&CAB

DATE: October 20, 1975

FROM : Chemist, Analytical Services Section, P&CAB

SUBJECT: Comments on Present NIOSH Analytical Methods for Beryllium -- DLCD Action Item No. 904

A memo from the Director of ORSD to the Director of NIOSH dated September 30, 1975, proposes certain actions that may be necessary in order for NIOSH to develop a revised recommended standard for beryllium. He proposes that DLCD review available sampling and analytical methods and provide ORSD with recommendations in these areas.

The analytical method presently being used is P&CAM#173, which is an AA procedure using a nitrous oxide-acetylene flame. The sensitivity of this method is 0.03 µg Be/ml and the detection limit is approximately 0.008 µg Be/ml.

If additional sensitivity is needed, several methods such as heated graphite furnace (HGA) atomic absorption spectrophotometry, emission spectroscopy, fluorimetry or electron capture gas chromatography would be possible. My feeling is that the HGA method would prove to be easier, faster and as precise as the other methods. Perkin-Elmer reports a sensitivity of approximately 0.5 ng Be/ml, which is about a fifty-fold increase over the direct aspiration AA procedure. We have not developed a method using the HGA, but very few problems would be anticipated in developing such a method for air samples.

However the possible problem of sampling beryllium on filters has not been checked out. It was reported by Black and Sievers[1] that volatile beryllium compounds are lost after collection on filters. If we had to check out this problem, several man-months of effort could conceivably be involved. We have no project milestones to cover studies on beryllium in FY'76. If this quantity of man-hours is necessary, certain current milestones would probably not be met.

John L. Holtz

[1]Marilyn S. Black and Robert E. Sievers, "Environmental Analysis Problems Created by Unexpected Volatile Beryllium Compounds in Various Samples" Anal. Chem. Vol. 45, No. 9, Aug. 1973 pp 1973-75.

Additional Information Regarding Occupational
Hazards of Beryllium Development by NIOSH
December 4, 1975

Evidence of Beryllium Carcinogenicity

(a) Animal Studies

Probably no compound known to man gives so consistent a carcinogenic response in so many animal species as does beryllium. In addition numerous studies have repeatedly shown beryllium to be carcinogenic by most routes of administration, i.e., inhalation; intravenous, intraperitoneal and subcutaneous injection; and intratracheal instillation.

As early as 1946 Gardner and Heslington[1] reported the induction of osteosarcoma in rabbits following intravenous injection of zinc beryllium silicate or beryllium oxide. The intravenous administration of zinc silicate, zinc oxide and silicitic acid to rabbits, however, failed to illicit this carcinogenic response. Over the years osteosarcoma has been induced in rabbits by these same and other beryllium compounds using intravenous or intramedullary administration.[2-13] In 1951 Dutra et al.[14] reported the induction of osteosarcoma in one of six rabbits following inhalation of beryllium oxide dust.

Vorwald[15] in 1953 demonstrated that rats develop pulmonary neoplasia following inhalation of beryllium sulfate down to concentrations of 2.8 $\mu g/m^3$. Similar findings have also been observed in rats by other investigators using this same and other compounds of beryllium.[16-18] As recent as 1972 Groth[19] reported ongoing research at NIOSH showing the induction of pulmonary metaplasia and cancer in female rats intratracheally administered several beryllium compounds.

Beryllium has also been shown to be carcinogenic to primates.[15,20] Vorwald[15] in 1966 reported the induction of pulmonary cancer in monkeys exposed by intrabronchial and/or bronchomural implantation of beryllium oxide and by inhalation of beryllium sulfate.

In view of studies demonstrating that beryllium and its compounds accumulate in the tracheobronchial lymph nodes[21,22] and in bone[23,24] target organs, in addition to the lung and bone for beryllium related carcinogenesis may well include the lymphatic system.

(b) Human Studies

Hardy et al.[25] in 1967 reported on the complications of beryllium disease among 535 individuals entered into the Beryllium Case Registry during 1952-1966. Of 14 subjects known to have subsequently developed cancer among this group three were diagnosed as having cancer of the bone. As the International Agency for Research on Cancer of the World Health Organization[26] has estimated that no more than 0.1 cases of bone cancer would have been expected to occur among these 535 individuals, the observation of 3 such cases by Hardy et al.[25] was striking. Even more striking was the observation that these three cases of bone cancer occurred among a subset of approximately 200 individuals all of whom had received no steroid medication, a form of therapy associated with an altered immune mechanism.

In 1970 Mancuso[27] reported on the roles of duration of beryllium exposure and beryllium induced bronchitis and pneumonitis in the etiology of lung cancer among beryllium production workers. Among 142 cases of beryllium related bronchitis and pneumonitis identified by De Nardi during 1940-1948. Six deaths due to lung cancer subsequently occurred, for an age-adjusted lung cancer mortality rate of 284.3 per 100,000 population.[27] This rate contrasted with 77.7 for all white males employed in the same beryllium production facility during 1937-1948, suggested Mancuso to conclude "prior chemical respiratory illness does influence the subsequent development of lung cancer among beryllium workers."[27] More recently Hasan and Kazemi[28] reported 4 lung cancer deaths among 53 males entered into the Beryllium Case Registry since 1966, an incidence higher than expected.

While each of the later two studies are limited in scope, they are higly consistent in demonstrating an association between beryllium induced respiratory disease and an increased incidence of lung cancer.

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