# New York State
# Heavy Metals Registry

## 2016 through 2020

New York State Department of Health
Center for Environmental Health
Bureau of Occupational Health and Injury Prevention

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# Background

The New York State (NYS) Department of Health (DOH) Heavy Metals Registry (HMR) is a tool for the surveillance of adult exposures to arsenic, cadmium, lead, and mercury. These metals are widely used in industry, and all have the potential to cause illness due to either acute or chronic exposure. While heavy metals have been used by humans for thousands of years and the adverse health effects associated with exposure to them are well known, exposure to these metals continues. Examination of the HMR data can identify exposures in both communities and workplaces, thus allowing for early initiation of measures to help prevent exposures and potential illness.

The NYSDOH established the HMR in 1980 under Sections 22.6 and 22.7 of the State Sanitary Code (10 NYCRR Part 22, see Appendix A), and reporting to the HMR began in 1982. All clinical laboratories, physicians, and health care facilities, both in-state and outside of NYS must report the test results of all NYS residents to the NYSDOH. For mercury, cadmium, and arsenic, only those tests above specified limits (Table 1) are required to be submitted to NYSDOH. From 1982 to 1986, blood lead levels of 40 micrograms per deciliter (µg/dL) or higher were reportable. In 1986, the reportable blood lead level was lowered to 25 µg/dL or higher. Then in 1992, as part of a major childhood lead poisoning initiative, a regulatory change required the reporting of all blood lead results for all age groups, regardless of level (10 NYCRR Part 67, see Appendix A). This reporting has helped track adult blood lead levels over time by verifying trends in both individuals and companies and has allowed NYSDOH to proactively identify adults potentially at risk before their blood lead levels increase further.

**Table 1. Reportable Levels of Heavy Metals in Blood or Urine**

| Metal | Sample | Reportable at or above |
|---|---|---|
| Lead | Blood | All levels |
| Cadmium | Blood<br>Urine | 10 ng/mL [1]<br>5 µg/L [2] |
| Mercury | Blood<br>Urine | 5 ng/mL<br>20 ng/L |
| Arsenic | Urine | 50 µg/L |

[1] ng/mL = nanograms per milliliter

[2] µg/L = micrograms per liter

Clinical laboratories, physicians and health care facilities report heavy metal test results to the NYSDOH. Once information is received on a person with an elevated level, NYSDOH contacts the person and/or their physician and interviews them to determine the possible sources of exposure, provide advice on appropriate measures to limit future exposures to the individual and his or her family, and answer any questions the individual may have. Additional information about how the HMR operates is provided in Appendix B.

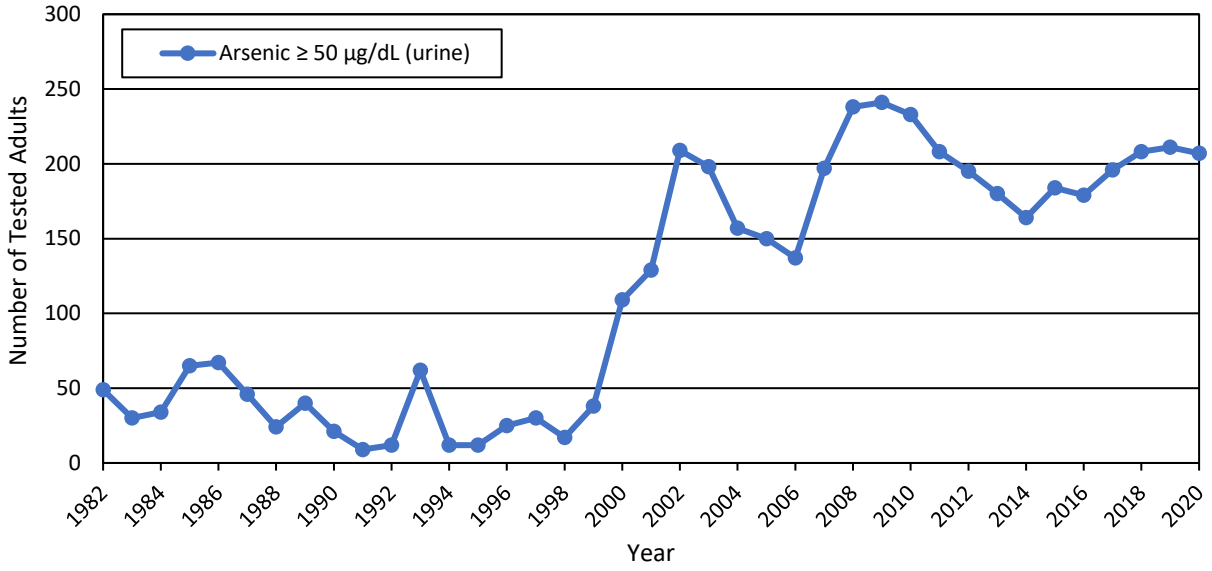
This report presents data for tests conducted from 2016 through 2020 and covers the four metals included in the HMR – arsenic, cadmium, lead and mercury. The number of adults reported since the inception of the HMR is presented for each metal. Because the same individuals may be tested in more than one year, the term “tested adults” is used in this report where the same individuals may be counted more than once, while the term “unique adults” is used where distinct counts only are included. Likewise, the number of tests can be more than the number of unique adults in a given year since many individuals are tested more than once. Case reports were ordered by patient identification numbers and the final dataset used in this report reflected the highest laboratory result for a patient within the period. This report is intended as a resource for programs providing preventive health care and for public health officials concerned with reducing overall morbidity from heavy metals poisonings. Because of the change in the reporting requirement for lead in 1992 and because testing for lead exposure among adults is much more common, lead tests account for approximately 75% of the tests added to the HMR each year. Therefore, much of this report focuses on the lead reports.

## Arsenic

Arsenic is a naturally occurring chemical element. In the environment, it combines with oxygen, chlorine, and sulfur to form inorganic arsenic compounds which are used in a number of industrial processes such as in the making of electronics. Fish and shellfish accumulate arsenic, most of which is in a relative non-toxic organic form.[1] Exposure to high levels of inorganic arsenic can cause death; exposure to lower levels can result in nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, darkening of the skin and the appearance of small “warts” on the palms, soles, and torso. Inorganic arsenic is a known carcinogen.[2]

From 1982 through 1999, the number of adults reported to the HMR for arsenic each year was, with a few exceptions, below 60. Individuals may be tested in more than one year. Figure 1 shows the number of adults tested each year with elevated arsenic. In 2000, 111 adults were reported. Since then, the number of adults reported continued to vary but remained above 100, with 1,001 adults were reported between 2016 and 2020. There was an increase to 244 adults reported in 2010, followed by a smaller peak of 211 adults in 2019 (Figure 1). This rise may be the result of an increase in the number of people tested due to greater public awareness that exposure to heavy metals is possible through seafood consumption.

**Figure 1. Number of Tested Adults Reported to the Heavy Metals Registry for Arsenic, by Year**




During the years 2016-2020, a total of 1,001 adults were reported to the HMR for arsenic. About 56% of the adults reported to the HMR for arsenic were male, and about 65% were 50 years of age or older. Fifty-nine percent of the reported adults resided in Upstate New York (defined as all NYS counties outside of New York City (NYC)) while 40% resided in NYC (Table 2). For 9% of the adults reported, the exposure source was non-occupational, while for about 1% it was occupational; however, the source could not be identified for 89%. In general, non-occupational sources of arsenic exposure are attributed to eating seafood; over 99.5% of the known sources of nonoccupational exposure were due to eating seafood, with a few adults exposed to arsenic through the consumption of folk medicine and dietary supplements. Because most laboratories do not routinely distinguish between organic and inorganic forms of arsenic when they test, NYSDOH advises people with elevated arsenic results to avoid seafood consumption for two days prior to testing and have another test. This can help to indicate if seafood was the source of the initial arsenic level. There were 1,246 tests conducted between 2016 and 2020, with approximately 1.3 tests reported for each adult, indicating that people with reportable levels are either not being routinely retested, or if they are being retested, their arsenic levels are falling below the reporting level of 50 µg/dL. NYSDOH does not advise routine testing of individuals for arsenic in the absence of identifiable risk factors.

**Table 2. Total Number of Unique Adults Reported to the Heavy Metals Registry by Sex, Age, Exposure Source, and Geographic Region for Arsenic, 2016-2020**

| | N | % |
|---|---|---|
| **Number of Adults** | 1,001 | |
| Sex | | |
| Male | 559 | 55.8 |
| Female | 440 | 44.0 |
| Unknown | 2 | 0.2 |
| Age | | |
| ≤ 29 years | 75 | 7.5 |
| 30-49 years | 276 | 27.6 |
| ≥50 years | 650 | 64.9 |
| Exposure | | |
| Occupational | 12 | 1.2 |
| Non-occupational | 93 | 9.3 |
| Both | 1 | 0.1 |
| Unknown | 895 | 89.4 |
| Geographic Region | | |
| Upstate | 564 | 58.6 |
| NYC | 382 | 39.7 |
| Out of State | 17 | 1.8 |
| Total Number of Tests | 1,246* | |

**The number of tests adds up to more than the number of adults because adults can have multiple arsenic tests.*

*** Due to rounding, some percentage values may not sum up to 100.*

## Cadmium

Cadmium occurs naturally in soil and rocks. Because it does not corrode easily, it has many uses including batteries, pigments, metal coatings and plastics.[3] Exposure to cadmium can damage the kidneys, lungs, and bones.[4] Cadmium levels of 10 nanograms per milliliter (ng/mL) in blood and 5 µg/L in urine are reportable to NYSDOH. The number of adults with reportable levels for cadmium has varied considerably since the HMR began. Figure 2 shows the number of adults reported each year for cadmium. Individuals may be tested in more than one year; however, there have always been fewer than 30 adults each year reported to the HMR. NYSDOH does not advise routine testing for cadmium in the absence of identifiable risk factors. Between 2016 and 2020, there were 22 adults with elevated cadmium levels reported to the HMR and a total of 23 tests were conducted (Table 3). Approximately 68% of those reported were male, 86% of them were 50 years or older, 50% of them were NYC residents and about 46% resided in Upstate. None of the individuals had known occupational exposure, while nine individuals had non-occupational exposures through unspecified environmental sources. Detailed exposure information could not be obtained due to a lack of response from the cases after multiple interview attempts.

**Figure 2. Number of Tested Adults Reported to the Heavy Metals Registry for Cadmium, by Year**

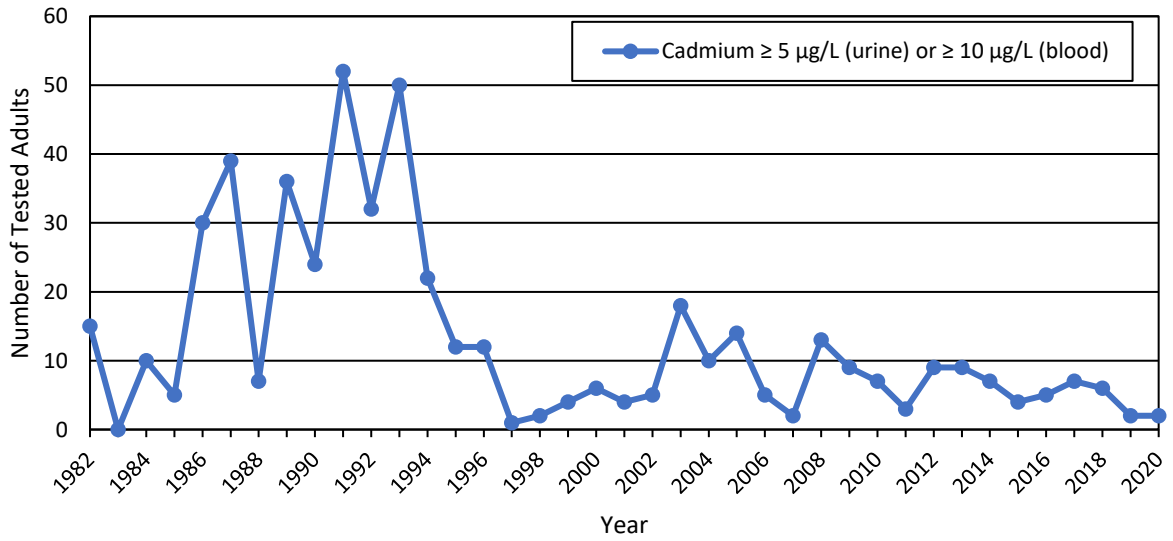


**Table 3. Total Number of Unique Adults Reported to the Heavy Metals Registry by Sex, Age, Exposure Source, and Geographic Region for Cadmium, 2016-2020**

| | N | % |
|---|---|---|
| **Number of Adults** | 22 | |
| Sex | | |
| Male | 7 | 31.8 |
| Female | 15 | 68.2 |
| Age | | |
| ≤29 years | 1 | 4.6 |
| 30-49 years | 2 | 9.1 |
| ≥50 years | 19 | 86.4 |
| Exposure | | |
| Occupational | 0 | 0 |
| Non-occupational | 9 | 40.9 |
| Both | 0 | 0 |
| Unknown | 13 | 59.1 |
| Geographic Region | | |
| Upstate | 10 | 45.5 |
| NYC | 11 | 50 |
| Out of State | 1 | 4.6 |
| Total Number of Tests | 23* | |

**The number of tests adds up to more than the number of adults because adults can have multiple arsenic tests.*

## Lead

Lead, a naturally occurring element, is found in all parts of our environment. Lead from deteriorating lead-based paints, ceramic products, caulking, and leaded gasoline and pipe solder are primarily responsible for exposures in children. Workers can be exposed to lead by creating dust or fumes during everyday work activities with products that include lead, such as paint, ammunition, solder, and leaded cables. Other non-occupational exposures can include contaminated spices and dietary supplements. Exposure to lead can affect the brain and other parts of the nervous system, reproductive system, kidneys, digestive system, and the body's ability to make blood.[5]

The results of all blood lead tests, regardless of level, performed on individuals residing or employed in NYS are reported to the HMR. Between 2016 and 2020, 7,845 adults (16 years and older) residing or employed in NYS were reported to the HMR with elevated blood lead levels (greater than or equal to 10 µg/dL). There was a steady decrease in the number of elevated blood lead levels reported to the HMR since the mid-1990's (Figure 3) until 2010 when a slight increase was observed. Although the total number of blood lead tests has increased since 2010, there has been an overall decrease in the number of individuals with elevated blood lead levels (Figure 4). Approximately 99% of all adults tested in 2016 had blood lead levels less than 10 µg/d, assuming one test per individual for those tests less than 10 µg/dL. In 2020, this increased to 99% of all adults tested.

Females represented over 80% of those adults with blood lead levels less than 10 µg/dL (data not shown). Although NYS does not require testing all pregnant women for blood lead, NYSDOH regulations state that a health care provider should test pregnant women at high risk[6], and the state has established guidelines for health care practitioners to assist in determining a woman's risk of lead poisoning on her initial prenatal visit.[7] The high number of females with low blood lead levels could be a result of an increase in women receiving pre-natal blood lead tests.

**Figure 3. Number of Tested Adults Reported to the Heavy Metals Registry for Lead, by Year and Blood Lead Level, 1982-2020**

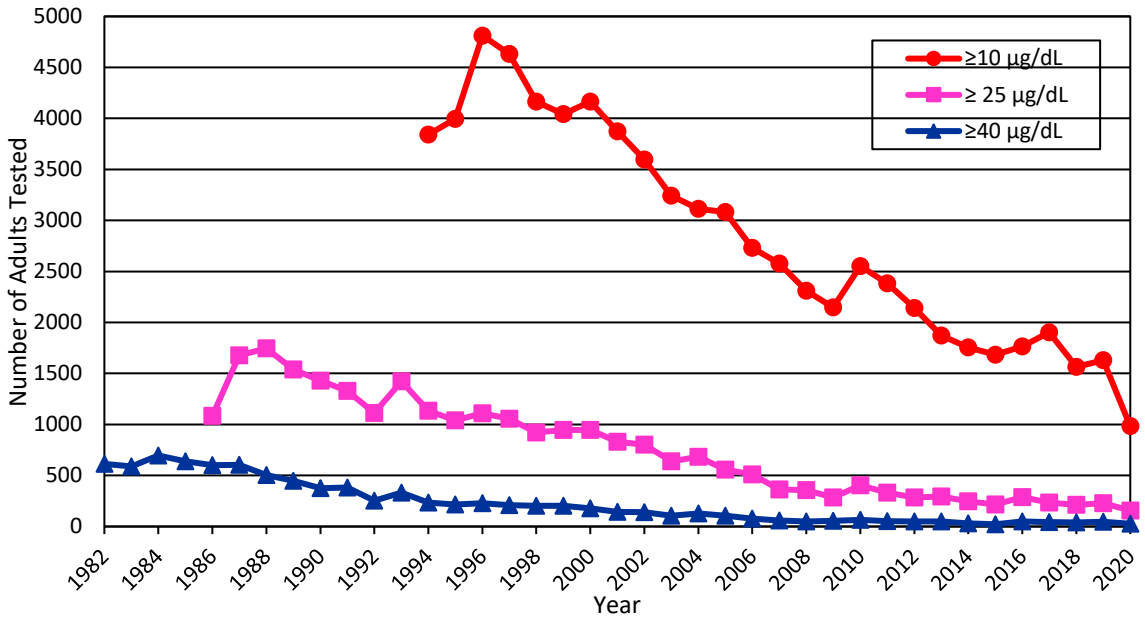
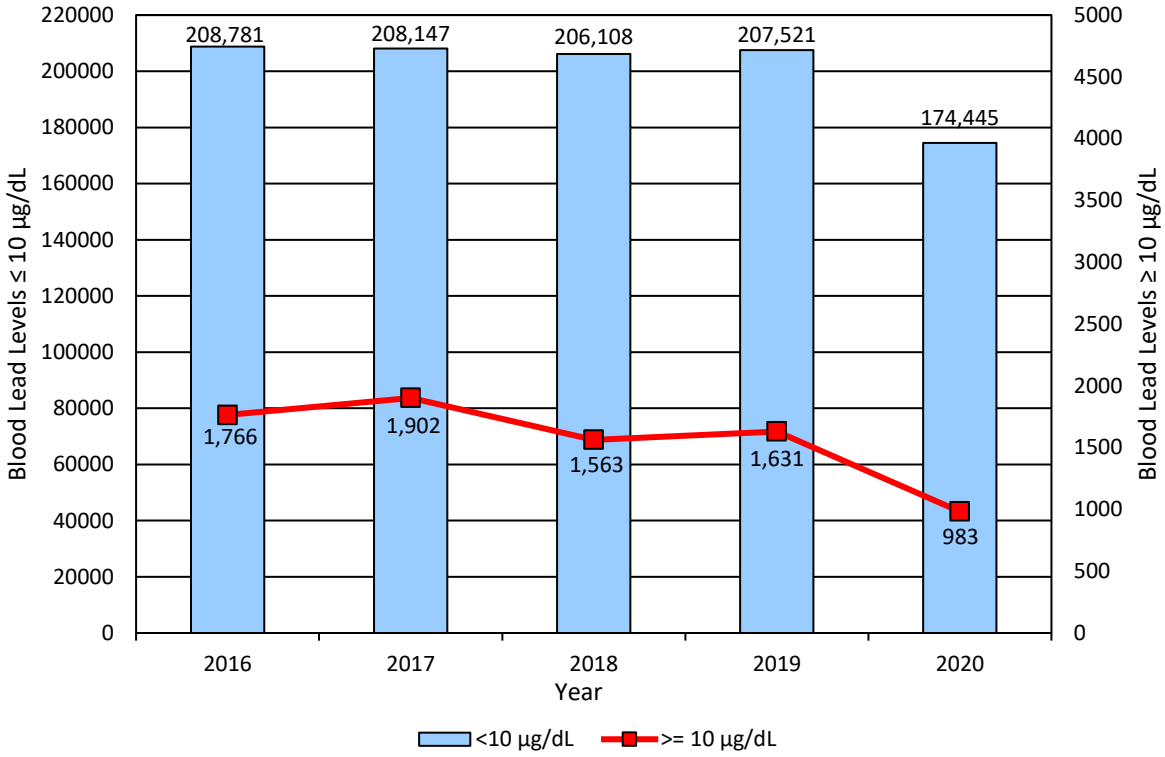


**Figure 4. Number of Tested Adults Reported to the Heavy Metals Registry for Lead, by Year and Blood Lead Level, 2016-2020**




In general, tested adults with blood lead levels 10 µg/dL and greater reported to the HMR between 2016 and 2020 were primarily males 30 to 49 years of age, and more than half resided in Upstate (Table 4). Although approximately 85% (6,684 adults) of those with blood lead 10 µg/dL and greater were male and 15% (1,180 adults) were female, gender distribution varies by blood lead level (Table 5). Approximately 15% of those with the lowest blood lead levels (10 µg/dL and 24 µg/dL) and 17% of those with the highest (60 µg/dL and greater) blood lead levels are female. The highest blood lead levels among females were all associated with non-occupational exposures (data not shown). Almost 70% of the tested adults with unknown exposures were not interviewed because they could not be contacted after repeated attempts were made. Thus, detailed exposure information could not be obtained. Changes in the number of people reported to the HMR from 2016 through 2020 are similar for NYC and Upstate (Figure 5). The change in blood lead levels from 2016 through 2020 is similar for those in NYC and those in Upstate. There was a slight increase in 2017, followed by a plateau in 2018 and 2019, leading to a decline in 2020 (less than 1000 adults) in both upstate and NYC. (Figure 5).

**Table 4. Total Number of Unique Adults Reported to the Heavy Metals Registry with Blood Lead Levels ≥ 10 µg/dL, by Sex, Age, Exposure Source, and Geographic Region for Lead, 2016–2020**

| | N | % |
|---|---|---|
| **Number of Adults** | 7,845 | |
| Sex | | |
| Male | 6,684 | 85.2 |
| Female | 1160 | 14.8 |
| Unknown | 1 | 0 |
| Age | | |
| ≤29 years | 1,472 | 18.8 |
| 30-49 years | 3,649 | 46.5 |
| ≥50 years | 2,720 | 34.7 |
| Unknown | 4 | 0 |
| Exposure | | |
| Occupational | 4,111 | 52.4 |
| Non-occupational | 1,170 | 14.9 |
| Both | 275 | 3.5 |
| Unknown | 2,289 | 29.2 |
| Geographic Region | | |
| Upstate | 4,341 | 55.3 |
| NYC | 2,639 | 33.6 |
| Out of State | 631 | 8.0 |
| Unknown | 234 | 3.0 |
| Total Number of Tests | 14,764* | |

**The number of tests adds up to more than the number of adults because adults can have multiple lead tests.*

**Table 5. Total Number of Unique Adults Reported with Blood Lead Levels ≥ 10 µg/dL to the Heavy Metals Registry, by Sex, Age, Exposure Source, Geographic Region and Blood Lead Level, 2016-2020**

| | Blood Lead Levels (µg/dL) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **10-24** | | **25-39** | | **40-59** | | **60+** | | **Total** | |
| | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** |
| **Tested Adults** | **6,724** | **85.7** | **918** | **11.7** | **162** | **2.1** | **41** | **0.5** | **7,845** | **100** |
| Sex | | | | | | | | | | |
| Male | 5,705 | 84.9 | 813 | 88.6 | 132 | 81.5 | 34 | 82.9 | 6,684 | 85.2 |
| Female | 1,018 | 15.1 | 105 | 11.4 | 30 | 18.5 | 7 | 17.1 | 1,160 | 14.8 |
| Unknown | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Age | | | | | | | | | | |
| ≤ 29 years | 1,256 | 18.7 | 169 | 18.4 | 39 | 24.2 | 8 | 19.5 | 1,472 | 18.8 |
| 30-49 years | 3,134 | 46.6 | 420 | 45.8 | 75 | 46.6 | 20 | 48.8 | 3,649 | 46.5 |
| ≥ 50 years | 2,330 | 34.7 | 329 | 35.8 | 48 | 29.2 | 13 | 31.7 | 2,720 | 34.7 |
| Unknown | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Exposure | | | | | | | | | | |
| Occupational | 3,443 | 51.2 | 562 | 61.2 | 89 | 54.9 | 17 | 41.5 | 4,111 | 52.4 |
| Non-occupational | 934 | 13.9 | 181 | 19.7 | 40 | 24.7 | 15 | 36.6 | 1,170 | 14.9 |
| Both | 206 | 3.1 | 53 | 5.8 | 10 | 6.2 | 6 | 14.6 | 275 | 3.5 |
| Unknown | 2,141 | 31.8 | 122 | 13.3 | 23 | 14.2 | 3 | 7.3 | 2,289 | 29.2 |
| Geographic Region | | | | | | | | | | |
| Upstate | 3,688 | 54.9 | 529 | 57.6 | 92 | 56.8 | 32 | 78.0 | 4,341 | 55.3 |
| NYC | 2,283 | 34.0 | 295 | 32.1 | 53 | 32.7 | 8 | 19.5 | 2,639 | 33.6 |
| Out of State | 552 | 8.2 | 68 | 7.4 | 11 | 6.8 | 0 | 0 | 631 | 8.0 |
| Unknown | 201 | 2.9 | 26 | 2.8 | 6 | 3.7 | 1 | 2.4 | 234 | 3.0* |

**Due to rounding, some percentage columns may not sum to 100.*

**Figure 5. Number of Tested Adults Reported to the Heavy Metals Registry with Blood Lead Levels ≥ 10 µg/dL, by Year and Geographic Region, 2016-2020**

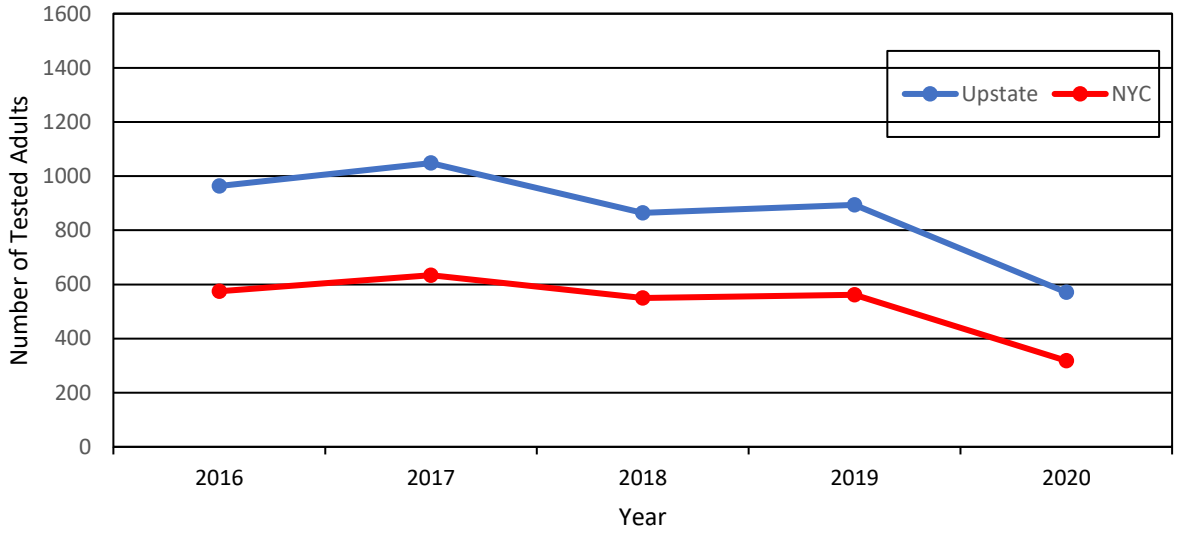
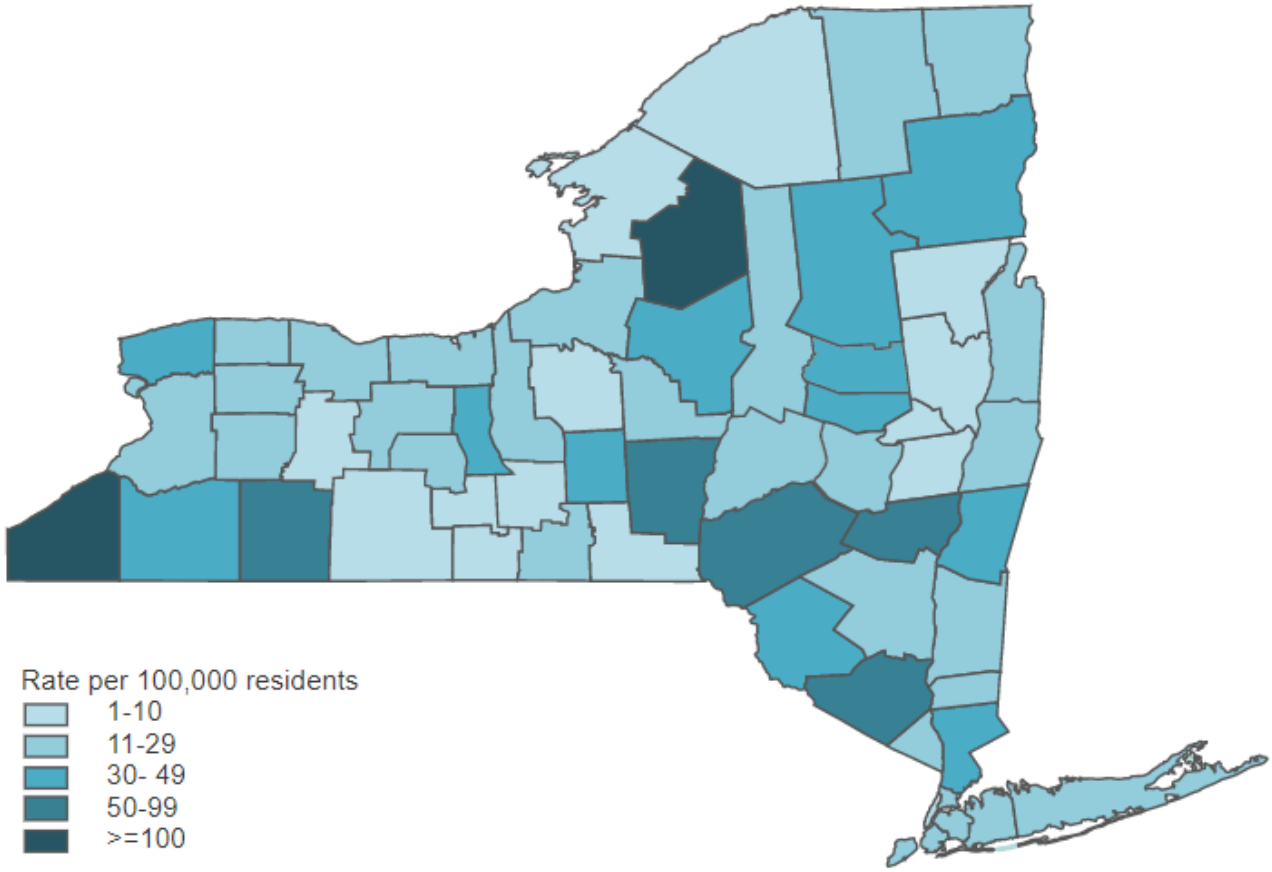



**Figure 6. Mean Annual Prevalence Rate of Adults with Elevated Blood Lead Levels ≥ 10 ug/dL, by County of Residence, NYS 2016-2020**



The county of residence for individuals reported with elevated blood lead levels (greater than or equal to 10 µg/dL) is displayed in Figure 6. Between 2016 and 2020, the lowest prevalence rates were observed in New York and Tompkins counties and the highest rates were observed in Lewis and Chautauqua counties. While this figure shows where people who get tested live, there is no obvious pattern in the geographic distribution of the individuals. There are several people (about 9% of reported adults) who reside out of state (Table 5) but are exposed to lead due to a work location in NYS. It is likely that more people stayed home during the Covid-19 pandemic, leading to more exposure to lead especially for residents of older homes built before 1978. Increased surveillance to detect blood lead levels and increased awareness about lead poisoning is suggested for counties with higher rates.

**Table 6. Number of Unique Adults Reported with Occupational Exposures and Blood Lead Levels > 10 µg/dL, by Source of Exposure, 2016-2020**

| | Blood Lead Levels (µg/dL) | | | | |
|---|---|---|---|---|---|
| **Exposure Source** | **10-24** | **25-39** | **40-59** | **≥60** | **Total** |
| Bridge Worker | 791 | 160 | 27 | 3 | 981 |
| Casting (bullets etc.) | 25 | 10 | 4 | 1 | 40 |
| Stained Glass | 65 | 17 | 1 | 0 | 83 |
| Iron/steel structure | 360 | 64 | 4 | 1 | 429 |
| Job exposure typical of occupation | 1,803 | 268 | 38 | 8 | 2,117 |
| Smelter work | 104 | 2 | 0 | 0 | 106 |
| Lead abatement | 90 | 8 | 3 | 0 | 101 |
| Metal Recycling | 58 | 10 | 2 | 1 | 71 |
| Lead glass/powder | 6 | 3 | 2 | 0 | 11 |
| Residential remodeling | 148 | 33 | 10 | 10 | 201 |
| Target Shooting | 493 | 130 | 22 | 5 | 650 |
| Radiator Repair | 11 | 0 | 0 | 0 | 11 |
| Work with wires/cables | 29 | 1 | 0 | 0 | 30 |
| Unknown | 2,197 | 131 | 23 | 3 | 2,354 |
| Total | 6,180 | 837 | 136 | 32 | 7,185 |

**Table 7. Number of Unique Adults Reported with Non-Occupational Exposures and Blood Lead Levels > 10 µg/dL, by Source of Exposure, 2016-2020**

| | Blood Lead Levels (µg/dL) | | | | |
|---|---|---|---|---|---|
| **Exposure Source** | **10-24** | **25-39** | **40-59** | **≥60** | **Total** |
| Accidental Ingestion | 1 | 0 | 0 | 0 | 1 |
| Cookware | 17 | 1 | 0 | 0 | 18 |
| Environmental | 40 | 5 | 0 | 0 | 45 |
| Institutionalized | 4 | 0 | 0 | 0 | 4 |
| Medical Procedure | 1 | 0 | 0 | 0 | 1 |
| Hobby, Jewelry, Crafts | 1 | 1 | 0 | 0 | 2 |
| Pica | 14 | 5 | 5 | 1 | 25 |
| Retained bullet fragments | 43 | 6 | 4 | 1 | 54 |
| Diet, Folk Medicine | 282 | 30 | 16 | 7 | 335 |
| Unknown | 175 | 0 | 0 | 0 | 175 |
| Total | 403 | 48 | 25 | 9 | 660 |

As used in this report, the term occupational includes exposures that are classified as occupational exposures only, or both occupational and non-occupational. The primary sources of lead for occupationally exposed individuals with elevated blood lead levels (greater than or equal to 10 µg/dL) are displayed in Table 6. The highest number of those who worked in residential remodeling had 60 µg/dL and greater blood levels suggesting greater exposure in this occupational field. Bridge workers, target shooting, and iron/steel structure occupations had relatively higher number of workers were reported to the HMR with varying levels of lead exposures.

The primary sources of non-occupational exposure among individuals with blood lead levels greater than or equal to 10 µg/dL are displayed in Table 7. Individuals with non-occupational exposures are primarily exposed through the consumption of folk medicines/dietary supplements, retained bullet fragments and environmental exposure. Lead has been found in some traditional folk medicines used by South Asian, Middle Eastern and Hispanic cultures. In some cultures, people believe that lead can be useful in treating ailments such as arthritis, infertility, and upset stomach.[8] These exposures primarily occur in the NYC area, and the NYC Department of Health and Mental Hygiene has developed outreach materials to address these exposures.[9] Exposure to lead is also a concern during the renovation/remodeling of any home built before 1978, after which lead was banned from household paint. NYSDOH has developed outreach materials and staff routinely assists homeowners in assessing and reducing their potential for exposure.[10] People can also be exposed to lead from target shooting as a hobby since most ammunition contains lead in either the bullet or the primer. The highest non-occupational blood lead levels (over 60 µg/dL) occurred among those using folk medicines/dietary supplements, followed by retained bullet fragments in the body and other environmental exposures.

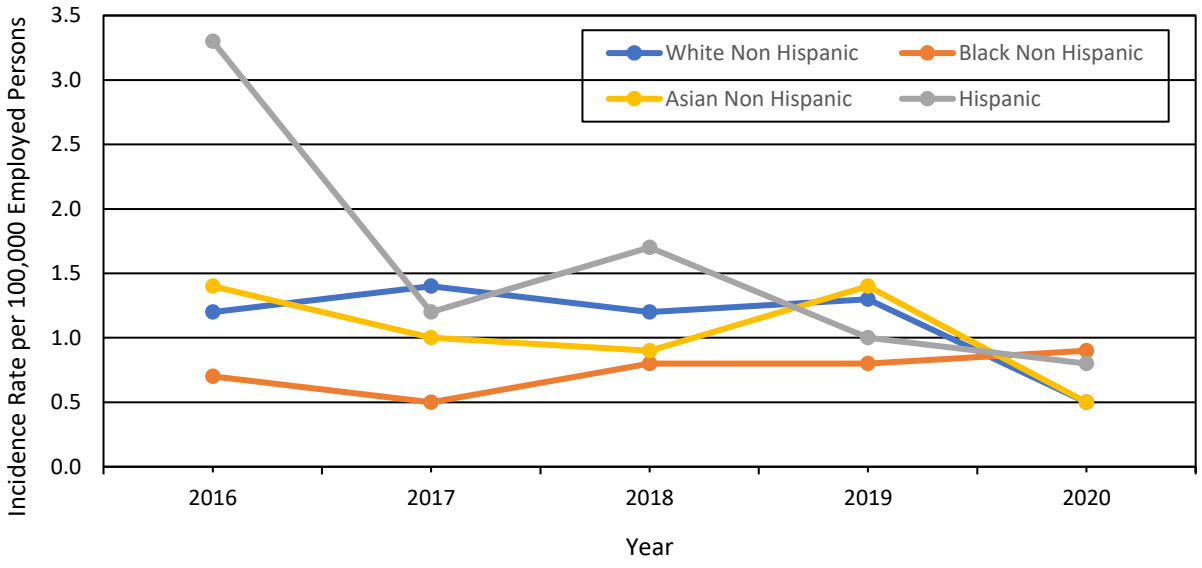
## Adult Blood Lead Epidemiology and Surveillance (ABLES)

NYS participates in the National Institute for Occupational Safety and Health surveillance program, Adult Blood Lead Epidemiology and Surveillance (ABLES), which is a state-based surveillance program of laboratory-reported adult blood lead levels.[11] For the ABLES program, adults are defined as persons 16 years or older. The objective of the ABLES program is to build state capacity to improve adult blood lead surveillance programs and to measure trends in adult blood lead levels. NYSDOH submits lead data from the HMR to the ABLES program annually. Nationally, 41 states participate in ABLES. The Occupational Safety and Health Administration (OSHA) has used national program data to identify industries where elevated blood lead levels indicate a need for national focus. Over the past 17 years, a 50% decrease in the national prevalence rates of blood lead levels 25 µg/dL or greater has been documented using ABLES data. NYSDOH has used ABLES data to identify trends and identify areas for targeted interventions.

## Disparities in Lead Exposure

As shown in Figure 7 below, there has generally been a decline in the incidence rate of elevated adult blood lead levels (25 µg/dL or greater) among various groups of New Yorkers during 2015-2020.

**Figure 7. Incidence Rate of New York State Residents with Blood Lead Levels > 25 µg/dL, per 100,000 Employed Persons*, by Race and Ethnicity and Year, 2016- 2020**



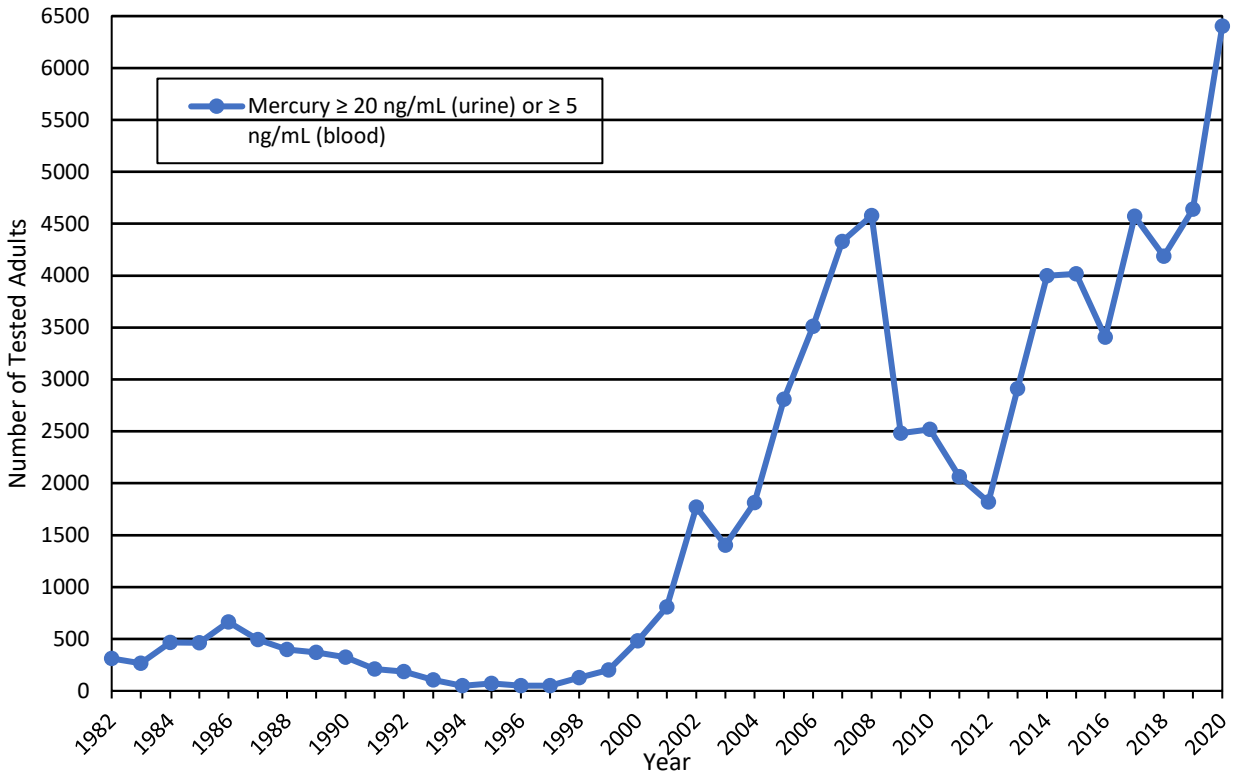

** Incident cases and rates are calculated using the number of elevated cases reported during a calendar year, but not reported in the immediately preceding year, divided by the state's annual employed population.*

Amongst Hispanic adults reported to the HMR for blood lead levels of 25 µg/dL or higher, a 4-fold decrease was observed in the incidence rate in 2020 compared to 2016. In 2016 the incidence rate was 3.3 per 100,000 employed adults in compared to 0.8 in 2020. Amongst Non-Hispanics, White Non-Hispanic adults also had a 2.4-fold decrease in the incidence rate in 2020 compared to 2016. In 2016, the incidence rate was 1.2 compared to 0.5 in 2020. Similarly, among the Non-Hispanic Asians, the incidence rate was 2.8 times lower in 2020 compared to 2016 (0.5 vs 1.4). However, amongst Black Non-Hispanic adults, the incidence rate increased from 0.7 in 2016 to 0.9 per 100,000 employed workers in 2020 which should be noted.

## Mercury

Mercury occurs naturally in the environment in several forms. One common form is metallic mercury (also called elemental mercury). Metallic mercury is a silvery, odorless liquid that can evaporate at room temperature, becoming a vapor. Mercury can combine with other chemicals to form inorganic or organic mercury compounds. Inorganic mercury is mercury combined with other chemical elements such as chlorine, sulfur, or oxygen. Organic mercury is mercury combined with carbon-based compounds. One common form of organic mercury is methylmercury, which is produced by microorganisms in water and soil, and accumulates in fish. Exposure to high levels of mercury can damage the nervous system and cause irritability, tremors, changes in vision or hearing and memory problems. Mercury can also harm the kidneys and developing fetus.[12] People are exposed to metallic mercury when they inhale the vapors. People can be exposed to inorganic and organic mercury when they eat foods or other products contaminated with mercury. Urine and blood testing are the accepted methods to assess mercury exposure for medical purposes. The type of test performed depends upon the form of mercury to which a person may have been exposed. An elevated urine test for mercury indicates an elemental or inorganic source of mercury exposure. An elevated blood test for mercury indicates a recent exposure to a high concentration of mercury vapor or exposure to an organic mercury source (for example, methylmercury from a recent fish meal). Levels of mercury that are reportable to the NYSDOH are 5 ng/mL in blood and 20 ng/mL in urine, however only those individuals with blood mercury levels of 60 ng/mL are routinely interviewed by HMR staff (see Appendix B for program operation details).

**Figure 8. Number of Adults with Elevated Blood Mercury Reported to the Heavy Metals Registry, by Year**




Between 2016 and 2020, the number of adults with elevated blood mercury reported to the HMR has increased, with 6,403 adults reported in 2020 (Figure 8). During this time, 23,213 adults were tested for mercury. Because some individuals were tested more than once, there were a total of 26,346 tests during this period (Table 8). About 49% percent of these were males and 52% percent were females, and 61% percent of them were 50 years of age and older. Almost 65% percent of those tested were residents of NYC while 32% percent resided in upstate NY. About five percent of adults reported to the HMR, with non-occupational exposures resulting from seafood consumption, while 95% percent of them had an unknown exposure., although previous research has shown that the vast majority of adults with mercury in the blood are seafood consumers.[12] Commonly consumed fish included salmon, tuna, and swordfish, with more than 90% of adults eating seafood a few times or more per week.[11]

**Table 8. Total Number of Unique Adults Reported to the Heavy Metals Registry by Sex, Age, Exposure Source, and Geographic Region for Mercury, 2016-2020**

| | N | % |
|---|---|---|
| **Number of Adults** | 23,213 | |
| Sex | | |
| Male | 11,201 | 48.3 |
| Female | 11,987 | 51.6 |
| Age | | |
| ≤ 29 years | 1,848 | 8.0 |
| 30-49 years | 7,281 | 31.4 |
| ≥50 years | 14,083 | 60.7 |
| Exposure | | |
| Occupational | 23 | 0.1 |
| Non-occupational | 1,099 | 4.7 |
| Both | 7 | 0 |
| Unknown | 22,084 | 95.1 |
| Geographic Region | | |
| Upstate | 14,929 | 65.1 |
| NYC | 626 | 2.7 |
| Out of State | 7,383 | 32.2 |
| Total Number of Tests | 26,346* | |

**The number of tests adds up to more than the number of adults because many adults have multiple mercury tests*.

## Highlight: Lead may be a hidden workplace danger

While there has been a decline in the prevalence of elevated blood lead levels among adults reported to NYSDOH over the 38 years of the HMR, staff remain diligent at identifying exposure sources. In October 2019, HMR staff identified a new specialty window and door restoration company in the registry with 27 employees tested for blood lead levels. Four of the 27 employees had elevated blood lead levels above 100 micrograms per deciliter (µg/dL) and most of the remaining employees' blood lead levels ranged between 30 – 90 µg/dL. The employees of this company had among the highest recorded blood lead levels in the history of the HMR. As a frame of reference, in 2015 NIOSH designated 5 ug/dL as the reference blood lead level for adults, with an elevated blood lead level defined as greater than 5 ug/dL. Also, OSHA standard establishes limits for the maximum amount of lead to be permitted in employees' blood and, among several actions, requires a medical surveillance program for all employees exposed at or above the action level of 30 µg/dL for more than 30 days per year. Many workers from this company were symptomatic, and some underwent chelation treatment, which involves the administration of medicines that bind to the lead and remove it from the body.

This specialty company used sub-contracted field technicians to remove pre-1980s windows and doors from a commercial building being renovated and delivered them to a warehouse workshop. Inside the warehouse, employees stripped the paint, and sanded and refurbished the windows. The old buildings that were being renovated had leaded paint on interior and exterior surfaces as well as on windows and doors. The employer did not test the surfaces for lead. The workers did not realize that when they were working with the lead-based painted surfaces on the windows, they were in contact with a material that could cause negative health effects, many of which are long-term. HMR staff contact with employees indicated a lax safety culture and no enforcement of rules. There were deficiencies in respiratory protection, hygiene, and sanitation. Interviews conveyed a lack of clear direction to use respirators to block lead dust inhalation. Workers were unaware of important hygiene practices after working with lead, such as washing hands, taking showers, and changing contaminated clothing before leaving the worksite to prevent "take-home lead" exposure. There was a lack of employee understanding about the separation of areas and processes that were "clean" versus "dirty" with lead dust. In addition, this small company didn't have a health and safety director; there was not one person in charge of ensuring health and safety protocols were in place or being followed.

The employees and the company cooperated with HMR staff when they realized that people were getting sick at work from lead exposure and the company saw the need to engage in better health and safety practices. Operations were shut down completely in the warehouse. Employees were placed on a medical monitoring plan following OSHA guideline. The company hired a training company and reached out to the safety group from their insurance carrier to assist them. Engineering controls in the form of a new ventilation system in a dedicated room were implemented. A Respiratory Protection Program was set up, with fit-testing and medical clearance; other appropriate personal protective equipment (PPE) was assigned. Employees are now required to wear this PPE when working with lead or other hazardous materials. Work areas and breakrooms were surface tested for lead and the facility was thoroughly cleaned and retested. Access to showers and improved sanitation/housekeeping methods were put in place. Standard operating procedures (SOPs) were written incorporating all the changes in policy and procedures. Employees have been trained on the SOPs and on annual lead training, including a

review of the OSHA standard and the hazards of lead. HMR staff provided information about the local Occupational Health Clinic Network (OHCN)'s site that can provide follow-up medical care. The local Occupational Health Clinic for the Western Region of NYS was the designated clinic for follow-up. This clinic in Buffalo is part of NYS's Occupational Health Clinic Network (OHCN), the only state-based occupational health clinic network in the U.S.; it has 9 locations throughout the state. The mission is not only to help prevent work-related illnesses and injuries, but to provide a range of services to diagnose, detect, and treat workers who are injured or ill because of workplace exposures, injuries or job hazards. Their comprehensive occupational medicine services help workers to achieve the best possible recovery. The OHCN also provides consultation and assistance to employers by providing services such as education, medical surveillance and clearance examinations and work restriction programs. Staff continue to track employees of the worksite to monitor their blood lead levels, which are now all below 30 µg/dL, and to follow up on company progress.

It may be almost 100 years since any company has advertised that lead guards our health, but from this scenario it is evident that workers can still get lead poisoning from repeated exposure to old lead paint dust. Other sources of lead present hazards in the workplaces of our state. These exposures have the potential to cause poisoning and illness to our workers. The daily review of blood lead data conducted by the HMR staff identified such exposures and resulted in a success story to help workers at a small window restoration company be protected on the job.

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## Appendix A - State Regulations for Reporting Heavy Metals

**22.6 Reporting heavy metals in blood and urine**. Every physician, clinical laboratory, and health facility in attendance of a person with a blood or urine test resulting in a value at or above those listed in section 22.7 of this Part, shall report such occurrence to the State Commissioner of Health within 10 days of the receipt of the results of such test. The report shall be on such forms as prescribed by the State Commissioner of Health.

**Historical Note**
Sec filed May 14, 1981 eff. Dec. 1, 1981.

**22.7 Reportable levels of heavy metals in blood and urine**. For purposes of section 22.6 of this Part, the following levels of heavy metals in blood and urine samples are reportable to the State Commissioner of Health: Metal Sample Reportable at or above Lead Blood 25 µg/dL Cadmium Blood Urine 10 ng/mL 5 µg/L Mercury Blood Urine 5 ng/mL 20 ng/mL Arsenic Urine 50 µg/L.

| *Metal* | *Sample* | *Reportable at or above* |
|---|---|---|
| Lead | Blood | 25 µg/dL |
| Cadmium | Blood | 10 ng/mL |
| | Urine | 5 µg/L |
| Mercury | Blood | 5 ng/mL |
| | Urine | 20 ng/mL |
| Arsenic | Urine | 50 µg/L |

**Historical Note**
Sec filed May 14, 1981, and. filed Sept. 11, 1986
eff. Sept. 11, 1986

Subpart 67-3
REPORTING OF BLOOD LEAD LEVELS

SEC 67-3.1 Laboratory reporting of blood lead levels for public health follow up

Section 67-3.1 Laboratory reporting of blood lead levels for public health follow up.
(a) For purposes of this Subpart, laboratory shall mean any laboratory that holds a permit issued in accordance with Public Health Law Article 5, Title V and is authorized to conduct blood lead analyses.

(b) Laboratories shall report the results of all blood lead analyses performed on residents of New York State to the Commissioner of Health and to the local health officers in whose jurisdictions the subjects of the tests reside. If the laboratory reports electronically to the Commissioner of

Health in accordance with subdivision (e) below, the Department of Health shall notify the appropriate local health officer of the test results and the laboratory shall be deemed to have satisfied the reporting requirements of this section.

## Appendix B - Overview of HMR Program Operations

Clinical laboratories, health care providers and health care facilities can report heavy metal test results electronically through the internet or manually on paper forms to the New York State (NYS) Department of Health (DOH). All information reported to the Registry is confidential, and records and computer files are maintained in accordance with DOH regulations concerning medical data containing individual identifiers. Access to the data by anyone other than Registry personnel is restricted and carefully monitored so that confidentiality is maintained. Approximately 99% of all tests for lead were submitted electronically. This was similar for tests of other heavy metals: 95% of arsenic and mercury, and 100% of cadmium tests were all submitted electronically.

Once information is received on a person with an elevated level, DOH contacts the person and/or their health care provider and interviews them to determine the possible sources of exposure, provide advice on appropriate control measures to limit future exposures to the individual and his or her family, and answer any questions the individual may have. DOH also collects demographic information, such as level of education, primary language spoken, and ethnicity along with information about the subject's work and home environments. When the exposure is work-related, DOH gathers information on the employer, work location, protection measures in place and whether coworkers are also potentially exposed. Following the interview, DOH provides individuals with brochures appropriate to their exposure sources describing methods to reduce exposure, along with the telephone number of the local state-sponsored occupational health clinic in the event they wish to pursue additional follow-up on their test results (a list of NYS Occupational Health Clinic locations and contact information can be found at: https://www.health.ny.gov/environmental/workplace/clinic.htm).

DOH performs the contacts described above for all individuals with reportable levels of arsenic and cadmium, or reportable urine mercury level. Therefore, effective February 2014, only those individuals with blood mercury levels at or above 60 ng/mL have been interviewed. A fact sheet about potential sources of mercury exposure and prevention techniques is mailed to all others not interviewed. Prior to that, interviews occurred at or above blood mercury levels of 25 ng/mL. Currently, interviews are conducted for lead exposures of women of childbearing age (ages 16-45), and 16- and 17-year-olds with blood lead levels greater than or equal to 5 µg/dL. For all other adults, the interviews are conducted for anyone with blood lead levels at or above 15 µg/dL. All children are followed by the DOH Childhood Lead Poisoning Primary Prevention Program. DOH regularly sends letters advising pregnant women to have their newborns tested at birth and works directly with the local health departments on case management.

When DOH identifies a workplace with employees with high or persistently elevated heavy metal levels, DOH conducts follow-up with the employer. For situations where an employer has not previously had an employee who was reported to the HMR, an industrial hygienist contacts

the company to determine the exposure circumstances, learn whether coworkers are at risk, and assess whether the company is taking appropriate measures to control exposures. With all contacts, the industrial hygienist protects the confidentiality of the individual reported. An important focus of these efforts is smaller businesses that do not have either fulltime medical or industrial hygiene resources to evaluate their worksites. At a minimum, DOH provides advice over the telephone, with a follow-up letter summarizing the recommendations. Depending on the severity or persistence of the problem, or the uniqueness of the source of exposure, DOH may ask for permission to conduct an on-site industrial hygiene evaluation. That evaluation is then followed by a written report that is submitted to the employer and to the union representative, if applicable.

In all cases, DOH's goal is to reduce exposure to all heavy metals. For workplace exposures, DOH recommendations are guided by the federal Occupational Safety and Health Administration (OSHA) standards and the experience of the industrial hygienists in addressing similar exposures. In these instances, DOH encourages employers to implement site-specific exposure reduction measures and monitoring to help assure that exposures have been reduced.

The HMR database is an interactive system which is updated daily. Both blood lead and other heavy metal reports are received electronically from laboratories daily and are added to the database each morning. All surveillance and follow-up information are available to DOH instantly as changes and updates occur. This greatly enhances the ability of DOH to determine if a report has already been received; correct report and case data immediately; make new information directly available to all staff; uncover and correct errors, add new employers, assign cases to interviewers; and track the progress of cases with elevated test results, daily. Daily updates allow staff to rapidly respond to highly elevated levels to ensure that the case is receiving proper medical management, to identify others at risk, and to intervene to prevent further exposures.