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Letter to the Editor

Assessing Risk of Indium Lung Disease to Workers in Downstream Industries

Choi et al. [2015] recently evaluated Korean workers exposed to indium compounds to assess health outcomes indicative of interstitial lung disease. They found meaningful associations between serum indium concentration and the biomarkers Krebs von den Lungen-6 (KL-6) and surfactant protein-D (SP-D), as well as interstitial changes on high-resolution computed tomography (HRCT). Work sites assessed in their study included indium-tin oxide (ITO) target manufacturing facilities, indium reclaim factories, and display panel manufacturing plants.

We reported similar relationships between health outcomes and indium exposure in workers at an ITO production facility that also reclaimed indium in the United States [Cummings et al., 2014]. Absent from our study, but included in the Korean assessment, were data from workers downstream to the manufacturing of ITO targets, such as display panel manufacturing plants that utilize the ITO targets to apply a thin film of ITO by sputtering. The extent of occupational exposure to ITO and other indium-containing compounds in these downstream industries in the United States remains largely unknown. Hines et al. [2013] found that workers at ITO thin film deposition companies were exposed to indium between sputtering runs when ITO targets were resurfaced or during cleaning of chamber interiors and shields. In fact, personal indium air concentration reached 5.4 mg/m^3 for cleaning sputter or evaporation chambers [Hines et al., 2013], which is orders of magnitude above the Japanese respirable exposure limit of 0.3 $\mu g/m^3$ [MHLW, 2010].

There is precedent for indium lung disease occurring in exposed workers from downstream industries in China. Xiao et al. [2010] reported pulmonary alveolar proteinosis in a worker exposed to indium as a "sandblaster" for a mobile phone manufacturing company. This worker used aluminum oxide sand to clean material used for sputtering of ITO targets for deposition on liquid crystal display (LCD) screens [Xiao et al., 2010]. His serum indium measured 151.8 $\mu g/L$, indicating exposure, and thoracoscopic lung biopsy revealed only indium deposition, without other components of the sand. The worker underwent whole lung lavage but died 58 months after diagnosis [Xiao et al., 2015].

The risk of indium lung disease in the industries responsible for manufacturing ITO targets and reclaiming indium from spent targets is now well-established [Omae et al., 2011; Cummings et al., 2012]. However, more information is needed to understand the risk to workers in downstream industries. We therefore, applaud the effort by Choi et al. to include this under-studied group in their research and request that they present their findings by industry. Specifically, results limited to the workers from the two display panel manufacturing plants could help elucidate a number of important issues. For example, are markers of exposure and health similar in downstream workers to those seen in manufacturing and reclaim? Or do these outcomes and therefore, risk of indium lung disease vary by industry?

If worker exposure to ITO and other indium-containing compounds in downstream industries is similar to that in ITO manufacturing and indium reclaim, there are potentially far-reaching implications. At the very least, a more in-depth review of industries that utilize ITO targets in their processes would be warranted, to determine the extent of worker exposure, worker health status, and need for exposure reduction and education about indium lung disease.

AUTHORS' CONTRIBUTIONS

All authors contributed meaningfully to this letter.

DISCLOSURE (AUTHORS)

The authors report no conflicts of interest.

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DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of NIOSH.

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