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Exposure to Hazardous Metals During Electronics Recycling at Four UNICOR Facilities

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Health Hazard Evaluation Report
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UNICOR
Elkton, Ohio; Texarkana, Texas;
Atwater, California; and Marianna, Florida
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Highlights of the NIOSH Health Hazard Evaluation

The National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from the United States Department of Justice, Office of the Inspector General, in their health and safety investigation of the UNICOR electronics recycling program at four Bureau of Prison institutions. The request concerned reports of exposure to metals, especially lead and cadmium, among staff and inmates involved with the glass breaking operation of electronics recycling at the four UNICOR facilities. We were asked to assess the current medical surveillance program and make recommendations for future surveillance.

What NIOSH Did

- We conducted site visits in Elkton, Ohio, on February 21–22, 2008, and March 25, 2008; in Atwater, California, on October 15, 2008; in Texarkana, Texas, on June 24–25, 2008, and July 16, 2008; and in Marianna, Florida, on February 17–18, 2009.
- We reviewed medical surveillance records, individual medical records, and industrial hygiene sampling records from each institution.
- We visited each institution and toured the current and/or former recycling and glass breaking facilities.
- We met with staff and inmates to hear their concerns and present our findings.
- We measured exposures to lead and cadmium at the Elkton and Texarkana facilities.

What NIOSH Found

- Available records, including results of biological monitoring, and interviews with staff and inmates documented no health problems that could be linked to recycling work. Very few records were available for inmates who worked during the early years of electronics recycling at Elkton and Texarkana.
- Exposure monitoring and medical surveillance were not performed during the first several years of operation at Elkton and Texarkana, so we could not determine the extent of exposure to lead and cadmium during that time. Descriptions of operations during those times suggest that exposures were not well controlled, causing the potential for exposure above occupational exposure limits for lead and cadmium.
- Past exposure monitoring at Atwater documented exposure to lead and cadmium over occupational exposure limits when the glass breaking booth was in its first location, but not when it was moved to the loading dock.
- Past exposure monitoring at Marianna documented exposure to lead and cadmium below occupational exposure limits.
- The sampling we performed demonstrated exposure to lead and cadmium far below occupational exposure limits at Elkton and Texarkana.

What Managers Can Do

- At a minimum, ensure full compliance with all applicable Occupational Safety and Health Administration (OSHA) standards. The General Industry Lead Standard [29 CFR 1910.1025], the Cadmium Standard [29 CFR 1910.1027], the Hazard Communication Standard [29 CFR 1910.1200], and the Respiratory Protection Standard [29 CFR 1910.134] should all be followed. Full compliance includes record keeping requirements, communication requirements, compliance plans, and medical surveillance.
- We strongly recommend that UNICOR voluntarily follow the more protective guidelines for lead exposure outlined in the letter we wrote for our site visit to Atwater, California.
- In addition to complying with the OSHA requirements, we recommend that the preplacement examination for cadmium exposure be identical to the periodic examinations so that baseline health status may be obtained prior to exposure. Contract a board-certified, residency-trained occupational medicine physician who is familar with applicable OSHA ations to oversee the medical surveillance program.
- Carefully evaluate the qualifications and expertise of any consultant who is hired to assess occupational health and safety issues. One useful benchmark for vetting individuals who provide industrial hygiene services is the designation of certified industrial hygienist. Hire a certified industrial hygienist if outside expertise is needed to assess environmental health and safety issues.
- Perform a detailed job hazard analysis prior to beginning any new operation or before making changes to existing operations.
- Designate a union safety and health representative to provide consistent employee representation on the joint labor-management safety committee that meets quarterly. Because inmates are not represented on this committee, ensure that they are informed of its proceedings and have a voice in improving workplace safety and health.

What Employees Can Do

- Notify your supervisor and union safety representative if you have concerns or health problems you think are related to your job.
- Participate in employer sponsored medical surveillance programs.

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Introduction

On November 27, 2007, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from the United States Department of Justice (USDOJ), Office of the Inspector General (OIG), in their health and safety investigation of the Federal Prison Industries, Inc. (UNICOR) electronics recycling program at Bureau of Prisons (BOP) institutions in Elkton, Ohio; Texarkana, Texas; and Atwater, California. We were asked to assess the current medical surveillance program for inmates and staff exposed to lead and cadmium during electronics recycling, and to make recommendations for future surveillance. In addition, we were asked to assess past exposures to lead and cadmium, and to investigate the potential for "take-home" exposure. Later we were asked to perform a similar evaluation for the BOP institution in Marianna, Florida.

We reviewed medical surveillance records, individual medical records, and industrial hygiene sampling records from each institution. We visited each institution and toured the current and/or former recycling and glass breaking facilities and met with staff and inmates to hear their concerns and present our findings. We also performed industrial hygiene sampling at Elkton and Texarkana. At the time of our site visits, glass breaking was being performed at Elkton and Texarkana, but not at Marianna or Atwater. Letters containing detailed information about our assessment, findings, and recommendations for each facility were sent to the OIG and the warden and union at each facility after each of these evaluations. In August 2009, the OIG forwarded additional data for inmates at Elkton. This report contains a summary of our findings at each institution, a review of the additional biological monitoring for Elkton, and overall conclusions and recommendations. For a copy of the individual letters for each BOP institution, please call 513-841-4382.

Facility Evaluations

Federal Correctional Institution Elkton

Electronics recycling at the Federal Correctional Institution (FCI) Elkton appears to have taken place from 1997 until May 2003 without adequate engineering controls, respiratory protection, medical surveillance, or industrial hygiene monitoring. Because

of the lack of biological monitoring and industrial hygiene data, we cannot determine the extent of exposure to lead and cadmium that occurred during that time frame, but descriptions of work tasks from staff and inmates indicate that exposures were not well controlled, causing the potential for exposure above occupational exposure limits (OELs) for lead and cadmium. Based upon available sampling results, we determined that the current glass breaking operation (GBO) controls exposure to lead and cadmium to far below occupational exposure limits. The GBO can be further enhanced to limit exposure to those performing glass breaking as well as limiting the migration of lead and cadmium from the GBO into other areas. Results of biological monitoring of staff and inmates since 2003 were unremarkable. While some take-home contamination was documented in inmate cubicles, surface wipe sampling and biological monitoring suggest that take-home contamination did not pose a health threat. In late August 2009, the USDOJ provided biological monitoring data for 10 inmates, 8 of whom were on the roster of inmates performing glass breaking. The results of this monitoring were unremarkable. One inmate glass breaker was tested in early April 2002, prior to the installation of the glass breaking booth in 2003. This inmate is the only individual for whom we have results prior to that time. His blood lead level (BLL) was 5 micrograms per deciliter (µg/dL), and his blood cadmium level (CdB) was 0.7 micrograms per liter.

We cannot determine the extent of exposure to lead that occurred in the chip recovery process because of the lack of data. Descriptions of work tasks from staff and a BLL of 5 µg/dL in an inmate 4 months after the process ended indicate that exposure to lead during this process did occur. We found no evidence that actions were taken to prevent exposure to lead at the outset in the chip recovery process and that no medical surveillance was performed until after the process ended.

Medical surveillance has not complied with Occupational Safety and Health Administration (OSHA) standards. No medical exams (including physical examinations) were done on inmates, staff received inconsistent examinations and biological monitoring by their personal physicians, biological monitoring for lead was not done at standard intervals, and results were not communicated to the inmates. Inappropriate biological monitoring tests such as urine lead and arsenic testing have been done. Records of medical surveillance were not maintained by the employer for the appropriate length of time.

After careful review of existing records and current operations, we conclude that the only persons with current potential for exposure to either lead or cadmium over the OSHA action level are the inmates who perform glass breaking or monthly filter change-out. We believe that medical surveillance can be discontinued for all other inmates and staff. Some former inmates and/or staff may require surveillance under the OSHA Cadmium Standard.

Federal Correctional Institution Texarkana

Electronics recycling at FCI Texarkana appears to have been performed from late 2001 until May 2004 without appropriate engineering controls, respiratory protection, medical surveillance, or industrial hygiene monitoring. Because of the sparse biological monitoring and industrial hygiene data, we cannot determine the extent of exposure to lead and cadmium that occurred during that time. Descriptions of work tasks from staff and inmates indicate that exposures were not well controlled, causing a potential for exposure above OELs for lead and cadmium. Based on information provided to us and our industrial hygiene sampling, we believe that the current GBO is a significant improvement with respect to controlling worker exposures to cadmium and lead. Some lead- and cadmium-containing dust is still being carried out of the glass breaking booth. Although this does not represent a serious health hazard, it shows a need to maintain good housekeeping throughout the glass breaking area.

Exposures since May 2004 are sufficiently low that the OSHA-mandated medical surveillance has not been required since that time. In addition, the results of medical surveillance conducted since 2003 on inmates and staff were generally unremarkable. It is not possible to quantify past exposures to determine whether they triggered the OSHA lead and/or cadmium standard prior to that time. Inmates are advised of the results of their monitoring and see the physician's assistant; however, records of medical surveillance are not maintained by the employer for the appropriate length of time. Some staff have refused to participate in medical surveillance paid by UNICOR but conducted by their personal physicians.

After careful review of existing records and current operations, we conclude that medical surveillance can be discontinued for inmates and staff who work in electronics recycling and GBO. UNICOR may choose to continue to perform the limited biological monitoring currently in place as an additional safeguard against excessive exposure and to provide reassurance to inmates and staff.

United States Penitentiary Atwater

Inmates were exposed to cadmium and lead above OELs during glass breaking from 2002–2003. It appears that inmates worked without adequate respiratory protection from April 2002 until July 2002. Exposures seem to have been better controlled with relocation of the GBO to the spray booth; however, one sample taken after the relocation demonstrated significant airborne cadmium exposure. Results of medical surveillance of inmates and staff were unremarkable. The medical surveillance program was not in compliance with the OSHA lead and cadmium standards, and medical clearance was not performed for respirator use, a violation of the OSHA respiratory protection standard. If the GBO reopens, UNICOR should thoroughly characterize exposures to lead and cadmium and perform medical surveillance in compliance with the applicable OSHA standards until documentation shows that exposures are controlled below the OELs. Medical surveillance is not needed if the GBO remains closed.

Federal Correctional Institution Marianna

Limited exposure monitoring data suggests that exposures to metals in the FCI GBO may have been sufficiently low such that OSHA-mandated medical surveillance was not required. In addition, the results of medical surveillance conducted on inmates and staff were unremarkable. However, if the GBO reopens, UNICOR should continue to perform the limited biological monitoring currently in place as an additional safeguard against excessive exposure and to provide reassurance to inmates and staff. Medical surveillance is not needed if the GBO remains closed.

Overall Conclusions

UNICOR did not conduct adequate planning and job hazard analysis before initiating electronics recycling operations at the facilities we evaluated. As a result, potential health hazards were not identified in a timely manner, no training was provided to UNICOR staff or inmate workers, and adequate hazard controls were not established for up to several years at some BOP institutions. Factory managers did not receive training, guidance, or oversight needed to address health hazards associated with electronics recycling. Despite this, although testing was incomplete,

BLL, urine cadmium (CdU), and CdB results were below OELs for the vast majority of inmates and staff. No biological monitoring or medical records were available for inmates who were released or transferred.

Overall Recommendations for UNICOR Electronics Recycling Operations

Occupational health and safety should be an integral part of all UNICOR operations. UNICOR needs to commit adequate resources and staff to address workplace hazards and maintain an ongoing program of environmental monitoring to confirm that engineering and work practice controls are sufficiently protective. Environmental monitoring also provides data to determine which provisions of the OSHA Cadmium and Lead Standards should be applied for the GBO. A union safety and health representative should be selected at each BOP institution. This individual should be a regular participant on the joint labor-management safety committee that meets quarterly. Because inmates have no mechanism for representation on this committee, they should be informed of its proceedings and have a way to voice their concerns about and ideas for improving workplace safety and health.

Full compliance with all applicable OSHA standards is mandatory, including the General Industry Lead Standard [29 CFR 1910.1025], the Cadmium Standard [29 CFR 1910.1027], the Hazard Communication Standard [29 CFR 1910.1200], and the Respiratory Protection Standard [29 CFR 1910.134]. Full compliance includes record keeping requirements, hazard communication requirements, compliance plans, and medical surveillance. In addition, the preplacement examination for cadmium exposure should be identical to the periodic examinations so that baseline health status may be assessed and documented prior to exposure. UNICOR should voluntarily follow the more protective guidelines for lead exposure and BLLs set forth by an expert panel [Kosnett et al. 2007]. These guidelines were endorsed by the California Department of Public Health and the Council of State and Territorial Epidemiologists in 2009 and therefore were not included in the initial letters sent to Elkton and Texarkana, but they should be applied to all UNICOR facilities where exposure to lead occurs.

UNICOR should carefully evaluate the qualifications and expertise of consultants hired to assess occupational or environmental health and safety issues. One useful benchmark for vetting individuals who provide industrial hygiene services is the designation of certified industrial hygienist. Certification by the American Board of Industrial Hygiene ensures that prospective consultants have met standards for education, ongoing training, and experience and have passed a rigorous certification examination. The UNICOR and/or BOP industrial hygienists can assist in the selection of consultants.

While air sampling in the GBOs suggests that the level of protection afforded by powered air purifying respirators (PAPRs) may not be needed, continued use of PAPRs does have benefits in this setting. Loose-fitting PAPRs are comfortable and provide cooling in the potentially hot work environment. In addition, they offer the benefit that fit testing is not required. Additional periodic air sampling should be conducted to help ensure that exposures remain consistently below all applicable OELs before a reduction in the level of respiratory protection in the GBOs is considered.

A detailed job hazard analysis should be performed prior to beginning any new operation or before making changes to existing operations. This analysis will allow potential hazards to be identified prior to exposing staff or inmates and identify appropriate controls and personal protective equipment. Involve the UNICOR industrial hygienist in these job hazard analyses. If medical surveillance is needed, BOP should perform preplacement evaluations of exposed staff and inmates. Use a board-certified, residency-trained occupational medicine physician who is familiar with applicable OSHA regulations to oversee the medical surveillance program. UNICOR or BOP may be able to find a local hysician, or contract with Federal Occupational Health. The occupational medicine physician should also oversee medical clearance for respirators.

References

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Acknowledgments and Availability of Report

The Hazard Evaluations and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found. HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

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