

## 1999 Annual Report on Blood Lead Levels Among Adults in Michigan

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## **Summary:**

This is the second annual report on surveillance of blood lead levels among Michigan adults. It is based on regulations that went into effect on October 11, 1997 that require laboratories to report all blood lead levels analyzed.

In 1999, 10,442 reports were received for 9,484 individuals  $\geq$ 16 years of age. One thousand six (10.6%) individuals had blood lead levels greater than or equal to 10 µg/dL; 273 of those 1006 had lead levels greater than or equal to 25 µg/dL and 11 of those 273 had blood lead levels greater than or equal to 50 µg/dL.

There were 3,508 more reports (on 3,111 individuals) received in 1999 compared to 1998. However, the total number of individuals with blood lead levels greater than or equal to 10  $\mu$ g/dL deceased from 14.4% in 1998 to 10.6% in 1999. The number and percent of individuals with blood lead levels greater than or equal to 25  $\mu$ g/dL deceased from 303 (4.8%) in 1998 to 273 (2.8%) in 1999 and the number and percent of individuals with blood lead levels greater than or equal to 50  $\mu$ g/dL deceased from 31 (0.5%) in 1998 to 11 (0.1%) in 1999. We are encouraged both by the increased compliance with the reporting law as evidenced by the increased number of reports and the reduction in blood lead levels greater than or equal to 25  $\mu$ g/dL since last year's report.

Individuals with blood lead levels greater than or equal to 10  $\mu$ g/dL were more likely to be men (94.6%), white (88.4%), and have an average age of 42. They were most likely to live in Wayne (16.1%), St. Clair (10.6%), Ingham (8.0%), Muskegon (7.1%), and Montcalm (6.9%) counties.

Occupational exposure was the predominant source of lead exposure in Michigan adults. These exposures typically occurred where individuals were casting brass or bronze fixtures, repairing car radiators, or performing abrasive blasting on outdoor metal structures such as bridges, overpasses or water towers. Another common but less frequent exposure occurred at shooting ranges.

Work place follow-up at 35 companies where individuals worked, with blood lead levels greater than or equal to 25  $\mu$ g/dL showed that 24 of 35 (69%) were in violation of the lead standard. Initial evaluation of these inspections shows them to be effective relative to other types of workplace enforcement inspections and suggests that they play a role in helping to reduce blood lead levels. We will continue to evaluate and follow this trend to determine if the initial findings remain over a more prolonged period of time after a greater number of inspections have been completed.

The second year of operation of an adult blood lead surveillance system in Michigan proved successful in continuing to identify a large number of individuals with elevated blood lead levels and sources of workplace exposures that could be remediated to reduce lead exposure. Ongoing surveillance in future years will determine if the favorable trend in lower blood lead levels found between 1998 and 1999 will continue.

### **Background:**

This is the second annual report on surveillance of blood lead levels among Michigan adults. Blood lead levels of Michigan residents, including children, have been monitored by the state since 1992. From 1992 to 1995, laboratories performing analyses of blood lead levels, primarily of children, had been voluntarily submitting reports to the Michigan Department of Public Health and then beginning in 1996 to the Michigan Department of Community Health (MDCH). The Michigan Department of Community Health promulgated regulations effective October 11, 1997 that require laboratories to submit reports of both children and adults to the MDCH, for any blood testing for lead. Coincident with this, the Michigan Department of Consumer and Industry Services (MDCIS) received federal funding in 1997 from the Centers for Disease Control and Prevention (CDC) to monitor adult blood lead levels, as part of the Adult Blood Lead Epidemiology and Surveillance (ABLES) Program. As of January 2000, 28 states have established lead registries through the ABLES Program for surveillance of adult lead absorption, primarily based on reports of elevated blood lead levels (BLL) from clinical laboratories. In addition to the 28 states funded for ABLES, there are 6 unfunded states conducting similar surveillance programs.

### The Michigan Adult Blood Lead Registry:

#### **Reporting Regulations and Mechanism**

Since 1978, Michigan has required clinics, labs, hospitals and employers to report any patient with a known or suspected work-related disease including lead poisoning, to the MDCIS, under Part 56 of Public Act 368 of 1978. Since October 11, 1997, laboratories performing blood lead analyses of Michigan residents are required to report the results of all blood lead level tests (BLLs) to the Michigan Department of Community Health. Prior to these new regulations, few reports of elevated lead levels among adults were received.

The laboratories are required to report blood sample analysis results, patient demographics, and employer information on a standard Michigan Department of Community Health Lead Reporting Form (Appendix I). The physician or health provider ordering the blood lead analysis is responsible for completing the patient information (section I), the physician/provider information (section II) and the specimen collection information (section IIa). Upon receipt of the blood sample for lead analysis, the clinical laboratory is responsible for completion of the laboratory information (section III). All clinical laboratories conducting business in Michigan that analyze blood samples for lead must report all adult and child blood lead results to the Michigan Department of Community Health, Childhood Lead Poisoning Prevention Program (MDCH/CLPPP) within 5 working days.

All blood lead results on individuals 16 years or older are forwarded to the Michigan Department of Consumer and Industry Services for potential follow-up. A summary of blood lead results from 1999 on children less than 16 years old is in Appendix II.

### **Laboratories**

Only laboratories that meet the Occupational Safety and Health Administration (OSHA) requirements for blood lead analysis and are approved by OSHA can conduct a BLL test performed under the lead standard for employer medical-screening. Appendix III lists the approved laboratories in Michigan.

### Data Management

When BLL reports are received at the MDCH they are reviewed for completeness. For those reports where information is missing, copies are returned to the physician/provider to complete. Lead Registry staff code the information on the lead reporting form using a standard coding scheme and enter this information into a computerized database. Each record entered into the database is visually checked for any data entry errors, duplicate entries, missing data, and illogical data. These quality control checks are performed monthly.

### Case Follow Up

Adults whose BLL is 25  $\mu$ g/dL or higher are contacted for an interview. A letter is sent to the individual explaining Michigan's lead surveillance program and inviting them to answer a 15-20 minute telephone questionnaire about their exposures to lead and any symptoms they may be experiencing. The questionnaire collects patient demographic data, work exposure and history information, symptoms related to lead exposure, information on potential lead-using hobbies and non-work related activities, and the presence of young children in the household to assess possible takehome lead exposures among these children. Trained medical interviewers administer the questionnaire.

### <u>Michigan OSHA (MIOSHA) Requirements for Medical Monitoring and Medical</u> <u>Removal</u>

MIOSHA requirements for medical surveillance (i.e. biological monitoring) and medical removal are identical to Federal OSHA's. The requirements for medical removal differ for general industry and construction. For general industry, an individual must have two consecutive blood lead levels above  $60 \ \mu\text{g/dL}$  or an average of three blood lead levels greater than  $50 \ \mu\text{g/dL}$  before being removed (i.e. taken pursuant to the standard or the average of all blood tests conducted over the previous six months, which ever is longer). For construction, an individual needs to have only two consecutive blood lead level measurements taken pursuant to the standard above  $50 \ \mu\text{g/dL}$ . However, an employee shall not be required to be removed if the last blood sampling test indicates a blood lead level at or below  $40 \ \mu\text{g/dL}$ . See Appendix IV for a more detailed description of the requirements.

In the absence of a specific exposure to lead, blood lead levels in the general population are typically below 10  $\mu$ g/dL (1).

#### **Dissemination of Surveillance Data**

Quarterly data summaries, without personal identifiers, are forwarded to the Program's funding agency, the National Institute for Occupational Safety and Health (NIOSH). NIOSH compiles quarterly reports from all states that require reporting of BLLs and publishes them in the Morbidity and Mortality Weekly Report (MMWR). (See Appendix V for most recent quarterly summary).

### **Results:**

1999 is the second year with complete laboratory reporting in Michigan since the lead regulations became effective on October 11, 1997. Accordingly, this report provides a summary of all the reports of adult blood lead levels received in 1999 as well as more detailed information from interviews of those adults with BLLs 25  $\mu$ g/dL and greater. It also describes the Michigan Occupational Safety and Health Administration (MIOSHA) inspections at the work sites where these individuals were exposed to lead.

### **Blood Lead Levels Reported in 1999**

#### Number of Reports and Individuals

Between January 1 and December 31, 1999, the State of Michigan received 10,442 blood lead level reports for individuals 16 years of age or older. Because an individual may be tested more than once each year, the 10,442 reports received were for 9,484 individuals (Table 1). Of the 9,484 individuals, 8,218 were first reported to the state in 1999. The following descriptive statistics are based on the 9,484 <u>individuals</u> reported in 1999, and are based on the highest BLL reported for each of these adults.

### **Distribution of Blood Lead Levels**

In 1999, 1,006 (10.6%) of the 9,484 adults reported had blood lead levels greater than or equal to 10  $\mu$ g/dL; 273 of those 1,006 had blood lead levels greater than or equal to 25  $\mu$ g/dL and 11of those 273 had blood lead levels greater than or equal to 50  $\mu$ g/dL (Table 1). A total of 8,478 (89.4%) of the adults reported in 1999 had BLLs less than 10  $\mu$ g/dL.

#### **Gender and Age Distribution**

#### **<u>All Blood Lead Levels</u>**

Approximately two-thirds of the adults reported to the Registry were male (66.7%), with females representing one-third of the reports (33.3%). Gender was unknown for 130 adults reported (Table 2). The age distribution is shown in Table 3. The average age was 43.

#### **Blood Lead Levels** $\geq 10 \, \mu g/dL$

For the 1,006 adults reported to the Registry with blood lead levels greater than or equal to  $10 \,\mu\text{g/dL}$ , 951 (94.6%) were men and 54 (5.4%) were women. Gender was unknown for 1 individual (Table 2). The age distribution for these adults was similar to the reports of all BLLs. The average age was 42 (Table 3).

#### **Race Distribution**

#### **All Blood Lead Levels**

Although laboratories are required to report the patients' race, this information is frequently not completed. Race was missing for 5,681 (59.9%) of the 9,484 adults reported. Where race was known, 3,102 (81.6%) were reported as white, 603 (15.9%) were reported as African American, 62 (1.6%) were reported as Native American, 23 (0.6%) were reported as Asian/Pacific Islander, and 13 (0.3%) were reported as multiracial (Table 4).

#### <u>Blood Lead Levels $\geq 10 \ \mu g/dL$ </u>

For adults with blood lead levels greater than or equal to  $10 \mu g/dL$  where race was indicated, 658 (88.4%) were reported as white, 69 (9.3%) were reported as African American, 12 (1.6%) were reported as Native American, 4 (0.5%) were reported as Asian/Pacific Islander, and 1 (0.1%) were reported as multiracial (Table 4).

#### **Geographic Distribution**

The 8,661 adults were reported to the Registry from 82 of Michigan's 83 counties. The largest number of adults reported in 1999 lived in Wayne county (1,743, 20.1%), followed by Oakland (855, 9.9%), Ingham (565, 6.5%), and Genesee (499, 5.8%). County was unknown for 823 adults (Figure 1 and Table 5). There were no reports received for adults in Lake county in 1999.

Figure 2 and Table 6 show the county of residence of the 984 adults with blood lead levels greater than or equal to  $10 \,\mu$ g/dL. The largest number of adults reported with a BLL of  $10 \,\mu$ g/dL and greater

were from Wayne county (158, 16.1%), followed by St. Clair (104, 10.6%), Ingham (79, 8.0%), Muskegon (70, 7.1%), and Montcalm (68, 6.9%). County was unknown for 22 adults.

Figure 3 and Table 7 show the county of residence for the 270 adults with blood lead levels greater than or equal to 25  $\mu$ g/dL. The largest number of adults reported with a BLL of 25  $\mu$ g/dL and above were from St. Clair county (42, 15.6%), followed by Muskegon (37,13.7%), Wayne (35, 13.0%), and Montcalm (20, 7.4%). County was unknown for 3 adults.

Figure 4 and Table 8 show the percentage of adults tested for blood lead within each county with BLLs of 10  $\mu$ g/dL or greater. Keweenaw (1, 100%), Montcalm (68, 51.9%), Ionia (56, 44.8%), Clinton (41, 43.2%), and Baraga (5, 41.7%) counties had the highest percentages of adults with BLLs of 10  $\mu$ g/dL or greater.

Figure 5 and Table 9 show the percentage of adults tested for blood lead within each county with BLLs of 25  $\mu$ g/dL or greater. Baraga (4, 33.3%), Montcalm (20, 15.3%), Ionia (18, 14.4%), and St. Clair (42, 14,1%) counties had the highest percentage of adults with BLLs of 25  $\mu$ g/dL or greater.

Figure 6 and Table 10 show the incidence rates of BLLs of 10  $\mu$ g/dL and above, by county, for women. There were 53 women reported in 1999 with a BLL of 10  $\mu$ g/dL or greater. Alger (30/100,000), Hillsdale (12/100,000), and Muskegon (11/100,000) had the 3 highest incidence rates.

Figure 7 and Table 11 show the incidence rates of BLLs of  $10 \mu g/dL$  and above, by county, for men. There were 931 men reported in 1999 with a BLL of  $10 \mu g/dL$  or greater. Montcalm (333/100,000), Ontonagon (254/100,000), and Ionia (238/100,000) had the 3 highest incidence rates. The overall incidence rate for men was 27 times higher than that for women (27/100,000 vs 1/100,000).

### Industry

Table 12 shows the industries of 2,385 of the 9,484 adults who had blood lead levels tested in 1999, by blood lead levels. Industry was unknown for 7,084 adults. Fifteen individuals were not included in Table 12 since the source of lead exposure was known to be non-work.

The primary metal industry (Standard Industrial Classification (SIC) 33) which involves the casting of lead-containing brass (copper/zinc) and bronze (copper/tin) parts has the highest percentage of workers with blood lead levels greater than 25  $\mu$ g/dL. The next highest percentages were in facilities that do radiator manufacturer or repair (SIC 55, 75, 76). Metal fabrication (SIC 34) and machinery manufacturing (SIC 35) had workers with elevated blood lead levels exposed to lead from similar casting operations as the primary metal companies; however the casting operation was only one part of these industries' overall operations. Special Trade Construction (SIC 17) also had a high percentage of workers with a BLL greater than 25  $\mu$ g/dL. This is the industry that performs abrasive blasting of outdoor metal structures (i.e. bridges, water towers).

Figure 8 shows the distribution of non-construction companies that reported at least one adult with a BLL of 25  $\mu$ g/dL or greater in Michigan during 1999. These companies primarily perform brass/bronze casting operations or radiator repair activities.

#### **Summary of All Industrial Hygiene Inspections**

In its two years of operation, the statewide surveillance system identified 60 companies where MIOSHA had not performed an inspection for lead in at least three years (Table 13). Thirty-five of these companies have now been inspected. Inspections of these 35 companies resulted in 30 of the 35 (86%) companies receiving citations for a violation of an occupational health standard (Table 14). Twenty-four of the 35 (69%) companies were issued citations for violations of the lead standard (Table 15).

Of the 60 companies identified 33 were identified by elevated blood lead reports collected because of a company's medical surveillance program and 19 from an individual having the test performed by their personal health care provider. For 8 we were unable to determine why the blood lead sample was collected. Ten of the 19 companies identified because an individual had the blood lead test performed by their personal health care provider were inspected. Six of the 10 (60%) companies were cited for a lead violation. This is slightly less than the 18 of 25 (72%) companies cited for a lead violation who were identified because of a company medical screening.

### **Evaluation of the Effectiveness of Industrial Hygiene Interventions**

A special initiative was conducted this past year to determine the effectiveness of inspections of companies where at least one worker had a blood lead level 30-39 µg/dL but no greater than 39 µg/dL and at least one worker had a blood lead level 40-49 µg/dL but no greater than 49 µg/dL. Companies were grouped into four categories: one or more employees with blood lead level  $\geq 50$  µg/dL; one or more employees whose highest blood lead level was 40-49 µg/dL; and one or more employees whose highest blood lead level was 30-39 µg/dL; and no blood lead reports were received on any employees but the company had reported to the U.S. Environmental Protection Agency that they used 10,000 or more pounds of lead per year. A comparison in the number of citations and the amount of penalties was made between the four lead groups and with a control group of companies that did not use lead. Blood lead levels before and after inspection were also compared. A costbenefit analysis was performed.

Thirty-one inspections were performed; 7 companies in the  $\geq 50 \ \mu g/dL$  group; 6 companies in the 40-49  $\mu g/dL$  group; 10 companies in the 30-39  $\mu g/dL$  group, and 8 in the no blood lead group. The number of citations and penalties did not differ between the three blood lead groups but were markedly increased compared to the lead using but no blood lead group (Table 16). Violations of specific components of the lead standard were similar between the three blood lead groups (Table 17). The number of citations and penalties issued at companies with at least one employee reported to have a blood lead greater than 30  $\mu g/dL$  was greater than those issued to companies in the same type of industries not using lead (Table 18). Comparison of blood leads between pre and post inspection is shown in (Table 19). The total cost to identify lead exposed workers at problem worksites was \$125 (\$53-\$459) per lead exposed worker.

The number, type of citations, amount of penalties, and penalties per citation were similar for all three blood lead groups (Tables 16 and 17). Multiple violations were found at all blood lead levels but not when the company was reported to use lead but no blood lead reports were received. When we compared the different blood lead groups to control companies which were matched by industry type and inspected because of employee complaints, only companies with blood leads  $\geq 50 \ \mu g/dL$  had statistically more citations, penalties and penalties per citations than these matched control companies. However, the companies in the 40-49  $\mu g/dL$  and 30-39  $\mu g/dL$  blood lead groups had more citations, higher penalties and higher penalties per citation but they were not statistically different than the control companies (Table 18). Only in the group inspected because the blood was greater than or equal to 50  $\mu g/dL$  was there a statistically significant drop in the blood leads levels after the inspection (Table 19).

We interpret the data to show that inspections of companies where employees had blood levels 30-39  $\mu$ g/dL or 40-49  $\mu$ g/dL were as effective in identifying companies that were in violation of the lead standard as limiting inspections to companies where an employee had a blood lead  $\geq$  50  $\mu$ g/dL. In addition the inspection of the companies with the lower blood lead levels was at least as effective in identifying overall violations as inspecting companies because of employees complaints. Employee complaint generated inspections are the most frequent type of inspections conducted by MIOSHA.

The goal of a MIOSHA inspection for lead is to reduce employee exposure to lead and other work place hazards. We could only demonstrate this in the  $\geq 50 \ \mu g/dL$  blood lead inspection group although there was a nonstatistical reduction in the percentage of workers with blood leads greater than 25  $\mu g/dL$  in the 30-39  $\mu g/dL$  blood group. In addition to the small sample size and limited statistical power, we may not have allowed sufficient time to have elapsed for corrective engineering or workplace action to be reflected in blood lead levels. We will continue to track blood lead results of these companies in the future. We are also currently assessing the effectiveness of inspecting companies where at least one worker had a blood lead 25-29  $\mu g/dL$  but no greater than 29  $\mu g/dL$ .

#### Interviews of Adults with Blood Lead Levels of 25 µg/dL or Greater

Between October 15, 1997 and March 1, 2000 there were 354 reports received on adults with blood lead levels  $\geq$ 25 µg/dL. Two hundred sixty-three of these individuals completed an interview by telephone and 91 had questionnaires completed from a review of their medical records. The following summary of interview data is based on the 263 questionnaires completed by telephone. These 263 adults were reported to the Registry from October 15, 1997 to December 31, 1999.

Table 20 lists the demographic characteristics of the 263 adults with completed questionnaires by highest lead level reported. Most of the completed questionnaires were of males (95.4%), which parallels the gender distribution of the number of lead level reports  $\geq 10 \,\mu$ g/dL submitted for adults

in 1999. There was no difference in gender by highest blood lead level. The percentage of African-Americans was greater among adults with higher blood lead levels. The percentage of ever or current smokers was higher among adults with the higher blood lead levels. The group with the highest lead levels had the youngest mean age.

Table 21 presents the types of lead-related symptoms reported during the interviews, by lead level. Only individuals who had daily or weekly symptoms were included in this table. Loss of 10+ pounds without dieting, continued loss of appetite, frequent pain/soreness, muscle weakness, headache, dizziness, feeling depressed, being tired, and feeling nervous, waking up at night and being irritable were associated with increasingly higher levels of blood lead. Having any gastro-intestinal, muscloskeletal, or nervous system symptom was associated with increasingly higher levels of blood lead. Table 22 shows the reporting of lead-related diseases by lead level category.

Table 23 presents the type of industry by lead level reported among those interviewed. Overall, 44% worked in brass/bronze foundries, followed by 27% working in construction. However, there was a higher percentage of workers in construction (66.7%) at the highest lead levels reported, compared to foundries. Table 24 presents the number of years worked by highest lead level reported for the adults who completed a questionnaire. The shorter term workers (i.e. worked in a lead exposed job for 5 or fewer years) were more likely to have higher blood lead level results.

Table 25 lists the types of working conditions reported by the interviewed adults, again by highest lead level reported. Workers with lower lead levels were more likely to report having their work clothing laundered at work, having a showering facility and having a separate lunch room. They also were more likely to report eating in the lunch room. As expected, workers with higher blood lead levels were more likely to have been removed from the job. In 7 companies we had responses to the working condition questions before and after an inspection of the facility. Generally the responses post-inspection indicated improvements in working conditions had occurred after the time of the inspection (Table 26).

The questionnaire also asks about children in the household, in order to document the potential for and extent of take-home lead. One-third of the adults interviewed reported children age 6 and younger living or spending time in the home (Table 27). Ten of the 83 children potentially exposed had an elevated lead level.

#### **Case Histories**

The most common sources of work place lead exposure in Michigan are from removing paint from outdoor metal structures, such as overpasses, bridges and water towers and, casting brass or bronze parts and repairing radiators. The 1998 annual report provided examples of both the clinical presentation and industrial hygiene follow up of an abrasive blaster and a brass foundry worker. This year, we have highlighted a case of adult lead poisoning from exposure to lead at a shooting range.

#### **Case History**

A man in his late 40's was reported with a blood lead level of 66 mg/dL. He reported the following symptoms: abdominal pain before eating, being tired, unable to concentrate, joint pain, muscle weakness, and being unable to have an erection. He denied weight loss, loss of appetite, headache, dizziness, feeling sad, feeling nervous, waking up at night or nightmares. He had exposure to lead at his regular job. In addition to regularly shooting fire arms at an indoor range he swept up at the range. He denied collecting the bullets and remelting them. He smoked cigarettes. He indicated he did not smoke in the shooting range but did keep his cigarettes in his pocket.

The shooting range was inspected by MIOSHA and cited for: 1) not performing air monitoring for lead; 2) not implementing a written hazard communication program and training employees; 3) failure to use a high efficiency particulate (HEPA) filter vacuum or other equally effective method to remove lead accumulations which were found throughout the facility; 4) an absence of an adequate respiratory protection program; and 5) absence of a medical monitoring program.

### **Discussion:**

An individual may have a blood lead test performed as part of an employer medical-screening program or as part of a diagnostic evaluation by their personal physician. Whatever the reason for testing, the results are then sent by the testing laboratories to the MDCH as required by law. If the individual reported is an adult, the report is then forwarded to the MDCIS and maintained in the ABLES Program Lead Registry. If the individual has a blood lead level of  $25 \,\mu$ g/dL or greater, they are then interviewed by a trained medical interviewer by telephone. The interview details demographic information, exposure history and the presence and nature of lead related symptoms. In some instances a MIOSHA enforcement inspection is conducted to document current exposures to lead at work and the company's compliance with the lead standard.

Michigan is one of 34 states conducting surveillance of elevated blood lead levels. Michigan requires the reporting of <u>all</u> blood lead level results. Major benefits for reporting all blood lead levels are: the ability to calculate the rates of elevated blood lead levels in specific groups of interest; the ability to monitor compliance with the testing requirements of the lead standard; and facilitating the tracking of reports from particular employers to monitor their progress in reducing workers' exposures to lead.

Data from the state surveillance systems shows that elevated lead levels from occupational exposures are an important public health problem in the United States (2). It is well-documented that exposure to lead may cause serious health effects in adults, including injury to the nervous system, kidneys, and blood-forming and reproductive systems in men and women. The level of lead in the blood is a direct index of a worker's recent exposure to lead as well as an indication of the potential for

adverse effects from that exposure (3). A further problem is that workers can bring lead home on their clothes and expose children to lead. Children can experience serious health effects from lower levels of lead exposure compared to adults.

Average blood lead levels in the United States general population range from 2.1 to 3.4  $\mu$ g/dL with 1.5 to 4.6% of adults tested for blood lead having blood lead levels greater than or equal to 10  $\mu$ g/dL (1). On the average, blood lead levels are higher in the elderly, in men, and in African-Americans and Hispanics. Despite these differences, the mean blood lead levels and the percentage greater than 10  $\mu$ g/dL for these sub populations are not clinically significantly different (1). A blood lead level greater than or equal to 10  $\mu$ g/dL is an indication of exposure and increased absorption of lead regardless of age, race and gender.

In 1999, there were 1,006 adults reported in Michigan with blood lead levels greater than or equal to 10  $\mu$ g/dL. Ninety-five percent were men. The average age was 42. They were predominately white (88.4%). They predominately resided in a band of counties stretching across the state from Muskegon and Oceana to Wayne and Macomb. The exposure was predominately occupational in origin, occurring during the casting of brass/bronze parts or among abrasive blasters removing paint from outdoor metal structures, or among workers repairing car radiators.

Based on the experience in other states we presume that the number of reports of elevated blood lead levels we receive is an underestimate of the true number of Michigan citizens with elevated blood leads (4,5).

Eleven adults had blood lead levels above 50  $\mu$ g/dL, which is the maximum blood lead level allowed in the work place. One of these 11 adults was exposed to lead while performing abrasive blasting on outdoor metal structures, 2 while casting brass or bronze, 2 from building demolition activities, 1 from painting, 1 from welding, 2 in auto manufacturing, and 2 while target shooting as a hobby.

An inspection was conducted at 35 companies where a worker was reported with a blood lead level  $\geq 25 \ \mu g/dL$ . Twenty-four of 35 (69%) of these companies were cited for violations of the lead standard (Table 15). An evaluation of the effectiveness of conducting inspections at facilities where blood leads were 30  $\mu g/dL$  was conducted this past year. The results showed that even if the highest reported blood lead level was less than 50  $\mu g/dL$  (the cutoff level at which medical removal of a worker is required) then a significant number of violations of the MIOSHA standard were found on inspection.

In its second year of operation the surveillance system for lead proved successful in continuing to identify large numbers of adults with elevated lead levels and sources of exposure that could be remediated to reduce exposures. We are encouraged both by the increased compliance of the reporting law as evidenced by the increased number of laboratory reports and by the reduction in blood lead levels greater than or equal to  $25 \,\mu g/dL$ . We will continue to monitor for this trend in the year 2000.

### References

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## Appendices

Appendix I	Blood Lead Analysis Reporting
Appendix II	MDCH/CLPPP Summary
Appendix III	OSHA Blood Lead laboratories
Appendix IV	Summary of Michigan' Lead Standards
Appendix V	MMWR Summary

## Table 1. Distribution of Highest Blood Lead Levels(BLLs) Among Adults Reported During 1999

BLLs (µg/dL)	<u>Number</u>	Percent
<10	8,478	89.4
10-24	733	7.7
25-29	114	1.2
30-39	111	1.2
40-49	37	0.4
50-59	9	0.1
≥ 60	2	0.02
TOTAL	9,484*	100.02**

\*In 1999, 10,442 BLL reports were received for 9,484 individuals. \*\*Percentages do not add to 100% due to rounding.

## Table 2. Distribution of Gender Among Adults Testedfor Blood Lead in Michigan: 1999

<u>Gender</u>	All Blood Leac <u>Number</u>	d Level Tests <u>Percent</u>	Blood Lead Le <u>Number</u>	vels ≥ 10 μg/dL <u>Percent</u>
Male	6,240	66.7	951	94.6
Female	3,114	33.3	54	5.4
TOTAL	9,354*	100.0	1005**	100.0

\*Gender was unknown for 130 individuals.

\*\* Gender was unknown for 1 individual.

## Table 3. Distribution of Age Among Adults Testedfor Blood Lead in Michigan: 1999

	All Blood L	All Blood Lead Level Tests		els $\geq 10 \ \mu g/dL$
Age Range	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>
16-19	585	6.2	8	0.8
20-29	1,620	17.1	166	16.5
30-39	2,175	22.9	259	25.8
40-49	2,187	23.1	300	29.8
50-59	1,454	15.3	187	18.6
60-69	613	6.5	66	6.6
70-79	529	5.6	11	1.1
80-89	264	2.8	6	0.6
90-99	35	0.4	1	0.1
100 +	22	0.2	2	0.2
TOTAL	9,484	100.1*	1,006	100.1*

\*Percentages do not add to 100% due to rounding.

## Table 4. Distribution of Race Among Adults Testedfor Blood Lead in Michigan: 1999

	All Blood Lead Level Tests		<b>Blood Lead Lev</b>	els $\geq 10 \ \mu g/dL$
Race	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>
Caucasian	3,102	81.6	658	88.4
African American	603	15.9	69	9.3
Native American	62	1.6	12	1.6
Asian/Pacific Islander	23	0.6	4	0.5
Multiracial	13	0.3	1	0.1
TOTAL	3,803*	100.0	744**	<b>99.9</b> ***

\*Race was unknown for 5,681 individuals.

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\*\*Race was unknown for 262 individuals.

\*\*\*Percentages do not add to 100% due to rounding.

## Table 5. Distribution of Adults Tested for Blood Leadin Michigan by County of Residence: 1999

<b>County</b>	<u>Number</u>	<b>Percent</b>	<u>County</u>	<u>Number</u>	<b>Percent</b>
Alcona	4	0.05	Keweenaw	1	0.01
Alger	4	0.05	Lake	-	-
Allegan	41	0.5	Lapeer	52	0.6
Alpena	18	0.2	Leelanau	7	0.1
Antrim	7	0.1	Lenawee	96	1.1
Arenac	12	0.1	Livingston	55	0.6
Baraga	12	0.1	Luce	3	0.03
Barry	22	0.3	Mackinac	39	0.5
Bay	93	1.1	Macomb	536	6.2
Benzie	17	0.2	Manistee	31	0.4
Berrien	130	1.5	Marquette	56	0.6
Branch	22	0.3	Mason	20	0.2
Calhoun	132	1.5	Mecosta	22	0.3
Cass	8	0.1	Menominee	3	0.03
Charlevoix	21	0.2	Midland	49	0.6
Cheboygan	23	0.3	Missaukee	22	0.3
Chippewa	68	0.8	Monroe	224	2.6
Clare	53	0.6	Montcalm	131	1.5
Clinton	95	1.1	Montmorency	6	0.1
Crawford	15	0.2	Muskegon	434	5.0
Delta	24	0.3	Newaygo	30	0.3
Dickinson	14	0.2	Oakland	855	9.9
Eaton	63	0.7	Oceana	18	0.2
Emmet	36	0.4	Ogemaw	5	0.1
Genesee	499	5.8	Ontonagon	22	0.3
Gladwin	9	0.1	Osceola	9	0.1
Gogebic	6	0.1	Oscoda	1	0.01
Grand Traverse	91	1.1	Otsego	39	0.5
Gratiot	52	0.6	Ottawa	144	1.7
Hillsdale	23	0.3	Presque Isle	6	0.1
Houghton	19	0.2	Roscommon	7	0.1
Huron	27	0.3	Saginaw	214	2.5
Ingham	565	6.5	Saint Clair	297	3.4
Ionia	125	1.4	Saint Joseph	27	0.3
Iosco	8	0.1	Sanilac	38	0.4
Iron	2	0.02	Schoolcraft	6	0.1
Isabella	39	0.5	Shiawassee	65	0.8
Jackson	108	1.2	Tuscola	25	0.3
Kalamazoo	179	2.1	Van Buren	50	0.6
Kalkaska	9	0.1	Washtenaw	298	3.4
Kent	263	3.0	Wavne	1.743	20.1
			Wexford	17	0.2
			TOTAL	8,661*	100.0

\*County was unknown for 823 adults.

## Table 6. Distribution of Adults with Blood Lead Levels (BLLs) ≥10 μg/dL in Michigan by County of Residence: 1999

<b>County</b>	<u>Number</u>	<b>Percent</b>	<b>County</b>	<u>Number</u>	<b>Percent</b>
Alcona		_	Keweenaw	1	0.1
Alger	1	0.1	Lake	-	-
Allegan	-	-	Lapeer	4	0.4
Alpena	3	0.3	Leelanau	1	0.1
Antrim	-	-	Lenawee	1	0.1
Arenac	-	-	Livingston	4	0.4
Baraga	5	0.5	Luce	1	0.1
Barry	1	0.1	Mackinac	3	0.3
Bay	8	0.8	Macomb	54	5.5
Benzie	1	0.1	Manistee	2	0.2
Berrien	13	1.3	Marquette	-	-
Branch	3	0.3	Mason	2	0.2
Calhoun	4	0.4	Mecosta	-	-
Cass	1	0.1	Menominee	-	-
Charlevoix	1	0.1	Midland	4	0.4
Cheboygan	2	0.2	Missaukee	1	0.1
Chippewa	15	1.5	Monroe	9	0.9
Clare	1	0.1	Montcalm	68	6.9
Clinton	41	4.2	Montmorency	-	-
Crawford	-	-	Muskegon	70	7.1
Delta	1	0.1	Newaygo	1	0.1
Dickinson	-	-	Oakland	46	4.7
Eaton	7	0.7	Oceana	2	0.2
Emmet	3	0.3	Ogemaw	1	0.1
Genesee	32	3.3	Ontonagon	9	0.9
Gladwin	-	-	Osceola	1	0.1
Gogebic	2	0.2	Oscoda	-	-
Grand Traverse	2	0.2	Otsego	1	0.1
Gratiot	17	1.7	Ottawa	19	1.9
Hillsdale	5	0.5	Presque Isle	1	0.1
Houghton	-	-	Roscommon	-	-
Huron	6	0.6	Saginaw	14	1.4
Ingham	79	8.0	Saint Clair	104	10.6
Ionia	56	5.7	Saint Joseph	5	0.5
Iosco	_	-	Sanilac	7	0.7
Iron	-	-	Schoolcraft	_	-
Isabella	5	0.5	Shiawassee	14	1.4
Jackson	8	0.8	Tuscola	1	0.1
Kalamazoo	6	0.6	Van Buren	3	0.3
Kalkaska	1	0.1	Washtenaw	13	1.3
Kent	29	2.9	Wavne	158	16.1
		,	Wexford	-	-
			TOTAL	984*	100.0

\*County was unknown for 22 adults.

## Table 7. Distribution of Adults with Blood Lead Levels (BLLs) ≥25 μg/dL in Michigan by County of Residence: 1999

<b>County</b>	<u>Number</u>	<b>Percent</b>	<u>County</u>	<u>Number</u>	<b>Percent</b>
Alcona	-	-	Keweenaw	-	-
Alger	-	-	Lake	-	-
Allegan	-	-	Lapeer	1	0.4
Alpena	1	0.4	Leelanau	-	-
Antrim	-	-	Lenawee	1	0.4
Arenac	-	-	Livingston	-	-
Baraga	4	1.5	Luce	-	-
Barry	-	-	Mackinac	1	0.4
Bay	2	0.7	Macomb	14	5.2
Benzie	-	-	Manistee	-	-
Berrien	5	1.9	Marquette	-	-
Branch	1	0.4	Mason	-	-
Calhoun	2	0.7	Mecosta	-	-
Cass	-	-	Menominee	-	-
Charlevoix	-	-	Midland	-	-
Cheboygan	-	-	Missaukee	-	-
Chippewa	4	1.5	Monroe	-	-
Clare	-	-	Montcalm	20	7.4
Clinton	2	0.7	Montmorency	-	-
Crawford	-	-	Muskegon	37	13.7
Delta	-	-	Newaygo	-	-
Dickinson	-	-	Oakland	7	2.6
Eaton	2	0.7	Oceana	2	0.7
Emmet	1	0.4	Ogemaw	-	-
Genesee	10	3.7	Ontonagon	3	1.1
Gladwin	-	-	Osceola	-	-
Gogebic	-	-	Oscoda	-	-
Grand Traverse	-	-	Otsego	-	-
Gratiot	5	1.9	Ottawa	9	3.3
Hillsdale	-	-	Presque Isle	-	-
Houghton	-	-	Roscommon	-	-
Huron	-	-	Saginaw	5	1.9
Ingham	10	3.7	Saint Clair	42	15.6
Ionia	18	6.7	Saint Joseph	-	_
Iosca	-	-	Sanilac	4	1.5
Iron	-	-	Schoolcraft	-	_
Isabella	1	0.4	Shiawassee	3	1.1
Jackson	5	1.9	Tuscola	-	
Kalamazoo	2	0.7	Van Buren	1	0.4
Kalkaska	- 1	0.4	Washtenaw	2	0.7
Kent	7	2.6	Wavne	35	13.0
	,		Wexford	-	-
			TOTAL	270*	100.0

\*County was unknown for 3 adults.

## Table 8. Percentage\* of Adults with Blood Lead Levels (BLLs) ≥10 μg/dL in Michigan by County of Residence: 1999

<u>County</u>	<u>Number</u>	<b>Percent</b>	<b>County</b>	<u>Number</u>	<b>Percent</b>
Alcona			Keweenaw	1	100.0
Alger	1	25.0	Lake	-	-
Allegan	-	-	Lapeer	4	7.7
Alpena	3	16.7	Leelanau	1	14.3
Antrim	-	-	Lenawee	1	1.0
Arenac	-	-	Livingston	4	7.3
Baraga	5	41.7	Luce	1	33.3
Barry	1	4.5	Mackinac	3	7.7
Bay	8	8.6	Macomb	54	10.1
Benzie	1	-	Manistee	2	6.5
Berrien	13	10.0	Marquette	-	-
Branch	3	13.6	Mason	2	10.0
Calhoun	4	3.0	Mecosta	-	-
Cass	1	12.5	Menominee	-	-
Charlevoix	1	4.8	Midland	4	8.2
Cheboygan	2	8.7	Missaukee	1	4.5
Chippewa	15	22.1	Monroe	9	4.0
Clare	1	1.9	Montcalm	68	51.9
Clinton	41	43.2	Montmorency	-	-
Crawford	-	-	Muskegon	70	16.1
Delta	1	4.2	Newaygo	1	3.3
Dickinson	-	-	Oakland	46	5.4
Eaton	7	11.1	Oceana	2	11.1
Emmet	3	8.3	Ogemaw	1	20.0
Genesee	32	6.4	Ontonagon	9	40.9
Gladwin	-	-	Osceola	1	11.1
Gogebic	2	33.3	Oscoda	-	-
Grand Traverse	2	2.2	Otsego	1	2.6
Gratiot	17	32.7	Ottawa	19	13.2
Hillsdale	5	21.7	Presque Isle	1	16.7
Houghton	-	-	Roscommon	-	-
Huron	6	22.2	Saginaw	14	6.5
Ingham	79	14.0	Saint Clair	104	35.0
Ionia	56	44.8	Saint Joseph	5	18.5
Iosco	-	-	Sanilac	7	18.4
Iron	-	-	Schoolcraft	-	-
Isabella	5	12.8	Shiawassee	14	21.5
Jackson	8	7.4	Tuscola	1	4.0
Kalamazoo	6	3.4	Van Buren	3	6.0
Kalkaska	1	11.1	Washtenaw	13	4.4
Kent	29	11.0	Wayne	158	9.1
			Wexford	-	
			TOTAL	984**	11.4

\*Denominator used was the total number of adults tested for blood lead within each county (Table 5).

\*\*County was unknown for 22 adults.

## Table 9. Percentage\* of Adults with Blood Lead Levels (BLLs) ≥25 μg/dL in Michigan by County of Residence: 1999

<b>County</b>	<u>Number</u>	<b>Percentage</b>	<u>County</u>	<u>Number</u>	<b>Percentage</b>
Alcona	-	-	Keweenaw	-	-
Alger	-	-	Lake	-	-
Allegan	-	-	Lapeer	1	1.9
Alpena	1	5.6	Leelanau	-	-
Antrim	-	-	Lenawee	1	1.0
Arenac	-	-	Livingston	-	-
Baraga	4	33.3	Luce	-	-
Barry	-	-	Mackinac	1	2.6
Bay	2	2.2	Macomb	14	2.6
Benzie	-	-	Manistee	-	-
Berrien	5	3.8	Marquette	-	-
Branch	1	4.5	Mason	-	-
Calhoun	2	1.5	Mecosta	-	-
Cass	-	-	Menominee	-	-
Charlevoix	-	-	Midland	-	-
Cheboygan	-	-	Missaukee	-	-
Chippewa	4	5.9	Monroe	-	-
Clare	-	-	Montcalm	20	15.3
Clinton	2	2.1	Montmorency	-	-
Crawford	-	-	Muskegon	37	8.5
Delta	-	-	Newaygo	-	-
Dickinson	-	-	Oakland	7	0.8
Eaton	2	3.2	Oceana	2	11.1
Emmet	1	2.8	Ogemaw	-	-
Genesee	10	2.0	Ontonagon	3	13.6
Gladwin	-	-	Osceola	-	-
Gogebic	-	-	Oscoda	-	-
Grand Traverse	-	-	Otsego	-	-
Gratiot	5	9.6	Ottawa	9	6.3
Hillsdale	-	-	Presque Isle	-	-
Houghton	-	-	Roscommon	-	-
Huron	-	-	Saginaw	5	2.3
Ingham	10	1.8	Saint Clair	42	14.1
Ionia	18	14.4	Saint Joseph	-	-
Iosco	-	-	Sanilac	4	10.5
Iron	-	-	Schoolcraft	-	-
Isabella	1	2.6	Shiawassee	3	4.6
Jackson	5	4.6	Tuscola	-	-
Kalamazoo	2	1.1	Van Buren	1	2.0
Kalkaska	1	11.1	Washtenaw	2	0.7
Kent	7	2.7	Wayne	35	2.0
			Wexford	-	-
			TOTAL	270**	3.1

\*Denominator used was the total number of adults tested for blood lead within each county (Table 5).

\*\*County was unknown for 3 adults.

## Table 10. Annual Incidence of Blood Lead Levels (BLLs) ≥10 ug/dL Among Women in Michigan by County of Residence: 1999

	Number	Michigan	Rate per
<b>County</b>	<b>Reported</b>	<b>Population Women</b>	100,000 women
Alger	1	3,377	30
Clinton	2	21,995	9
Genesee	1	171,668	1
Hillsdale	2	16,854	12
Ingham	3	116,067	3
Ionia	1	19,544	5
Isabella	1	22,941	4
Kent	3	195,307	2
Macomb	2	294,538	1
Mason	1	10,178	10
Montcalm	1	19,511	5
Muskegon	7	61,686	11
Oakland	7	440,572	2
Ottawa	5	70,929	7
Saginaw	1	85,172	1
Saint Clair	2	57,248	3
Shiawassee	1	27,194	4
Van Buren	1	26,983	4
Wayne	11	861,959	1
TOTAL	53 *	3,712,439	* 1 ***

\*Gender was unknown for 1 adult and county was unknown for 1 female adult.

\*\*Total number of women in all 83 counties of Michigan age 16+ years; 1990 US. Census population data. \*\*\*Rate per 100,000 women, age 16+ years.

## Table 11. Annual Incidence of Blood Lead Levels (BLLs) ≥10 ug/dL Among Men in Michigan by County of Residence: 1999

	Number	Michigan	Rate per
<b>County</b>	<b>Reported</b>	<b>Population Men</b>	<u>100,000 Men</u>
Alpena	3	11,194	27
Baraga	5	3,040	164
Barry	1	18,651	5
Bay	8	40,726	20
Benzie	1	4,676	21
Berrien	13	57,584	23
Branch	3	14,851	20
Calhoun	4	49,100	8
Cass	1	18,187	5
Charlevoix	1	7,848	13
Cheboygan	2	7,829	26
Chippewa	15	15,524	97
Clare	1	9,133	11
Clinton	39	21,118	185
Delta	1	13,715	7
Eaton	7	33,625	21
Emmet	3	9,043	33
Genesee	31	151,753	20
Gogebic	2	7,098	28
Grand Traverse	2	23,175	9
Gratiot	17	14,078	121
Hillsdale	3	15,665	19
Huron	6	12,771	47
Ingham	76	104,140	73
Ionia	55	23,154	238
Isabella	4	20,414	20
Jackson	8	58,480	14
Kalamazoo	6	82,532	7
Kalkaska	1	4,914	20
Kent	26	176,836	15
Keweenaw	1	676	148
Lapeer	4	27,394	15
Leelanau	1	6,219	16
Lenawee	1	33,298	3
Livingston	4	43,352	9
Luce	1	2,094	48
Mackinac	3	4,014	75
Macomb	52	270,303	19
Manistee	2	8,045	25
Mason	1	9,342	11
Midland	4	27.812	14

## Table 11. Annual Incidence of Blood Lead Levels (BLLs) ≥10 ug/dL Among Men in Michigan by County of Residence: 1999

	Number	Michigan	Rate per
<u>County</u>	<b>Reported</b>	<b>Population Men</b>	100,000 Men
Missaukee	1	4,363	23
Monroe	9	48,450	19
Montcalm	67	20,116	333
Muskegon	63	57,143	110
Newaygo	1	13,609	7
Oakland	39	404,134	10
Oceana	2	8,062	25
Ogemaw	1	6,832	15
Ontonagon	9	3,543	254
Osceola	1	7,208	14
Otsego	1	6,469	15
Ottawa	14	67,092	21
Presque Isle	1	5,180	19
Saginaw	13	74,145	18
Saint Clair	102	52,442	195
Saint Joseph	5	20,985	24
Sanilac	7	14,495	48
Shiawassee	13	25,031	52
Tuscola	1	20,242	5
Van Buren	2	24,797	8
Washtenaw	13	111,653	12
Wayne	147	743,467	20
TOTAL	931 *	3,391,310	** 27 ***

\*Gender was unknown for 1 adult and county was unknown for 20 male adults.

\*\*Total number of men in all 83 counties of Michigan age 16+ years; 1990 US. Census population data. \*\*\*Rate per 100,000 men, age 16+ years.

## Table 12. Distribution of Industry Among Adults in Michiganby Blood Lead Level (ug/dL): 1999

Standard Industrial Classification (SIC)	<10 ug/dL	10-24 ug/dL	25-39 ug/dL	40-49 ug/dL	50-59 ug/dL	60+ ug/dL	Total	% 25+ ug/dL
AGRICULTURE (01-07)	4	1	0	0	0	0	5	0.0
<b>CONSTRUCTION AND MINING (10-17)</b>	376	111	51	5	3	0	546	10.8
Mining (10-14)	8	0	0	0	0	0	8	0.0
Other Construction (15-16)	6	2	0	0	0	0	8	0.0
Special Trade Construction (17)	362	109	51	5	3	0	530	11.1
MANUFACTURING (20-39)	532	332	132	23	2	2	1,023	15.5
Food (20)	3	0	0	0	0	0	3	0.0
Apparel Made from Fabric (23)	1	0	0	0	0	0	1	0.0
Lumber and Wood (24)	2	0	0	0	0	0	2	0.0
Furniture and Fixtures (25)	3	3	0	0	0	0	6	0.0
Printing (27)	15	1	0	0	0	0	16	0.0
Chemicals (28)	121	1	0	0	0	0	122	0.0
Rubber (30)	4	4	0	0	0	0	8	0.0
Other Nondurables (31)	1	0	0	0	0	0	1	0.0
Stone/Clay/Glass(32)	23	3	3	0	0	0	29	10.3
Primary Metals (33)	83	149	100	20	1	1	354	34.5
Metal Fabrication (34)	75	132	19	2	0	0	228	9.2
Machinery (35)	21	9	5	1	0	0	36	16.7
Electronics (36)	26	4	1	0	0	0	31	3.2
Transportation (37)	140	20	3	0	1	1	165	3.0
Measuring Instruments (38)	6	0	0	0	0	0	6	0.0
Miscellaneous Mfg Industries (39)	8	6	1	0	0	0	15	6.7
TRANSP., & PUBLIC UTILITIES (40-49)	168	28	5	0	0	0	201	2.5
WHOLESALE AND RETAIL TRADE (50-59)	78	11	5	0	1	0	95	6.3
Wholesale-Durable Goods (50)	30	6	0	0	0	0	36	0.0
Building Materials (52)	2	1	0	0	0	0	3	0.0
General Merchandise Stores (53)	10	0	0	0	0	0	10	0.0
Food Stores (54)	4	0	0	0	0	0	4	0.0
Automotive Dealers, Gasoline Services (55)	5	4	5	0	1	0	15	40.0
Miscellaneous Apparel, Accessory Stores (56)	2	0	0	0	0	0	2	0.0
Eating and Drinking Places (58)	18	0	0	0	0	0	18	0.0
Other Retail Trade (59)	7	0	0	0	0	0	7	0.0

## Table 12. Distribution of Industry Among Adults in Michiganby Blood Lead Level (ug/dL): 1999

Standard Industrial Classification (SIC)	<10 ug/dL 10-2	24 ug/dL 25-3	39 ug/dL 40-4	9 ug/dL 50-59	ug/dL 6	60+ ug/dL	Total % 2	25+ ug/dL
FINANCE, INSURANCE, REAL ESTATE (60-67)	8	1	0	0	0	0	9	0.0
<b>SERVICES (70-89)</b>	287	58	11	1	1	0	358	3.6
Hotels (70)	5	0	0	0	0	0	5	0.0
Business (73)	17	1	0	0	0	0	18	0.0
Automotive Repair (75)	3	22	8	1	0	0	34	26.5
Repair (76)	1	3	2	0	0	0	6	33.3
Recreation (79)	4	4	0	0	0	0	8	0.0
Health (80)	65	2	0	0	0	0	67	0.0
Education (82)	44	7	1	0	0	0	52	1.9
Social Services (83)	5	1	0	0	0	0	6	0.0
Engineering Services (87)	133	18	0	0	1	0	152	0.7
Other Services (72, 84, 86, 88)	10	0	0	0	0	0	10	0.0
PUBLIC ADMINISTRATION (91-97)	123	23	2	0	0	0	148	1.4
General Government (91)	38	6	0	0	0	0	44	0.0
Police (92)	28	16	2	0	0	0	46	4.3
Public Finance (93)	1	1	0	0	0	0	2	0.0
Human Resources (94)	6	0	0	0	0	0	6	0.0
Environmental Quality (95)	31	0	0	0	0	0	31	0.0
Admin. Of Economic Programs (96)	1	0	0	0	0	0	1	0.0
Military (97)	18	0	0	0	0	0	18	0.0
TOTAL	1,576	565	206	29	7	2	2,385*	10.2

\*Industry was unknown for 7,084 adults. Fifteen adults with a source of lead exposure known to be non-work related were excluded.

## Table 13. Inspection Status of Sixty Companies that were Identified from a Blood Lead Report of ≥25 μg/dL in Michigan, 10-15-1997 to 03-01-2000

Inspection Status	<u>Number</u>	<b>Percent</b>
Completed Inspections	35	58
Scheduled for Inspection	18	30
No Follow-Up Planned	6 *	10
Closed	1	2
Total	60	100

\*No follow-up planned: out of jurisdiction (3 companies), work completed (2 companies), self employed – referred to OSHA Consultation (1 company).

## Table 14. Results of Thirty-Five Companies that were Inspected from a Blood Lead Report of ≥25 μg/dL in Michigan, 10-15-1997 to 03-01-2000

Inspection Results	<u>Number</u>	Percent
Cited for Lead Standard Violation(s) Only	4	11.4
Cited for Lead Standard and Other Violation(s)	20	57.1
Cited for Non-Lead Standard Violation(s) Only	6	17.1
Not Cited for any Violation(s)	5 *	14.3
Total	35	99.9 **

\*For two companies, source of elevated blood lead determined not to be related to inspected company.

<sup>\*\*</sup>Percentages do not add to 100% due to rounding.

## Table 15. Thirty-Five Companies Inspected Resulting from Michigan Adults with Blood Lead Levels (BLLs) of ≥25 µg/dL, Interviewed from 10-15-1997 to 03-01-2000

	Comm	ania	Cited for	Cited for Violation			
Industry (SIC)*	Number	<u>Percent</u>	or Lead S <u>Number</u>	<u>Percent</u>			
Construction (15-17)							
Other Construction (16)	1	2.9	1	100			
Special Trade Construction (17)	7	20.0	5	71			
Manufacturing (20-39)							
Printing (27)	1	2.9	1	100			
Primary Metals (33)	4	11.4	3	75			
Metal Fabrication (34)	6	17.1	2	33			
Machinery (35)	1	2.9	1	100			
Electronics (36)	1	2.9	1	100			
Transportation (37)	4	11.4	2	50			
Services (70-89)							
Automotive Repair (75)	5	14.3	4	80			
Repair (76)	2	5.7	2	100			
Recreation (79)	1	2.9	1	100			
Education (82)	1	2.9	1	100			
Government (91-97)							
Human Resources (94)	1	2.9	-	-			
Total	35	100.2 *	** 24	*** 69			

\*Standard Industrial Classification.

\*\*Percentages do not add to 100% due to rounding.

\*\*\*Eleven companies were not cited in violation of the Lead Standard.

## Table 16. Median and Range for All Citations and Penalties andLead Related Citations and Penalties by Group, Michigan

	Group I (7	) (≥50 Φg/dl)	Group II (6) (40-49 Φg/dl)		Group III (10) (30-39Φg/dl)		Group IV (8) (No Blood Lead Reports)	
Median and Range for all Citations	8.00	(1-18)	5.00	(0-28)	6.50	(0-12) (P=.44)	0.50	(0-6)
Median and Range for all Penalties	\$1,750	(\$0-\$8,000)	\$1,225	(\$0-\$10,500)	\$488	(\$0-\$15,750) (P=.80)	\$0	(\$0-\$875)
Median and Range for all Penalties per Citation	\$146	(\$0-563)	\$246	(\$0-\$750)	\$75	(\$0-\$1,431) (P=.78)	\$0	(\$0-\$146)
Median and Range for Lead- Related Citations	5.00	(0-14)	1.00	(0-23)	4.50	(0-11) (P=.45)	0	(0-3)
Median and Range for Lead- Related Penalties	\$1,500	(\$0-\$8,000)	\$350	(\$0-\$8,000)	\$188	(\$0-7,875) (P=.66)	\$0	(\$0-\$875)
Median and Range for Penalties per Lead-Related Citations	\$250	(\$115-\$750)	\$370	(\$350-\$1100)	\$282	(\$0-\$1313) (P=.50)	\$0	(\$0-292)

## Table 17. Number and Percentage of Companies which ViolatedSpecific Provisions of the Lead Standard by Group, Michigan

Specific Lead Rules	Group I (7 #	$(\geq 50 \Phi g/dl)$ %	Group II (6) #	) (40-49 <b>Φ</b> g/dl) %	Group III (1 #	0) (30-39 <b>Φ</b> g/dl) %	Group IV ( #	<ul><li>(No Blood Lead Reports)</li><li>%</li></ul>	
1: Airborne Concentrations (R325.51903-4)	2	28.6	0	0	4	40.0	0	0	
2: Exposure Monitoring (R325.51905-13)	6	85.7	3	50.0	5	50.0	0	0	
3: Methods (R325.51914-16b)	4	57.1	1	16.7	4	40.0	1	12.5	
4: Respiratory Protection (R325.51917-21)	2	28.6	1	16.7	1	10.0	0	0	
5: Protective Clothing (R325.51922-24)	3	42.9	1	16.7	4	40.0	0	0	
6: Housekeeping (R325.51925-26)	4	57.1	2	33.3	3	30.0	2	25.0	
7: Hygiene (R325.51928-31a)	2	28.6	1	16.7	3	30.0	0	0	
8: Medical Monitoring (R325.51932-48)	5	71.4	2	33.3	5	50.0	0	0	
9: Information & Training (R325.51949-50b)	4	57.1	2	33.3	4	40.0	3	37.5	
10: Record Keeping (R325.51951-58)	1	14.3	1	16.7	1	10.0	1	12.5	
Any Lead Rule	6	85.7	3	50.0	6	60.0	3	37.5	

# Table 18. Comparison of Median Penalty, Number of Citations,<br/>Penalties Per Citation by Group in Comparison to Control<br/>Companies Matched by SIC Code, Michigan

	Groups I, II and III combined	Control	Group I (7) (≥ 50 Φg/dl)	Control	Group II (6) (40-49 Φg/dl)	Control	Group III (10) (30-39Φg/dl)	Control	Group IV (8) ( No Blood Lead Reports)	Control
Median and Range for All Penalties	\$1500 (\$0-15,750)	\$665 (P=.001)	\$1,750 (\$0-\$8,000)	\$0 (\$0-\$9,100) (P=.01)	\$1,225 (\$0-\$10,500)	\$0 (\$0-\$2,400) (P=.09)	\$488 (\$0-\$15,750)	\$0 (\$0-\$3,650) (P=.17)	\$0 (\$0-\$875)	\$0 (\$0-\$4,200) (P=.09)
Median and Range for All Citations	7.00 (0-28)	2.96 (P=.001)	8.00 (1-18)	3.00 (0-30) (P=.02)	5.00 (0-23)	1.00 (0-6) (P=.12)	6.50 (0-12)	2.00 (0-20) (P=.08)	0.50 (0-6)	1.50 (0-7) (P=.38)
Median and Range for All Penalties per Citation	\$117 (\$0-\$1432)	\$179 (P=.008)	\$146 (\$0-\$563)	\$0 (\$0-\$763) (P=.03)	\$246 (\$0-\$750)	\$0 (\$0-\$2,400) (P=.22)	\$75 (\$0-1,431)	\$0 (\$0-\$1,225) (P=.33)	\$0 (\$0-\$146)	\$0 (\$0-\$1,375) (P=.08)

## Table 19. Blood Lead Test Results Before andAfter Inspection by Group, Michigan

	Group I (6) (≥ 50 Pre	Φg/dl)* Post	Group II (3)** ( Pre	(40-49 Φg/dl) Post	Group III (6)*** Pre	(30-39Φg/dl) Post
Individuals Tested for Blood Lead	24	14	73	132	208	150
Number $\geq 25 \Phi g/dl$	16	10	45	82	38	16
Percent $\geq 25\Phi g/dl$	67% (OR=.8, 959	71% % CL .15-4.14)	62% (OR=.98	62% 8, 95% CL .52-1.84)	18% (OR=1.87	11% , 95% CL .96-3.68)
Average Blood Lead ( $\Phi g/dl$ )	51 (P=.02)	29	30 (P=	36 .64)	20 (P=.9	20 97)

\*Results from 6 companies, 1 company closed after inspection.

\*\*Results from 3 companies, 2 companies no lead was found, 3<sup>rd</sup> company no test results received.

\*\*\*Results from 6 companies, 2 companies no lead was found, 1 company closed lead operation, 1 no test results received.
# Table 20. Demographic Characteristics of Michigan Adults with Blood Lead Levels (BLLs) of ≥25 μg/dL, Interviewed from 10-15-1997 to 03-01-2000, by Highest Reported Blood Lead Level (μg/dL)

Demographic	25-29	µg/dL	30-39	µg/dL	40-49	µg/dL	50-59	µg/dL	≥ 60 µ	ıg/dL	TOT	TAL	Chi
<u>Characteristics</u>	<u>Number</u>	Percent	<u>Square</u>										
Male	59	(98.3)	130	(95.6)	38	(90.5)	18	(94.7)	6	(100)	251	(95.4)	
Female	1	( 1.7)	6	( 4.4)	4	( 9.5)	1	( 5.3)	-	-	12	( 4.6)	1.08(P=0.299)
Hispanic origin	2	( 3.6)	3	( 2.3)	2	( 4.8)	-	-	-	-	7	( 2.8)	0.23(P=0.635)
White	54	(91.5)	119	(87.5)	34	(81.0)	17	(89.5)	4	(66.7)	228	(86.7)	
African American	4	( 6.8)	13	( 9.6)	6	(14.3)	2	(10.5)	2	(33.3)	27	(10.3)	
Asian/Pacific Islander	-	-	1	( 0.7)	-	-	-	-	-	-	1	( 0.4)	
Native American/Alaskan	-	-	2	(1.5)	-	-	-	-	-	-	2	( 0.8)	
Other	1	(1.7)	1	( 0.7)	2	( 4.8)	-	-	-	-	4	(1.5)	
Average Age	43	(n=60)	43	(n=136)	47	(n=42)	48	(n=19)	36	(n=6)	43	(n=263)	
Ever Smoked	43	(72.9)	92	(78.6)	29	(78.4)	12	(80.0)	5	(100.0)	181	(77.7)	1.47(P=0.225)
Now Smoke	28	(65.1)	66	(71.7)	23	(79.3)	9	(75.0)	4	(80.0)	130	(71.8)	1.51(P=0.219)

# Table 21. Symptoms of Michigan Adults with Blood Lead Levels (BLLs) of ≥25 μg/dL, Interviewed from 10-15-1997 to 03-01-2000, by Highest Reported Blood Lead Level (μg/dL)

	25-29	ug/dL	30-39	ug/dL	40-49 (	ug/dL	50-59 j	lg/dL	≥ 60 µ	lg/dL	тот	AL	Chi
<u>Symptoms</u>	<u>Number</u>	Percent	Number	Percent	<u>Number</u>	Percent	<u>Number</u>	Percent	Number	Percent	Number	Percent	<u>Square</u>
CASTDO INTESTINAI													
GASTRO-INTESTINAL	2	(52)	17	(12.0)	10	(29.6)	2	(17.6)			25	(12.0)	4.20(D=0.026)
Lost 10+ lbs without diet	3	(5.2)	17	(12.9)	12	(28.0)	3	(17.0)	-	-	35	(15.8)	4.39(P=0.030) 7 55(P=0.006)
Continued loss of appetite	3	(5.0)	22	(16.3)	10	(23.8)	4	(21.1)	2	(33.3)	41	(15.0)	7.53(P=0.000)
Pains in belly	/	(11.7)	21	(15.6)	14	(33.3)	5	(27.8)	-	-	47	(18.0)	5.54(P=0.067)
MUSCULOSKELETAL													
Frequent pain/soreness	16	(27.1)	52	(38.5)	26	(63.4)	8	(44.4)	3	(50.0)	105	(40.5)	7.79(P=0.005)
Muscle weakness	7	(12.1)	31	(23.3)	17	(40.5)	7	(38.9)	3	(50.0)	65	(10.3)	13.1(P=0.000)
Musele weakless	/	(12.1)	51	(23.3)	17	(40.5)	1	(30.7)	5	(30.0)	05	(23.3)	
NERVOUS													
Headaches	5	(8.3)	29	(21.6)	15	(35.7)	6	(31.6)	1	(16.7)	56	(21.5)	7.41(P=0.006)
Dizziness	2	(3.3)	7	(5.3)	7	(16.7)	2	(11.1)	1	(16.7)	19	(7.4)	5.69(P=0.017)
Depressed	5	(8.6)	22	(16.8)	6	(14.6)	6	(31.6)	3	(50.0)	42	(16.5)	7.89(P=0.005)
Tired	20	(33.9)	73	(54.9)	29	(70.7)	11	(57.9)	4	(66.7)	137	(53.1)	9.28(P=0.002)
Nervous	4	(6.7)	23	(17.3)	10	(23.8)	5	(27.8)	2	(33.3)	44	(17.0)	7.99(P=0.005)
Waking up at night	11	(18.3)	46	(34.6)	17	(40.5)	9	(47.4)	4	(66.7)	87	(33.5)	10.7(P=0.001)
Nightmares	-	-	6	(4.5)	4	(9.8)	-	-	-	-	10	(3.9)	0.80(P=0.373)
Irritable	11	(19.0)	42	(31.6)	18	(43.9)	8	(44.4)	3	(50.0)	82	(32.0)	8.46(P=0.004)
Unable to concentrate	5	( 8.6)	29	(21.6)	9	(22.0)	3	(15.8)	1	(16.7)	47	(18.2)	1.04(P=0.307)
REPRODUCTIVE													
Unable to have an erection	1	(1.7)	7	( 5.8)	3	(8.1)	2	(11.8)	-	-	13	(5.5)	1.68(P=0.195)
Trouble having a child	4	(7.0)	6	( 4.8)	-	-	-	-	-	-	10	(4.1)	3.44(P=0.064)
Gastro-Intestinal Symptoms	8	(13.3)	38	(28.1)	20	(47.6)	9	(47.4)	2	(33.3)	77	(29.4)	13.1(P=0.000)
Musculoskeletal Symptoms	17	(28.8)	59	(43.7)	28	(66.7)	9	(50.0)	4	(66.7)	117	(45.0)	10.8(P=0.001)
Nervous Symptoms	28	(46.7)	91	(67.9)	32	(76.2)	15	(78.9)	4	(66.7)	170	(65.1)	8.75(P=0.003)
Reproductive Symptoms	5	(8.3)	13	( 9.8)	3	(7.5)	2	(10.5)	-	-	23	( 8.9)	0.08(P=0.778)
Any Symptoms	37	(61.7)	99	(73.3)	35	(83.3)	18	(94.7)	4	(66.7)	193	(73.7)	7.35(P=0.007)
Average Number Symptoms	1.7	(n=60)	3.2	(n=135)	4.7	(n=42)	4.2	(n=19)	4.5	(n=6)	3.2	(n=262)	
		<u> </u>		. ,		` '		` '		``'		. ,	

# Table 22. Lead Related Health Conditions of Michigan Adults with Blood Lead Levels (BLLs) of ≥25 μg/dL, Interviewed from 10-15-1997 to 03-01-2000, by Highest Reported Blood Lead Level (μg/dL)

	25-29	ug/dL	30-39	ug/dL	40-49	ug/dL	50-59	µg/dL	<u>&gt;</u> 60 µ	.g/dL	TOT	AL	Chi
Lead Related Disease	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>	<u>Square</u>
Anemia	1	( 1.7)	1	( 0.8)	1	( 2.4)	2	(10.5)	-	-	5	( 2.0)	2.37(P=0.124)
Kidney Disease	-	-	23	(1.5)	1	( 2.4)	-	-	-	-	3	( 1.2)	0.11(P=0.738)
High Blood Pressure	3	( 5.0)	21	(16.2)	7	(17.9)	3	(16.7)	-	-	34	(13.4)	1.20(P=0.273)

# Table 23. Industry of Michigan Adults with Blood Lead Levels (BLLs) of ≥25 μg/dL, Interviewed from 10-15-1997 to 03-01-2000, by Highest Reported Blood Lead Level (μg/dL)

	25-29	ug/dL	30-39	µg/dL	40-49	µg/dL	50-59	ug/dL	<u>&gt; 60 µ</u>	lg/dL	ТОТ	AL
Industry (SIC Code*)	Number	Percent	<u>Number</u>	Percent	<u>Number</u>	Percent	Number	Percent	Number	Percent	<u>Number</u>	<b>Percent</b>
			1								1	(0,1)
Mining (13)	-	-	1	( 0.7)	-	-	-	-	-	-	1	(0.4)
Other Construction (15)	1	(1.7)	-	-	-	-	-	-	-	-	1	( 0.4)
Special Trade Construction (17)	11	(18.3)	35	(25.7)	13	(31.0)	7	(36.8)	4	(66.7)	70	(26.6)
Printing and Publishing (27)	-	-	1	( 0.7)	-	-	-	-	-	-	1	( 0.4)
Stone/Clay/Glass (32)	-	-	4	(2.9)	-	-	-	-	-	-	4	(1.5)
Foundries (33)	26	(43.3)	65	(47.8)	16	(38.1)	6	(31.6)	2	(33.3)	115	(43.7)
Fabricated Metal Products (34)	8	(13.3)	10	(7.4)	5	(11.9)	-	-	-	-	23	( 8.7)
Machinery (35)	1	(1.7)	2	(1.5)	1	(2.4)	2	(10.5)	-	-	6	(2.3)
Electronics (36)	1	(1.7)	-	-	-	-	-	-	-	-	1	( 0.4)
Automobile (37)	1	(1.7)	3	(2.2)	2	( 4.8)	-	-	-	-	6	(2.3)
Other Durables (39)	1	(1.7)	1	(1.7)	-	-	-	-	-	-	2	( 0.8)
Transportation, Utilities (40)	1	(1.7)	1	( 0.7)	-	-	-	-	-	-	2	( 0.8)
Transportation, Utilities (49)	2	(3.3)	2	(1.5)	-	-	-	-	-	-	4	(1.5)
Automotive Repair (75)	4	( 6.7)	2	(1.5)	2	( 4.8)	3	(15.8)	-	-	11	( 4.2)
Repair (76)	-	-	1	(0.7)	-	-	-	-	-	-	1	(0.4)
Recreation (79)	-	-	1	(0.7)	-	-	-	-	-	-	1	(0.4)
Education (82)	1	(1.7)	1	(0.7)	-	-	-	-	-	-	2	(0.8)
Engineering Services (87)	-	-	1	(0.7)	-	-	-	-	-	-	1	(0.4)
Police (92)	2	(3.3)	-	-	-	-	-	-	-	-	2	(0.8)
Human Resources (94)	-	-	1	(0.7)	-	-	-	-	-	-	1	(0.4)
Military (97)	-	-	1	(0.7)	-	-	-	-	-	-	1	(0.4)
Unknown	-	-	3	(2.2)	3	(7.1)	1	( 5.3)	-	-	7	(2.7)
TOTAL	60	(100)	136	(100)	42	(100)	19	(100)	6	(100)	263	(100)

\*Standard Industrial Classification.

# Table 24. Number of Years Worked of Michigan Adults with Blood Lead Levels (BLLs) of ≥25 μg/dL, Interviewed from 10-15-1997 to 03-01-2000, by Highest Reported Blood Lead Level (μg/dL)

Number of <u>Years Worked</u>	25-29 <u>Number</u>	µg/dL <u>Percent</u>	30-39 <u>Number</u>	µg/dL <u>Percent</u>	40-49   <u>Number</u>	µg/dL <u>Percent</u>	50-59   <u>Number</u>	µg/dL <u>Percent</u>	<u>&gt;</u> 60 μ <u>Number</u>	.g/dL <u>Percent</u>	TOT <u>Number</u>	AL <u>Percent</u>	Chi <u>Square</u>
<u>&lt;</u> 5	32	(56.1)	58	(44.6)	22	(56.4)	10	(58.8)	4	(66.7)	126	(50.6)	
6 – 10	12	(21.1)	19	(14.6)	5	(12.8)	5	(29.4)	1	(16.7)	42	(16.9)	
11 - 20	9	(15.8)	25	(19.2)	6	(15.4)	1	( 5.9)	1	(16.7)	42	(16.9)	
21 - 30	4	(7.0)	23	(17.7)	2	( 5.1)	1	(5.9)	-	-	30	(12.0)	
<u>&gt;</u> 31	-	-	5	( 3.8)	4	(10.3)	-	-	-	-	9	( 3.6)	0.22(P=0.637)

# Table 25. Working Conditions Reported by Michigan Adults with Blood Lead Levels (BLLs) of ≥25 μg/dL, Interviewed from 10-15-1997 to 03-01-2000, by Highest Reported Blood Lead Level (μg/dL)

	25-29	µg/dL	30-39	µg/dL	40-49	ug/dL	50-59	µg/dL	<u>&gt; 60 µ</u>	lg∕dL	ТОТ	AL	Chi
Working Conditions	<u>Number</u>	<b>Percent</b>	<u>Number</u>	<b>Percent</b>	<u>Number</u>	Percent	<u>Number</u>	<b>Percent</b>	<u>Number</u>	Percent	<u>Number</u>	Percent	<u>Square</u>
Separate lockers: dirty and clean*	45	(76.3)	91	(74.0)	24	(61.5)	14	(77.8)	2	(40.0)	176	(72.1)	2.05(P=0.152)
Work clothes laundered: work*	38	(63.3)	82	(64.6)	20	(51.3)	8	(44.4)	1	(16.7)	149	(59.6)	7.01(P=0.008)
Shower facility*	42	(72.4)	103	(82.4)	22	(56.4)	9	(52.9)	3	(60.0)	179	(73.4)	5.56(P=0.018)
Lunch room*	45	(77.6)	106	(84.8)	25	(64.1)	10	(55.6)	1	(20.0)	187	(76.3)	12.1(P=0.001)
Clean off dust and wash	52	(88.1)	118	(93.7)	31	(81.6)	16	(88.9)	5	(100)	222	(90.2)	0.06(P=0.803)
Eat in lunchroom*	36	(70.6)	70	(60.9)	20	(52.6)	6	(33.3)	1	(25.0)	133	(58.8)	10.0(P=0.002)
Wear respirator*	40	(69.0)	98	(78.4)	29	(74.4)	11	(61.1)	5	(100)	183	(74.7)	0.11(P=0.740)
Smoke in work area**	18	(64.3)	46	(67.6)	11	(47.8)	4	(44.4)	3	(75.0)	82	(62.1)	1.09(P=0.296)
Keep cigarettes in pocket while working**	9	(31.0)	34	(50.0)	9	(39.1)	1	(11.1)	3	(75.0)	56	(42.1)	0.03(P=0.869)
Exposed to Lead now*	40	(70.2)	92	(74.8)	22	(64.7)	13	(76.5)	2	(40.0)	169	(71.6)	0.52(P=0.471)
Removal from job*	4	( 6.8)	16	(12.9)	9	(24.3)	6	(33.3)	2	(40.0)	37	(15.2)	12.7(P=0.000)

\*Based on positive questionnaire responses.

\*\*Based on negative questionnaire responses.

# Table 26. Changes in Response to Questions on Working Conditions in FacilitiesBefore and After a MIOSHA Enforcement Inspection

			Stat	tus of Work	ing Condit	ions	
	Number of	Bet	ter	No Cl	nange	Wo	rse
Working Conditions	<b>Facilities</b>	<u>Number</u>	<b>Percent</b>	<u>Number</u>	Percent	<u>Number</u>	<u>Percent</u>
Separate lockers: dirty and clean*	7	5	(71)	1	(14)	1	(14)
Work clothes laundered: work*	6	3	(50)	1	(17)	2	(33)
Shower facility*	6	4	(67)	0		2	(33)
Lunch room*	5	0		4	(80)	1	(20)
Clean off dust and wash hands before eating*	9	3	(33)	4	(44)	2	(22)
Eat in lunchroom*	5	3	(60)	0		2	(40)
Wear respirator*	8	1	(13)	3	(38)	4	(50)

\*Based on positive questionnaire responses.

# Table 27. Number of Children Potentially Exposed to Take-Home Lead from Michigan Adults with Blood Lead Levels (BLLs) of ≥25 μg/dL, Interviewed from 10-15-1997 to 03-01-2000, by Highest Reported Blood Lead Level (μg/dL)

Children Potentially Exposed	25-29   <u>Number</u>	µg/dL <u>Percent</u>	30-39 <u>Number</u>	µg/dL <u>Percent</u>	40-49 <u> </u> <u>Number</u>	ıg/dL <u>Percent</u>	50-59 <u>j</u> <u>Number</u>	ıg/dL <u>Percent</u>	<u>&gt;</u> 60 μ <u>Number</u>	.g/dL <u>Percent</u>	TOT <u>Number</u>	AL Percent	Chi <u>Square</u>
Children living or spending time in house	19	(31.7)	46	(34.3)	9	(21.4)	7	(36.8)	2	(33.3)	83	(31.8)	0.09(P=0.767)
Children tested for lead	3	(16.7)	9	(20.5)	4	(50.0)	2	(28.6)	1	(50.0)	19	(24.1)	2.39(P=0.122)
Children had elevated lead levels	1	(33.3)	6	(54.5)	2	(66.7)	-	-	1	(100)	10	(50.0)	0.05(P=0.830)

### Figure 1. Distribution of Adults Tested for Blood Lead in Michigan by County of Residence: 1999



**Oakland** and **Wayne** counties had the highest number of adults reported, with 855 and 1,743 adults, respectively.

Figure 2. Distribution of Adults with Blood Lead Levels (BLLs) ≥10 ug/dL in Michigan by County of Residence: 1999



**St. Clair** and **Wayne** counties had the highest number of adults with blood lead levels of 10 ug/dL or greater reported, with 104 and 158 adults, respectively.

Figure 3. Distribution of Adults with Blood Lead Levels (BLLs) ≥25 ug/dL in Michigan by County of Residence: 1999



**Muskegon** and **St. Clair** counties had the highest number of adults with blood lead levels of 25 ug/dL or greater reported, with 37 and 42 adults, respectively.

# Figure 4. Percentage of Adults with Blood Lead Levels (BLLs) ≥10 ug/dL in Michigan by County of Residence: 1999\*



\*Denominator used was the total number of adults tested for blood lead within each county.

Figure 5. Percentage of Adults with Blood Lead Levels (BLLs) ≥25 ug/dL in Michigan by County of Residence: 1999\*



\*Denominator used was the total number of individuals tested for blood lead in each county.

## Figure 6. Annual Incidence of Blood Lead Levels (BLLs) ≥10 ug/dL Among Women in Michigan by County of Residence: 1999\*



\*Rate per 100,000 women age 16+; denominator is the 1990 US. Census population data.

Figure 7. Annual Incidence of Blood Lead Levels (BLLs) ≥10 ug/dL Among Men in Michigan by County of Residence: 1999\*



\*Rate per 100,000 men age 16+; denominator is the 1990 US. Census population data.

Figure 8. Geographic Distribution of Non-Construction Companies Reporting Adults with Blood Lead Levels (BLLs) ≥25 ug/dL in Michigan: 1999





#### DEPARTMENT OF COMMUNITY HEALTH

#### HEALTH LEGISLATION AND POLICY DEVELOPMENT

#### BLOOD LEAD ANALYSIS REPORTING

Filed with the Secretary of State on September 25, 1997. These rules take effect 15 days after filing with the Secretary of State

(By authority conferred on the community public health agency by section 5111 of Act No. 368 of the Public Acts of 1978, as amended, section 8 of Act No. 312 of the Public Acts of 1978, and Executive Reorganization Order No. 1996-1, being §§333.5111 and 325.78, and 330.3101 of the Michigan Compiled Laws)

R 325.9081 Definitions.

Rule 1. (1) As used in these rules:

(a) "Blood lead analysis report form" means the form used to report the required reportable information for blood that has been analyzed for lead.

(b) "Agency" means the community public health agency.

(c) "Physician/provider" means a licensed professional who provides health care services and who is authorized to request the analysis of blood specimens. For this purpose, provider may also mean the local health department.

(2) The term "local health department," as defined in Act No. 368 of the Public Acts of 1978, as amended, being §333.1101 et seq. of the Michigan Compiled Laws, has the same meaning when used in these rules.

325.9082 Reportable information.

Rule 2. (1) Reportable information is specifically related to blood samples submitted to clinical laboratories for lead analysis.

(2) Upon initiating a request for blood lead analysis, the physician/provider ordering the blood lead analysis shall complete the client information (section I) and the physician/provider information (section II) of a blood lead analysis report form designated by the agency or shall complete another similar form that ensures the inclusion of the same required data and shall provide all of the following information:

June 24, 1997

Effective: October 11, 1997

(a) All of the following information with respect to the individual tested:

(i) Name.

(ii) Sex

(iii) Racial/ethnic group.

(iv) Birthdate.

(v) Address, including county.

(vi) Telephone number.

(vii) Social security number and medicaid number, if applicable.

(viii) If the individual is a minor, the name of a parent or guardian and social security number of the parent or guardian.

(ix) If the individual is an adult, the name of his or her employer.

(b) The date of the sample collection.

(c) The type of sample (capillary or venous).

(3) The blood lead analysis report form or a document with the same data shall be submitted with the sample for analysis to a clinical laboratory that performs blood lead analysis.

(4) Upon receipt of the blood sample for lead analysis, the clinical laboratory shall complete the laboratory information (section III) and provide all of the information required and/or submitted by the physician/provider and the following:

(a) The name, address, and phone number of the laboratory.

(b) The date of analysis.

(c) The results of the blood lead analysis in micrograms of lead per deciliter of whole blood rounded to the nearest whole number.

R 325.9083 Reporting responsibilities.

Rule 3. (1) All clinical laboratories doing business in this state that analyze blood samples for lead shall report all blood lead results, rounded to the nearest whole number, for adults and children to the Community Public Health Agency, Childhood Lead Poisoning Prevention Program (CPHA/CLPPP), 3423 N.M.L. King Jr. Blvd., Lansing , MI 48909. Reports shall be made within 5 working days after test completion.

(2) Nothing in this rule shall be construed to relieve a laboratory from reporting results of a blood lead analysis to the physician or other health care provider who ordered the test or to any other entity as required by state, federal, or

local statutes or regulations or in accordance with accepted standard of practice, except that reporting in compliance with this rule satisfies the blood lead reporting requirements of Act No. 368 of the Public Acts of 1978, as amended, being §333.1101 et seq. of the Michigan Compiled Laws.

### R 325.9084 Electronic communications.

Rule 4. (1) A clinical laboratory may submit the data required in R 325.9083 electronically to the agency.

(2) For electronic reporting, upon mutual agreement between the reporting laboratory and the agency, the reporting shall utilize the data format specifications provided by the agency.

R 325.9085 Quality assurance.

Rule 5. For purposes of assuring the quality of submitted data, each reporting entity shall allow the agency to inspect copies of the medical records that will be submitted by the reporting entity to verify the accuracy of the submitted data. Only the portion of the medical record that pertains to the blood lead testing shall be submitted. The copies of the medical records shall not be recopied by the agency and shall be kept in a locked file cabinet when not being used. After verification of submitted data, the agency shall promptly destroy the copies of the medical records.

R 325.9086 Confidentiality of reports.

Rule 6. (1) The agency shall maintain the confidentiality of all reports of blood lead tests submitted to the agency and shall not release reports or any information that may be used to directly link the information to a particular individual, unless the agency has received written consent from the individual, or from the individual's parent or legal guardian, requesting the release of information.

(2) Medical and epidemiological information that is released to a legislative body shall not contain information that identifies a specific individual. Aggregate epidemiological information concerning the public health that is released to the public for informational purposes only shall not contain information that identifies a specific individual.

R 325.9087 Blood lead analysis report form.

Rule 7. The blood lead analysis report form reads as follows:

### MICHIGAN DEPARTMENT OF COMMUNITY HEALTH BLOOD LEAD ANALYSIS REPORT DATA/INFORMATION REQUIRED BY ADMINISTRATIVE RULE #<u>R 325,9082 and R 325,9083</u>

I.	CLIENT I	NEORMATION		
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Last Name	First Name			Initial
Address	City	State	ZIP Code	County
Area Code and Phone Number				
Date of Birth	Patient's Social So	ecurity Number	Does this c □ yes	hild have Medicaid?
Sex	<b>Aale</b>	Race □ Native American (	1)	Ethnic Group
	emale	<ul> <li>□ Asian/Pacific Islan</li> <li>□ Black (3)</li> <li>□ White (5)</li> </ul>	ider (2)	□ Hispanic (1)
Parent/Guardian Name (please print)		□ Multiracial (7)		
Parent/Guardian Social Security Number	<u>х</u> Г х		If Patient is an	adult, list Employer
П.	PHYSICIAN/PROV	IDER INFORMATION	8	- <u>1</u>
Physician or Clinic Name	<del></del> `			
Mailing Address	City		State	Zip Code
Area Code and Phone Number			·	
IIa.	SPECIMEN COLLEC	TION INFORMATIO	N nen	
Specimen Collection Date	Type of Sp	ecimen: 🗆 Capillary	∨□ Venous	
Ш.	LABORATORY Completion require	'INFORMATION d by testing laboratory		
		Specin	nen Number	
BLOOD LEAD LEVEL MICH	OGRAMS PER DECI	LITER Date o	of Analysis	
Laboratory Name	r			
Area Code and Phone Number				
			and the second secon	

MDCH - Childhood Lead Poisoning Prevention Project, 3423 N. M.L. King, Jr. Blvd., Lansing, MI 48909 (517) 335-8885 Fax Number (517) 335-8509 DCH-0395 Leadvciplead.fm 6/98

Authority: Act 368, PA 1978



The Michigan Department of Community Health (MDCH) Childhood Lead Poisoning Prevention Project (CLPPP) works to maintain a surveillance system to monitor all blood lead levels throughout Michigan; to assure screening of children at risk and assure follow-up of children identified with elevated levels; to educate the general public and relevant professionals about lead poisoning; and to collaborate with other government and community-based organizations in the effort to prevent childhood lead poisoning. The project's emphasis is on children less than six years of age.

The surveillance system, a collection of data on all childhood blood lead tests throughout the state, serves several purposes. 1) Cumulative statewide numbers are ascertained for children screened and for elevated levels--by age, area of residence, race, and Medicaid status--and are used for assessment and policy development. 2) All blood lead results for a given county or district are passed on to the appropriate local health department, helping staff to provide essential nursing and environmental health services for children with elevated blood lead (EBL) levels.

At a blood lead level of 10, 15, or 20ug/dL, depending on local protocol, a public health nurse visits the home to assess problems and educate the family on nutrition, hygiene, and other ways to reduce the child's exposure. An environmental health sanitarian inspects the home to assess lead paint and other hazards. Data on these visits and any remediation efforts are then reported back to the state. 3) Data on screening and EBL follow-up efforts are reported to the Centers for Disease Control and Prevention (CDC). Cumulative numbers are reported quarterly, and annual child- and addressspecific data are added (with actual names and addresses replaced by serial ID#s) to the CDC's national Childhood Blood Lead Surveillance (CBLS) database. MDCH CLPPP contributed to the CBLS for the first time with data for 1998, and will soon provide 1999 data.

In March 1999, MDCH CLPPP outlined a "statewide screening plan," as a guidance for physicians deciding whether and when to test children for blood lead. In brief, the plan states that a child should be tested for blood lead at 12 and 24 months of age (or between 36 and 72 months if not tested previously) if he or she 1) is Medicaid-enrolled, or 2) resides in a CLPPP- designate high-risk ZIP code area, or 3) is living in a situation where the answer is "yes" to any of the following questions:

- 1. Does the child live in (or often visit) a house built before 1950 with peeling or chipping paint? This could include a day care, preschool, or home of a relative.
- 2. Does the child live in (or often visit) a house built before 1978 that has been remodeled within the last year?
- 3. Does the child have a brother or sister (or playmate) with lead poisoning?
- 4. Does the child live with an adult whose job or hobby involves lead?
- 5. Does the child's family use any home remedies that may contain lead?

MDCH CLPPP held four regional conferences in 1999, in Kalamazoo, Marquette, Saginaw, and Detroit. Each conference included several sessions on the prevention and treatment of childhood lead poisoning. Other education efforts included a Lead Week publicity campaign, other presentations to professional groups, answering public and professional phone calls, and facilitating local outreach efforts.

Collaboration efforts in 1999 included the Rental-Property Owners' Liaison Committee, which formulated and distributed a list of ten things every rental-property owner can do to help keep homes lead safe.

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	1 4%	532 6% 2	0 0%	79 6%	48 6%	1 2%	0 0%	14 4%	62 2%	1 1%	6 2%	7 2%	A	4 - 4%	A C 10%		0 0%	3 1%	0 0%	3 1%	0 6	2 0 1%	1 0%	0 0%	0 0%	59 59 3%	2 2%	246 10% 10	1 3%	26 4%	3 1%	0 0%	4 13%	0 0%	5 1%	0 0%	0 0%	Number of Children Number Children Tested Childre	Children Confirmed Childr	RESULTS OF BLOOD L
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N 1 220 625	City of 257,260	4,133	ex Det 116,376	naw 26,210	en 10,953	isee 10,460	raft 2,126	8,050	oh 9,384	21,069	/ 27,719	mon 3.497	10,003	16 683	1,442	1 3,136	jon 2,270	v 3,037	4,314	l 83,718	o 5,242	on 22 107	m 7,744	16,133	.ee 1,743	nee 5,511 5.950	4,496	5,550	te 11,357	e 5,193	1C 2,781 36.730	1,374	on 7,915	e 15,352	u 3,084	7,259	2,249	Units	Pre-1950 H	_
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va 2 n/a 0 n/a 0 n/a 55 77 434 10% 5.467 7% 2.121 3%	7,806 24,776 22% 3,550 14% 1,327 5%		9 18,243 6,125 9% 229 4% 90 1%	003 3,034 1,010 5% 10 1% 4 0%	1,487 1,110 221 5% 5 2% 2 1% 3,377 1,526 701 11% 16 2% 4 1%	5,637 1,274 437 8% 6 1% 2 0%	556 176 118 21% 1 1% 0 0%	3,395 836 81 2% 1 1% 0 0%	5,241 1,372 304 6% 12 4% 3 1%	12,853 2,666 355 3% 13 4% 5 1%	17,661 5,833 1,480 8% 50 3% 24 2%	6 303 243 /2 /20 0 0% 0 0%	%         965         240         72         7%         1         2%         0         0%         0         0%	1,000         201         00 <th< td=""><td></td><td>17% 1,768 549 268 15% 3 1% 1 0%</td><td>13% 511 146 30 6% 2 7% 1 3%</td><td>22% 1,531 472 52 3% 0 0% 0 0%</td><td>34% 2,150 638 230 11% 7 3% 3 1%</td><td>19% 89,356 9,197 5,132 6% 90 2% 33 1%</td><td>26% 4,044 1,017 288 7% 2 1% 1 0%</td><td>19%         625         211         39         6%         1         3%         0         0%           36%         14.514         4.146         1.837         13%         141         8%         51         3%</td><td>34% 4,926 1,361 541 11% 10 2% 1 0%</td><td>33% 11,678 1,942 880 8% 12 1% 2 0%</td><td>25% 1,158 350 27 2% 0 0% 0 0%</td><td>4%         1,685         336         362         21%         3         1%         1         0%           0%         6,498         1,233         99         2%         0         0%         0         0%</td><td>26%         2,815         847         317         11%         6         2%         4         1%</td><td>39% 2,083 583 36 2% 1 3% 1 3%</td><td>17% <b>4</b>,799 1,463 574 12% 6 1% 1 0%</td><td><b>1,484</b> 552 53 4% 0 0% 0 0%</td><td>0% 56640 5.335 2.214 4% 23 1% 9 0%</td><td><u>38% 429 159 74 17% 1 1% 1 1%</u></td><td><u>3%</u> 11,409 690 76 1% 1 1% 1 1%</td><td>1%         7,775         1,626         373         5%         17         5%         5         1%</td><td><u>1,480 227 10 1% 0 0% 0 0%</u></td><td><u>% 6,887, 979 91 1% 2 2% 2 2%</u></td><td>5         737         295         50         7%         2         4%         1         2%</td><td>Children <age 5.<br="">Under Age Below Number of Skaf Tobal Number of Children Number of Children Children Children Tested Children Tested</age></td><td>Age &amp; Poverty Children &lt; Age &amp; Children Confirmed Children Confirmed &gt;=10ug/dL &gt;=10ug/dL</td><td>FACTORS RESULTS OF BLOOD LEAD TES</td></th<>		17% 1,768 549 268 15% 3 1% 1 0%	13% 511 146 30 6% 2 7% 1 3%	22% 1,531 472 52 3% 0 0% 0 0%	34% 2,150 638 230 11% 7 3% 3 1%	19% 89,356 9,197 5,132 6% 90 2% 33 1%	26% 4,044 1,017 288 7% 2 1% 1 0%	19%         625         211         39         6%         1         3%         0         0%           36%         14.514         4.146         1.837         13%         141         8%         51         3%	34% 4,926 1,361 541 11% 10 2% 1 0%	33% 11,678 1,942 880 8% 12 1% 2 0%	25% 1,158 350 27 2% 0 0% 0 0%	4%         1,685         336         362         21%         3         1%         1         0%           0%         6,498         1,233         99         2%         0         0%         0         0%	26%         2,815         847         317         11%         6         2%         4         1%	39% 2,083 583 36 2% 1 3% 1 3%	17% <b>4</b> ,799 1,463 574 12% 6 1% 1 0%	<b>1,484</b> 552 53 4% 0 0% 0 0%	0% 56640 5.335 2.214 4% 23 1% 9 0%	<u>38% 429 159 74 17% 1 1% 1 1%</u>	<u>3%</u> 11,409 690 76 1% 1 1% 1 1%	1%         7,775         1,626         373         5%         17         5%         5         1%	<u>1,480 227 10 1% 0 0% 0 0%</u>	<u>% 6,887, 979 91 1% 2 2% 2 2%</u>	5         737         295         50         7%         2         4%         1         2%	Children <age 5.<br="">Under Age Below Number of Skaf Tobal Number of Children Number of Children Children Children Tested Children Tested</age>	Age & Poverty Children < Age & Children Confirmed Children Confirmed >=10ug/dL >=10ug/dL	FACTORS RESULTS OF BLOOD LEAD TES

Note: Column for Children Tested reflects capillary and venous blood tests. Columns for Children Confirmed reflect venous tests only.

\*\*\*Kids Count in Michigan, 1996 Data Book [children ages 0-4 below 125% poverty]

Note: Counts of children tested and blood lead levels are reported from Michigan Depurtment of Community Health, Childhood Lead Peisoning Prevention Project statewide database.

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### **OSHA BLOOD LEAD LABORATORIES: MICHIGAN**

#### Laboratory Name

Warde Medical Laboratory Quest Diagnostics Regional Medical Laboratories Comprehensive Health Services Inc Detroit Health Department DMC University Laboratories AAC Trinity Inc Blodgett Toxicology Lab Michigan Department of Community Health Sparrow Regional Laboratories Mount Clemens General Hopsital Hackley Hospital Laboratory

City
Ann Arbor
Auburn Hills
Battle Creek
Detroit
Detroit
Detroit
Farmington Hills
Grand Rapids
Lansing
Lansing
Mount Clemens
Muskegon

County Washtenaw Oakland Calhoun Wayne Wayne Wayne Kent Ingham Ingham Macomb Muskegon



### SUMMARY OF MICHIGAN'S LEAD STANDARDS

In 1981, under the authority of the Michigan Occupational Safety and Health Act (MIOSHA), Michigan promulgated a comprehensive standard to protect workers exposed to lead in general industry (i.e., R325.51971 - 325.51958). That standard was most recently amended in February, 1998. In October 1993, MIOSHA adopted by reference the federal Occupational Safety and Health Administration's (OSHA) Lead Standard for Construction (i.e., 29 CFR 1926.62). That standard was most recently amended October 18, 1999. Both the MIOSHA lead construction and the general industry lead standards establish an "action level" (30 micrograms of lead per cubic meter of air [ug/m<sup>3</sup>] averaged over an eight-hour period) and a permissible exposure limit (50 ug/m<sup>3</sup> averaged over an eight hour period) for employees. Both standards require employers to conduct initial exposure monitoring and to provide employees written notification of these monitoring results. If employee exposure levels exceed the permissible exposure limit (PEL), employees are required to develop a written compliance program that addresses the implementation of feasible engineering and/or work practice controls to reduce and maintain employee exposures below the PEL. The lead construction standard also allows the use of administrative controls to achieve this objective. An employer's obligations concerning hygiene facilities, protective work clothing and equipment, respiratory protection, medical surveillance and training under the lead construction standard are triggered initially by job tasks and secondarily by actual employee exposure level to lead. Under the General Industry Lead Standard, these potential obligations are triggered by actual employee exposure levels to lead. Medical surveillance and training are triggered by exposures above the action level (A.L.), whereas protective clothing and equipment, respiratory protection and hygiene facilities are triggered by exposures above the PEL.

The medical surveillance program requirements for Michigan's General Industry lead standard versus those required in Construction Lead Standard do vary. Under the General Industry lead standard, a medical surveillance program must be implemented which includes periodic biological monitoring (blood tests for lead and zinc protoporphyrin [ZPP] levels), and medical exams/consultation for all workers exposed more than 30 days per year to lead levels exceeding the A.L. Under the lead construction standard, a distinction is made between "initial medical surveillance" (consisting of biological monitoring in the form of blood sampling and analysis for lead and ZPP levels) and secondary medical surveillance (consisting of follow-up biological monitoring and a medical examination/consultation). The initial medical exam is triggered by employee exposure to lead on any day at or above the A.L. for more than 30 days in any 12 consecutive months period.

Michigan's General Industry standard mandates that employees exposed at or above the A.L. must be removed from the lead exposure when:

- A periodic blood test and follow-up blood test indicate that the blood lead level (BLL) is at or above 60 micrograms per deciliter (ug/dl) of whole blood.
- Medical removal is also triggered if the average of the last 3 BBL or the average of all blood sampling tests conducted over the previous six months, whichever is longer, indicates the

employees blood lead level is at or above 50 ug/dl. Medical removal is not required however, if the last blood sampling test indicates a blood lead level at or below 40 ug/dl of whole blood.

When a final medical determination reveals that an employee has a detected medical condition which places that employee at an increased risk of material impairment to health from the lead exposure.

The Lead Construction Standard mandates removal of an employee from a lead exposure at or above the AL when:

- A periodic and follow-up blood test indicates that an employee's BLL is at or above 50 ug/dl; or
- There is a final medical determination that an employee has a detected medical condition which places that employee at an increased risk of material impairment to health from the lead exposure.

When an employee can return to work at their former job also differs by standard. The General Industry lead standard allows an employee to return to his or her former job status under any of the following circumstances:

- If the employee's BLL was at or above 70 ug/dl, then 2 consecutive blood tests must have the BLL at or below 50 up/dl.
- If the employee's BLL was at or above 60 ug/dl or due to an average BLL at or above 50 ug/dl, then 2 consecutive BLL must be at or below 40 ug/dl.
- For an employee removed due to a final medical determination, when a subsequent medical determination no longer detects a medical condition which places the employee at an increased risk of material impairment to health from exposure to lead.

The Lead Construction Standard allows the employer to return an employee to their former job status under these circumstances:

- If the employee's BLL was at or above 50 ug/dl, then 2 consecutive blood tests must have the employee's BLL at or below 40 ug/dl.
- For an employee removed due to a final medical determination, when a subsequent medical determination no longer has a detected medical condition which places the employee at an increased risk of material impairment to health from exposure to lead.

Both the General Industry and Construction Standards have a medical removal protection benefits provision. This provision requires employers maintain full earnings, seniority and other employment rights and benefits of temporarily removed employees up to 18 months on each occasion that an

employee is removed from exposure to lead. This includes the right to their former job status as though the employee had not been medically removed from the job or otherwise medically limited.

#### **Provisions of General Industry and Construction Standards**

Workers exposed to lead have a right to: an exposure assessment, respiratory protection, protective clothing and equipment, hygiene facilities, medical surveillance, medical removal and training. The triggering mechanisms that activate these rights are primarily based upon employee lead exposure levels. However, under the Lead Construction Standard, many of these rights are initially triggered by the specific work activity being performed.

#### **Exposure Assessment**

Air monitoring must be conducted to determine employee airborne lead exposure levels when a potential lead exposure exists. Under the Lead Construction Standard, however, specific work activities are identified/categorized that require "interim protection" (i.e., respiratory protection, personal protective clothing and equipment, work clothes change areas, hand washing facilities, biological monitoring and training) until air monitoring has been performed that establishes that these lead exposure levels are within the acceptable limits (A.L. or P.E.L.).

### **Respiratory Protection**

Respiratory protection is required whenever employee exposure levels exceed the PEL and as an interim control measure under the Lead Construction Standard. The level of respiratory protection required is dependent upon the actual employee exposure level or by the job activities identified in the Lead Construction Standard.

### **Protective Clothing/Equipment**

Protective clothing/equipment (i.e., coveralls or similar full body clothing; gloves, hats, shoes or disposable shoe coverlets; and face shield, vented goggles, or other applicable equipment) is required whenever employee exposure levels exceed the PEL and as an interim protection measure under the Lead Construction Standard.

#### **Hygiene Facilities**

Hygiene facilities (i.e., clothing change areas, showers, eating facilities) are required whenever employee exposures to lead exceed the PEL. Except for shower facilities, these same hygiene facilities must be provided as interim protection under the Lead Construction Standard. The construction employer must, however, provide hand washing facilities in lieu of the shower facility as an interim protection.

#### **Medical Surveillance**

Medical surveillance (i.e., medical exam and consultation) is required when workers are exposed to

lead at or exceeding the A.L. for more than 30 days a year. Biological blood sampling and analysis to determine lead and ZPP levels is required initially under the Lead Construction Standard when employee lead exposure is at or exceeds the A.L. on any single day. Under the General Industry Lead Standard, it is required when employees are exposed to concentrations of airborne lead greater than the A.L. for more than 30 days per year.

### **Medical Removal**

Workers covered by the General Industry Lead Standard have the right to be removed from airborne lead exposures at or above the A.L. when their periodic and follow-up blood lead level is at or above 60 ug/dl or when an average of the last three blood lead levels or the average of all blood sampling tests conducted over the previous six months, whichever is longer, indicates the employee blood lead level is at or above 50 ug/dl. However, under this later removal criteria, they are not required to be removed if the last blood sampling test indicates a blood lead level at or below 40 ug/dl.

Workers covered by the Construction Lead Standard have the right to be removed from airborne lead exposures at or above the A.L. on each occasion that a periodic and follow-up blood sample test indicate that the employee's blood lead level is at or above 50 ug/dl.

Under both the General Industry and Construction Lead Standards, workers also have the right to be removed from airborne lead exposures at or above the A.L. whenever there is a final medical determination that has detected that they have a medical condition that places them at an increased risk of material impairment to health from exposure to lead.

### Training

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Under the General Industry Lead Standard, employees exposed to any level of airborne lead must be informed of the contents of appendix A and B from that standard.

Under both the General Industry and Construction Lead Standard, employees who are exposed at or above the A.L. level on any day or who are subject to exposure to lead compounds which may cause skin or eye irritation must be provided comprehensive training covering all topics specified in those standards.

Also, under the Lead Construction Standard, employees involved in any of the specified work activities requiring interim controls, must receive training prior to initiating those activities that addresses the recognition and avoidance of unsafe conditions involving lead and the specific regulations applicable to the worksite that have been established to control or eliminate the hazards associated with exposure to lead.

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Adult Blood Lead Epidemiology and Surveillance -- United States, Se



# March 19, 1999 / 48(10);213-6,223

# Adult Blood Lead Epidemiology and Surveillance -- United States, Second and Third Quarters, 1998, and Annual 1994-1997

Chronic lead exposure in adults can damage the cardiovascular, central nervous, renal, reproductive, and hematologic systems. CDC's Adult Blood Lead Epidemiology and Surveillance (ABLES) program monitors laboratory-reported elevated blood lead levels (BLLs) among adults in the United States. During 1998, 27 states \* reported surveillance data to ABLES. This report presents prevalence data for elevated BLLs for the second and third quarters of 1998 and compares them with corresponding quarters of 1997, and presents annual prevalence data for elevated BLLs from 1994 through 1997 for each participating state. The findings indicate that of the approximately 20,000 persons tested for blood lead and reported to ABLES each quarter, approximately 4000 BLLs were elevated. The 1994-1997 prevalence rates of elevated BLLs among adults provide a crude comparison of the levels and trends among the 27 states participating in the program.

ABLES defines an adult as a person aged greater than or equal to 16 years and an elevated BLL in an adult as greater than or equal to 25 ug/dL, although BLL reporting thresholds vary among the states. Persons with duplicate BLL tests are included once per quarter and once per year at the highest BLL for that person. Denominators for calculating prevalence during 1994-1997 are the population figures (aged 16-64 years) of the individual participating states (1). An upper age cutoff of 64 years is used because 90%-95% of adult lead exposures occur at work. Not all of the current 27 ABLES states reported data over the entire period from 1994 through 1997.

Second Quarter, 1998

During April 1-June 30, 1998, of the 20,212 adults for whom BLLs were reported by the states, 3727 (18%) had levels greater than or equal to 25 ug/dL, a 14% decrease compared with the 4335 reported for the second quarter of 1997 (2) and a 12% decrease compared with the 4243 reported for the first quarter of 1998 (3) (Figure\_1). Of the 3727, 182 (5%) were reported with BLLs greater than or equal to 50 ug/dL (the Occupational Safety and Health Administration {OSHA} level for medical removal from the workplace {4}), an 8% decrease compared with 197 reported for the second quarter of 1997 (2) and a 4% increase compared with 175 reported for the first quarter of 1998 (3).

Third Quarter, 1998

During July 1-September 30, 1998, of the 20,511 adults for whom BLLs were reported by the participating states, 3322 (16%) had BLLs greater than or equal to 25 ug/dL, a 21% decrease compared with 4180 persons reported for the third quarter of 1997 (5) and an 11% decrease compared with 3727 reported for the second quarter of 1998 (Figure 1). Of the 3322, 182 (6%) were reported with BLLs greater than or equal to 50 ug/dL, a 13% decrease compared with 209 reported for the third quarter of 1997 (5) and an equal number compared with the second quarter of 1998.

Annual ABLES Prevalence, 1994-1997

http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00056742.htm

04/10/2000

### Adult Blood Lead Epidemiology and Surveillance -- United States, Se

The prevalence of adults with BLLs greater than or equal to 25 ug/dL per million adults aged 16-64 years varied among the participating states for 1994 through 1997 (Figure 2). These rates ranged from 15 per million for Arizona (1994) to 442 per million for Pennsylvania (1997). Michigan, New Mexico, Rhode Island, and Wyoming began reporting in 1997; Ohio and Minnesota began reporting in 1996; and Illinois last reported in 1996.

Reported by: JP Lofgren, MD, Alabama Dept of Public Health. K Schaller, Arizona Dept of Health Svcs. S Payne, MA, Occupational Lead Poisoning Prevention Program, California Dept of Health Svcs. BC Jung, MPH, Div of Environmental Epidemiology and Occupational Health, Connecticut Dept of Public Health. R Gergely, Iowa Dept of Public Health. W Davis, MPA, Occupational Health Program, Bur of Health, Maine Dept of Human Svcs. E Keyvan-Larijani, MD, Lead Poisoning Prevention Program, Maryland Dept of Environment. R Rabin, MSPH, Div of Occupational Safety, Massachusetts Dept of Labor and Workforce Development. A Allemier, Dept of Medicine, Michigan State Univ, East Lansing. M Falken, PhD, Minnesota Dept of Health. C DeLaurier, Div of Public Health Svcs, New Hampshire State Dept of Health and Human Svcs. B Gerwel, MD, Occupational Disease Prevention Project, New Jersey State Dept of Health. R Prophet, PhD, New Mexico Dept of Health. R Stone, PhD, New York State Dept of Health. S Randolph, MSN, North Carolina Dept of Health and Human Svcs. A Migliozzi, MSN, Bur of Health Risk Reduction, Ohio Dept of Health. E Rhoades, MD, Oklahoma State Dept of Health. A Sandoval, MS, State Health Div, Oregon Dept of Human Resources. J Gostin, MS, Occupational Health Program, Div of Environmental Health, Pennsylvania Dept of Health. M Stoeckel, MPH, Rhode Island Dept of Health. A Gardner-Hillian, Div of Health Hazard Evaluations, South Carolina Dept of Health and Environmental Control. D Salzman, MPH, Bur of Epidemiology, Texas Dept of Health. W Ball, PhD, Bur of Epidemiology, Utah Dept of Health. L Toof, Div of Epidemiology and Health Promotion, Vermont Dept of Health. P Rajaraman, MS, Washington State Dept of Labor and Industries. J Tierney, Wisconsin Dept of Health and Family Svcs. T Klietz, Wyoming Dept of Health. Div of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health, CDC.

### **Editorial Note**

Editorial Note: The symptoms of adult lead poisoning include fatigue, irritability, insomnia, and headaches. Occupations known to expose workers to lead include radiator repair, battery manufacture and recycling, smelting, and construction or remodeling involving lead-based paint. Lead exposure can be prevented by engineering controls, good housekeeping, personal protective equipment, and fastidious hygiene. Medical removal from a lead-exposed job is required by OSHA when a workers' BLL is greater than or equal to 50 ug/dL.

Second quarter data for 1997 through the first quarter of 1998 indicate that the number of persons with BLLs greater than or equal to 25 ug/dL reported by participating states was approximately 4000 per quarter. An apparent decrease in the number of persons with BLLs greater than or equal to 25 ug/dL occurred in both the second and third quarters of 1998. Furthermore, the testing level has remained relatively constant, indicating that the decrease probably is not caused by the performance of fewer BLL tests. However, amendments to previous quarterly reports are likely to occur when fourth quarter reports are received. These amendments occur because ABLES is concerned with the diagnosis date of the blood lead laboratory report and not the date the laboratory result was received by the state health department. Therefore, additional data collected through ABLES are needed to interpret the current quarterly data and their implications for projecting trends.

State-specific prevalences presented in this report may not accurately reflect workplace lead exposures because not all employers tested lead-exposed employees for elevated BLLs and not all laboratories reported results. For example, data from the National Health and Nutrition Examination Survey (NHANES III, 1988-1991) (6,7) predicted approximately 700,000 adults with BLLs greater than or equal to 25 ug/dL in the entire United States; ABLES data, adjusted for a national estimate, predicted approximately 18,000 persons with

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BLLs greater than or equal to 25 ug/dL in 1994. In addition, the denominators for the prevalence rates are the respective state populations aged 16-64 years, but the percentage of working persons in this age group who were reported to be exposed to lead is unknown and varies from state to state.

All ABLES data are subject to certain limitations and, as with state-specific prevalence data, may not convey a true picture of workplace lead exposure. Variation in the number of persons with BLLs greater than or equal to 25 ug/dL reported quarterly and annually to ABLES may reflect changes in 1) the year-to-year efforts of participating states and lead-using industries within them to identify lead-exposed workers and to prevent new exposures; 2) occupational exposures to lead; 3) compliance with OSHA requirements regarding blood lead monitoring; and 4) workforce size in lead-using industries. Variations in quarterly and annual nationwide reporting totals might represent normal fluctuations in case reporting, which might result from changes in staffing and funding in state-based surveillance programs, interstate differences in worker BLL testing by lead-using industries, or random variations. Individual state contributors must be consulted for accurate interpretations of state-specific prevalences and trends.

The findings in this report document the continuing hazard of lead exposure as an occupational health problem in the United States. ABLES enhances surveillance for this preventable condition by increasing the number of participating states, exploring ways to increase the usefulness of reporting, and alerting the public to potential new sources of lead.

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Alabama, Arizona, California, Connecticut, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, Wisconsin, and Wyoming.

#### Figure\_1

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FIGURE 1. Total number of adults\* tested\* and whose blood lead levels (BLLs) were  $\geq\!\!25~\mu\text{g/dL}$ , by quarter — 27 states participating in Adult Blood Lead Epidemiology and Surveillance,\* 1997-1998



\*Persons aged 16-64 years, categorized according to the highest reported BLL for that person during the given quarter. Data for the second and third quarters of 1998 were not available for New Mexico; the corresponding 1997 quarters were used as estimates.

The reporting threshold varies among the participating states; the value includes persons with BLLs <25 µg/dL. However, the following states do not report persons with BLLs <25 µg/dL: Maryland, Massachusetts, New Jersey, North Carolina, and Oregon. \*Alabama, Arizona, California, Connecticut, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Okla-

homa, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Utah, Vermont, Washing-ton, Wisconsin, and Wyoming.

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#### Figure 2

FIGURE 2. Prevalence of blood lead levels  $\geq 25 \ \mu g/dL$  among adults\*, reported by states participating in Adult Blood Lead Epidemiology and Surveillance - United Stat es, 1994-1997



\*Per 1 million adults aged 16-64 years.

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<sup>†</sup>Minnesota and Ohio began reporting in 1996. Illinois last reported in 1996. Michigan, New Mexico, Rhode Island, and Wyoming reported for the first time in 1997. ABLES program data are known to be underreported. These data represent the level of functioning of the various state ABLES programs, but do not necessarily represent a true picture of workplace lead exposure in individual states.

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