STATEMENT OF
EDWARD J. BAIER

ACTING DIRECTOR
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CENTER FOR DISEASE CONTROL
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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ON

POSSIBLE HAZARDS OF ARSENIC AND ITS INORGANIC COMPOUNDS
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16. Abstract (Limit: 200 words) This testimony given before the U.S. Department of Labor Fact Finding Hearing summarized current findings concerning exposures of workers to arsenic (7440382) and its compounds. Since 1820 the possibility that arsenic might be a carcinogen has been recognized. Several recent studies among smelter workers indicated a mixed report. Some have noted significantly increased lung cancer mortality which was correlated with length of employment and with increasing degrees of inorganic arsenic exposure. Excessive mortality due to tuberculosis, heart disease, and cirrhosis of the liver was also reported. A study of workers in an insecticide facility in England also indicated that inorganic arsenic may be a human carcinogen and corroborated the smelter results as this was the only compound to which both groups of workers were exposed. NIOSH has urged the lowering of the standard for arsenic exposures to at least as low as 0.05 milligrams of arsenic/cubic meter. Although this standard might not prevent all carcinogenic effects of arsenic, it would at least significantly reduce the incidence of arsenic induced cancer.

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REVIEW OF BASIS FOR THE NIOSH CRITERIA DOCUMENT ON INORGANIC ARSENIC

Arsenic has been known and used as a poison for centuries. Exposure to concentrations that do not produce acute effects can result in signs of chronic toxicity such as hyperpigmentation, hyperkeratoses, and peripheral neuropathy. Skin contact can cause local irritation. Nasal perforations have been reported as a result of exposure to arsenic trioxide. It was to prevent these effects of systemic intoxication and local contact that previous standards were established.

The first suggestion that arsenic might be a carcinogen was made in 1820. Since that time, opinion has been sharply divided, partly because all efforts to produce tumors in animals have failed. Furthermore, some of the reports attributing cases of cancer (particularly skin cancer) to prior arsenic exposure were of questionable validity, and some others were negative. In several early studies of mortality among smelter workers, the authors concluded that the incidence of cancer deaths was not excessive. However, these studies did not examine mortality due to respiratory cancer, and an examination by NIOSH of the data published in these papers suggested that an excess had existed for that type of cancer. The mortality experience of workers in one of these same smelters was studied recently, and the authors reported significantly increased lung cancer mortality. A study of a different smelter population also reported significantly increased respiratory cancer mortality. This report showed that the cancer risk increased with increasing length of employment and with increasing degree of exposure to inorganic arsenic. Excessive mortality due to

tuberculosis, heart disease, and cirrhosis of the liver was also reported, but the excesses did not correlate with length of employment or with degree of exposure.

In addition to inorganic arsenic, smelter workers are exposed to a variety of substances in the workplace, and some of these could be postulated to have played a role in the observed carcinogenic effect. Sulfur dioxide is one of these and in the paper that reported increasing respiratory cancer deaths with increasing inorganic arsenic exposure an increasing respiratory cancer mortality with increasing sulfur dioxide exposure was also shown. However, the cancer mortality did not increase consistently with both degree of exposure to sulfur dioxide and length of employment as it had with inorganic arsenic exposure. While inorganic arsenic seemed the most probable carcinogen, a contribution by sulfur dioxide or other unknown agents could not be ruled out.

A study of mortality among employees of an insecticide plant in England helped to clarify the question. A significant increase in cancer mortality was reported, with the greatest excess mortality being due to lung and skin cancer deaths. Workers at the insecticide plant were also exposed to a variety of substances in addition to inorganic arsenic, but these data further implicated inorganic arsenic as a human carcinogen since it was the most prominent exposure shared by workers in all the smelters and in the insecticide plant. There was no significant exposure to sulfur dioxide in the insecticide plant.

Having concluded that inorganic arsenic was the major factor if not the only factor in the etiology of these cancers, available data on environmental concentrations associated with cancer were reviewed. Scanty data from the English insecticide study suggested that exposures had averaged approximately 0.5 mg As/cu m, the current Federal standard, but the data were few and had a very wide range, so that the significance of a mean was questionable. Similarly, the data available on exposure levels in an American smelter provided little guidance in selecting an exposure limit. Although these data averaged 0.2 mg As/cu m for areas with the least excess cancer mortality, the significance of the average was again questionable due to the small number of data points and the very wide range of values.

Convinced that the current standard was too high, even to prevent responses such as local skin irritation, NIOSH felt that lowering the standard only enough to prevent these effects might not be sufficient reduction to reduce carcinogenic effects as well. Therefore, NIOSH recommended "that the standard be set at least as low as 0.05 mg As/cu m," realizing that this standard might not prevent all carcinogenic effects of arsenic, but believing that if absolute prevention were not achieved this reduction would "at the minimum, significantly reduce the incidence of arsenic-induced cancer."

DEVELOPMENTS SINCE PUBLICATION OF THE RECOMMENDED STANDARD

This hearing was stimulated by two new reports, that by the Allied Chemical Corporation and that by Ott et al of the Dow Chemical Company. These reports further support the conclusion that inorganic arsenic alone can cause respiratory cancer in man. In addition, these papers for the first time associate occupational exposure to inorganic arsenic with increased lymphoma deaths. A third study, published after the criteria document, also reports excessive respiratory cancer mortality among smelter workers in Japan. While all of these papers demonstrate the carcinogenic effect of inorganic arsenic, none of them provide sufficient information for estimating a safe exposure level, or for judging the appropriateness of 0.05 mg As/cu m.

These investigations suggest several modifications that might be incorporated into the inorganic arsenic criteria document previously submitted by NIOSH. Changes in the recommendations contained in the criteria document are under consideration. Before any modifications are finalized, information presented at this hearing or which may be submitted to NIOSH will be considered, and modifications to the recommended standard for inorganic arsenic will be submitted after appropriate review by NIOSH.