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# Lead Hazard Surveillance Using an Environmental Reporting Database

David J. Valiante, Syed Shafiq-Ur Rab, and Martha J. Stanbury

Division of Environmental and Occupational Health Services, New Jersey Department of Health and Senior Services, Trenton, New Jersey 08625

This article describes the use of an environmental reporting database to identify potential lead exposure hazards in companies listing lead in their inventory of reportable chemicals in the workplace. The findings provide insight into the prevalence of underreporting of elevated blood lead levels that occurs in occupational lead surveillance systems which utilize laboratory reporting. We identified over 6000 companies reporting lead on the New Jersey Department of Environmental Protection—Right To Know survey and contacted 701 companies believed to have potential for occupational lead exposure. Unidentified cases of employee elevated blood lead levels and subsequent underreporting of these cases by clinical laboratories do not appear to be a significant problem in the New Jersey Department of Health and Senior Services lead surveillance system among companies self-reporting lead inventories to the state's Department of Environmental Protection. The uses and limitations of environmental databases for occupational health surveillance are discussed. VALIANTE, D.J.; SHAFIQ-UR RAB, S.; STANBURY, M.: LEAD HAZARD SURVEILLANCE USING AN ENVIRONMENTAL REPORTING DATABASE. APPL. OCCUP. ENVIRON. HYG. 12(11):769-772; 1997. © 1997 AIH.

Previous studies in California and Massachusetts have indicated that laboratory-based reporting of adult elevated blood lead levels may identify only a small percentage of individuals with work-related lead toxicity.<sup>(1-3)</sup> These findings raise questions on the amount of underreporting that occurs in adult blood lead surveillance. Since laboratory-based reporting is the primary surveillance system for occupational lead exposure in the United States,<sup>(4)</sup> underreporting can reduce the system's ability to identify problem workplaces and can prevent effective deployment of intervention resources.

The amount of underreporting of adult elevated blood lead levels in the New Jersey Department of Health and Senior Services (NJDHSS) lead surveillance system is unknown, but can occur due to companies not performing employee blood lead testing either because lead exposure is not suspected, exposure levels are wrongly assumed to be insignificant, or there is intentional disregard of the biological monitoring requirement of the Occupational Safety and Health Administration's (OSHA's) Lead Standard, 29 CFR 1910.1025. Underreporting can also occur when a company uses an out-of-state laboratory that is not required to report under New Jersey clinical laboratory reporting regulations,<sup>(5)</sup> or if a laboratory is unaware of or noncompliant with the reporting regulations.

An alternative approach for identifying lead exposure haz-

ards in the workplace is hazard surveillance. Froines *et al.*<sup>(6)</sup> define hazard surveillance as the ongoing assessment and evaluation of chemical use and worker exposure to those chemicals in industry. There are a number of informational databases available to determine lead use and exposure in the workplace. Examples include OSHA's Integrated Management and Informational System (IMIS), which contains exposure data from compliance inspections, and the National Institute for Occupational Safety and Health's (NIOSH's) National Occupational Exposure Assessment (NOES) industry survey containing data on chemical use by industry. In New Jersey an environmental reporting database from the New Jersey Department of Environmental Protection (NJDEP) is available that identifies companies listing lead in their inventory of reportable chemicals in the workplace.

This article describes a study to assess the extent of underreporting in the NJDHSS laboratory-based occupational lead surveillance system, based on identification and evaluation of companies reporting lead in the NJDEP database.

## Methods

NJDHSS maintains a surveillance system to identify adult elevated blood lead levels through required reporting by clinical laboratories.<sup>(7)</sup> An active lead surveillance program is in place to collect case reports; conduct follow-up interviews; provide medical consultation to affected individuals and their physicians; perform industrial hygiene evaluations or make OSHA referrals of workplaces identified as the source of exposure; and provide educational materials to individuals, employers, and physicians. Since its inception in 1985, the NJDHSS Lead Registry has received approximately 26,000 reports of blood lead levels equal to or greater than 25  $\mu\text{g}/\text{dl}$  on over 5000 individuals. Follow-up to these reports has identified over 350 employers as the likely source of the lead exposure.

The NJDEP Community Right to Know (DEP/RTK) survey is mandated by the New Jersey Worker and Community Right to Know Act<sup>(8)</sup> and requires employers to report, each year, hazardous substances used, stored, or manufactured at their facilities. The purpose of this survey is to assemble and disseminate information on chemical use that will help citizens, government, and industry in the state plan for and work toward a safer, environmentally sound New Jersey. In 1992 NJDEP sent surveys to over 32,000 employers in manufacturing and other specified businesses likely to maintain inventories of hazardous substances. The DEP/RTK survey mandates reporting the presence of any amount of 2000 reportable substances for all manufacturing plus certain nonmanufacturing

companies regardless of size. Prior to 1994 there was no reporting threshold; in 1994 a reporting threshold of 500 pounds for most substances on the DEP/RTK list was implemented. Although this database is available only in New Jersey, it is similar to a national database, the Environmental Protection Agency's Toxic Release Inventory (TRI) 40 CFR Part 372, with three important exceptions. TRI has a higher reporting threshold (10,000 pounds), has a smaller list of reportable substances (607), and covers only manufacturing companies with ten or more employees.

This study evaluated company-reported data from both the 1990 and 1992 DEP/RTK surveys, identifying 6002 companies reporting lead. DEP/RTK survey information was evaluated by a team of three staff industrial hygienists to decide which companies to include in a NJDHSS lead user survey. Companies reporting less than 100 pounds of lead (3739, 62%) were eliminated from further consideration on the decision by staff industrial hygienists that inventories below this amount would not yield significant findings of lead exposure to justify a survey of this size. Over half of the remaining 2263 companies were presumed to be free of significant occupational exposure, including automobile dealers and service stations probably reporting lead in batteries (152, 7%), duplicate company entries (87, 4%), and companies reporting unleaded gasoline, lead in paint, certain lead compounds, lead solder, and other lead-containing products unlikely to result in significant occupational exposure to lead (1091, 48%). 232 companies (10%) were previously identified by the NJDHSS Lead Registry through 1992. Thus, 701 companies remained from the DEP/RTK list that presented a potential for finding lead exposure and unreported cases of elevated blood lead levels.

To obtain accessory information on the potential for occupational lead exposure and the current state of the employer's lead exposure prevention program, a lead user survey of the 701 companies was conducted by NJDHSS. The survey requested information on the type of lead product used, amount of lead used, how it was used, number of employees and lead-exposed employees, and whether the company conducted biological monitoring for lead. Because employer familiarity with the requirements of the OSHA Lead Standard and compliance with its air and biological monitoring component are critical for successful laboratory-based surveillance of lead toxicity, the survey also asked a series of questions related to compliance with the OSHA Lead Standard, including respiratory protection, engineering controls, hygiene facilities, and air sampling. Finally the company was asked to provide air sampling data on lead to the NJDHSS.

## Results

NJDHSS received 577 completed lead user surveys by mail and 78 surveys were completed over the telephone from the 701 companies for a total of 655 responses (93%). 326 (50%) companies claimed they no longer used lead, had closed, or had reported on the NJDHSS survey lead in batteries or other forms which would not result in occupational exposure. An additional 258 (39%) companies were classified as insignificant lead users because the potential for lead exposure was determined by NJDHSS industrial hygienists to be minimal. These included companies involved in soldering, using materials containing trace amounts of lead, lead anodes, purchased leaded

TABLE 1. Industry Type of 71 Companies Surveyed by NJDHSS

SIC	Description	No. of Companies
26	Paper and allied products	1
27	Printing	3
28	Chemical and allied products	7
29	Petroleum refining	1
30	Rubber and miscellaneous plastics	1
32	Glass products	2
33	Primary metals	6
34	Fabricated metal products	12
35	Industrial/commercial machinery and computer equipment	10
36	Electronic and other electrical equipment	9
37	Transportation equipment	1
38	Measuring, analyzing, and controlling instruments	8
39	Sporting and athletic goods	2
49	Utility services	1
51	Wholesale trade—pharmaceutical	1
80	General medical and surgical hospitals	5
87	Testing labs	1
	Total	71

glass, and print type. This left 71 companies (11%) suspected of having the potential for tangible occupational lead exposure and possible unreported cases of elevated blood lead levels. The 71 companies represent a wide range of industries, as illustrated in Table 1.

The NJDHSS lead survey found that 63 of 71 (89%) lead-using companies answered yes to the question on knowledge of the provisions of the OSHA Lead Standard. Fifty of the 71 (70%) identified companies provided information on lead levels in air to NJDHSS. Actual air sampling data were received from 22 companies (31%) initially, and an additional 23 companies (32%) conducted air monitoring and provided results after being notified by NJDHSS of the initial exposure assessment requirement in the OSHA Lead Standard. Five companies asserted that they conducted air monitoring, but rather than providing actual results, provided only statements that levels were below the OSHA action level. Two of the 50 (4%) companies providing air monitoring results for lead had levels above the OSHA permissible exposure limit (PEL) of 50  $\mu\text{g}/\text{m}^3$ . A third company reported air levels above the PEL, but a subsequent site visit by NJDHSS revealed that the reported levels were erroneous because they were actually results from wipe samples taken during an OSHA Consultation Services visit. The remaining 47 companies reported levels below the OSHA action level of 30  $\mu\text{g}/\text{m}^3$ . No companies reported lead levels between 30 and 50  $\mu\text{g}/\text{m}^3$ .

Twenty-one (30%) of the 71 companies did not conduct air monitoring for lead. Eight companies representing various types of lead operations and lacking air monitoring data were selected for on-site evaluation by an NJDHSS industrial hygienist. For the remaining 13 companies with no air monitoring data, five were planning to conduct air monitoring data for lead, four followed our suggestion to conduct biological monitoring in lieu of air sampling and had results under 25  $\mu\text{g}/\text{dl}$ ,

TABLE 2. Hazard Surveillance Site Investigations

Lead Product	Industry	Use	Investigation Result
Lead alloy	Hospital	Fabricating patient shielding (radiation treatment)	<ul style="list-style-type: none"> <li>• Low air and blood lead levels</li> <li>• Contamination problem</li> <li>• Fact sheet mailing to all New Jersey hospitals</li> <li>• Generated two elevated cadmium reports</li> </ul>
Lead metal	Ammunition manufacturing	Bullets	<ul style="list-style-type: none"> <li>• Contamination problem</li> <li>• Air/blood lead data not available</li> <li>• OSHA referral</li> </ul>
Lead solder	Art	Stained glass	<ul style="list-style-type: none"> <li>• Low air lead levels</li> <li>• Lead came (strips) is purchased and installed, soldered at the joints</li> </ul>
Lead pigment	Communication wire and cable	High temperature cable	<ul style="list-style-type: none"> <li>• Facility closed prior to air sampling</li> </ul>
Lead babbitt	Industrial machine manufacturing	Friction shaft bearing	<ul style="list-style-type: none"> <li>• Sporadic demand for bearing</li> <li>• Substitute plastic bearing available</li> </ul>
Lead scrap metal	Commercial equipment manufacturing	Fire door counterweight	<ul style="list-style-type: none"> <li>• Intermittent production of door</li> <li>• Mechanical cutting of lead</li> </ul>
Lead scrap metal	Recreational	Fishing lures	<ul style="list-style-type: none"> <li>• Low air and blood lead levels</li> </ul>
Lead type	Printing	Block for print	<ul style="list-style-type: none"> <li>• Low air lead levels</li> <li>• Use of Linotype machine decreasing</li> <li>• Small print shops</li> </ul>

two were included in a fact sheet mailing to New Jersey hospitals producing lead alloy shielding, and two eliminated or reduced their use of lead to insignificant levels to end their involvement with us. The eight site visits found only one company (ammunition manufacturer) with the potential for a lead exposure problem. NJDHSS industrial hygienists found little evidence of significant airborne lead exposure at the seven other workplaces because of either a low hazard process involving lead, sporadic use of lead, or low exposure levels measured during the on-site evaluation. Table 2 provides details of these site investigations.

Biological monitoring was performed by only 16 (23%) of the 71 companies initially, increasing to 31 percent after recommendation by NJDHSS. Since biological monitoring is triggered by a lead air level of 30  $\mu\text{g}/\text{m}^3$  on more than 30 days per year, companies with air monitoring results below the OSHA action level were not required to perform blood lead testing. The 22 companies testing employee blood lead levels reported levels below the reportable level of 25  $\mu\text{g}/\text{dl}$ , and only three companies reported levels in the 10 to 20  $\mu\text{g}/\text{dl}$  range. Of the two companies with air levels of lead above the OSHA PEL, one conducted biological monitoring on NJDHSS recommendation (peak level = 19  $\mu\text{g}/\text{dl}$ ) and one did not conduct biological monitoring, claiming that the exposure was a one-time occurrence (lead paint removal in a refinery).

### Discussion

This study did not find significant lead exposure and/or workers with elevated blood lead levels in a population of companies reporting lead inventories to an environmental database and not previously identified through laboratory reporting. These findings suggest that companies in general industry with lead exposure hazards sufficient to cause elevated blood lead levels above the New Jersey reporting level of 25  $\mu\text{g}/\text{dl}$  were conducting the necessary biological monitoring that allows for

capture by a laboratory-based surveillance system. The relatively low occurrence of air (31%) and biological (23%) monitoring found during our initial contact with the 71 employers believed to have potential for significant lead exposure was not a factor in underreporting, as evidenced by the absence of exposures revealed during the evaluation of companies without these data. Of greater significance to the sensitivity of a laboratory-reporting surveillance system is employer recognition of potential worker exposure and performance of a hazard assessment, including an evaluation of how lead is used and its potential for contact with the worker. Underreporting is likely to occur when biological monitoring is not conducted because these initial procedures were ignored or incomplete. For example, elevated blood lead levels may occur when the primary exposure to lead is through ingestion and air levels are below the level OSHA uses to require biological monitoring.

Lead exposure potential is difficult to determine in a large, diverse group of companies reporting lead. This study found that many of the companies reporting lead were insignificant users with regard to exposure levels, based on reported air monitoring data and site visits. A notable difference between the Rudolf *et al.*<sup>(1)</sup> and Papanek *et al.*<sup>(2)</sup> studies, which surveyed potential lead-using facilities in California, and this study was the absence of radiator repair shops in the NJDHSS list of 701 potentially significant lead-using facilities. This occurred primarily because many radiator repair shops were previously identified by the NJDHSS Lead Registry, did not report lead to DEP/RTK survey, or did not report amounts over 100 pounds. Telephone follow-up by the NJDHSS to a sample of radiator repair shops found that some shops had changed over to lead-free solder, while others stated that the increasing use of modern, plastic radiators has reduced the amount of lead use associated with repair. However, it is likely that lead exposure and elevated blood lead levels continue to occur in many radiator repair shops working with lead.

The main purpose of the DEP/RTK survey is to collect and

disseminate summary chemical inventory data throughout the state. Using this type of database to identify companies with potential employee lead exposure has its limitations. Perhaps the most significant limitation in using an environmental reporting database is that information on the production process and use of lead is insufficient for determining the extent of potential occupational lead exposure to the workers. This lack of information necessitates the additional step of gathering pertinent information on potential lead use and exposure from the company. Another limitation is the reliance on the accuracy and completeness of self- or company-reported data. Evidence of incomplete reporting on the DEP/RTK survey was found by comparing Lead Registry data with DEP/RTK data: three companies (1%) identified by our Lead Registry in 1990 or 1992 as having employees with elevated blood lead levels did not report lead on the DEP/RTK survey during the same time period. Another concern involving data quality is company reliance on one episode of air monitoring, which may not adequately represent true exposure. This problem was evident in a company that provided NJDHSS with air monitoring data indicating no lead exposure, but a later evaluation of the complete industrial hygiene report found that lead was not used on the day the samples were taken. Unfortunately, on-site validation of the information obtained was not possible at the majority of companies surveyed. Also, the DEP/RTK database was not complete. In 1992 over 2500 (8%) companies did not respond to the DEP/RTK survey, preventing evaluation of a large group of companies for potential lead use. A possible limitation exists in our method of eliminating several thousand companies from follow-up at the initial phase based on a threshold of 100 pound inventory and certain lead processes (e.g., soldering), potentially resulting in missed significant exposures.

The construction industry was not included in this study because it is not covered by the DEP/RTK survey. Available data indicate that construction workers, particularly painters and laborers, have a high risk of developing lead toxicity when working with lead paint.<sup>(3)</sup> Surveillance utilizing blood lead reports is problematic in the construction industry, where smaller companies, a mobile work force, and jobs of short duration all present difficulties in identifying currently exposed workers and conducting timely intervention. This is an area where hazard surveillance can be utilized to identify a lead exposure problem much sooner. Useful hazard surveillance techniques for the construction industry may include the use of advertisement bulletins and newspapers such as Dodge Reports, which provide information on upcoming construction activity with the potential for lead exposure.

### Conclusion

The findings of this study indicate that hazard surveillance using company-reported data of lead inventory primarily in the manufacturing sector did not find additional cases of elevated blood lead levels in the worker population and thus adds little to the existing capabilities of laboratory-based surveillance. For this particular group of companies reporting lead, underreporting of worker elevated blood lead levels does not appear to be a problem and the NJDHSS laboratory-based surveillance is

shown to be a comprehensive system for capturing work-related elevated blood lead levels in general industry. However, the use of hazard surveillance data sources should continue in the attempt to produce a higher yield of companies with lead exposure hazards, particularly in industries where lead exposure is variable or the association with a lead hazard is not clearly defined. A combination of exposure information (OSHA IMIS), lead use (NIOSH NOES), worker's compensation reports, industry classification (standard industrial classification codes), and planned work activity may prove to be successful in identifying occupational lead exposure problems not detected by laboratory based reporting.<sup>(9,10)</sup> Ideally, hazard surveillance data sources can be used to supplement laboratory-based reporting of elevated blood lead levels in providing a comprehensive picture of lead exposure hazards occurring in the workplace.<sup>(11)</sup> These efforts must continue in occupational lead surveillance if we are to meet the US Public Health Service objective for the year 2000 of eliminating exposures which result in workers having blood lead levels greater than 25 µg/dl.

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