United States Government Accountability Office

GAO

Report to the Ranking Member, Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, House of Representatives

March 2011

# LEAD IN TAP WATER

# CDC Public Health Communications Need Improvement


GAO-11-279

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Highlights

Highlights of GAO-11-279, a report to the Ranking Member, Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, House of Representatives

### Why GAO Did This Study

In February 2004, the Centers for Disease Control and Prevention (CDC) was asked to assess the effects of elevated lead levels in tap water on Washington, D.C., residents. In April 2004, CDC published the results. However, an inaccurate statement and incomplete descriptions of the limitations of the analyses resulted in confusion about CDC's intended message. GAO was asked to examine (1) CDC's actions to clarify its published results and communicate current knowledge about the contribution of lead in tap water to elevated blood lead levels (BLL) in children and (2) CDC's changes to its procedures to improve the clarity of the information in its public health communications. GAO reviewed CDC communication policies and procedures and interviewed CDC officials.

### What GAO Recommends

GAO is making two recommendations to CDC: (1) publish an article providing a comprehensive overview of tap water as a source of lead exposure and communicating the potential health effects on children and (2) develop procedures to address any confusion after information is published. CDC generally concurred with GAO's recommendations. For the second recommendation, while CDC described procedures it is developing, the agency did not explicitly address all components of the recommendation.

View GAO-11-279 or key components. For more information, contact Cynthia A. Bascetta at (202) 512-7114 or bascettac@gao.gov.

### What GAO Found

CDC officials told GAO that although the agency does not have a policy to monitor the use of or clarify information in public health publications, the agency took actions to address confusion it created related to the 2004 *Morbidity and Mortality Weekly Report* (MMWR) article about elevated lead levels in Washington, D.C., tap water. For example, in 2008, CDC officials contacted District of Columbia Water and Sewer Authority officials requesting corrections to a statement in a fact sheet published by the water authority that incorrectly characterized information from the 2004 MMWR article. In addition, CDC also published articles in the 2010 MMWR intended to clarify the confusion, such as a June 25, 2010, article that discussed limitations about how information in the 2004 article could be used. While CDC took these actions, among others, to clarify confusion about the effect of elevated lead levels in District tap water, as of January 2011, CDC had no plans to publish an overview of the current knowledge about the contribution of elevated lead levels in tap water to BLLs in children, as suggested by a CDC internal incident analysis of issues surrounding the 2004 MMWR article.

CDC officials told GAO they had begun an initiative and revised procedures designed to help ensure the accessibility and clarity of CDC public health communications, both agencywide and in the National Center for Environmental Health, the center responsible for lead poisoning prevention programs. For example, under the new initiative, CDC will revise existing procedures to help ensure that information that CDC publishes, such as guidelines and recommendations, is easily accessible by a common portal on CDC's Web site. While the initiative and revised procedures focus on making CDC information more accessible and on preventing errors or unclear statements in CDC communications, they do not include actions to address confusion that may arise after information is published, such as occurred with the 2004 MMWR article. Without agency procedures specifically addressing how and when to take action about confusion after publication, CDC runs the risk of inconsistent responses across the agency when its published information is not interpreted as CDC intended.

CDC's mission to promote the nation's public health relies on its credibility in presenting accurate, reliable, and timely information. Communicating the agency's current knowledge about the health effects of lead levels in tap water and developing procedures that allow it to address confusion in a timely, consistent manner could improve the public's understanding of the effect of lead in water and help CDC mitigate the risk of confusion in other situations and protect its credibility.

# Contents

**Abbreviations**

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| BLL | blood lead level |
| CDC | Centers for Disease Control and Prevention |
| CLPPP | Childhood Lead Poisoning Prevention Program |
| CMS | Centers for Medicare & Medicaid Services |
| DCDOH | District of Columbia Department of Health |
| EPA | Environmental Protection Agency |
| HHS | Department of Health and Human Services |
| MMWR | *Morbidity and Mortality Weekly Report* |
| NCEH | National Center for Environmental Health |
| NHANES | National Health and Nutrition Examination Survey |
| pbb | parts per billion |
| $\mu$g/dL | micrograms per deciliter |

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**United States Government Accountability Office**
**Washington, DC 20548**

March 14, 2011

The Honorable Brad Miller
Ranking Member
Subcommittee on Energy and Environment
Committee on Science, Space, and Technology
House of Representatives

Dear Mr. Miller:

In February 2004, the District of Columbia Department of Health (DCDOH) requested assistance from the Centers for Disease Control and Prevention (CDC) to assess the effects of elevated lead levels in the city's residential tap water on the city's residents.[1] Elevated levels of lead in tap water can result in elevated blood lead levels (BLL), which can cause adverse health effects in adults and children.[2] CDC, an agency in the Department of Health and Human Services (HHS), is responsible for developing lead poisoning prevention programs and policies, and collaborating with federal and state partners, health departments, and health care providers to prevent lead poisoning.[3] CDC assists state and local partners in developing laboratory-based surveillance systems for BLLs among children and assists states in the analysis and dissemination of lead surveillance data. These activities help contribute to CDC's efforts in support of HHS's Healthy People 2020 goal of eliminating elevated BLLs in children.[4]

[1]Tap water includes water used for drinking, cooking, and preparing infant formula and juice.

[2]Exposure to lead, which can lead to elevated BLLs, and potentially to lead poisoning, can affect nearly every system in the body, including the nervous, reproductive, renal, cardiovascular, and gastrointestinal systems. This can also cause behavior problems and learning disabilities in young children.

[3]Lead poisoning occurs once a child's BLL reaches 10 micrograms of lead per deciliter of blood.

[4]Healthy People 2020 is a national health promotion and disease prevention initiative that strives to identify nationwide health improvement priorities and to promote quality of life, healthy development, and healthy behaviors across all life stages. The goal to eliminate elevated BLLs in children was previously an objective for the Healthy People 2010 initiative.

In response to DCDOH's request, CDC worked with individuals from DCDOH and the U.S. Public Health Service[5] to investigate the effect of lead in the District of Columbia's[6] tap water on the BLLs of residents. On April 2, 2004, CDC published the preliminary results in an article in the *Morbidity and Mortality Weekly Report* (MMWR), the agency's primary vehicle for disseminating public health information.[7] MMWR is intended to provide information that is timely, reliable, and accurate. However, according to CDC officials, the article inaccurately stated that no children had BLLs over CDC's established level of concern, when in fact some children's BLLs exceeded that level.[8] Specifically, despite stating that "no safe BLL has been identified"[9] for children, the article indicated that although lead in tap water contributed to a small increase in BLLs in the District, no children were identified with BLLs above CDC's established level of concern, even in homes with water lead levels that were greatly in excess of Environmental Protection Agency (EPA) standards.[10] Additionally, CDC officials have stated that the MMWR article did not fully describe limitations on how the results should be interpreted and used. In a June 2010 article in a District newspaper, CDC's Director said that CDC

[5]The U.S. Public Health Service Commissioned Corps consists of more than 6,500 public health professionals who support federal agencies' health promotion and disease prevention efforts and public health science activities.

[6]Throughout, we refer to the District of Columbia as the District.

[7]L. Stokes et al., "Blood Lead Levels in Residents of Homes with Elevated Lead in Tap Water–District of Columbia, 2004," *Morbidity and Mortality Weekly Report*, vol. 53 (Apr. 2, 2004). CDC posted this article online at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5312a6.htm.

[8]In 1991, CDC set a "level of concern" for children at the lead poisoning threshold of 10 micrograms per deciliter of blood in response to evidence associating BLLs of 10 micrograms per deciliter or greater with adverse health effects and has noted that this BLL should prompt public health actions. Actions to reduce lead exposure can include the use of water filters on taps in homes.

[9]CDC also stated that it recognizes that a BLL of 10 micrograms per deciliter did not define a threshold for the harmful effects of lead and that research conducted since 1991 has strengthened the evidence that children's physical and mental development can be affected at BLLs of less than 10 micrograms per deciliter. In other words, there currently is no demonstrated safe concentration of lead in blood, and adverse health effects can occur at lower concentrations.

[10]In an effort to prevent and mitigate the adverse health consequences resulting from elevated lead levels in drinking water, EPA set a limit of 15 parts per billion of lead in water as a regulatory standard for water utilities. Water utilities in violation of this limit must take specified actions to reduce their water lead levels. Some of the households in the District had water lead levels of 300 parts per billion or greater.

communicated scientific results poorly in the 2004 MMWR article and that as a result the article "may have led some people to improperly minimize concerns about lead exposure and conclude that lead in the water had never been a problem." Examples of confusion regarding the seriousness of the health risks include a news report in which a District official was quoted as saying that CDC's view was that residents' health had not been affected by elevated water lead levels in the District, and a news report from another city, which cited the article to downplay the seriousness of the effect of elevated water lead levels in the city on the health of children. CDC's Director stated in a June 2010 letter to the Chairman of the Subcommittee on Investigations and Oversight, House Committee on Science and Technology, that the agency planned to make improvements to agency procedures to enhance the accuracy and clarity of CDC information.

You asked us to examine CDC's efforts to address confusion and clarify information in the 2004 MMWR article related to elevated BLLs in District residents. In this report, we examine (1) the actions CDC has taken to clarify the information in the agency's 2004 MMWR article about BLLs of District residents and to communicate current knowledge about the contribution of lead in tap water to elevated BLLs in children and (2) changes CDC has made to its procedures in an effort to ensure the clarity of the information in its public health communications.

To describe the actions CDC has taken to clarify the information in the agency's 2004 MMWR article about BLLs of District residents and to communicate current knowledge about the contribution of lead in tap water to elevated BLLs in children, we reviewed CDC documents and publications related to the elevated lead levels in the District's tap water, including the 2004 MMWR article and a 2010 MMWR article describing the limitations of the 2004 article; CDC correspondence with local agencies, such as the District of Columbia Water and Sewer Authority (Water and Sewer Authority); CDC's February 2010 internal incident analysis—requested by CDC's Office of the Director—of its response to issues surrounding elevated water lead levels in the District; media reports that refer to information in the 2004 MMWR article; and congressional reports and testimony. We also reviewed CDC reports and other documents describing subsequent investigations related to or referenced in the 2004 MMWR article, such as EPA's report on the potential causes of elevated lead levels in District tap water. We interviewed CDC officials, including

officials from the National Center for Environmental Health (NCEH), about their actions to clarify any confusion related to information in the 2004 MMWR article.[11] We also interviewed CDC officials about any ongoing work CDC has conducted since publishing its preliminary findings in the 2004 MMWR article, and any additional work planned for the future to clarify information in the 2004 MMWR article. We interviewed officials from the Office of the Director and other senior management officials to determine their responses to the internal incident analysis and any related directives from the Office of the Director to NCEH or other CDC entities, and we examined the status of agency activities to respond to any related directives. We also attended a meeting of the Advisory Committee on Childhood Lead Poisoning Prevention—a federal advisory committee to CDC—in November 2010 to obtain any updates to the findings presented in 2004 or other relevant information.

To describe changes CDC has made to its procedures in an effort to ensure the clarity of the information in its public health communications, we reviewed CDC communication policies and procedures and interviewed CDC officials about any initiatives the agency is developing or has implemented since 2004 to help ensure that the messages presented in its public health communications are clear and accurate.

We conducted this performance audit from August 2010 through February 2011 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

## Background

The MMWR series is one of three scientific publications published by CDC and is regarded as CDC's flagship publication.[12] The publication's primary audience is made up of professionals, including medical professionals, such as clinicians, and state and local public health officials, and the

[11]NCEH is a component of CDC that plans, directs, and coordinates programs to maintain and improve the health of the American people by addressing public health effects resulting from noninfectious, nonoccupational environmental exposures, such as lead.

[12]CDC's other scientific publications are *Preventing Chronic Disease* and *Emerging Infectious Diseases*.

publication also reaches CDC's federal partners, such as EPA and the Centers for Medicare & Medicaid Services (CMS). In addition to the weekly reports, the MMWR series also includes *MMWR Recommendations and Reports*, which contain in-depth articles that relay policy statements for prevention and treatment on all areas in CDC's scope of responsibility, such as recommendations from CDC advisory committees. CDC can also issue articles that it calls Dispatches to allow for immediate publication of urgent public health information. The Dispatches are generally subsequently published in the MMWR. The April 2, 2004, MMWR weekly report included an article on the BLLs of District residents that was first published as a Dispatch on March 30, 2004.

## Exposure to Lead in the Environment

Lead is a dangerous contaminant commonly found in the environment that can affect almost every organ and system in the body. The main target for lead toxicity is the nervous system. In addition to causing behavior problems and learning disabilities in young children, elevated BLLs can cause such effects as damage to the brain and kidneys. In pregnant women, elevated BLLs may cause miscarriage.

Drinking contaminated tap water is one way humans may be exposed to lead.[13] While measures taken during the past two decades have greatly reduced exposures to lead in tap water, lead still can be found in some metal water fixtures, interior water pipes, or pipes connecting a house to the main water pipe in the street. Lead in tap water usually comes from the corrosion of older fixtures; lead service lines, including lead service pipes; or the solder that connects pipes.

Federal law requires that blood lead screening tests be made available to all children enrolled in Medicaid.[14] CMS's *State Medicaid Manual* requires that these screenings be performed at ages 12 and 24 months and that all children aged 36 to 72 months who have not previously been screened also receive a blood lead test. The American Academy of Pediatrics agrees with these requirements for screening and has also stated that efforts must

[13]Deteriorating lead-based paint and lead-contaminated dust are the main sources of exposure to lead for U.S. children. Lead-based paints were banned for use in housing in 1978. All houses built before 1978 are likely to contain some lead-based paint. Previously, leaded gasoline was an important source of exposure until the use of leaded gasoline was phased out in the 1980s. This decline was complemented by the ban on the sale of leaded gasoline as of December 31, 1995, under amendments to the Clean Air Act.

[14]42 U.S.C. §§ 1396a(a)(43), 1396d(r).

continue to test children who are at high risk for lead exposure. Beginning in 1995, elevated BLLs—the first noninfectious condition—were designated as a nationally notifiable condition reportable to CDC. The District (along with 36 states and the city of New York) has reported elevated BLLs of 10 micrograms per deciliter ($\mu$g/dL) of blood or higher for children to CDC. The District has reported this BLL information to CDC since 1997.

The District's Childhood Lead Poisoning Screening and Reporting Act of 2002 requires that each health care provider or facility in the District perform a blood test for lead poisoning as part of a well-child care visit for each child that they serve who is under the age of six and resides in the District. The test must occur between ages 6 months and 14 months, and a second test must occur between ages 22 months and 26 months. Both tests must be performed unless parental consent is withheld or an identical test has already been performed within the previous 12 months.[15] If a child's age exceeds 26 months and a blood lead screening has not been performed, the child must be screened twice before age 6.[16] The District also requires health care providers or facilities to report the results of blood tests for lead poisoning on every child under age 6 who resides in the District to the child's parents.[17]

## CDC's Roles and Responsibilities regarding Lead

As the nation's public health agency, CDC has set levels of concern—the BLL that should prompt public health actions—for lead exposure since the 1960s.[18] In 1991, CDC set the level of concern at 10 $\mu$g/dL of blood for

[15]Until March 14, 2007, the first blood test was to be performed between 6 and 9 months. See 2006 D.C. Stat. 16-265.

[16]D.C. Code Ann. § 7-871.03(b).

[17]D.C. Code Ann. § 7-871.03(c), (d).

[18]These public health actions could include health officials distributing information to the public about preventing exposure to lead in water, such as recommendations for the use of water filters on residential water taps, for the consumption of only bottled water, or for clinicians to perform diagnostic blood lead tests on children suspected of having lead exposure or an elevated BLL.

children aged 6 months to 15 years and 25 μg/dL for adults.[19] However, CDC has also recognized that a BLL of 10 μg/dL does not define a threshold for the harmful effects of lead—in other words, no safe blood lead level has been identified for children.

The Lead Contamination Control Act of 1988 authorized CDC to initiate programs to eliminate childhood lead poisoning in the United States.[20] As a result of this act, the CDC Childhood Lead Poisoning Prevention Program (CLPPP) was created. One of the program's primary responsibilities is to educate the public and health care providers about childhood lead poisoning. CDC's CLPPP also provides funding to state and local health departments to determine the extent of childhood lead poisoning by screening children for elevated BLLs. Since the inception of CDC's lead program, nearly 60 state and local jurisdictions have received funding for their state and local CLPPPs. CDC's efforts contribute to the Healthy People 2020 initiative, which includes an objective to eliminate elevated BLLs in children. As of 2007 to 2008, the latest years for which data were available, approximately 1.2 percent of children aged 1 to 5 years nationwide had BLLs exceeding 10 μg/dL.[21]

In addition, the Advisory Committee on Childhood Lead Poisoning Prevention advises and guides CDC regarding new scientific knowledge and technical developments and their practical implications for childhood

[19]In November 2010, CDC's Advisory Committee on Childhood Lead Poisoning Prevention—whose goal is to provide advice to assist the nation in reducing the incidence and prevalence of childhood lead poisoning—published "Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women," which provides guidance regarding blood lead testing and follow-up care for pregnant and lactating women with lead exposure. While CDC states that there is no apparent threshold below which adverse effects of lead do not occur and has not identified an allowable exposure level or level of concern to connote a safe or unsafe level of exposure for either the mother or the fetus, the guidelines recommend follow-up activities to identify and control lead sources in the home beginning at BLLs ≥ 5 μg/dL in pregnant and lactating women rather than at 10 μg/dL.

[20]Pub. L. No. 100-572, § 3, 102 Stat. 2884, 2887-89 (codified as amended at 42 U.S.C. § 247b-1).

[21]The National Health and Nutrition Examination Survey (NHANES) is a national survey, and starting with the period 1999 to 2000, public releases of data collected on a biannual basis occur at least twice a year, or more often if needed. The most recent survey period for which data were available was 2007 to 2008. The NHANES is the source of data used to measure progress for the Healthy People 2020 objective of eliminating elevated BLLs in children aged 1 to 5 years.

lead poisoning prevention efforts.[22] In November 2010, the advisory committee initiated a work group to recommend new approaches, terminology, and strategies for defining elevated BLLs among children.

## EPA's Roles and Responsibilities regarding Lead

Under the Safe Drinking Water Act, EPA is responsible for regulating contaminants that may pose a public health risk and that are likely to be present in public water supplies, including lead.[23] EPA's Lead and Copper Rule established a 15 parts per billion (ppb) lead action level as a regulatory standard for water utilities in an effort to prevent and mitigate the adverse health consequences resulting from elevated lead levels in drinking water.[24] Water systems must sample tap water at locations that are at high risk of lead contamination, generally because they are served by lead service lines or are likely to contain lead solder in the household plumbing. If more than 10 percent of the samples at residences contain lead levels over 15 ppb, the water systems must take action to lower these levels, such as replacing lead service lines in the distribution system or treating water to reduce its corrosion of the service lines, and notify EPA and residents.

## The District's Elevated Water Lead Levels Prior to CDC's Involvement

The District's Water and Sewer Authority owns and operates a system that delivers water—produced by the U.S. Army Corps of Engineers Washington Aqueduct—to customers in the District. In 2000, the Washington Aqueduct began to use chloramine instead of chlorine in its disinfection process.[25] This change likely contributed to elevated water lead levels.

By late 2001, the Water and Sewer Authority became aware that the levels of lead in the District's tap water were above EPA's limit of 15 ppb, and it notified EPA of that fact in August 2002. Beginning in 2002, the Water and

[22]The advisory committee also provides advice and guidance to HHS's Secretary and Assistant Secretary for Health.

[23]Pub. L. No. 93-523, 88 Stat. 1660 (1974) (codified as amended at 42 U.S.C. §§ 300f–300j-25).

[24]40 C.F.R. § 141.80(c)(1) (2010).

[25]The Washington Aqueduct changed its disinfection process after EPA issued regulations requiring that water treatment systems reduce the production of disinfection by-products that result from the use of chlorine because of concerns that the by-products of chlorine were carcinogenic. See 63 Fed. Reg. 69,390 (Dec. 16, 1998) (codified at 40 C.F.R. §§ 141.130-141.135).

Sewer Authority notified its customers of the elevated water lead levels by issuing notices, distributing educational brochures, and holding public meetings. In the fall of 2003, the Water and Sewer Authority requested assistance from DCDOH in responding to District residents' inquiries about the health effects of the elevated water lead levels. District residents, including infants and children, would have been exposed to elevated levels of lead in tap water during this period if they used unfiltered water for drinking, cooking, or preparing infant formula or juice.

## Information in the 2004 MMWR Article

Staff from NCEH, along with individuals from DCDOH and the U.S. Public Health Service, contributed to CDC's investigation on the effect of lead in the District's tap water on the BLLs of residents, which was presented in the April 2, 2004, MMWR article. The 2004 MMWR article reported the results of two analyses from CDC's investigation, which was conducted in February and March 2004. (See app. I for a copy of the 2004 MMWR article.) The first analysis was conducted to identify trends in BLLs in District residents before and after the changes in the water disinfection process. The second analysis was conducted to determine whether residents in homes with the highest water lead levels (300 ppb or greater) had BLLs at or above CDC's level of concern of 10 $\mu$g/dL.

The summary statement of the 2004 MMWR article's findings noted that the elevated water lead levels might have contributed to a small increase in BLLs among District residents. The article's Editorial Note section opened with a sentence that incorrectly stated the results of the first analysis. The sentence read, "The findings in this report indicate that although lead in tap water contributed to a small increase in BLLs in D.C., no children were identified with BLLs $\geq$ 10 $\mu$g/dL, even in homes with the highest water lead levels." The statement that "no children were identified with BLLs $\geq$ 10 $\mu$g/dL" was incorrect, relative to the first analysis. Since the 2004 MMWR article was published, CDC officials have said that in its first analysis some children were identified with BLLs $\geq$ 10 $\mu$g/dL, which is CDC's level of concern for children. The last part of the statement indicating that none of the children in homes with the highest water lead levels had BLLs > 10 $\mu$g/dL was correct, in that none of the 30 children in the second analysis had BLLs that reached CDC's level of concern, according to CDC officials. While the 2004 MMWR article discussed some limitations to its findings, it did not discuss other limitations that

addressed how information in the 2004 MMWR article could be used.[26] For example, it did not state that the article should not be used to make conclusions about the contribution of lead in tap water to BLLs in the District.

## Confusion about the 2004 MMWR Article's Findings

The statement in the 2004 MMWR article that incorrectly links the results of the two analyses in the same editorial note and the incomplete description of the limitations to the article's findings have resulted in this information being interpreted in the press and by others in ways other than as CDC intended. For example:

- In a May 2004 hearing before the House Committee on Government Reform, some business and environmental advocates included references to the 2004 MMWR article to (1) support their assertion that the elevated water lead levels did not warrant a panicked reaction in the District or (2) draw conclusions about the relationship between BLLs and water lead levels in the District, which CDC later stated were inappropriate.
- In July 2004, a newspaper article from a major metropolitan city that was experiencing elevated lead levels in schools' tap water included information about the 2004 MMWR article's findings to support statements that downplayed the seriousness of the effect of elevated water lead levels in the city on the health of children.
- In a February 2008 fact sheet, the Water and Sewer Authority referenced the 2004 MMWR article and included statements that gave the impression that the health of District children had not been affected by elevated lead levels in the District's tap water.
- In February 2009, the General Manager of the Water and Sewer Authority was quoted in a newspaper article as saying that CDC's view was that residents' health had not been affected by elevated water lead levels in the District.

[26]The 2004 MMWR article included the following limitations to its findings: the BLL surveillance data included multiple tests on the same person, and persons with lead poisoning are tested more frequently than those with low BLLs; fingerstick tests, which were used in some cases, are more subject than venous samples to contamination by ambient lead; and neither the blood nor the water lead test results were collected from a randomized sample.

- As recently as December 2010, news articles in the District reported that in the 2004 MMWR article CDC indicated that it found no evidence of measurable or significant harm to the public health of District children from elevated lead levels in tap water.

  In addition, CDC officials have recognized that the 2004 MMWR article may have led people to conclude that there was no danger to children from the elevated water lead levels.

## CDC Has Issued Statements to Address Confusion It Created Related to the 2004 MMWR Article, but Has Not Published an Overview of the Effects of Lead in Tap Water on BLLs in Children

Although CDC does not have a policy to monitor the use of or clarify information in public health publications, such as the information in the 2004 MMWR article, the agency issued statements to address confusion it created related to elevated lead levels in the District's tap water. However, as of January 2011, the agency had no plans to publish an overview of the current knowledge about the effects of lead in tap water on BLLs in children. Specifically, CDC has not published an overview of what is known and not known about tap water as a source of lead exposure and the potential health effects on children, as suggested by the CDC internal incident analysis.

### CDC Has Issued Statements and Taken Other Actions to Address Confusion It Created Related to the 2004 MMWR Article

CDC officials told us that although the agency does not have a policy to monitor the use or clarify interpretations of information in public health publications, such as the 2004 MMWR article, the agency has issued statements to address confusion it created related to the 2004 MMWR article. Specifically, agency officials said they have taken some actions since 2006 to address confusion CDC created about the 2004 MMWR article when they became aware of specific instances of confusion. For example:

- In July 2006, a CDC official was interviewed for an article published in an environmental science journal and provided information to address public statements attributed to a health advisor for the District's Water and Sewer Authority that incorrectly characterized information from the 2004 MMWR article. The CDC official stated that the 2004 MMWR article did not say that drinking water with very high water lead levels, such as those found in some District homes, was safe.

- In February 2008, a CDC official corresponded with the District's Water and Sewer Authority officials about a statement in a February 2008 fact sheet published by the water authority that incorrectly characterized information in the 2004 MMWR article. Specifically, the CDC official noted that the fact sheet misstated the conclusions of the 2004 MMWR article and gave the impression that the health of District residents had not been affected by elevated lead levels in the tap water. The CDC official requested that the statement be corrected. In April 2009, the Director of NCEH sent a letter to the General Manager of the water authority noting that this correction and others had not been made and once again asked that statements published in the fact sheet be corrected to accurately reflect the conclusions in the 2004 MMWR article: that because no threshold for adverse health effects in young children had been demonstrated, public health interventions should focus on eliminating all lead exposures in children.

- In 2009, the Chief of the Healthy Homes and Lead Poisoning Prevention Branch contacted officials responsible for drinking water safety in Seattle and New York City to discuss reports that officials were quoted in newspaper articles in those localities and had mischaracterized information in the 2004 MMWR article to downplay the effect of lead in water and that these cities had relaxed their drinking water standards based on the 2004 MMWR article. The CDC official said that she contacted the officials to clarify the 2004 MMWR article's message about the public health effect of elevated lead levels in the District's tap water and was assured that they had not used the 2004 MMWR article to make any changes in their drinking water standards.

More recently, CDC sent a letter to state and local CLPPP managers, published articles in the MMWR, and contacted District newspaper officials to address confusion it created related to the 2004 MMWR article. Specifically:

- In May 2010, CDC provided clarifying information in a letter to state and local CLPPP managers. (See app. II for a copy of the May 2010 letter.) The Chief of the Healthy Homes and Lead Poisoning Prevention Branch sent a letter dated May 20, 2010, to state and local CLPPP managers saying that the first sentence in the Editorial Note section in the 2004 MMWR article incorrectly stated the results of the first analysis, as some children were identified with BLLs above 10 $\mu$g/dL. Additionally, the letter presented results of a 2009 analysis that included new BLL data that had not been available to CDC in 2004. The letter further stated that the results of this new analysis confirmed the original finding, which CDC stated was that lead in water was associated with an increase in BLLs. The letter also

restated CDC's intended message presented in the 2004 MMWR article—that no safe blood lead level had been identified and all sources of lead exposure should be controlled or eliminated. The letter was also posted on the CDC Web site.

- On May 21, 2010, CDC issued a Notice to Readers in the MMWR providing the same information about the 2009 analysis and addressing the confusion CDC created related to the 2004 MMWR article.[27] (See app. III for a copy of the May 21, 2010, MMWR Notice to Readers.)

- On June 25, 2010, CDC issued a Notice to Readers in the MMWR noting the limitations of the results of the second analysis in the 2004 MMWR article.[28] (See app. IV for a copy of the June 25, 2010, MMWR Notice to Readers.) The Notice to Readers stated that the results of the second analysis should not be used to (1) make conclusions about the contribution of lead in tap water to BLLs in the District, (2) predict what might occur in other situations where lead levels in tap water are high, or (3) determine safe levels of lead in tap water.

- In December 2010, CDC officials said that they contacted a District newspaper when it published news reports that included misinterpretions of the results of the 2004 MMWR article. CDC officials said that they contacted the newspaper the same day that the first news report was published, and for several days thereafter when additional news reports were published, to request clarifications. CDC officials told us that they also had submitted a letter to the newspaper to provide more information to help ensure that the public correctly understood the 2004 MMWR article's intended message. The letter was published in December 2010 and stated that CDC's opinion on the health impact of lead in the District's water supply has not changed and that a new study reports what the

[27]CDC posted the May 2010 letter online at http://www.cdc.gov/nceh/lead/blood_levels.htm. The May 2010 Notice to Readers was posted online at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5919a4.htm. CDC also included a link to the Notice to Readers at the top of the 2004 MMWR article, which was posted online at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5312a6.htm.

[28]CDC posted the June 2010 Notice to Readers online at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5924a6.htm. CDC also included a link at the top of the 2004 MMWR article, which was posted at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5312a6.htm.

agency has been saying since 2004—the presence of lead service lines increases the BLLs in the District's children.[29]

## CDC Has Not Published an Overview of the Effects of Lead in Tap Water on BLLs in Children

Although CDC has taken actions to address confusion specific to the 2004 MMWR article, as of January 2011, CDC had not taken action to publish an overview of the current knowledge about the contribution of elevated lead levels in tap water to BLLs in children and the associated health effects. The 2010 internal incident analysis of CDC's involvement in and response to issues surrounding elevated water lead levels in the District noted that because the relative contribution of tap water to elevated BLLs in children has become more apparent as exposure to lead paint and leaded gasoline has been reduced or eliminated, a systematic evaluation of the relative contribution of tap water to elevated BLLs should be conducted.[30] Specifically, the internal incident analysis suggested that CDC conduct such an evaluation and publish the information in an article in the *MMWR Recommendations and Reports* that would serve as a position paper covering the issues of lead in municipal water supplies and summarizing what is known and not known about its contribution to historic and contemporary BLLs in children. A CDC official said that as of January 2011, CDC had no plans to conduct such an evaluation and publish an overview on the effects of lead in water on BLLs in children in the *MMWR Recommendations and Reports*. CDC noted that while the agency does not lack the authority to undertake such an evaluation, the agency believes that such an evaluation is better suited to EPA, given EPA's responsibility, regulatory authority, and expertise. The agency also noted that EPA is currently in the process of reviewing EPA's regulations for the control of

[29]The newspaper article reported on a recently published CDC study that presents the results of research and analyses on the relationship between partial lead pipe replacement, water lead levels, and BLLs, using data from the District. Lead pipe replacement—which can include removal of the pipe lengths located on both public and private property—is a method for reducing water lead levels by reducing exposure to lead. CDC officials have stated that there is some question as to the efficacy of this method of replacement based on findings that indicate a temporary increase in lead levels may occur when the work is being done. The research results were published online in *Environmental Research* in November 2010 in an article titled, "Association between children's blood lead levels, lead service lines, and water disinfection, Washington, DC, 1998-2006."

[30]While the internal incident analysis did not provide specific recommendations with a defined timeline for their completion, CDC officials said the analysis served as an independent source of information to the Director of CDC about CDC's role in the District. It also identified potential areas of improvement to address the issue of lead in water more broadly and to more effectively handle similar situations regarding CDC communications in the future.

lead and copper in drinking water.[31] CDC noted that the agency could provide technical assistance to EPA and would consider publishing an article after the EPA review is complete. However, publishing an article in the *MMWR Recommendations and Reports* on the latest findings regarding the relationship between BLLs and lead in water could be of assistance to EPA. Moreover, it would allow CDC, in a timely manner, to address any remaining confusion related to the health effects of lead in water in a venue targeted to CDC's audience. Because CDC has not published an overview of the health effects of lead in water in the *MMWR Recommendations and Reports*, clinicians and state and local health officials who look to CDC for comprehensive information on public health issues may be uncertain about what is known and not known about the contribution of elevated lead levels in tap water to BLLs in children.

## CDC Has Begun an Initiative and Revised Procedures to Help Ensure That CDC Information Is Accessible and Clear, but These Procedures Do Not Address Confusion after Publication

CDC officials told us they had begun an initiative and revised procedures to help ensure the accessibility and clarity of CDC public health communications prior to publication, both agencywide and in NCEH. Specifically, an official from the Office of the Director told us that the CDC Office of the Associate Director of Science has begun an initiative to revise existing procedures to help ensure that information that CDC publishes, such as guidelines and recommendations, is easily accessible by a common portal on CDC's Web site. As of January 2011, CDC officials were still determining what type of CDC products and communication methods would be included in the initiative. In addition, CDC officials told us that NCEH, the center responsible for lead poisoning prevention programs and the 2004 MMWR article, had revised its clearance procedures for certain products, including those submitted to the MMWR, in an effort to ensure that the information presented is accurate and clear. CDC officials said that the revised NCEH clearance procedures are more rigorous and systematic and include requirements for additional peer review of some products, as well as review of some products by the Office of the Director, to help ensure that senior officials are aware of the products. For example, CDC documents that include major scientific findings or conclusions representing scientific breakthroughs or that directly contradict previous science that served as the basis for public health policy will be elevated to the Office of the Director for review. The officials said that the agency

[31]See 75 Fed. Reg. 63,177 (Oct. 14, 2010). EPA is currently evaluating potential long-term revisions to the Lead and Copper Rule, which aims to protect public health by minimizing lead levels in drinking water, primarily by reducing water corrosivity. The Lead and Copper Rule established an action level of 15 ppb for lead in drinking water.

believes the initiative and revised procedures will help to mitigate the risk of other communications being subject to the type of confusion or misinterpretation surrounding the 2004 MMWR article. As of January 2011, CDC did not have time frames for completing the Office of the Director's initiative.

Despite the agency's current actions to strengthen review of CDC communications prior to publication, CDC officials said that neither the initiative nor the revised procedures will include actions to address confusion after publication. For example, if CDC becomes aware that information is being interpreted incorrectly, the procedures will not direct CDC staff to reach out to newspapers or other entities that have published the information to request corrections or clarifications. The importance of having procedures for this type of outreach was noted in the internal incident analysis, which stated that when CDC messages are not on target or are misinterpreted, such as happened in reaction to the 2004 MMWR article, CDC should respond in appropriate visible forums to publicly and expeditiously correct itself or correct those who are interpreting the message. Further, neither the initiative nor the revised procedures will include any postpublication review of certain types of communications that are similar to the 2004 MMWR article, such as those that are published in an expedited time frame and address urgent or high-profile issues, to determine whether corrections or clarifications are needed based on how the communications have been interpreted or used. Because CDC does not have procedures for addressing confusion after publication, the agency runs the risk that its staff will provide inconsistent responses to interpretations of its information that differ from what CDC intended.

## Conclusions

Although CDC has taken some belated actions to clarify confusion related to the 2004 MMWR article on BLLs of residents in the District, the agency does not plan to publish a comprehensive review of the role of tap water as a source of lead exposure that would communicate what is known about the contribution of lead in water to elevated BLLs in children. A goal of the Healthy People 2020 initiative is to eliminate elevated BLLs in children. Although significant progress has been made in reducing lead exposure from lead-based paint and leaded gasoline, CDC has an opportunity to refocus its efforts toward accomplishing this Healthy People 2020 goal and to make a significant contribution to scientific literature by clearly describing what is known about the effect of lead in tap water on BLLs in children.

CDC's credibility as the nation's premier public health agency relies on presenting accurate, reliable, and timely information to the public. Information that is inaccurate or unclear in a CDC public health publication could result in confusion—such as resulted when some readers understood the 2004 MMWR article to state that elevated lead levels in tap water were not a concern in the District or in their area—and could undermine the agency's credibility. The potential for presenting confusing information may increase when the agency has to respond quickly, as it did when it published the 2004 MMWR article 6 weeks after the DCDOH requested CDC's assistance. When CDC presents potentially confusing information and does not respond in a timely or consistent fashion to clarify confusion following publication of a public health product, the agency runs the risk that an incorrect interpretation of the intended message could put the public at risk of adverse health effects, such as those that result from elevated water lead levels. CDC can mitigate the risk of such misinterpretations as well as the resulting risk to its credibility by developing procedures that allow it to address confusion in a timely, consistent manner.

## Recommendations for Executive Action

We are recommending that the Director of CDC take two actions, the first to clarify confusion about the contribution of lead in tap water to elevated BLLs, and the second to improve the clarity of CDC's published information on public health issues.

1. Publish an article in an *MMWR Recommendations and Reports* that conveys what is known and not known about tap water as a source of lead exposure and communicates the potential health effects in children of elevated lead levels in water in consultation with EPA, as appropriate.

2. Develop procedures to review previously published information and determine whether additional information should be published to help ensure the correct understanding of the public health message. The procedures could include criteria to use when deciding how to respond in certain situations, such as the event in the District, in which

- CDC learns of confusion about the public health message and determines that clarification or additional information should be published or

- CDC issues or releases a product in an expedited time frame or based on uncertain or incomplete information and determines additional information should be published to clarify the original public health message, even if there is no evidence of confusion.

## Agency Comments

CDC reviewed a draft of this report and provided written comments, which are reprinted in appendix V. CDC generally concurred with our recommendations and submitted general comments on the draft.

CDC agreed with our first recommendation to publish an article in an *MMWR Recommendations and Reports*. While CDC previously stated that it had no plans to publish such an article, it stated in its written comments that it now plans to publish an article in an *MMWR Recommendations and Reports* that will focus on what is known about tap water as a source of lead exposure and summarize the potential health effects in children from lead exposures.

Related to our second recommendation to develop procedures to review previously published information and determine whether additional information should be published to help ensure the correct understanding of the public health message, CDC said it planned to adopt several procedures for taking action when the agency becomes aware of confusion about its message. CDC's written comments indicated that these procedures will be effective when approved by the CDC Director. Specifically, CDC stated that when appropriate, it may take actions to address significant errors of understanding or perception resulting from public health information disseminated by the agency. For example, for errors of understanding or perception in which there is a persistent, broad, or otherwise significant misinterpretation of information in a public health product, CDC will present the scientific conclusions in clear language in several ways, such as a posting on the CDC Web site or by direct outreach to the news and electronic media, including via press releases or letters to the editor. However, within these procedures, CDC did not explicitly address situations where CDC issues or releases a product in an expedited time frame or based on uncertain or incomplete information and determines additional information should be published to clarify the original public health message, even if there is no evidence of confusion. It is important that CDC take this additional step in order to help ensure that the agency can address confusion in a timely manner and thereby mitigate risk to the public's health or the agency's credibility.

CDC also provided technical comments, which we incorporated as appropriate.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the Secretary of Health and Human Services and other interested parties. The report also will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-7114 or at bascettac@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Other major contributors to this report are listed in appendix VI.

Sincerely yours,

Cynthia A. Bascetta
Managing Director, Health Care

# Appendix I: 2004 *Morbidity and Mortality Weekly Report* Article about Blood Lead Levels of District Residents

On April 2, 2004, the Centers for Disease Control and Prevention (CDC) published the following article in the *Morbidity and Mortality Weekly Report*, which presented results of the investigation on the effect of lead in the District's tap water on the blood lead levels of residents. Additionally, in 2010 CDC added the information contained in the box under the article's title. The article is presented here in its electronic version, which was accessed from CDC's Web site.

CDC Home | Search | Health Topics A-Z

MMWR

*Weekly*

April 2, 2004 / 53(12);268-270

# Blood Lead Levels in Residents of Homes with Elevated Lead in Tap Water --- District of Columbia, 2004

The methods and findings in this April 2004 *MMWR* report have been the subject of continuing interest. In two Notices to Readers, published in the May 21, 2010, and June 25, 2010, issues, CDC has noted limitations of methods employed and the manner in which findings were communicated. Readers should be aware of these limitations, as well as the steps taken to address them.

The two Notices to Readers are as follows:

1. Notice to Readers: Examining the Effect of Previously Missing Blood Lead Surveillance Data on Results Reported in the MMWR. Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5919a4.htm.
2. Notice to Readers: Limitations Inherent to a Cross-Sectional Assessment of Blood Lead Levels Among Persons Living in Homes with High Levels of Lead in Drinking Water. Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5924a6.htm.

CDC authors have published an extended analysis. See: Brown MJ, Raymond J, Homa D, Kennedy C, Sinks T. Association between children's blood lead levels, lead service lines, and water disinfection. Washington DC, 1998–2006. Environ Res 2010. Epub ahead of print. Available at http://www.elsevier.com/wps/find/journaldescription.cws_home/622821/description.

*On March 30, this report was posted as an* MMWR Dispatch *on the* MMWR *website* (http://www.cdc.gov/mmwr).

Lead exposure adversely affects intellectual development in young children and might increase the risk for hypertension in adults (*1*). In the District of Columbia (DC), of an estimated 130,000 residences, approximately 23,000 (18%) have lead service pipes (Daniel Lucey, MD, DC Department of Health [DCDOH], personal communication, March 24, 2004). The Environmental Protection Agency (EPA) requires water authorities to test tap water in 10--100

residences annually for lead. In March 2003, DC Water and Sewer Authority (WASA) expanded its lead-in-water testing program to homes with lead service pipes extending from the water main to the house. By late January 2004, results of the expanded water testing indicated that the majority of homes tested had water lead levels above EPA's action level of 15 parts per billion (ppb). On February 16, DCDOH requested CDC assistance to assess health effects of elevated lead levels in residential tap water. DCDOH also requested deployment of officers of the United States Public Health Service (USPHS) to assist in the investigations. This report summarizes the results of the preliminary investigations, which indicated that the elevated water lead levels might have contributed to a small increase in blood lead levels (BLLs). The investigation of elevated water lead levels is ongoing. In the interim, DCDOH has recommended that young children and pregnant and breast-feeding women refrain from drinking unfiltered tap water (*2*).

CDC's BLL of concern for children, 10 $\mu$g/dL, was adopted in 1991 in response to evidence associating BLLs >10 $\mu$g/dL with adverse health effects (*3*). Adverse health effects have been reported recently at BLLs <10 $\mu$g/dL, particularly in vulnerable populations (e.g., infants and children) (*4,5*); no safe BLL has been identified (*6*). Longitudinal analysis was conducted to identify trends in BLLs in DC before and after changes in the water disinfection process by comparing homes with lead service pipes to homes without lead service pipes. Both the percentage of BLLs ≥10 $\mu$g/dL and those ≥5 $\mu$g/dL were examined over time. Cross-sectional analysis of BLLs of residents in homes with the highest water lead levels was conducted to determine if residents had BLLs ≥10 $\mu$g/dL.

**Longitudinal Analysis of Childhood Blood Lead Screening Tests**

WASA provided DCDOH and CDC with a list of homes (n = 26,141) with lead service pipes. During January 1998--December 2003, the DCDOH blood lead surveillance system recorded 84,929 BLLs. Of these, 43,314 (51%) tests were venous, and 6,794 (8%) were fingerstick; sample type was not listed on the remaining tests. All blood tests were used in this analysis. For each year of testing, these databases were linked by address. A total of 11,061 BLL laboratory requisition slips listed an address with a lead service pipe.

During 1998--2000, the percentage of BLLs ≥10 $\mu$g/dL and ≥5 $\mu$g/dL decreased substantially, regardless of the type of service pipe (Figure). During 2000--2003, the percentage of BLLs ≥10 $\mu$g/dL in persons living in homes known to have lead service pipes decreased from 9.8% to 7.6% (p = 0.008). The percentage of BLLs ≥5 $\mu$g/dL in persons living in houses without lead service pipes continued to decrease, from 22.7% to 15.6% (n = 14,152; p<0.001). However, the percentage of BLLs ≥5 $\mu$g/dL in persons living in homes with lead service pipes did not decrease statistically significantly (from 696 [32.4%] to 405 [31.2%]; p = 0.34).

**Cross-Sectional Study of Homes with >300 ppb Lead in Water**

WASA provided the results of lead testing on water samples from 6,170 homes. Of these, 163 (3%) had lead levels >300 ppb in second-draw water collected after a change in water temperature, indicating that some of the lead in the water leached from water pipes outside the home. USPHS officers working in the DCDOH Incident Command structure contacted residents in the 140 (86%) homes that had telephones and arranged for visits to draw venous samples for BLLs. The DC Public Health Laboratory determined BLLs by using graphite furnace atomic absorption spectrophotometry for 184 persons in 86 households who consented to having blood drawn. Residents were provided with a water filter and information about reducing lead exposure. In addition, in 12 of the households contacted, 17 persons had a venous blood test

drawn independently and reported to DCDOH since January 2004. These test results also were included in this analysis.

Of the 201 residents from 98 homes with water lead levels >300 ppb tested for BLLs, all had BLLs below CDC's levels of concern (10 μg/dL for children aged 6 months--15 years and 25 μg/dL for adults) (Table). Of the 201 residents, a total of 153 (76%) reported drinking tap water, and 52 households (53%) reported using a water filter. On February 26, 2004, DCDOH sent a letter to all DC homes with lead service pipes, recommending that young children and pregnant and breast-feeding women refrain from drinking unfiltered tap water (*2*).

**Reported by:** *L Stokes, PhD, NC Onwuche, P Thomas, PhD, JO Davies-Cole, PhD, T Calhoun, MD, AC Glymph, MPH, ME Knuckles, PhD, D Lucey, MD, District of Columbia Dept of Health. T Cote, MD, G Audain-Norwood, MA, M Britt, PhD, ML Lowe, MCRP, MA Malek, MD, A Szeto, MPH, RL Tan, DVM, C Yu, M Eberhart, MD, US Public Health Svc. MJ Brown, ScD, C Blanton, MS, GB Curtis, DM Homa, PhD, Div of Emergency and Environmental Health Svcs, National Center for Environmental Health, CDC.*

**Editorial Note:**

The findings in this report indicate that although lead in tap water contributed to a small increase in BLLs in DC, no children were identified with BLLs ≥10μg/dL, even in homes with the highest water lead levels. In addition, the longitudinal surveillance data indicate a continued decline in the percentage of BLLs ≥10 μg/dL. The findings in this report suggest that levels exceeding the EPA action level of 15 ppb can result in an increase in the percentage of BLLs ≥5 μg/dL. Homes with lead service pipes are older, and persons living in these homes are more likely to be exposed to high-dose lead sources (e.g., paint and dust hazards). For this reason, in all years reported, the percentage of test results ≥10 μg/dL and the percentage of test results ≥5 μg/dL at addresses with lead service pipes were higher than at addresses without lead service pipes.

The findings in this report are subject to at least three limitations. First, the BLL surveillance data include multiple tests on the same person, and persons with lead poisoning are tested more frequently than those with low BLLs. Second, fingerstick tests are more subject than venous samples to contamination by ambient lead (*7*). Finally, neither the blood nor the water lead test results were collected from a randomized sample. Water was collected from homes with a high probability of having lead service pipes; the March 2004 BLL screening program was limited to families living in homes with the highest water lead levels, and the routine blood lead surveillance program focused on identifying children at highest risk for lead exposure. For these reasons, the percentages of BLLs ≥5 μg/dL or ≥10 μg/dL reported probably are higher than those found in the general population. However, none of these factors should affect the relative differences between percentage of tests ≥5 μg/dL by water line type, nor do they explain the change in trajectory of the percentage of tests ≥5 μg/dL by year after 2000.

The cause of the elevated water lead levels in DC is under review. Although the increase is associated temporally with the change in the disinfection process from chlorine to chloramines that occurred in November 2000, whether this change contributed to increased lead in the water is unknown.

Because no threshold for adverse health effects in young children has been demonstrated (*6*), public health interventions should focus on eliminating all lead exposures in children (*8*). Lead

concentrations in drinking water should be below the EPA action level of 15 ppb. Officials in communities that are considering changes in water chemistry or that have implemented such changes recently should assess whether these changes might result in increased lead in residential tap water. EPA has asked all state health and environmental officials to monitor lead in drinking water at schools and day care centers. More information about lead poisoning is available from CDC at http://www.cdc.gov/nceh/lead/lead.htm.

**Acknowledgments**

This report is based in part on data collected by SB Adams, LC Cooper, PhD, KJ Elenberg, JM Gusto, MPH, JE Hardin, P Karikari-Martin, MPH, L Velazquez, PharmD, AA Walker, US Public Health Svc.

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2. District of Columbia Department of Health. Health advisory: lead in Washington, DC. February 26, 2004. Available at http://www.dchealth.dc.gov.
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8. Rogan WJ, Ware JH. Exposure to lead in children---how low is low enough? N Engl J Med 2003;348:1515--6.

## Table

**TABLE. Blood lead levels (BLLs) of residents in homes with >300 parts per billion in drinking water, by age group — District of Columbia, March 2004**

| | BLL (µg/dL) | |
|---|---|---|
| Age group (yrs) | Median | Range |
| 1–5 (n = 17) | 3 | 1–6 |
| 6–15 (n = 13) | 2 | 1–4 |
| 16–40 (n = 56) | 3 | 1–14 |
| 41–60 (n = 69) | 4 | 1–20 |
| ≥61 (n = 46) | 6 | 2–22 |
| Total (n =201) | | |

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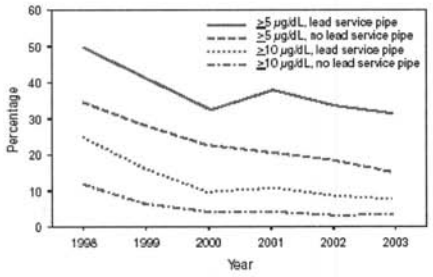
## Figure

FIGURE. Percentage of tests with elevated blood lead levels, by year and water-line type — District of Columbia, January 1998–September 2003

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# Appendix II: 2010 Letter Clarifying Information about the 2004 *Morbidity and Mortality Weekly Report* Article

On May 20, 2010, the Centers for Disease Control and Prevention (CDC) sent the following letter to state and local Childhood Lead Poisoning Prevention Program managers to address confusion related to the first sentence in the Editorial Note section of the 2004 *Morbidity and Mortality Weekly Report* article, which contained an incorrect statement. Additionally, the letter presented results of a recent analysis that included new blood lead level data that had not been available to CDC in 2004. The letter is presented here in its electronic version, which was accessed from CDC's Web site.

CDC - Lead - Important update: Washington, D.C. Blood Lead Level Tests

Centers for Disease Control and Prevention
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# Important update: Washington, D.C. Blood Lead Level Tests

May 20 2010

Lead Poisoning Prevention Program Managers

Dear Colleague,

The Centers for Disease Control and Prevention, Healthy Homes and Lead Poisoning Prevention Branch has recently acquired and analyzed blood lead test results that were not available to us in 2004 during the public health response to elevated drinking water lead levels in Washington DC and the report of blood lead levels in Washington published in Morbidity Mortality Weekly Review in April 2004. 1

A substantial number of blood lead test results from blood specimens collected in 2003 were unavailable for the analysis published in the 2004 MMWR. In 2009, CDC acquired all known 2003 blood lead test results for DC residents and completed a reanalysis to determine if the addition of the previously missing tests altered the results reported in the 2004 MMWR. The reanalysis included the 9,765 tests used in the original analysis plus 1,753 tests reported in surveillance data after the MMWR was published and 12,168 tests that had not been included in the surveillance files. The reanalysis showed that addition of the missing test data led to a decrease in the proportion of tests with blood lead levels ≥ 5 µg/dL or ≥ 10 µg/dL in 2003, regardless of the type of service line supplying water to the home (Table 1). These results do not change CDC's original conclusions that ... *the percentage of test results >10 µg/dL and the percentage of test results >5 µg/dL at addresses with lead service pipes were higher than at addresses without lead service pipes.*

**Table 1: The Percent of Elevated Blood Lead Tests in 2003 by Type of Water Service Line and Data Set.**

| Service Line Type | 2004 MMWR Dataset* | Dataset Reported in 2009** | 2004 MMWR Dataset* | Dataset Reported in 2009** |
|---|---|---|---|---|
| | % ≥ 10 µg/dL | % ≥ 10 µg/dL | % ≥ 5 µg/dL | % ≥ 5 µg/dL |
| Lead Service Line | 7.6 | 6.0 1. | 31.2 | 26.5 3. |
| No Lead Service Line | 2.8 | 2.0 2. | 15.6 | 13.4 4. |

* n=9,683; ** n=10,637. The water service line type was unknown for 2, 670 tests. 1. p=0.09; 2. p< 0.001; 3. p=0.007; 4. p< 0.001

The first sentence of the Editorial Note in the 2004 MMWR referred to a cross-sectional study of homes with very high lead levels in drinking water and stated that ... *no children were identified with blood lead >10µg/dL, even in homes with the highest water lead levels.* This sentence was misleading because it referred only to data from the cross-sectional study, and did not reflect findings of concern from the separate longitudinal study that showed that children living in homes serviced by a lead water pipe were more than twice as likely as other DC children to have had a blood lead level ≥10 µg/dL. CDC reiterates here a key message from the 2004 article ... *because no threshold for adverse health effects in young children has been demonstrated (no safe blood level has been identified), all sources of lead exposure for children should be controlled or eliminated. Lead concentrations in drinking water should be below the U. S. Environmental Protection Agency's action level of 15 parts per billion.*

The complete report of the reanalysis can be found at http://www.cdc.gov/nceh/lead/leadinwater/.

I would also like to bring to your attention two other strategies to reduce children's exposure to lead in water. First, on our website www.cdc.gov/nceh/lead/waterlines.htm you can find a letter dated January 12, 2010 that discusses recent research related to blood lead levels and partial replacement of lead water service lines. This research indicates that partial lead service line replacement is associated with increased risk for blood lead levels ≥ 5 µg/dL or ≥ 10 µg/dL. CDC has also recommended that state and or local lead programs work closely with the agency responsible for oversight of water authority compliance with the lead and copper rule to ensure that water samples are taken when inspections are done for children with elevated blood lead levels in areas where the water lead levels exceed the EPA water lead action level of 15 ppb.

Best Wishes,

Mary Jean Brown ScD, RN
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Centers for Disease Control and Prevention
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Atlanta, GA 30341

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1 Stokes L, Onwuche NC, Thomas P, et al., Blood Lead Levels in Residents of Homes with Elevated Lead in Tap Water – District of Columbia, 2004; MMWR Weekly, April 2, 2004, 53(12); 268-270.

CDC - Lead - Important update: Washington, D.C. Blood Lead Level Tests

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# Appendix III: May 21, 2010, Notice Clarifying Information about the 2004 *Morbidity and Mortality Weekly Report* Article

On May 21, 2010, the Centers for Disease Control and Prevention (CDC) published the following Notice to Readers in the *Morbidity and Mortality Weekly Report* (MMWR) to clarify information about the first sentence in the Editorial Note in the 2004 MMWR article and to present results of a recent analysis that included new blood lead level data that had not been available to CDC in 2004. The Notice to Readers is presented here in its electronic version, which was accessed from CDC's Web site.

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Morbidity and Mortality Weekly Report (*MMWR*)

# Notice to Readers: Examining the Effect of Previously Missing Blood Lead Surveillance Data on Results Reported in *MMWR*

*Weekly*
**May 21, 2010 / 59(19);592**

During 2000--2003, the District of Columbia (DC) experienced very high concentrations of lead in drinking water. In February 2004, the DC Department of Health requested assistance from CDC to assess health effects of elevated lead levels in residential tap water. CDC reviewed available blood lead surveillance data for the period 1998--2003 and reported the findings of a longitudinal analysis and cross-sectional study in *MMWR* on April 2, 2004 (*1*).

A substantial number of blood lead test results from blood specimens collected in 2003 were unavailable for the analysis published in the 2004 *MMWR* report. In 2009, CDC acquired all known 2003 blood lead test results for DC residents and completed a reanalysis to determine whether the addition of the previously missing tests altered the previously reported results. The complete reanalysis is available at http://www.cdc.gov/nceh/lead/leadinwater.

The reanalysis included the 9,765 tests used in the original analysis, plus 1,753 tests reported in surveillance data after the *MMWR* report was published, and 12,168 tests that had not been included in the surveillance files. The reanalysis showed that addition of the missing test data led to a decrease in the percentage of tests with elevated blood lead levels ≥5 μg/dL or ≥10 μg/dL in 2003, regardless of the type of service line supplying water to the home (Table). These results do not change CDC's original conclusions that "the percentage of test results ≥10 μg/dL and the percentage of test results ≥5 μg/dL at addresses with lead service pipes were higher than at addresses without lead service pipes."

In the 2004 *MMWR* report, the first sentence of the Editorial Note referred to a cross-sectional study of homes with very high lead levels in drinking water and stated that "no children were identified with blood lead ≥10 μg/dL, even in homes with the highest water lead levels." This sentence was misleading because it referred only to data from the cross-sectional study and did not reflect findings of concern from the separate longitudinal study that showed that children living in homes serviced by a lead water pipe were more than twice as likely as other DC children to have had a blood lead level ≥10 μg/dL. CDC reiterates here a key message from the 2004 report: "because no threshold for adverse health effects in young children has been demonstrated," no safe blood level has been identified, and all sources of lead exposure for children should be controlled or eliminated. "Lead concentrations in drinking water should be below the U.S. Environmental Protection Agency's action level of 15 ppb."

## Reference

1. CDC. Blood lead levels in residents of homes with elevated lead in tap water---District of Columbia, 2004. MMWR 2004;53:268--70.

**TABLE. Percentage of tests with elevated blood lead levels, by type of water service line* and data set --- District of Columbia, 2003**

| Water service line type | Surveillance data set used in 2004 *MMWR* report† | All known blood lead tests§ | Surveillance data set used in 2004 *MMWR* report† | All known blood lead tests§ |
|---|---|---|---|---|
| | % ≥10 µg/dL | % ≥10 µg/dL | % ≥5 µg/dL | % ≥5 µg/dL |
| Lead service line | 7.6 | 6.8 | 31.2 | 30.2 |
| No lead service line | 2.8 | 2.3 | 15.6 | 14.9 |

* Water service line type was unknown for 2,670 tests.

† **Source:** CDC. Blood lead levels in residents of homes with elevated lead in tap water---District of Columbia, 2004. MMWR 2004;53:268--70; n = 9,683.

§ n = 21,016.

# Appendix IV: June 25, 2010, Notice Clarifying Information about the 2004 *Morbidity and Mortality Weekly Report* Article

On June 25, 2010, the Centers for Disease Control and Prevention (CDC) published the following Notice to Readers in the *Morbidity and Mortality Weekly Report* (MMWR) that noted the limitations of the results of an analysis in the 2004 MMWR article. The Notice to Readers is presented here in its electronic version, which was accessed from CDC's Web site.

Centers for Disease Control and Prevention
Your Online Source for Credible Health Information

Morbidity and Mortality Weekly Report (*MMWR*)

# Notice to Readers: Limitations Inherent to a Cross-Sectional Assessment of Blood Lead Levels Among Persons Living in Homes with High Levels of Lead in Drinking Water

*Weekly*
**June 25, 2010 / 59(24);751**

During 2000--2003, the District of Columbia (DC) experienced very high concentrations of lead in drinking water. In February 2004, the DC Department of Health requested assistance from CDC to assess health effects of elevated lead levels in residential tap water. CDC reviewed available blood lead surveillance data for the period 1998--2003 and reported the findings of a longitudinal analysis and a cross-sectional assessment in *MMWR* on April 2, 2004 (*1*).

The cross-sectional assessment was designed for a limited purpose, to take a snapshot of blood lead levels in the homes with the highest levels of lead in water and to provide service to children at risk for lead poisoning. The assessment had several design limitations. The data were not collected in a manner that would allow a comparison between the amount of lead consumed in drinking water and blood lead levels. Additionally, the blood lead levels did not necessarily represent what peak blood levels might have been before the problems with the DC water supply were recognized. Thus, these results should not be used to make conclusions about the contribution of water lead to blood lead levels in DC, to predict what might occur in other situations where lead levels in drinking water are high, or to determine safe levels of lead in drinking water. The dataset for the cross-sectional assessment is not available to CDC for further analysis.

CDC has conducted a more thorough analysis of trends in DC blood lead levels for the period 1998--2006, which confirms the conclusions in the original analysis. In addition, CDC has examined the association between DC blood lead levels and the partial replacement of leaded drinking water service lines. Preliminary data show that strategies of replacing only the publicly owned portion of lead pipes (known as partial mitigation) do not decrease (and might increase) blood lead levels. CDC notified the U.S. Environmental Protection Agency, DC, and other jurisdictions when these preliminary findings became known, and is following up with more definitive guidance. These findings have been submitted to a scientific journal for publication. The information related to the preliminary findings concerning partial lead pipe replacement is available at http://www.cdc.gov/nceh/lead/leadinwater.

## Reference

1. CDC. Blood lead levels in residents of homes with elevated lead in tap water---District of Columbia, 2004. MMWR 2004;53:268--70.

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

References to non-CDC sites on the Internet are provided as a service to *MMWR* readers and do not constitute or imply endorsement of these organizations or their programs by CDC or the U.S. Department of Health and Human Services. CDC is not responsible for the content of pages found at these sites. URL addresses listed in *MMWR* were current as of the date of publication.

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**Questions or messages regarding errors in formatting should be addressed to mmwrq@cdc.gov.

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# Appendix V: Comments from the Centers for Disease Control and Prevention

DEPARTMENT OF HEALTH & HUMAN SERVICES — OFFICE OF THE SECRETARY

Assistant Secretary for Legislation
Washington, DC 20201

FEB 22 2011

Cynthia Bascetta
Managing Director, Health Care
U.S. Government Accountability Office
441 G Street N.W.
Washington, DC 20548

Dear Ms. Bascetta:

Attached are comments on the U.S. Government Accountability Office's (GAO) draft report entitled, "LEAD IN TAP WATER: CDC Communication About Health Effects Needs Improvement" (GAO 11-279).

The Department appreciates the opportunity to review this report prior to publication.

Sincerely,

Jim R. Esquea

Jim R. Esquea
Assistant Secretary for Legislation

Attachment

**GENERAL COMMENTS OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES (HHS) ON THE GOVERNMENT ACCOUNTABILITY OFFICE'S (GAO) DRAFT REPORT ENTITLED, "LEAD IN TAP WATER: CDC COMMUNICATION ABOUT HEALTH EFFECTS NEEDS IMPROVEMENT" (GAO-11-279)**

The Department appreciates the opportunity to review and comment on this draft report. The Centers for Disease Control and Prevention (CDC) generally concurs with the GAO's recommendations and respectfully submits the following general comments.

- The Environmental Protection Agency (EPA) is responsible for periodically reviewing its drinking water contaminant rules and revising them if appropriate at least once every six years as required by the Safe Drinking Water Act (SDWA). The EPA is currently conducting a review of the lead and copper rule.

- CDC's activities are distinct from those of EPA. CDC's role in preventing lead poisoning in children supports state and city programs and works with other Federal agencies to monitor the blood lead levels of children in the United States, to establish guidelines that protect children from lead, and to investigate situations where children have been exposed to lead. CDC's Childhood Lead Poisoning Prevention Program (CLPPP) provides funding to state and local health departments to determine the extent of childhood lead poisoning by screening children for elevated blood lead levels and ensuring that lead-poisoned infants and children receive medical and environmental follow-up (case management). This program also supports the development of state and local government agencies' capacity to prevent lead poisoning in their communities through the development of protective policies.

- CDC made efforts in 2004 to stop ongoing exposures to lead from drinking water in the District of Columbia. CDC assisted in efforts to notify vulnerable members of the community, assure that filters or alternative sources of drinking water were available, and to increase screening of blood lead levels.

- In December 2010, CDC published its complete analysis of the effects of lead in D.C. tap water from 1998-2006. The citation for the article is Environmental Research 111 (2011) 67–74.

- Related to the GAO's first recommendation, CDC plans to publish an article in the MMWR Recommendations & Reports publication. The article will focus on what is known about tap water as a source of lead exposure. It will also summarize the potential health effects in children from lead exposures. The article will draw from several previously released documents including those already available on the CDC Childhood Lead Poisoning Prevention Web site, the 2007 ATSDR Toxicological Profile on lead, CDC's analysis of

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**GENERAL COMMENTS OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES (HHS) ON THE GOVERNMENT ACCOUNTABILITY OFFICE'S (GAO) DRAFT REPORT ENTITLED, "LEAD IN TAP WATER: CDC COMMUNICATION ABOUT HEALTH EFFECTS NEEDS IMPROVEMENT" (GAO-11-279)**

childhood blood lead levels in DC from 1998-2006, the EPA's 2006 Air Quality Criteria for Lead, and other EPA sources.

- Related to the GAO's second recommendation, when CDC becomes aware of significant errors of understanding or perception resulting from public health information disseminated by CDC, the agency may pursue one or more of the following actions as appropriate under the circumstances:

    1. For factual errors in content or data, CDC will publish errata, letters to the editor, or notice to readers, in the original source publication.
    2. For errors of understanding or perception in which there is a persistent, broad or otherwise significant misinterpretation of the factual data or conclusions which could cause a threat to public health or safety or jeopardize the credibility of the agency, CDC will present the scientific conclusions in clear language in one or more of the following venues.
        a. Publication on the www.cdc.gov web site
        b. Direct outreach to the news and electronic media, including via press releases or letters to the editor.
        c. Direct communication with state and local health departments, clinicians and professional organizations
        d. Direct communication with community organizations, advocacy groups and public meetings

    The CDC response will be jointly led by the Offices of the Associate Director for Science and the Associate Director for Communication. These procedures will be actionable immediately upon approval by the CDC Director, concurrent with the development and approval process of agency policies.

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# Appendix VI: GAO Contact and Staff Acknowledgments

## GAO Contact

Cynthia A. Bascetta, (202) 512-7114 or bascettac@gao.gov

## Staff Acknowledgments

In addition to the contact named above, Karen Doran, Assistant Director; April W. Brantley; Natalie Herzog; Amy C. Leone; Lisa Motley; and Roseanne Price made key contributions to this report.

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