

# Evolution of a State Occupational Lead Exposure Registry: 1986–1996

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*In the first 11 full years of operation (January 1, 1986, through December 31, 1996) of an adult lead registry in New Jersey, 23,456 reports of occupational lead toxicity (blood lead level  $\geq 1.21 \mu\text{mol/L}$ ) in 4,011 workers, involving 496 workplaces, were received. The majority of the reports and workers were from the manufacturing and construction industries. Over the 11 years, the annual numbers of reports and workers declined, although the annual numbers of involved workplaces remained stable, as did the number of newly identified workers and workplaces. The decline occurred primarily in the manufacturing industry; the construction industry experienced an increase in reports and reported workers. For all years combined, 36% of reported workers had at least one blood lead level equal to or greater than  $1.93 \mu\text{mol/L}$ , although in the most recent years the percentage dropped overall and in both the manufacturing and construction industries.*

Occupational lead toxicity remains a public health problem in the United States, although the adverse effects of lead have been known for centuries.<sup>1</sup> Twenty-six states have established registries for the surveillance of adult lead toxicity, based primarily on clinical laboratory reports of elevated blood lead levels (BLL). The states' experiences provide useful information for registry design and operation and for occupational lead poisoning prevention activities. The New Jersey Department of Health and Senior Services (NJDHSS) has had a lead surveillance system, Adult Blood Lead Epidemiology and Surveillance (ABLES), since October 1985. An earlier article reported on the results of the ABLES system from 1986 through the first half of 1989.<sup>2</sup> This article reports on the results of the ABLES system from its first full year of operation in 1986 through 1996.

## Methods

The NJDHSS promulgated a regulation requiring in-state clinical laboratories to report cases of inorganic lead toxicity, defined as a BLL equal to or greater than  $1.21 \mu\text{mol/L}^*$ , among adults, effective October 1985.<sup>3</sup> In 1990, another regulation was promulgated, requiring physicians to report cases of occupational lead poisoning.<sup>4</sup> The NJDHSS ABLES system database contains information from the reports and follow-up on the reports, including case identifiers and demographics, date of report, BLL, exposure source, work-

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\* $1 \mu\text{mol/L} = 20.7 \mu\text{g/dL}$ .

TABLE 1

Occupational Lead Toxicity Reports Received by the New Jersey Adult Blood Lead Epidemiology and Surveillance (ABLES) System, by Year—1986–1996\*

Year	All Workplaces					All Workplaces Except Two†	
	Reports (n)	Workers (n)	New Workers (%)‡	Workplaces (n)	New Workplaces (%)§	Reports (n)	Workers (n)
1986	1,124	687	90	95	83	1,057	659
1987	687	415	55	96	43	498	318
1988	1,927	951	71	125	42	922	588
1989	4,294	1,054	45	128	45	1,023	560
1990	4,134	1,154	40	119	34	1,409	709
1991	3,255	881	31	113	29	1,064	524
1992	1,964	724	36	121	40	908	525
1993	1,831	704	43	110	28	1,162	550
1994	1,769	644	34	97	32	960	478
1995	1,282	548	33	99	30	766	404
1996	1,189	534	41	124	30	945	442
Total	23,456	4,011 <sup>  </sup>		496 <sup>  </sup>		10,714	3,224

\* Reports of blood lead levels (BLLs)  $\geq 1.21 \mu\text{mol/L}$ ; does not include 201 reports received in 1985 because reporting did not begin until October 1985.

† All except reports and workers from two workplaces, a battery manufacturing company (Company A) and a chemical manufacturing company (Company B).

‡ Percentage of all workers for the year; does not include 112 workers first reported in 1985.

§ Percentage of all workplaces for the year; does not include 15 workplaces first reported in 1985.

|| Workers may be counted in more than 1 year. The total is the number of unique workers and does not include 11 workers reported only in 1985.

|| Workplaces may be counted in more than 1 year. The total is the number of unique workplaces, and does not include two workplaces reported only in 1985.

place identifiers, and Standard Industrial Classification (SIC) codes. The database also contains information on follow-up actions taken by the ABLES system staff, such as employee, employer, and physician interviews; educational materials mailings; workplace industrial hygiene visits; and referrals to the federal Occupational Safety and Health Administration (OSHA). Information in the ABLES database on all BLL reports greater than or equal to  $1.21 \mu\text{mol/L}$  among New Jersey workers from January 1, 1986, through December 31, 1996, was analyzed in order to determine the extent of reported occupational lead toxicity and trends over time.

## Results

### Trends in Numbers of Reports, Workers, and Workplaces

Between January 1, 1986, and December 31, 1996, 23,456 reports with BLLs equal to or greater than  $1.21$

$\mu\text{mol/L}$  on 4,011 workers were received. Nearly all of the reports were from clinical laboratories. The annual number of reports fluctuated in the years 1986 through 1988, more than doubled in 1989, and then steadily decreased through 1996, when there was less than one-third of the number in 1989. The annual number of reported workers followed a similar pattern, except that the number peaked in 1990. The highest percentages of the annual number of workers who were newly identified were 90% in 1986, 55% in 1987, and 71% in 1988; the percentage fluctuated between 31% and 45% in subsequent years. A great deal of the variation in the number of reports and workers each year is explained by two workplaces, which represented 54% of the reports and 20% of the workers from 1986 through 1996. Both of these workplaces are manufacturing companies, one of batteries (Company A) and the other of chemicals (Company B) (Table 1).

The total number of unique workplaces with reported workers with BLLs equal to or greater than  $1.21 \mu\text{mol/L}$  was 496, and the number reported each year varied between 95 and 128, with an increase between 1987 and 1989, decreases through 1994, and then increases in 1995 and 1996 almost to the 1989 number. The year with the highest percentage of workplaces that were newly identified was 1986 (83%), the first full year of NJDHSS ABLES system operation; thereafter, the percentage fluctuated between 28% and 45% (Table 1). Between 1986 and 1996, 51% of the workplaces were in the system for 1 year, 33% for 2 or 3 years, and 2% (nine workplaces) for all 11 years.

### Trends in Type of Industry

In the years 1986 through 1996 combined, the majority of the reports (86%) and reported workers (70%) were from the manufacturing industry, with most of the remainder from

TABLE 2

Occupational Lead Toxicity Reports Received by the New Jersey ABLES System, by Two-Digit Standard Industrial Classification (SIC) Code—1986–1996\*

SIC (Code)	Reports		Workers		Workplaces	
	n	%	n	%	n	%
<b>Manufacturing (20–39)</b>	<b>20,204</b>	<b>86</b>	<b>2,812</b>	<b>70</b>	<b>172</b>	<b>35</b>
Electronic/Other Electric Equipment† (36)	11,755	50	650	16	15	3
Chemicals & Allied Products‡ (28)	3,717	16	779	19	45	9
Primary Metal Industries (33)	2,625	11	861	21	41	8
Stone, Clay, & Glass Products (32)	1,449	6	302	8	18	4
Fabricated Metal Products (34)	277	1	85	2	14	3
Industrial Machinery & Equipment (35)	157	1	50	1	13	3
<b>Construction (15–17)</b>	<b>2,618</b>	<b>11</b>	<b>906</b>	<b>23</b>	<b>191</b>	<b>39</b>
Special Trade Contractors (17)	2,170	9	721	18	163	33
Heavy Construction Excluding Building (16)	412	2	163	4	19	4
<b>Services (70–89)</b>	<b>203</b>	<b>1</b>	<b>98</b>	<b>2</b>	<b>52</b>	<b>10</b>
Auto Repair, Services, & Parking (75)	90	<1	51	1	29	6
<b>Wholesale Trade (50)</b>	<b>188</b>	<b>1</b>	<b>64</b>	<b>2</b>	<b>16</b>	<b>3</b>
<b>Transportation &amp; Public Utilities (40–49)</b>	<b>79</b>	<b>&lt;1</b>	<b>43</b>	<b>1</b>	<b>24</b>	<b>5</b>
<b>Public Administration (91–97)</b>	<b>77</b>	<b>&lt;1</b>	<b>52</b>	<b>1</b>	<b>28</b>	<b>6</b>
<b>Other§</b>	<b>87</b>	<b>&lt;1</b>	<b>36</b>	<b>1</b>	<b>13</b>	<b>3</b>
<b>Total</b>	<b>23,456</b>	<b>100</b>	<b>4,011</b>	<b>100</b>	<b>496</b>	<b>100</b>

\* Reports of BLLs  $\geq 1.21 \mu\text{mol/L}$ ; does not include 201 reports received in 1985.

† Includes Company A—10,403 reports and 422 workers.

‡ Includes Company B—2,339 reports and 365 workers.

§ Includes retail trade, finance, insurance, and real estate and unknown SIC (22 reports, 16 workers, and 6 workplaces).

the construction industry, representing 11% of the reports and 23% of the workers. The identified workplaces were fairly evenly divided between manufacturing (35%) and construction (39%), with the next highest percentage (10%) from services. Within the manufacturing industry, electronic and other electric equipment, chemicals and allied products, primary metal industries, stone, clay and glass products, fabricated metal products, and industrial machinery and equipment represented substantial proportions of the reports and workers. In the construction industry, most of the reports, workers, and workplaces were from the special trades contractors, especially “painting and paper hanging” (Table 2). Fourteen of the detailed industries (ie, four-digit SIC code) within manufacturing and construction represented 73% of the workers and 36% of the workplaces (Table 3). The average number of reported workers per workplace was 16 in the manufacturing industry (12 without Companies A and B) and five in the construction industry.

The 11-year trend in annual numbers of reports, workers, and workplaces in the manufacturing industry was similar to the overall trend because the manufacturing industry comprised such a large percentage of all of the reports, workers, and workplaces. By contrast, the 11-year trend in the construction industry was one of increases—a 525%, 829%, and 329% increase in the number of reports, workers, and workplaces, respectively, between 1986 and 1996. In each of the years 1986 through 1992, over two-thirds of the reports and workers (excluding Companies A and B) were from the manufacturing industry and less than or approximately one-fifth of the reports and workers were from the construction industry. Conversely, after 1992, the manufacturing industry represented approximately one-half of the reports and workers each year, and one-third to one-half of the annual reports and workers were from the construction industry. By 1995 and 1996, a greater number of the workplaces were in the construction industry

than the manufacturing industry (Table 4).

### Trends in BLLs

Overall, 36% of the workers in the ABLES system had at least one BLL report equal to or greater than  $1.93 \mu\text{mol/L}$ , the BLL at which the worker may have adverse health effects and require medical evaluation. Forty-five percent of the workers in construction and 32% of the workers in manufacturing had at least one report with a BLL equal to or greater than  $1.93 \mu\text{mol/L}$  (Table 5).

In the years 1986 through 1994, the annual percentage of workers in the manufacturing industry with a BLL equal to or greater than  $1.93 \mu\text{mol/L}$  was fairly consistent (23% to 31%); then in 1995 and 1996 the percentage dropped to 17% and 20%, respectively. This trend in manufacturing remained the same when Companies A and B were removed from the analysis. In the construction industry, the percentage of workers with a BLL equal to or greater than  $1.93 \mu\text{mol/L}$  was higher than the

percentage in manufacturing each year but followed a similar trend, varying widely between 35% and 71% in the years 1986 to 1993 and dropping consistently between 1994 and 1996, to 30%, 27%, and 23%, respectively (Table 6).

## Discussion

### Trends in Reports, Workers, and Workplaces

During the NJDHSS ABLES system's first 11 full years of operation,

the annual number of reports and reported workers declined by approximately two-thirds and one-half, respectively, from the peak years (1989–1990), while the annual number of workplaces remained stable. A great deal of the decrease in the annual number of reports and workers is explained by two workplaces, both in manufacturing, which accounted for a substantial percentage of the total reports and workers. In the early 1990s, Company A changed its policy regarding the frequency of BLL testing, which resulted in fewer reports and reported workers. Company B ceased using lead in 1991; BLLs for a few workers involved in a cleanup of the facility continued to be reported through 1996.

Even with these two companies removed from the analysis, the annual number of reports, workers, and workplaces in manufacturing decreased from the peak years of 1989–1990 by 60%, 63%, and 40%, respectively. The decrease may relate to the 28% decline in employment in the manufacturing industry in New Jersey between 1987 and

**TABLE 3**

Workers and Workplaces Reported With Occupational Lead Toxicity to the New Jersey ABLES System, by Four-Digit SIC Code—1986–1996\*

SIC (Code)	Workers		Workplaces	
	n	%	n	%
Storage batteries (3691) <sup>†</sup>	571	14.2	4	0.8
Painting & paper hanging (1721) <sup>‡</sup>	448	11.2	97	19.6
Chemical preparations, nec <sup>§</sup> (2899) <sup>†</sup>	387	9.6	10	2.0
Vitreous china table & kitchenware (3262) <sup>†</sup>	214	5.3	1	0.2
Primary non-ferrous metals—copper (3331) <sup>†</sup>	205	5.1	1	0.2
Secondary non-ferrous metals (3341) <sup>†</sup>	190	4.7	9	1.8
Cold finishing of steel shapes (3316) <sup>†</sup>	183	4.6	2	0.4
Bridge, tunnel, & elevated highway (1622) <sup>‡</sup>	156	3.9	13	2.6
Inorganic pigments (2816) <sup>†</sup>	140	3.5	6	1.2
Structural steel erection (1791) <sup>‡</sup>	120	3.0	7	1.4
Plastics materials & resins (2821) <sup>†</sup>	93	2.3	4	0.8
Industrial organic chemicals, nec <sup>§</sup> (2869) <sup>†</sup>	68	1.7	4	0.8
Wrecking & demolition work (1795) <sup>‡</sup>	67	1.7	14	2.8
Electronic components, nec <sup>§</sup> (3679) <sup>†</sup>	67	1.7	6	1.2
All other	1,102	27.5	318	64.1
Total	4,011	100.0	496	100.0

\* Reports of BLLs  $\geq 1.21$   $\mu\text{mol/L}$ .

<sup>†</sup> Within the manufacturing industry.

<sup>‡</sup> Within the construction industry.

<sup>§</sup> Not elsewhere classified.

**TABLE 4**

Occupational Lead Toxicity Reports Received by the New Jersey ABLES System for Two Major SIC Categories, by Year—1986–1996\*

Year	Manufacturing <sup>†</sup>						Construction					
	Reports		Workers		Workplaces		Reports		Workers		Workplaces	
	n	% <sup>‡</sup>	n	% <sup>‡</sup>	n	% <sup>‡</sup>	n	% <sup>‡</sup>	n	% <sup>‡</sup>	n	% <sup>‡</sup>
1986	945	89	606	92	61	66	72	7	21	3	14	15
1987	383	77	258	81	56	60	83	17	34	11	21	22
1988	754	82	472	80	66	54	94	10	55	9	15	16
1989	829	81	450	80	68	54	87	9	57	10	29	23
1990	1,076	76	558	79	62	53	245	17	94	13	26	22
1991	840	79	402	77	56	50	148	14	83	16	29	26
1992	658	72	353	67	53	45	204	22	137	26	43	36
1993	536	46	262	48	46	43	574	49	261	47	47	44
1994	599	62	312	65	47	49	333	35	148	31	34	36
1995	415	54	236	58	40	41	328	43	150	37	46	47
1996	427	45	208	47	41	34	450	48	195	44	60	49
Total	7,462	70	2,025 <sup>§</sup>	63	170 <sup>  </sup>	34	2,618	24	906 <sup>§</sup>	28	191 <sup>  </sup>	39

\* Reports of BLLs  $\geq 1.21$   $\mu\text{mol/L}$ .

<sup>†</sup> Excluding two workplaces, Companies A and B.

<sup>‡</sup> Percentage of total reports, workers, workplaces for the year, excluding Companies A and B.

<sup>§</sup> Workers may be counted in more than 1 year; the total is the number of unique workers.

<sup>||</sup> Workplaces may be counted in more than 1 year; the total is the number of unique workplaces.

1996. Within manufacturing, employment in electronic and other electric equipment declined by 50%, in chemicals and allied products by 15%, in primary metal industries by

38%, in stone, clay, and glass products by 28%, and in fabricated metal products by 30%.<sup>5</sup>

The decrease may also be the result of changes in the manufacturing

processes, resulting in lead not being used or workers not being exposed. By December 1996, half of all of the workplaces identified between 1986 and 1996 had discontinued lead use, were no longer in operation, had moved out of state, had air lead levels below the OSHA action level, or had workers with BLLs lower than 1.21 µmol/L.

The decrease in the number of reports, workers, and workplaces from the manufacturing industry was partially offset by the increase in the number of reports, workers, and workplaces from the construction industry. Although employment in the New Jersey construction industry also declined 25% between 1987 and 1996,<sup>5</sup> the federal OSHA lead standard in construction, promulgated in 1993<sup>6</sup> with attendant publicity and enforcement actions, undoubtedly resulted in an increase in construction companies' testing their employees' BLLs. Also, in 1991, the New Jersey Department of Transportation (NJDOT), with the assistance of the NJDHSS ABLES system and OSHA, began including lead-safety provisions in their contracts for bridge construction, with a require-

**TABLE 5**  
Workers' Blood Lead Levels Reported to the New Jersey ABLES System, by Two-Digit SIC Code—1986–1996\*

SIC (Code)	Workers <i>n</i>	Workers With BLLs ≥ 1.93 µmol/L <sup>†</sup>	
		<i>n</i>	%
<b>Manufacturing (20–39)</b>	<b>2,812</b>	<b>910</b>	<b>32.4</b>
Electronic/Other Electric Equipment (36)	650	255	39.2
Chemicals & Allied (28)	779	220	28.2
Primary Metal Industries (33)	861	271	31.5
Stone/Clay/Glass Products (32)	302	94	31.1
Fabricated Metal Products (34)	85	20	23.5
Industrial Machinery & Equipment (35)	50	27	54.0
<b>Construction (15–17)</b>	<b>906</b>	<b>410</b>	<b>45.3</b>
Special Trade Contractors (17)	721	327	45.4
Heavy Construction Excluding Building (16)	163	70	42.9
<b>Services (70–89)</b>	<b>98</b>	<b>36</b>	<b>36.7</b>
Auto Repair, Services, & Parking (75)	51	19	37.3
<b>Wholesale Trade (50)</b>	<b>64</b>	<b>27</b>	<b>42.2</b>
<b>Transportation &amp; Public Utilities (40–49)</b>	<b>43</b>	<b>17</b>	<b>39.5</b>
<b>Public Administration (91–97)</b>	<b>52</b>	<b>13</b>	<b>25.0</b>
<b>Other<sup>‡</sup></b>	<b>36</b>	<b>13</b>	<b>36.1</b>
<b>Total</b>	<b>4,011</b>	<b>1,426</b>	<b>35.6</b>

\* Reports of BLLs ≥ 1.21 µmol/L.

<sup>†</sup> Workers with at least one BLL report ≥ 1.93 µmol/L.

<sup>‡</sup> Includes retail trade, finance, insurance, real estate, and unknown SIC.

**TABLE 6**  
Workers' Blood Lead Levels Reported to the New Jersey ABLES System for Two Major SIC Categories, by Year—1986–1996\*

Year	Workers With BLLs ≥ 1.93 µmol/L									
	Manufacturing		Manufacturing Except Companies A & B		Construction		All Other		Total	
	<i>n</i> <sup>†</sup>	% <sup>‡</sup>	<i>n</i> <sup>†</sup>	% <sup>‡</sup>	<i>n</i> <sup>†</sup>	% <sup>‡</sup>	<i>n</i> <sup>†</sup>	% <sup>‡</sup>	<i>n</i> <sup>†</sup>	% <sup>‡</sup>
1986	159	25	154	25	13	62	9	28	181	26
1987	106	30	84	33	24	71	11	44	141	34
1988	220	26	124	26	24	44	19	32	263	28
1989	295	31	153	34	20	35	24	46	339	32
1990	240	24	162	29	57	61	17	30	314	27
1991	175	23	93	23	44	53	18	47	237	27
1992	125	23	76	22	59	43	4	12	188	26
1993	108	26	65	25	118	45	8	31	234	33
1994	118	25	67	22	44	30	7	41	169	26
1995	65	17	38	16	41	27	5	28	111	20
1996	59	20	37	18	45	23	10	32	114	21

\* Reports of BLLs ≥ 1.21 µmol/L.

<sup>†</sup> Workers with at least one BLL report ≥ 1.93 µmol/L in the year.

<sup>‡</sup> Percentage of all workers in the year with BLLs ≥ 1.21 µmol/L whose BLLs were ≥ 1.93 µmol/L.

ment for monthly BLL testing of lead-exposed workers. Repair projects for 400 bridges and overpasses, projected by the NJDOT in the next 5 to 10 years, could result in continued increased reporting of lead toxicity among construction workers.

The most recent years' increases in the construction industry also may be due to increased lead abatement of residential and steel structures. New regulations for a 1993 law that requires licensing of lead-abatement workers and certification of lead-abatement contractors, promulgated in July 1997, are expected to cause future increases in the number of lead-abatement workers reported to the ABLES system.

Despite the overall reduction in the annual number of reported workers, the percentage that is new to the NJDHSS ABLES system each year has remained stable over the years, as have the annual number of workplaces and the percentage that are newly identified. This indicates an ongoing need for the ABLES system, as "new" workers and workplaces continue to be identified. The increase in reports and workers from the construction industry has meant additional effort in processing reports and follow-up by the NJDHSS ABLES system because of fewer workers per workplace and the greater mobility of workers in the construction industry.

### Trends in BLLs

In the last few years, a lower percentage of the workers reported to the NJDHSS ABLES system had at least one BLL equal to or greater than  $1.93 \mu\text{mol/L}$ ; the decrease was especially notable in the construction industry. A similar decrease appears to have occurred nationally, with the percentage of reported workers with BLLs greater than or equal to  $1.21 \mu\text{mol/L}$  dropping from 29% in 1993 to 22% in 1996.<sup>7-9</sup> The reduction in the annual percentage of reported workers with BLLs equal to or greater than  $1.93 \mu\text{mol/L}$  may very likely be due to lower exposures to

lead among workers. Alternate explanations include reduced compliance by the clinical laboratories with the reporting regulation and/or reduced employee testing by lead-using companies. However, the routine telephone follow-up with the major clinical laboratories when reports are not received from them for a month or more indicates that they complied as much or more with the reporting regulation in recent years as in earlier years. Therefore, laboratory compliance is not a likely explanation.

Earlier studies in other states found that not all workplaces with potential lead exposure test their employees' BLLs, especially in the construction industry.<sup>10-12</sup> A recent study by the NJDHSS, though not strictly comparable to the earlier studies, did not confirm these studies' findings. In this study, a survey was conducted of 701 companies that were identified by the 1990 and 1992 New Jersey Community Right to Know (NJCRTK) surveys of manufacturing and other companies likely to maintain inventories of hazardous substances. The lead survey did not find companies with significant lead exposure and/or workers with elevated BLLs that were not already identified through the ABLES system.<sup>13</sup> This study was limited in that the NJCRTK survey involves employer self-reporting and that construction companies were not included in the study.

Although there have been fewer workers reported from the manufacturing industry in recent years, the above-mentioned study does not indicate that this was due to companies not testing lead-exposed workers. In the construction industry, more workers have been reported in recent years, so fewer reported workers would not explain the decline in the percentage with BLLs greater than or equal to  $1.93 \mu\text{mol/L}$ .

The contribution of the NJDHSS ABLES system and federal OSHA area offices in New Jersey to the lower BLLs should be acknowl-

edged. In the years 1991 through 1996, the NJDHSS ABLES system interviewed by telephone and sent educational mailings to 153 workplaces and, between 1985 and 1996, conducted industrial hygiene site visits at 47 workplaces. Under a 1991 Memorandum of Understanding with the federal OSHA, the NJDHSS ABLES system referred 51 private employers of workers with elevated BLLs to OSHA, resulting in on-site inspections and other actions by OSHA.

### Concerns

Although the NJDHSS ABLES system appears to be effective in identifying lead-exposed workers and their workplaces and in reducing occupational lead exposure, the need for it continues and several concerns remain. One concern is that not all companies with potential lead exposure monitor their workers' BLLs. Hazard surveillance with all companies in industries most likely to have lead exposure is a useful approach to this problem.<sup>14</sup>

Another ongoing concern is that out-of-state laboratories are not required to report lead toxicity among New Jersey adults to the NJDHSS. Information from several other states indicates that this results in missed workers who have elevated BLLs.<sup>15</sup> States requiring reporting from out-of-state laboratories or a nationwide lead-reporting system with clinical laboratories reporting to the appropriate state lead registries are two measures that have been suggested to resolve this problem.<sup>15</sup> NJDOT bridge-painting contracts require the use of in-state laboratories for all BLL testing performed by the contractors. Also, receipt of all BLL reports, not only those equal to or greater than  $1.21 \mu\text{mol/L}$ , would provide a more complete picture of lead toxicity among workers. Recently, the NJDHSS published regulations to mandate reporting by clinical laboratories of *all* BLL tests.<sup>16</sup>

Several reviews by the NJDHSS ABLES system found significant

percentages of laboratory reports that did not have key information for follow-up, such as the patient's address or telephone number and information about the employer. The laboratory reporting regulation<sup>3</sup> was amended, effective in 1994, to require the employer's name, address, and telephone number, and the major laboratories were encouraged in meetings and by mail to improve reporting. These actions have resulted in better reporting. Electronic reporting by the laboratories, planned to begin in late 1998 in conjunction with the NJDHSS's childhood lead-poisoning prevention program, is expected to result in more efficient and complete reporting.

Exclusion of the construction industry from the OSHA lead standard until 1993 was of great concern to the NJDHSS ABLES system because of the high percentages of reported construction workers with BLLs equal to or over 1.93  $\mu\text{mol/L}$ . Since OSHA's promulgation of a construction lead standard in 1993, many more lead-exposed construction workers and their workplaces have been identified and followed up by the NJDHSS ABLES system.

## Conclusion

The long-term decreasing trend in the number of reports, workers, and workplaces from the manufacturing industry, coupled with a more recent trend of increases in the number of reports, workers, and workplaces in the construction industry, is expected to continue. The most recent national data show that the total numbers of reports of lead toxicity increased 11% in the first quarter of 1997 over that of 1996.<sup>9</sup> This is in contrast to

the long-term decreasing trend in the United States, similar to New Jersey's long-term decreasing trend. It remains to be seen if the recent nationwide increase will continue and if New Jersey also experiences an increase in the total number of reports of lead toxicity.

Data from additional years also are needed to determine if the very recent trend of lower percentages of reported workers with BLLs equal to or greater than 1.93  $\mu\text{mol/L}$  in both New Jersey and the United States is a temporary decline or a more permanent one.

Continuation and improvement of and adaptation to the changing types of industries with lead exposure by the NJDHSS ABLES system and other state lead registries are crucial to reaching the national goal of all workers having BLLs less than 1.21  $\mu\text{mol/L}$ .<sup>17</sup>

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