

Health Assessment for

BEACHWOOD BOROUGH AND BERKELEY TOWNSHIP NATIONAL PRIORITIES LIST NPL SITE

OCEAN COUNTY, NEW JERSEY

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SUMMARY

The Beachwood Borough and Berkeley Township National Priorities List (NPL) Site is located in Ocean County, New Jersey. A portion of the nearby population is exposed to generally low to moderately high levels of lead, copper, and manganese contamination by the ingestion of water. The sources of manganese are still under question and further sampling is required to define these sources. The lead and copper levels do not appear to be attributable to any specific sources or general soils contamination. Lead and copper levels are most likely related to the naturally occurring acidic and corrosive groundwaters which leach the metals from the household plumbing, and in certain instances, the serving wells. Data from a small number of the sampled wells, however, were anomalous and may indicate that portions of the aquifer are contaminated with lead from natural or man-made sources. Although the majority of the residences in Beachwood have been connected to the public water supply, data from the April-May 1986 investigation of a sample of Beachwood residences indicate that 6.7 percent of these are still using water with lead content in excess of the Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) of 0.05 mg/l. Approximately 27 percent of the water supplied to Beachwood residences exceeds the EPA Maximum Contaminant Level Goal (MCLG) of 0.02 mg/l for lead. For the Berkeley residences using private wells, approximately 27 percent of the sample residences exceed the MCL of 0.05 mg/l and 51 percent exceed the MCLG of 0.02 mg/l for lead. The reason for the discrepancy may be attributed to treatment by the Beachwood public water supplier that decreases the corrosiveness of the water. Currently, there appears to be a small segment of the area population that may be exposed to moderately high concentrations of lead in their potable water (0.7 mg/l). Lead contamination of potable water supplies is of public health concern. High concentrations of manganese may have health implications. The manganese concentrations that were found (0.617 mg/l maximum) relate mainly to the aesthetic qualities of the water rather than to public health.

BACKGROUND

SITE DESCRIPTION

The Beachwood/Berkeley site is located in Ocean County, New Jersey, and can be found on the U.S. Coast and Geodetic Survey map of the Toms River, New Jersey Quadrangle. The general area is bounded by the Toms River to the north, Cedar Creek to the south, Barnegat Bay to the east, and Manchester Township to the west. Beachwood Borough is extensively populated and approximately 2.7 square miles in area. Berkeley Township encompasses approximately 40 square miles in area and is primarily undeveloped. The study area is located in the New Jersey Pinelands

region, generally west of the Garden State Parkway. The New Jersey Pinelands region consists of the Pinelands National Reserve (northern Berkeley Township), the Pinelands Protection Area (central Berkeley Township), and the Pinelands Preservation Area (southern Berkeley Township).

A complaint registered by a private citizen in March 1982, prompted the New Jersey Department of Environmental Protection (NJDEP) to sample an individual well in which the lead level exceeded the EPA drinking water MCL of 0.05 mg/l. Further sampling by the NJDEP and the Ocean County Health Department found other lead-contaminated wells in Beachwood Borough and Berkeley Township. Approximately 20 percent of the wells sampled in Beachwood Borough and 4 percent in Berkeley Township had lead concentrations greater than the MCL of 0.05 mg/l.

The literature states that domestic well lead levels in 1982 ranged from below the detection limits of 0.01 mg/l to as high as 22.6 mg/l. Lead levels were below the detection limit in about 60 percent of the well water samples from Beachwood and 20 percent of the Berkeley well water samples. Detected lead concentrations in the samples have generally ranged from 0.02 to 0.2 mg/l.

A NJDEP administrative order, issued in December 1982, required Beachwood Borough to extend its public water supply to all homes within the Borough east of the Garden State Parkway and required all homes within that area to connect to the water supply system.

A later study of 90 residences conducted from April 8 to May 2, 1986, (45 Beachwood homes on public water and 45 Berkeley homes on well water) indicated that 18 of the Berkeley residences had copper levels greater than the 1.0 mg/l Secondary Maximum Contaminant Level (SMCL) in their well water. These values ranged from approximately 1.2 mg/l to 6.4 mg/l. None of the Beachwood homes potable water samples had elevated copper levels which may be because of the treatment to reduce the acidity of public water.

Water samples from three homes in Beachwood Borough and twelve homes in Berkeley Township had lead levels greater than the MCL of 0.05 mg/l. The "first flushed" (initial sample taken) samples generally contained higher levels of lead than the "60-minute" samples. The "60 minute" samples are samples taken after the line is flushed for 60 minutes. The "first flushed" lead levels ranged from 0.05 mg/l to 0.739 mg/l. EPA is expected to change the current MCL for lead of 0.05 mg/l to 0.02 mg/l. Under this guideline, the potable water of twelve of the Beachwood residences and twenty-three of the Berkeley residences would be above 0.02 mg/l limit during "first flush" conditions. Newer homes appear to be affected the most. Eight of the twelve Beachwood homes and twelve of the twenty-three Berkeley homes that were affected were less than a year old.

Water samples from one Beachwood home and seven Berkeley homes had manganese levels greater than the SMCL of 0.05 mg/l. These levels ranged from 0.051 mg/l to 0.617 mg/l. The data tended to discount plumbing as the source of manganese. Aquifer characteristics appeared to be the most likely source; however, further study is needed to confirm the sources of the manganese. The presence of manganese above the SMCL may cause objectionable aesthetic qualities in water such as unpleasant taste, colors, and stains on plumbing fixtures and laundry. Some evidence indicates that high levels of manganese in drinking water may be of human health concern.

ENVIRONMENTAL CONTAMINATION

A review of the literature for the Beachwood/Berkeley area indicates that the extent and occurrence of lead contamination is not related to any identifiable geographical pattern for this area. Specific sources for lead contamination could not be identified. Analysis of stream surface water and sediment samples in the study area did not indicate any unusual sources of lead that may contaminate the groundwater. Based on the monitoring well data, the local aquifer supplying the wells serving this area was not found to contain elevated concentrations of lead. However, because of the limited data, the possibility of isolated specific sources of lead cannot be totally eliminated.

The lead in the drinking water seems to be associated with the naturally occurring acidic groundwater interacting with lead-bearing components in the household plumbing. The main source of the lead for the majority of the domestic water sampled in the 1986 study appears to be from lead-tin solder commonly used to join household water pipes. The lead can be leached from these soldered joints by corrosive waters.

The copper in the drinking water was thought to be attributed to corrosive leaching of the copper from plumbing. The concentrations of copper and lead decreased over time as "flushing" of the lines progressed.

The presence of manganese in the drinking water is thought to be related to the aquifer characteristics. Elevated concentrations of manganese were found in water samples from only a few homes and a significant decrease in concentrations over time with "flushing" did not always occur. Further study is required to determine the manganese source.

DEMOGRAPHICS

Beachwood Borough is densely populated and located in an urban setting. Berkeley Township appears to be more rural in character and not densely populated. More specific demographic information was unavailable for our review.

EVALUATION

A. SITE CHARACTERIZATION (DATA NEEDS AND EVALUATION)

1. Environmental Media

Hydrological and geological investigations were included within the overall site investigation and their results are part of the Task Three: Site Investigations Report. Sampling efforts were directed toward groundwater, surface water, sediments, and soil (both surface and sub-surface). The site appears to have been adequately investigated in an attempt to define the sources of lead contamination. It appears that there are no major specific sources, such as a hazardous waste landfill, that would be implicated in the lead contamination. The data suggests that the naturally occurring corrosive water is leaching lead from household plumbing. In some instances, further study is required to define isolated anomalies of the most recent study. These include: (1) several wells where contamination is suspected to be linked to septic tank systems, (2) several wells where water samples contained excessive lead levels after flushing for 60 minutes, and (3) several wells where water samples contained excessive lead concentrations that were traced to the well water holding tanks.

2. Demographics and Land Use

Detailed demographic data of this area was unavailable for ATSDR's evaluation. Information is needed on the number of children under five years of age, the median age, the number of elderly persons over 62 years of age, the sex distribution, ethnic background, socioeconomic status, the occupations of employed persons, and the locations of schools, hospitals, and other facilities indicative of potentially high risk subpopulations.

3. Quality Control and Quality Assurance (QA/QC)

This Health Assessment was based on compiled data from the TASK THREE: SITE INVESTIGATIONS, BEACHWOOD/BERKELEY WELLS SITE, BOROUGH OF BEACHWOOD AND TOWNSHIP OF BERKELEY, OCEAN COUNTY, NEW JERSEY, VOLUME 1 TECHNICAL REPORT, SEPTEMBER 1987. It assumes that the samples were handled properly and the analytical data provided by the laboratories are correct. A review of the analytical data indicates that some problems with QA/QC procedures exist. Some of the well water samples were reported as having concentrations of dissolved contaminants higher than the total concentrations of the same contaminant. Insufficient information was available on QA/QC to further comment on the validity of the data.

B. ENVIRONMENTAL PATHWAYS

Currently, there do not appear to be any environmental pathways identified for the copper and lead contamination. Further study is required which may pinpoint localized soil or aquifer conditions that may contribute to

the contamination of the drinking water. Other Superfund studies in the area suggest that sporadic lead contamination of the aquifer may be occurring. However, the preponderance of the data collected for this site appear to suggest that the corrosive groundwater in the area interacting with the household plumbing and wells is the major source of the lead and copper contamination for the majority of the residential well water sampled.

The lead levels in the water samples of the majority of Beachwood and Berkeley residences dropped significantly after flushing for 60 minutes. Most residences achieved near the 60 minute lead levels after 4-5 minutes of flushing. Approximately 93 percent of the Berkeley homes and 98 percent of the Beachwood homes sampled had water lead levels less than the MCL of 0.05 mg/l after the flushing. However, these levels were expected to elevate again if water was left standing in the plumbing for approximately six hours.

Elevated manganese levels may be present because of local aquifer characteristics. This has yet to be confirmed by further testing.

C. HUMAN EXPOSURE PATHWAYS

Ingestion of water, either from wells or the public water supply is a primary human exposure pathway for the copper, lead, and manganese contamination. Dermal absorption and inhalation were not considered significant exposure pathways because of the physical and chemical characteristics of these contaminants.

PUBLIC HEALTH IMPLICATIONS

Some residents of the Beachwood Borough and Berkeley Township NPL Site, located in Ocean County, New Jersey are using municipal or private well drinking water contaminated with lead, copper, and manganese. However, lead contamination levels are the primary concern for residents on municipal water or private well water. Lead levels from samples taken in 1982 ranged from the detection limit of 0.01 mg/l to as high as 22.6 mg/l, and data from samples taken in April to May 1986 as high as 0.7 mg/l for a small segment of the population. The EPA's MCLG is 0.02 mg/l. The existing MCL is 0.05 mg/l.

It was reported that most of the residences in Beachwood have been connected to the municipal public water supply system; data from a 1986 sampling of numerous households show that 6.7 percent of these residences are still using water in excess of the EPA MCL for lead of 0.05 mg/l. Twenty seven percent of samples from the Berkeley residences on private well water contained lead levels above the EPA MCL of 0.05 mg/l. This is a marked difference and it may be attributed to Beachwood public water supply treatment (adjusting pH) for corrosiveness of their water.

The Task Three: Site Investigation Report indicated that a portion of the area population is still exposed to a moderately high level of lead in their potablewater (0.7 percent).

Exposure to lead is particularly dangerous for the unborn fetus, because of its greater sensitivity during development, and for young children because they absorb more of the lead that they ingest; and are more sensitive to its effects. A mother exposed to lead may transfer it to the fetus causing preterm birth, reduced birth weight, and decreased intelligence quotient (IQ) in the infant.

Lead exposure by ingestion may also decrease IQ scores and reduce the growth of young children. Recent evidence indicates that lead exposure may contribute to the development of hypertension. Lead can damage the brain and kidneys in adults or children. High levels of exposure to lead will cause abortion and affect the male reproductive system. The effects of lead are the same regardless of the exposure route of inhalation or ingestion.

Exposure to lead occasionally produces progressive mental deterioration in children. Clinical history of these children indicates steady loss of motor skills and speech. They may have severe hyperkinetic and aggressive behavior disorders and poorly controllable convulsive disorder. There may be a disability of sensory perception in these children that severely impairs learning. Microcytic, hypochromic anemia is more common than stippling of erythrocytes in affected children. The anemia may be hemolytic. The type of hemoglobin (HbA3) found in erythrocytes of anemic children with elevated concentration of lead in blood is characteristic of prematurely senescent erythrocytes, but the life-span of the majority of erythrocytes is normal. However, the anemia is seldom severe.

Investigators have reported kidney tumors in rats and mice that ingested large doses of lead. These observations suggest that lead may cause cancer in man. However, animal data are not sufficient for use in estimating the risk of cancer to humans. Occupational studies have not elucidated an increased risk of cancer in workers exposed to lead. Acute or chronic poisoning would probably result in death long before the onset of cancer.

The water sampling study, conducted in 1986, of the Berkeley area residences reported that a considerable number of private well users and a small number on the municipal system are still exposed to drinking water contaminated with lead. It is not known for how long this residential water was contaminated at levels above the EPA's MCL. Data for the 1982-1986 period is not available, and even if available it would be difficult to estimate the levels this community was exposed to during this time period. Lead bioaccumulates, but we lack sufficient information to estimate total exposure or the total body-burden levels over this time period.

Our primary documented concern is for those households that are currently using private well water. Water from the municipal system is governed by present drinking water regulations and laws. Municipal water systems possess the ability to reduce the corrosivity of their water to minimize the levels of heavy metals. Nevertheless, the risks to private well owners are unknown because routine monitoring and treatment of their water supply does not occur. Depending on individual use habits, the levels of lead in the drinking water of these homes may be of public health concern.

Many investigators consider manganese in drinking water to be without toxicological significance. Nevertheless, reported toxic effects with drinking water exposure to high levels of manganese include encephalitis-like and Parkinsonism-like central nervous system disorders, stunting of growth, impairment of bone development, and death (Taylor, 1949; Nightingale and Loosonoff, 1930; and Chilean Nitrate Education Bureau, Inc., 1948). However, the manganese contamination that was found in the Beachwood/Berkeley area did not appear to be at levels of public health concern.

The presence of manganese above the SMCL does not normally pose a public health threat because of the objectionable conditions such as unpleasant taste, colors, and stains on plumbing fixtures and laundry associated with the water usually limits use. Manganese in excess of 0.1 mg/l has been reported to cause turbidity and laundry problems, respectively (McKee and Wolf, 1963). The acceptable intake chronic (AIC) value used by the EPA for the ingestion of manganese is 0.22 mg/kg/day. This corresponds to a water concentration of 7.7 mg/l. The maximum concentration of manganese found in one Beachwood public water supply sample was 0.617 mg/l, which is an order of magnitude lower than the corresponding AIC water concentration value. The maximum concentration of manganese found in well water samples from Berkeley residences was 0.228 mg/l.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

This site is of potential health concern because of the risk to human health resulting from possible exposure to hazardous substances at concentrations that may result in adverse health effects. As noted in Section C above, human exposure to lead in groundwater may be occurring or may have occurred via ingestion of drinking water at levels of health concern.

The copper and lead data appears to conform with the hypothesis that sample levels would be high during the "first flush" and that levels would drop significantly during the later sample period "60 minutes". This suggests that the corrosive waters are leaching the copper and lead out of the household plumbing after a period of contact time.

From the data, there does not appear to be a single or a point source responsible for the sporadic lead, copper, and manganese contamination that occurs in both public and well water supplies. Further study is needed to define the cause of why several wells had elevated levels of lead after 60 minutes of flushing.

The majority of the lead and copper contaminants in the drinking water supplies sampled appears to originate from the corrosion of household plumbing by acidic groundwater. These metals could be leached from the plumbing or supplying well. Manganese may be present because of local aquifer characteristics. However, the source of the manganese is not definitely known at this time. The levels of manganese present during the April-May 1986 sampling appear to be of organoleptic than public health concern.

Treatment by the public water supplier for the Beachwood area may have resulted in waters that are less corrosive, which would result in lower lead and copper concentrations. However, a significant percentage of the area population would still be exposed to a lead level greater than the MCLG of 0.02 mg/l. In general, flushing of the water system before use significantly reduces the amount of lead and copper in the water.

RECOMMENDATIONS

1. Since corrosiveness of the water appears to be a major factor in the production of excessive levels of lead and copper at the tap, measures should be taken to further reduce the corrosiveness of the Beachwood public water supply, thereby further reducing the exposure. Further investigation and information dissemination is needed on the types of systems that may be used to reduce the corrosiveness of the groundwaters for existing private well users that have household plumbing with copper and lead-tin solder joints.
2. Reference 1 states that lead levels in certain tested wells in 1982 have reached levels as high as 22.6 mg/l, a dangerous level with respect to human consumption, especially pregnant women and children. Testing of all existing residences on private well water for lead levels should be performed for all households in the site area. Lead levels from the 1986 study of 90 residences reached a peak of 0.7 mg/l, still a level of concern for continual long-term ingestion. Since the lead levels drop with flushing of the water lines, residences with well water that have not been tested and those with levels above the MCL should be advised to flush the lines prior to ingestion of the water. This will tend to limit the amount of lead consumed.
3. As suggested in the Reference 1 recommendations, ordinances should be established to: (A) prohibit the use of lead-tin solder in this region, (B) encourage use of non-metallic pipe and, (C) prohibit use of well construction materials containing significant amounts of lead. Such ordinance would be in accordance with the provisions in the Safe Drinking

Water Act (SDWA) Amendments of 1986 which prohibits any pipe, solder, or flux containing lead in the installation or repair of any public water system and any plumbing in a residential or non-residential facility providing water for human consumption which is connected to a public water system (Section 109).

4. The results of the April to May 1986 study indicated that certain residences of the sample population showed anomalies in testing for lead, sulfate, chloride, and nitrate levels and that additional sampling was recommended for these homes. We agree with this recommendation. However, the study population is only a small segment of the probable overall affected population, hence, a large percentage of the population may continue to ingest lead levels greater than the MCL and MCLG unless the affected population is identified and informed of the protective measures available. Such notification would be in accordance with the provisions of Section 109 of the SDWA Amendments of 1986 which requires each water system to identify and provide notice to persons that may be affected by lead contamination of their drinking water where such contamination results from either the lead content in the construction materials of the public water system or the corrosivity of the water supply sufficient to cause leaching of lead.

5. Two residences BK-4 and BK-13 were identified as having extremely high levels of nitrates. These wells should be resampled immediately. If additional sampling confirms the high concentrations, then alternative water supplies should be considered unless the source of the nitrate contamination is identified and controlled.

6. Further sampling is recommended to determine the cause of the anomalous lead concentrations in some of the Beachwood/Berkeley private wells. Specific sources of lead near these locations may be possible.

In accordance with CERCLA as amended, the Beachwood Borough/Berkeley Township NPL Site located in Ocean County, New Jersey has been evaluated for appropriate follow-up with respect to health effects studies. Inasmuch as ATSDR has determined that human exposure to lead contaminated water is occurring, this problem merits additional attention. This site, however, is being considered for delisting by EPA and is currently being addressed by the New Jersey Department of Environmental Protection on a State-wide basis. Therefore, this site is not being considered for follow-up health studies at this time.

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