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DRINKING WATER

Safeguarding the District of Columbia's Supplies and Applying Lessons Learned to Other Systems

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Natural Resources and Environment

July 2004

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GAO Highlights

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Highlights of GAO-04-974T, a statement to the Subcommittee on Environment and Hazardous Materials, Committee on Energy and Commerce, House of Representatives

Why GAO Did This Study

Concerns have been raised about lead in District of Columbia drinking water and how those charged with ensuring the safety of this water have carried out their responsibilities. The 1991 Lead and Copper Rule (LCR) requires water systems to protect drinking water from lead by, among other things, chemically treating it to reduce its corrosiveness and by monitoring tap water samples for evidence of lead corrosion. If enough samples show corrosion, water systems officials are required to notify and educate the public on lead health risks and undertake additional efforts. The Washington Aqueduct, owned and operated by the U.S. Army Corps of Engineers, treats and sells water to the District of Columbia Water and Sewer Authority (WASA), which delivers water to D.C. residents. EPA's Philadelphia Office is charged with overseeing these agencies.

GAO is examining (1) the current structure and level of coordination among key government entities that implement the Safe Drinking Water Act's regulations for lead in the District of Columbia, (2) how other drinking water systems conducted public notification and outreach, (3) the availability of data necessary to determine which adult and child populations are at greatest risk of exposure to elevated lead levels, and what information WASA is gathering to help track their health, and (4) the state of research on the health effects of lead exposure.

The testimony discusses preliminary results of GAO's work. GAO will report in full at a later date.

www.gao.gov/cgi-bin/getrpt?GAO-04-974T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact John Stephenson at (202) 512-3841 or stephensonj@gao.gov.

What GAO Found

This statement discusses GAO's preliminary observations and highlights areas of further examination.

One of the key relationships in the effort to ensure the safety of the District's drinking water is the one between WASA, the deliverer of water, and EPA's Philadelphia Office, which oversees WASA's compliance with drinking water regulations. Recent public statements and corrective actions by these parties clearly indicate that coordination and communication between them could have been better in the years preceding the current lead controversy. GAO's future work will examine (to the extent appropriate) the interrelationships among other key agencies (such as the Aqueduct and the D.C. Department of Health); how other water systems in similar situations interacted with federal, state, and local agencies; and what the experiences of these other jurisdictions may suggest concerning how improved coordination can better protect drinking water in the District of Columbia.

Other water systems facing elevated lead levels used public notification and education practices that may offer lessons for conducting outreach to water customers. For example, some of the practices of the two water systems we have begun to examine – the Massachusetts Water Resources Authority and the Portland (Oregon) Water Bureau – include tailoring their communications to varied audiences in their service areas, testing the effectiveness of their communication materials, and linking demographic and infrastructure data to identify populations at greatest risk from lead in drinking water.

WASA faces challenges in collecting the information needed to identify District citizens at greatest risk from lead in drinking water. Specifically, WASA has partial information on which of its customers have lead service lines, and is in the process of obtaining more complete information. GAO's future work will examine the efforts of other water systems to go one step further by linking data on at-risk populations (such as pregnant mothers, infants, and small children) with data on homes suspected of being served by lead service pipes and other plumbing fixtures that may leach lead into drinking water.

Nationally, much is known about the hazards of lead once in the body and how lead from paint, soil, and dust enter the body, but little research has been done to determine actual lead exposure from drinking water, and the information that does exist is dated. In our future work, we will examine the plans of EPA and other organizations to fill this key information gap.

Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity to discuss our work to date on the issues surrounding elevated levels of lead in Washington, D.C. drinking water. At the request of this Subcommittee, we are examining issues concerning lead in drinking water generally and the situation in Washington, D.C., in particular. Our testimony today lays out our preliminary observations on these issues and highlights areas of further examination.

Although rarely the sole cause of lead poisoning, lead in drinking water can significantly increase a person's total lead exposure. EPA estimates that drinking water is the source of about 20 percent of Americans' lead exposure, but that it may be as high as 60 percent for infants who drink baby formulas and concentrated juices that are mixed with water. Adults who drink water with high lead concentrations could develop kidney problems or high blood pressure. Developing fetuses, infants and young children are more vulnerable to lead from all sources, including drinking water. Their exposure to lead may delay their physical or mental development.

The delivery of safe water to residents requires that water systems and regulators work cooperatively in fulfilling the requirements of the Safe Drinking Water Act.[1] In most cases, states have primary oversight and enforcement authority under the Act. Lead in drinking water is regulated under the Act's 1991 Lead and Copper Rule.[2] The rule requires water systems to treat their water to limit its corrosiveness, monitor tap water samples for evidence of elevated levels of lead, and report this information to their state. In addition, drinking water systems may consult with state health agencies when communicating with their customers about health risks from drinking water.

The relationship between regulators and water systems is more complicated in the District of Columbia, where the Washington Aqueduct,

[1]42 U.S.C. 300f-300j.

[2]40 C.F.R. pt. 141, subpart I. The Lead and Copper Rule established an action level of 15 parts per billion (ppb) for lead in drinking water. Under the rule, the action level is exceeded if lead levels are higher than 15 ppb in over 10 percent of tap water samples taken. For each monitoring period, a system must report the lead level at the 90th percentile of homes monitored. For example, if a system monitors 100 homes, it sorts its results from the lowest to the highest concentrations and reports the concentration it observed in the 90th sample.

owned by the U.S. Army Corps of Engineers, draws and treats water from the Potomac River. The Aqueduct sells the treated water to the District of Columbia Water and Sewer Authority (WASA), which distributes it to District residents. The Environmental Protection Agency's (EPA) Region III Office in Philadelphia, Pennsylvania, has primary oversight and enforcement authority for the District's public water systems. The District of Columbia's Department of Health, while having no formal role under the Safe Drinking Water Act, is responsible for educating District residents on potential health risks.

In the District, the Washington Aqueduct treats drinking water and monitors for most contaminants, while WASA monitors tap water samples for lead and reports these results to EPA's Philadelphia Office. Tap water monitoring is important because, unlike most drinking water contaminants, lead is not generally introduced to drinking water supplies from source water. Rather, lead leaches into drinking water as it travels through lead service pipes, over pipe joints connected with lead-based solder, and through brass plumbing fixtures that contain lead. According to EPA, its Philadelphia Office is responsible for providing technical assistance to the Aqueduct and WASA on how to comply with federal regulations; ensuring that they report the monitoring results to EPA by required deadlines; taking enforcement actions if violations occur; and using those enforcement actions to return the water systems to compliance in a timely fashion.

Significant concerns were raised in early 2004 about how federal and local agencies were carrying out their responsibilities under the Safe Drinking Water Act. At that time, the local media reported that a number of tap water samples showed elevated levels of lead.

You asked that we (1) examine the current structure and level of coordination among key government entities that implement the Safe Drinking Water Act's regulations for lead in the District of Columbia, and identify any improvements to increase efficiency and accountability, (2) determine how other drinking water systems that exceeded the EPA action level for lead have conducted public notification and outreach, (3) assess the availability of data necessary to determine which adult and child populations are at greatest risk of exposure to elevated lead levels, and what information WASA is gathering to help track their health, (4) evaluate the state of research on lead exposure, and how this information could help inform other drinking water utilities of potential problems in their systems.

To respond to these questions, we are interviewing key officials and staff with the federal and local agencies responsible for managing drinking water and monitoring health for lead exposure in Washington, D.C., including officials at EPA's headquarters and in its Philadelphia Office, WASA, the Washington Aqueduct, and the D.C. Department of Health. We are also (1) reviewing records documenting key activities and interactions among these agencies, and examining their current responses to the lead problem, (2) contacting academic and non-governmental experts in lead contamination, and (3) examining how other water systems facing similar circumstances notified and educated their customers on lead health risks, and how they interacted with federal, state, and local agencies to respond to the problem. Many of the facts and circumstances surrounding the District's lead controversy are the subject of active litigation. Accordingly, we do not take a position on these issues and on how they bear on the question of interagency coordination and communication, and instead report them only as stated by the affected parties.

We are here to present our preliminary observations on these issues. We will report our final findings and any recommendations we may develop at a later date. In summary:

- Providing safe drinking water requires that water systems, regulators, and public health agencies fulfill individual roles, yet work together in a coordinated fashion. It is particularly important that these entities report and communicate information to each other in a timely and accurate manner. Recent public statements and corrective actions by the responsible entities, particularly EPA and WASA, clearly indicate that coordination could have been better in the years preceding the current controversy. As our work continues, we will seek to examine (to the extent appropriate) specific ways in which improved coordination between EPA and WASA could help both agencies better fulfill their responsibilities. We will also examine interrelationships among other key agencies (such as the Aqueduct and the D.C. Department of Health); how other water systems in similar situations interacted with federal, state, and local agencies; and what the experiences of these other jurisdictions may suggest concerning how improved coordination can better protect drinking water in the District of Columbia.

- Other water systems facing elevated lead levels used public notification and education practices that appear to offer lessons for conducting outreach to water customers, including those in the District of Columbia. For example, some of the practices of the two systems we have begun to examine—the Massachusetts Water Resources Authority and the Portland

Water Bureau—include tailoring their communications to varied audiences in their service areas, testing the effectiveness of their communication materials, and linking demographic and infrastructure data to identify populations at greatest risk from lead in drinking water.

- WASA faces challenges in collecting the information needed to identify District citizens at greatest risk from lead in drinking water. Specifically, it has partial information on which of its customers have lead service pipes, although it is currently in the process of obtaining more complete information. In our future work, we will examine the efforts of other water systems to go one step further by linking data on at-risk populations (such as pregnant mothers, infants, and small children) with data on homes suspected of being served by lead service pipes and other plumbing fixtures that may leach lead into drinking water.

- Much is known about the hazards of lead in the human body and about how lead from paint, soil, and dust enter the body. However, little research has been done to determine actual lead exposure from drinking water, and the information that does exist is dated. In our future work, we will examine the plans of EPA and other organizations to fill this key information gap.

Background

Lead is unusual among drinking water contaminants in that it seldom occurs naturally in source water supplies like rivers and lakes. Rather, lead enters drinking water primarily as a result of the corrosion of materials containing lead in the water distribution system and in household plumbing. These materials include lead service pipes that connect a house to the water main, household lead-based solder used to join copper pipe, and brass plumbing fixtures such as faucets.

The Safe Drinking Water Act is the key federal law protecting public water supplies from harmful contaminants. The Act established a federal-state arrangement in which states may be delegated primary implementation and enforcement authority ("primacy") for the drinking water program. Except for Wyoming and the District of Columbia, all states and territories have received primacy. For contaminants that are known or anticipated to occur in public water systems and that the EPA Administrator determines may have an adverse impact on health, the Act requires EPA to set a non-enforceable maximum contaminant level goal (MCLG) at which no known or anticipated adverse health effects occur and that allows an adequate margin of safety. Once the MCLG is established, EPA sets an enforceable standard for water as it leaves the treatment plant, the maximum

contaminant level (MCL). The MCL generally must be set as close to the MCLG as is "feasible" using the best technology or other means available, taking costs into consideration.

The fact that lead contamination occurs after water leaves the treatment plant has complicated efforts to regulate it in the same way as most contaminants. In 1975, EPA set an interim MCL for lead at 50 parts per billion (ppb), but did not require sampling of tap water to show compliance with the standard. Rather, the standard had to be met at the water system before the water was distributed. The 1986 amendments to the Act directed EPA to issue a new lead regulation, and in 1991, EPA adopted the Lead and Copper Rule.

Instead of an MCL, the rule established an "action level" of 15 ppb for lead in drinking water, and required that water systems take steps to limit the corrosiveness of their water. Under the rule, the action level is exceeded if lead levels are higher than 15 ppb in over 10 percent of tap water samples taken. Large systems, including WASA, generally must take at least 100 tap water samples in a 6-month monitoring period. Large systems that do not exceed the action level or that maintain optimal corrosion control for two consecutive 6-month periods may reduce the number of sampling sites to 50 sites and reduce collection frequency to once per year. If a water system exceeds the action level, other regulatory requirements are triggered. The water system must intensify tap water sampling, take additional actions to control corrosion, and educate the public about steps they should take to protect themselves from lead exposure. If the problem is not abated, the water system must annually replace 7 percent of the lead service lines under its ownership.

The public notification requirements of the Safe Drinking Water Act are intended to protect public health, build trust with consumers through open and honest sharing of information, and establish an ongoing, positive relationship with the community.[3] While public notification provisions were included in the original Act, concerns have been raised for many years about the way public water systems notify the public regarding health threats posed by contaminated drinking water. In 1992, for example, we reported, among other things, that (1) there were high rates of noncompliance among water systems with the public notification regulations in effect at that time and (2) notices often did not clearly

[3] *Public Notification Handbook*, EPA Office of Water (EPA 816-R-00-010, June 2000).

convey the appropriate information to the public concerning the health risks associated with a violation and the preventive action to be taken.[4] The 1996 Amendments to the Safe Drinking Water Act attempted to address many of these concerns by requiring that consumers of public water supplies be given more accurate and timely information about violations and that this information be in a form that is more understandable and useful.

Drinking water is provided to District of Columbia residents under a unique organizational structure:

- *The U.S. Army Corps of Engineer*s' *Washington Aqueduct* draws water from the Potomac River and filters and chemically treats it to meet EPA specifications. The Aqueduct produces drinking water for approximately 1 million citizens living, working, or visiting in the District of Columbia, Arlington County, Virginia, and the City of Falls Church, Virginia. Managed by the Corps of Engineers' Baltimore District, the Aqueduct is a federally owned and operated public water supply agency that produces an average of 180 million gallons of water per day at two treatment plants located in the District. All funding for operations, maintenance, and capital improvements comes from revenue generated by selling drinking water to the District of Columbia, Arlington County, Virginia, and the City of Falls Church, Virginia.

- *The District of Columbia Water and Sewer Authority* buys its drinking water from the Aqueduct. WASA distributes drinking water through 1,300 miles of water mains under the streets of the District to individual homes and buildings, as well as to several federal facilities directly across the Potomac River in Virginia. From its inception in 1938 until 1996, WASA's predecessor, the District of Columbia Water and Sewer Utility Administration, was a part of the District's government. In 1996, WASA was established by District of Columbia law as a semiautonomous regional entity. WASA develops its own budget, which is incorporated into the District's budget and then forwarded to Congress. All funding for operations, improvements, and debt financing come from usage fees, EPA grants, and the sale of revenue bonds.

- *EPA's Philadelphia Regional Office* has primary oversight and enforcement responsibility for public water systems in the District.

[4]U.S. General Accounting Office, *Drinking Water: Consumers Often Not Well-Informed of Potentially Serious Violations*, GAO/RCED-92-135 (Washington, D.C. June 1992).

According to EPA, the Regional Office's oversight and enforcement responsibilities include providing technical assistance to the water suppliers on how to comply with federal regulations; ensuring that the suppliers report the monitoring results to EPA by the required deadlines; taking enforcement actions if violations occur; and using those enforcement actions to return the system to compliance in a timely fashion.

- *The District's Department of Health*, while having no formal role under the Act, is responsible for identifying health risks and educating the public on those risks.

Coordination Among Agencies Is Critical To Ensure Safe Drinking Water

Providing safe drinking water requires that water systems, regulators, and public health agencies fulfill individual responsibilities yet work together in a coordinated fashion. It is particularly important that these entities report and communicate information to each other in a timely and accurate manner. In the case of drinking water in the District of Columbia, one of the key relationships is the one between WASA, the deliverer of water to District customers, and EPA's Philadelphia Office, the regulator charged with overseeing WASA's compliance with drinking water regulations. Of particular note, one of WASA's key obligations is to monitor the water it supplies to District customers through a tap water sampling program, and to report these results accurately and in a timely manner to EPA's Philadelphia Office. As EPA itself has noted, one of the Philadelphia Office's key obligations is to ensure that WASA understands the reporting requirements and reports monitoring results by required deadlines.

It is noteworthy that WASA and EPA have taken or agreed to take steps that are clearly intended to improve communication and coordination between the agencies. For example:

- Under the Consent Order signed by EPA and WASA on June 17, 2004, WASA agreed to improve its format for reporting tap water samples by ensuring that the reports include tap water sample identification numbers, sample date and location, lead and copper concentration, service line materials, and reasons for any deviation from previously sampled locations. The monitoring reports are also to include the laboratory data sheets, which contain the raw test data recorded directly by the laboratory. Under the Order, WASA also agreed to submit to EPA for comment a plan and schedule for enhanced information, database management, and reporting. The plan is to describe how monitoring

reports will be generated, maintained, and submitted to EPA in a timely fashion.

- EPA's Philadelphia Office has altered the way in which it will handle compliance data from WASA and the Washington Aqueduct. According to the office, compliance data from both water systems will now be sent to those in the Office responsible for enforcing the Safe Drinking Water Act, so as to separate the enforcement/compliance assurance function from the municipal assistance function.

  Aside from the tap water monitoring issue, EPA's Philadelphia Office acknowledges that its oversight of WASA public notification and education efforts could have been better, noting that "In hindsight, EPA should have asked more questions about the extent, coverage and impact of DC WASA's public education program, and reacted to fill the public education gaps where they were evident."[5] To address the problem, the Philadelphia Office reported on its website that it will have to make some improvements in the way it exercises its own oversight responsibilities.[6] Suggested improvements include obtaining written agreement from WASA to receive drafts of education materials and a timeline for their submission, reviewing drafts of public education materials for compliance with requirements, as well as effectiveness of materials and delivery, and acquiring outside expertise to assist in evaluating outreach efforts.

  As our work continues, we will seek to examine (to the extent it does not conflict with active litigation) other ways in which improved coordination between WASA and EPA could help both agencies better fulfill their responsibilities. We will also examine interrelationships that include other key agencies, such as the Aqueduct and the D.C. Department of Health. We will also examine how other water systems in similar situations interacted with federal, state, and local agencies. These experiences may offer suggestions on how coordination can be improved among the agencies responsible for protecting drinking water in the District of Columbia.

[5]Letter from William C. Early, Regional Counsel, EPA Region III, to Eric H. Holder, Jr., Covington & Burling (June 25, 2004) attaching EPA's Response to May 13, 2004, letter from Covington & Burling, Response #26.

[6]http://www.epa.gov/dclead/pep_recommendations.htm.

Experiences of Other Water Systems Highlight Effective Ways to Inform and Educate the Public

WASA is not the first system to exceed the action level for lead. According to EPA, when the first round of monitoring results was completed for large water systems in 1991 pursuant to the Lead and Copper Rule, 130 of the 660 systems serving populations over 50,000 exceeded the action level for lead. EPA data show that since the monitoring period ending in 2000, 27 such systems have exceeded the action level.[7] As part of our work, we will be examining the innovative approaches some of these systems have used to notify and educate their customers. I would like to touch on the activities of two such systems, the Massachusetts Water Resources Authority and the Portland, Oregon, Water Bureau. Each of these systems has employed effective notification practices in recent years that may provide insights into how WASA, and other water systems, could improve their own practices.

Massachusetts Water Resources Authority

The Massachusetts Water Resources Authority (MWRA) is the wholesale water provider for approximately 2.3 million customers, mostly in the metropolitan Boston area. Under an agreement with the Massachusetts Department of Environmental Protection, monitoring for lead under the Lead and Copper Rule occurs in each of the communities that MWRA serves and the results are submitted together. Initial system-wide tap water monitoring results in 1992 showed a 90th percentile lead concentration of 71 ppb (meaning 10 percent of its samples scored at this level and above). According to MWRA, adjustments in corrosion control have led to a reduction in lead levels, but the 90th percentile lead concentration in MWRA's service area has still been above the action level in four of the seven sampling events since early 2000.

According to an MWRA official, the public education program for lead in drinking water is designed to ensure that all potentially affected parties within MWRA's service area receive information about lead in drinking water. He noted, for example, that while the Lead and Copper Rule requires that information be sent to consumers in their water bills, the large population of renters living in MWRA's service area often do not receive water bills. Therefore, MWRA included information about lead in its consumer confidence report, which is sent to all mailing addresses within the service area. Additionally, MWRA uses public service

[7]EPA Office of Ground Water and Drinking Water, *Summary: Lead action level exceedences for medium (3,300-50,000) and large (>50,000) public water systems* (Updated as of June 1, 2004).

announcements, interviews on radio and television talk shows, appearances at city councils and other local government agency meetings, and articles in local newspapers to convey information. MWRA also conducted focus groups to judge the effectiveness of the public education program and continually makes changes to refine the information about lead in drinking water.

An MWRA official also noted that MWRA focuses portions of its lead public education program on the populations most vulnerable to the health effects of lead exposure. For example, MWRA worked with officials from the Massachusetts Women, Infants and Children Supplemental Nutrition Program (WIC) to design a brochure to help parents understand how to protect their children from lead in drinking water. Among other things, the brochure includes the pertinent information in several foreign languages, including Spanish, Portuguese, and Vietnamese. The WIC program also includes information on how to avoid lead hazards when preparing formula.

Portland Water Bureau

The Portland Water Bureau provides drinking water to approximately 787,000 people in the Portland metropolitan area, nearly one-fourth of the population of Oregon. Since 1997, the city has exceeded the lead action level 6 times in 14 rounds of monitoring. According to Bureau officials, the problem stems mainly from lead solder used to join copper plumbing and from lead in home faucets. Portland's system has never had lead service lines, and the Water Bureau finished removing all lead fittings within the water system's control in 1998.

The Portland Water Bureau sought flexibility in complying with the Lead and Copper Rule. The state of Oregon allowed the Water Bureau to implement a lead hazard reduction program as a substitute for the optimal corrosion control treatment requirement of the Lead and Copper Rule. Portland's lead hazard reduction program is a partnership between the Portland Water Bureau, the Multnomah County and Oregon State health departments, and community groups. According to Portland Water Bureau officials, the program consists of four components: (1) water treatment for corrosion control; (2) free water testing to identify customers who may be at significant risk from elevated lead levels in drinking water; (3) a home lead hazard reduction program to prevent children from being exposed to lead from lead-based paint, dust, and other sources; and (4) education on how to prevent lead exposure targeted to those at greatest risk from exposure.

As the components suggest, the program is focused on reducing exposure to lead through all exposure pathways, not just through drinking water. For example, the Water Bureau provides funding to the Multnomah County Health Department's LeadLine—a phone hotline that residents can call to get information about all types of lead hazards. Callers can get information about how to flush their plumbing to reduce their lead exposure and can request a lead sampling kit to determine the lead concentration in the drinking water in their home. The Water Bureau also provides funding for lead education materials provided to new parents in hospitals, for billboards and movie advertisements targeted to neighborhoods with older housing stock, and to the Community Alliance of Tenants to educate renters on potential lead hazards. Each of these materials directs people to call the LeadLine if they need additional information about any lead hazard. The Water Bureau evaluates the results of the program by tracking the number of calls to the LeadLine, and by surveying program participants to determine their satisfaction with the program and the extent to which the program changed their behavior.

In January 2004, the Portland Water Bureau sent a targeted mailing to those residents most likely to be affected by lead in drinking water. The mailing targeted homes of an age most likely to contain lead-leaching solder where a child 6 years old or younger lived. Approximately 2,600 postcards were sent that encouraged residents to get their water tested for lead, learn about childhood blood lead screening, and reduce lead hazards in their homes. Water Bureau officials said that they obtained the information needed to target the mailing from a commercial marketing company, and that the commercial information was inexpensive and easy to obtain.

WASA Faces Challenges in Identifying At-Risk Populations

In an ideal world, a water utility such as WASA would have several different types of information that would allow it to monitor the health of individuals most susceptible to the health effects of lead in drinking water. The utility would know the location of all lead service lines and homes with leaded plumbing (pipes, solder and/or fixtures) within its service area. The utility would also know the demographics of the residents of each of these homes. With this information, the utility could identify each pregnant woman or child six years old or younger who would be most likely to be exposed to lead through drinking water. These individuals could then be educated about how to avoid lead exposure, and lead exposure for each of these individuals could then be monitored through water testing and blood lead testing.

Unfortunately, WASA and other drinking water utilities do not operate in an ideal world. WASA does have some information on the location of lead service lines within its distribution area. Its predecessor developed an inventory of lead service lines in its distribution system in 1990 as part of an effort to identify sampling locations to comply with the Lead and Copper Rule. According to WASA officials, identifying the locations of lead service lines was difficult because many of the records were nearly 100 years old and some of the information was incomplete. According to this 1990 inventory, there were approximately 22,000 lead service lines. WASA updated the inventory in September 2003, and estimated that it had 23,071 "known or suspected" lead service lines. WASA subsequently identified an additional 27,495 service lines in the distribution system made of "unknown" materials. Consequently, there is some uncertainty over the actual number and location of the lead service lines in WASA's distribution system. The administrative order that EPA issued in June 2004 requires WASA to further update its inventory of lead service lines.

Regardless of the information WASA has about the location of lead service lines, according to WASA officials, WASA has little information about the location of customers who are particularly vulnerable to the effects of lead. The District's Department of Health is responsible for monitoring blood lead levels for children in the District. Officials from the Department of Health told us that they maintain a database of the results of all childhood blood lead testing in the District, and have studied the distribution of blood lead levels in children on a neighborhood basis. However, according to a joint study by the D.C. Department of Health and the Centers for Disease Control and Prevention (CDC) published in March 2004, it is difficult to discern any effect of lead in drinking water on children's blood lead levels because the older homes most likely to have lead service lines are also those most likely to have other lead hazards, such as lead in paint and dust. This joint study also described efforts by the Department of Health and the United States Public Health Service to conduct blood lead monitoring for residents of homes whose drinking water test indicated a lead concentration greater than 300 ppb. None of the 201 residents tested were found to have blood lead levels exceeding the levels of concern for adults or children, as appropriate.

Researchers Face Gaps in Knowledge Regarding the Risks Posed by Lead in Drinking Water

A good deal of research has been conducted on the health effects of lead, in particular on the effects associated with certain pathways of contamination, such as ingestion of leaded paint and inhalation of leaded dust. In contrast, the most relevant studies on the isolated health effects of lead in drinking water date back nearly 20 years—including the Glasgow Duplicate Diet Study on lead levels in children upon which the Lead and Copper Rule is partially based.[8] According to recent medical literature and the public health experts we contacted, the key uncertainties requiring clarification include the incremental effects of lead-contaminated drinking water on people whose blood lead levels are already elevated from other sources of lead contamination and the potential health effects of exposure to low levels of lead. As we continue our work, we will examine the plans of EPA and other organizations to fill these and other key information gaps.

Lead is a naturally occurring element that, according to numerous studies, can be harmful to humans when ingested or inhaled, particularly to pregnant and nursing women and children aged six or younger. In children, for example, lead poisoning has been documented as causing brain damage, mental retardation, behavioral problems, anemia, liver and kidney damage, hearing loss, hyperactivity, and other physical and mental problems. Exposure to lead may also be associated with diminished school performance, reduced scores on standardized IQ tests, schizophrenia, and delayed puberty.

Long-term exposure may also have serious effects on adults. Lead ingestion accumulates in bones, where it may remain for decades. However, stored lead can be mobilized during pregnancy and passed to the fetus. Other health effects in adults that may be associated with lead exposure include irritability, poor muscle coordination and nerve damage, increased blood pressure, impaired hearing and vision, and reproductive problems.

There are many sources of lead exposure besides drinking water, including the ingestion of soil, paint chips and dust; inhalation of lead particles in soil or dust in air; and ingestion of foods that contain lead from soil or water. Extensive literature is available on the health impacts of lead exposure, particularly from contaminated air and dust. CDC identified in a

[8]Lacey R.F., et al. Lead in Water, Infant Diet and Blood: The Glasgow Duplicate Diet Study. *The Science of the Total Environment*, 41 (1985) 235-257.

December 2002 *Morbidity and Mortality Weekly Report* the sources of lead exposure for adults and their potential health effects.[9] In a September 2003 *Morbidity and Mortality Weekly Report*, CDC identified the most prevalent sources of lead in the environment for children, and correlated high blood lead levels in children with race, sex, and income bracket.[10] The surveys suggest that Hispanic and African-American children are at highest risk for lead poisoning, as well as those individuals who are recipients of Medicaid. Dust and soil contaminated by leaded paint were documented as the major sources of lead exposure. Children and adults living in housing built before 1950 are more likely to be exposed to lead paint and dust and may therefore have higher blood lead levels.

Articles in numerous journals have reported on the physical and neurological health effects on children of lead in paint, soil, and dust. The *New England Journal of Medicine* published an article in April 2003 that associated environmental lead exposure with decreased growth and delayed puberty in girls.[11] In 2000, the *Journal of Public Health Medicine* examined the implications of lead-contaminated soil, its effect on produce, and its potential health effects on consumers.[12] Lead can also enter children's homes if other residents are employed in lead contaminated workplaces. In 2000, *Occupational Medicine* found that children of individuals exposed to lead in the workplace were at higher risk for elevated blood lead levels.[13] The EPA has aided in some similar research through the use of its Integrated Exposure Uptake Biokinetic Model for

[9]Centers for Disease Control and Prevention. *Morbidity and Mortality Weekly Report: Adult Blood Lead Epidemiology and Surveillance – United States 1998-2001*. 13 December 2002.

[10]Centers for Disease Control and Prevention. *Morbidity and Mortality Weekly Report: Surveillance for Elevated Blood Lead Levels Among Children – United States 1997-2001*. 12 September 2003.

[11]*Sherry G. Selevan, Deborah C. Rice, Karen A. Hogan, Susan Y. Euling, et al.* "Blood lead concentration and delayed puberty in girls." *The New England Journal of Medicine*. Boston: Apr 17, 2003. Vol. 348, Iss. 16; pp. 1527-1536.

[12]Prasad LR, Nazareth B. "Contamination of Allotment Soil with Lead: Managing Potential Risks to Health." *Journal of Public Health Medicine*. 22(4) December 2000: 525-30.

[13]Chan, J, et al. "Predictors of Lead Absorption in Children of Lead Workers." *Occupational Medicine*. Vol 50, Issue 6, 398-405, 2000.

Lead in Children (IEUBK). This model predicts blood lead concentrations for children exposed to different types of lead sources.[14]

According to a number of public health experts, drinking water contributes a relatively minor amount to overall lead exposure in comparison to other sources. However, while lead in drinking water is rarely thought to be the sole cause of lead poisoning, it can significantly increase a person's total lead exposure—particularly for infants who drink baby formulas or concentrated juices that are mixed with water from homes with lead service lines or plumbing systems. For children with high levels of lead exposure from paint, soil, and dust, drinking water is thought to contribute a much lower proportion of total exposure. For residents of dwellings with lead solder or lead service lines, however, drinking water could be the primary source of exposure. As exposure declines from sources of lead other than drinking water, such as gasoline and soldered food cans, drinking water will account for a larger proportion of total intake. Thus, according to EPA, the total drinking water contribution to overall lead levels may range from as little as 5 percent to more than 50 percent of a child's total lead exposure.[15]

Mr. Chairman, this completes my prepared statement. I would be happy to respond to any questions you or other Members of this Subcommittee may have at this time.

Contact and Acknowledgments

For further information, please contact John B. Stephenson at (202) 512-3841. Individuals making key contributions to this testimony included Steve Elstein, Samantha Gross, Karen Keegan, Jessica Marfurt, and Tim Minelli.

[14]U.S. Environmental Protection Agency. *The IEUBK Model* http:www.opa.gov/superfund/programs/lead/ieubk.htm 16 April 2004.

[15]U.S. Environmental Protection Agency. *Lead and Copper Rule. The Federal Register*. Vol. 56 NO. 110, 7 June 1991.

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