

Health Consultation
Lexington Manor Subdivision Lead Contamination
Liberty Township, Butler County, Ohio

Prepared by:

Health Assessment Section
of the Ohio Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

STATEMENT OF THE ISSUES

The Health Assessment Section (HAS) of the Ohio Department of Health was asked by the United States Environmental Protection Agency (EPA) to evaluate site information associated with the Lexington Manor Subdivision in Liberty Township, Butler County, Ohio. Specifically, HAS staff were asked to determine whether lead contamination in the soil poses a health threat to residents and children living in the subdivision. This site presents a special concern because of the large number of children who are traditionally present in suburban housing developments and the highly elevated levels of lead detected in preliminary investigations of surface soils in the subdivision. HAS reviewed all the sampling data collected to date, toured the site, and met with a number of the residents. Information collected and reviewed to date will be the basis for the conclusions and recommendations made in this health consultation.

HISTORY AND BACKGROUND

(All background information was taken from the Site Assessment Report prepared for EPA by Tetra-Tech EM Inc.)

The Lexington Manor Subdivision is a 25-acre parcel of land located along Milikin Road in Liberty Township, Butler County, Ohio. The site consists of 46 lots developed by Ryland Homes, a majority of which have been developed into single family homes that are currently occupied. All of the homes utilize municipal water. The area surrounding the neighborhood consists of agricultural land and additional residential communities.

Before being developed into a residential community, the Lexington Manor Subdivision was the location of the Hamilton Sportsman=s Association, a skeet shooting range that operated until 1969. From 1969 until the site was recently developed, the land was used as a farm that most recently pastured cattle. Before the land was purchased by developer Lexington Manor, Inc. (LMI), lead shot was reported to have been removed from the property (Tetra-Tech, 2003).

In January 2000, H.T. Investments (HTI) commissioned a Phase II Environmental Assessment to evaluate the potential lead contamination in on-site soils after the Initial Phase I assessment prepared for The Ryland Group revealed the former presence of the skeet shooting range on the property. During the Phase II Environmental Assessments, a total of 32 soil samples were collected from the ground surface to a depth of 15 inches below ground surface. Total lead concentrations in the soil ranged from less than 47 parts per million (ppm) to 4,600 ppm. A second round of soil sampling was conducted later in January by The Payne Firm (TPF). TPF collected 37 soil samples that contained lead from 11 to 5,694 ppm. Conclusions in the TPF document indicated that the lead-contaminated area comprised 4.4 acres of the total property. Recommendations were made to: 1) roto-till the lead-contaminated soil with non-contaminated soil or 2) excavate and re-grade the lead-contaminated soil with a minimum of 1 foot of clean soil as a cap and establish a grass cover.

In March 2000, HTI hired Ray Hensley, Inc. to test roto-tilling as a means of treating the lead-contaminated soil. After roto-tilling, TPF collected soil samples to assess the effectiveness of the

roto-tilling procedure. Soil samples showed lead concentrations ranging from 410 to 2,900 ppm. TPF concluded that roto-tilling did not achieve the desired treatment results.

In March 2000, LMI officially acquired the property with the intention of developing it as residential lots for resale to Ryland Homes.

In April 2000, HTI implemented a plan to manage the lead-impacted soil that exceeded the EPA's removal standard for lead-contaminated soil of 400 ppm. The lead-contaminated soil was to be used to fill in low areas of the site, and the contaminated soil was to be stabilized in place with a product called Calci-met, or lime, to render it nonhazardous. Even after several attempts to treat the soil, the concentration of lead was not reduced below the 400 ppm removal level. In August 2000, TPF collected 12 soil samples from the areas where treated soil had been removed and placed in bury areas in the back portion of the property. Total lead concentrations in the post-removal soil samples ranged from 20 to 7,000 ppm. To further reduce the lead concentrations, additional soil was stripped from the five areas known to contain contaminated soils. In August 2000, after the additional soil was stripped, an additional soil sample was collected, and the lead concentration was reported to be below 400 ppm, the EPA removal action level for residential properties. Following the final sampling, Ryland homes officially purchased the property from LMI in August 2000. Construction of homes in Lexington Manor began shortly thereafter.

In 2002, a resident who purchased a home in the Lexington Manor subdivision was notified by a long-time resident of the area that the land the home was built on used to be a skeet shooting range. The resident became concerned about possible lead exposure and collected three soil samples from the property (Lot 32) and had them analyzed for total lead. The lead concentrations ranged from 665 to 1,460 ppm (Tetra-Tech, 2003). After this discovery, Ryland homes contracted TPF to collect eight soil samples from the impacted resident's yard. The analytical results from the eight samples indicated lead concentrations ranging from 1,500 to 3,300 ppm. Ryland Homes arranged for SRW Environmental Services (SRW) to collect an additional 19 samples from Lot 32 in November 2002 (Figure 1). Results showed lead concentrations ranging from 32 to 10,000 ppm. SRW recommended that all soil with lead concentrations greater than 400 ppm be excavated and disposed of off-site. In December 2002, Ohio EPA was contacted by residents in the Lexington Manor subdivision who expressed their concern over the presence of lead in their soils.

In December 2002, Ryland Homes issued a letter to the homeowners in the Lexington Manor Subdivision stating that their lots would be sampled and the soils would be analyzed for lead. SRW collected soil from each of the residential lots to which it was granted access. In March 2003, Ryland submitted a summary report detailing sampling and analytical results from the investigation. Results showed that at least 14 of the 46 lots contain lead concentrations greater than 400 ppm, with a high of 10,000 ppm in Lot 32.

Several residents in the community have joined to hire an environmental consultant to collect additional soil samples from their property. Verdant Energi and Environment was hired, and that firm collected 20 surficial soil samples each from Lot Nos. 7, 8, 10, 37, 40, and 42. Analytical

results were not available; however, a document presented by Verdant indicated that lead was detected at levels at least 10,000 ppm.

In April 2003, Ohio EPA issued a new release stating that Ohio EPA had requested EPA assistance in conducting a removal action at the Lexington Manor Site.

EPA Sampling of Lexington Manor

To confirm the presence of lead in the Lexington Manor soils and to determine the need for a removal action, Tetra Tech Superfund Technical Assistance and Response Team (START) collected 5 surficial soil samples from the backyards of Lot Nos. 24, 32, and 33. Sample S-1 was analyzed for total Resource Conservation and Recovery Act (RCRA) metals. Samples S-2 thru S-5 were analyzed for total lead and arsenic.

Total lead concentrations ranged from a low of 3,040 ppm in S-3 to 273,000 ppm in S-2. All five soil samples exceeded the EPA residential lead removal action level of 400 ppm. Total arsenic concentrations ranged from 23.2 ppm to 2,090 ppm. A leachability test (TCLP) was also run on one soil sample (S-2) to determine if the soil would be classified as hazardous under EPA regulations. The leachability test determines the amount of chemical that could be expected to leach out of the soil to potentially impact the underlying groundwater. Concentrations of lead in the one soil sample exceeded the regulatory leachability level of 5 micrograms per liter for lead but did not exceed the regulatory level for arsenic.

**Table 1
Soil Lead and Arsenic Concentrations
parts per million (ppm)**

Chemical	Action Level	S-1	S-2	S-3	S-4	S-5
TCLP Analysis						
Arsenic	5.0 ppb	NA	4.03	NA	NA	NA
Lead	5.0 ppb	NA	366	NA	NA	NA
Total Metals						
Arsenic	---	1,210	2,090	34.9	669	23.2
Lead	400	100,000	273,000	3,040	72,500	2,580

COMMUNITY HEALTH CONCERNS

On January 24, 2003, Ohio Department of Health staff, along with representatives from the Ohio

EPA, the Butler County Health Department, and the Cincinnati Children's Hospital met with about 40 residents in a private home in the Lexington Manor subdivision. Residents' main concerns involved their children's health. Many residents expressed concern that their children had played outside in the bare soil before grass cover was established on their yards. Parents were also concerned about dust that may be present in the air that could contain elevated levels of lead and could pose a health risk to their children. The parents were urged to have their children seen by a physician and tested for total blood lead. The Butler County Health Department arranged for blood lead screening to be conducted at the local health department; however, no residents brought their children to this screening. According to discussions with several parents, it appears that most of the families took their children to their family physician for blood lead testing rather than take advantage of the local health department's offer. HAS staff were not provided with any of the children's medical records. Conversations with several parents indicate that none of the children who were tested currently have elevated blood lead levels.

Beginning in June 2003, HAS staff began attending periodic meetings with a small group of residents and representatives from the EPA and the Ohio EPA to discuss site activities and to answer any health-related questions that the community may have. HAS staff developed a site-specific fact sheet that outlined site conditions and provided information about health effects of lead exposure (Attachment A). On June 25, 2003, HAS staff mailed this fact sheet, along with a fact sheet on arsenic exposure and also information on lead exposure prevention developed by the Ohio Department of Health Childhood Lead Program, to every home in the subdivision.

DISCUSSION OF THE ISSUES

Soil sampling conducted to date in the Lexington Manor subdivision has shown lead contamination above EPA removal guidelines in a large number of the 46 residential lots. The EPA sampling also identified arsenic present at elevated levels in the five soil samples collected. Arsenic was used as a hardening agent in the manufacture of shotgun shells to make the lead shot more durable. Currently, there are no removal standards for arsenic-contaminated soils; however, there are health-based screening guidelines. The health-based screening guidelines for arsenic are generally very low and are sometimes below levels detected in the native soil. In the remediation of arsenic-contaminated soils, HAS generally recommends cleaning or removing the soils so that the arsenic concentration is equal to or below the regional background concentration. It is unknown if the arsenic contamination in the Lexington Manor subdivision is as widespread as the lead or if the arsenic will be present only in areas of the highest lead contamination. It is anticipated that if the lead contaminated soils are treated or removed, the arsenic contamination would be removed as well. Currently, there are homes present on 43 of the 46 lots, with a large number of the homes being occupied. Many of the homes in the neighborhood have children who spend large amounts of time outside and have the potential to be exposed to the contaminated soils.

Exposure Pathways

Area residents have to come into physical contact with the lead-contaminated soils and have

been exposed to the contamination. In order for the residents to come into contact with the lead in the environment, there must be the development of a *completed exposure pathway*. A completed exposure pathway consists of five main parts: These include: 1) a source of lead in the environment; 2) a way for the lead to migrate from its source to the soil; 3) a place where the residents comes in to contact with the lead; 4) a pathway (route) by which the resident comes into contact with the lead (eating, breathing); and 5) people who could potentially be exposed. Exposure pathways can also be characterized as to when the exposure occurred, as in either the past, present, or future.

Physical contact with the lead in the environment by itself does not necessarily mean that a person develop adverse health effects. Lead=s ability to affect a resident=s health is also controlled by a number of factors, including:

- ! How much lead a person is exposed to (dose)
- ! How long a person is exposed to the lead (duration)
- ! How often a person is exposed to the lead (frequency)
- ! The resident=s age
- ! The resident=s diet and nutritional habits

Past Exposures

It is very difficult, if not impossible, to determine the extent of the residents= exposure to the lead-contaminated soils prior to being made aware of the contamination. Because there was initially no grass cover on the lots with the contaminated soils, it is likely that there was a completed exposure pathway. Parents have described situations in which their children played in the exposed dirt piles when they first moved into their homes. It is also likely that dust was an issue during the earlier stages of construction activities in the community, and this dust could have been contaminated with lead and be in the air. Because of these concerns, the residents were advised to have their children tested for total blood lead concentrations. Blood lead screening was offered to the community on May 17, 2003, by the Butler County Health Department; however, no residents took advantage of this service. It is unknown how many of the families in the community have had their children tested for lead by their family physicians. According to conversations with several of the parents, it does not appear that any of the children who were tested had elevated lead levels detected in their blood.

Current Exposures

Since being notified of the contaminated soils in their community, residents have been advised by HAS, the Ohio EPA, EPA, and the Butler County Health Department to limit their own and their children=s contact with the soils in their community. This advise includes discouraging children from playing in areas with bare soil and refraining from conducting any intrusive landscaping or gardening projects that involve disturbing the soils and potentially creating exposure to the contaminated soils. During a recent site visit, HAS observed that a majority of the yards in the community had grass cover. Grass serves as an effective barrier to the lead-

contaminated soils and reduces the opportunity for exposure. Currently, four lots do not have grass cover, and they could provide an opportunity for direct contact with the contaminated soils. It was also noticed during the site visit that most of the residents in the community have stopped watering their grass because of the general feeling among residents that their yards will be damaged by any future removal action that may occur in the community. As noted, the grass cover serves as a barrier to the soil. If the grass cover dies, then there is a greater opportunity for children and residents to be exposed to the lead in the soils. Another potential exposure route is through fugitive dust that may be generated from the uncovered lots or potentially from lots whose grass cover was not maintained. Watering lawns and maintaining healthy grass would serve to keep dust levels down. Because potentially complete exposure pathways exist, there is the possibility that residents could be exposed to lead in the soil at levels that might pose a health hazard.

Ingestion of contaminated soils is the most likely route of lead exposure, especially significant in residential areas where the exposure may occur as a result of frequent outdoor activities of young children. Young children are the group most likely to ingest dust and soil, either via accidental ingestion of dirt through hand to mouth action, or less commonly, through the direct consumption of soil. Older children are less likely to eat the soil, but they may ingest quantities of dirt on their hands. Adults are less likely to be exposed by this route. The airborne dispersal of contaminated soils is another potential route of transport leading to the inhalation of suspended dust. However, in general, the total dose due to inhalation will be small (Paustenbach, 1989). Another possible exposure route is ingestion of vegetables, especially root crops (potatoes, carrots, beets, etc.) grown in gardens. It is possible that vegetables grown in contaminated soils can absorb lead and/or arsenic and thus pose an exposure risk to the community. Residents can reduce exposure risk by utilizing aggressive housekeeping measures. Residents should encourage frequent hand-washing when engaging in outdoor activities. If residents wish to grow a garden, it is not advisable to grow root crops, and it is recommended that all other vegetables be washed thoroughly before consumption.

Lead Toxicity in Children

Children are the primary concern when it comes to exposure to lead because their bodies tend to absorb more lead than adults. For example, about 99% of the lead taken into the body of an adult will leave in the body waste within a couple of weeks, but only about 32% of the lead taken in by children will be eliminated by the body in the same manner (ATSDR, 1997). Children are also more sensitive to the effects of lead than are adults. At low levels, lead can affect a child's mental and physical growth. The major effect of intake of excessive amounts of lead into the body is damage to the blood-forming and nervous systems. Although no threshold has been established for the effects of lead on the blood system and on learning ability in children, the Centers for Disease Control and the EPA currently recognize a level of 10 micrograms per deciliter (ug/dl) of blood as being elevated in children. According to scientific and mathematical modeling, a lead level of 400 parts per million in soil has been linked to lead levels in blood that could approach the 10 ug/dl blood lead level in children. As a result of the potentially completed exposure pathways that currently exist in the Lexington Manor Subdivision and the extremely

high levels of lead that exist in the soil, the possibility exists that children in the community could be exposed to concentrations of lead that could result in adverse health effects.

CHILDREN=S HEALTH CONCERNS

ATSDR and HAS consider children in the assessment of all sites that pose a potential or real public health hazard. ATSDR and HAS use public health guidelines that are specifically developed to be protective of children. Children are often at greater risk than are adults from certain kinds of exposures to hazardous substances in the environment. As previously indicated, children playing in bare soil areas in the Lexington Manor Community have the potential to be exposed to levels of lead that could cause adverse health effects. The potential threat to health of area children is the main focus of this health consultation.

CONCLUSIONS

The potential exists for residents and children in the Lexington Manor Subdivision to be exposed to levels of lead in residential soil at levels that could cause adverse health effects. Prior to grass being grown in the individual yards, it is likely that residents, especially children, were exposed to elevated levels of lead in uncovered soils and in fugitive dust created during construction activities. Currently, parents are aware of the lead contamination in the soil and have been advised to restrict their children=s access to their yards, especially in those areas that are not covered by grass. It has been reported that several parents have had their children tested for elevated blood lead levels. HAS has not been made aware of any children who have been diagnosed with elevated blood lead levels. However, it is unknown if any residents or children are currently being exposed to the contaminated soil or if all the children in the community have been seen by a physician to have their blood tested for lead. On the basis of the extremely high levels of lead detected in soils and the likelihood that residents were exposed to the contaminated soils in the past and could be exposed currently or in the future, HAS has determined that the Lexington Manor Site poses a *public health hazard* to the residents and children living in the community.

RECOMMENDATIONS

1. Ryland Homes/Lexington Manor, Inc. should fully characterize the extent of the arsenic- and lead-contaminated soils in the Lexington Manor subdivision.
2. Ryland Homes/Lexington Manor, Inc. should remediate lead and arsenic contaminated soils.
3. Residents should maintain good housekeeping activities to reduce their chance of exposure to lead-contaminated soils or dust. Residents should encourage frequent hand-washing when engaging in outdoor activities. Any crops grown in residential gardens

should be thoroughly washed before consumption. Residents should avoid planting root crops, such as potatoes, carrots, and beets, because these crops have the potential to absorb lead and/or arsenic from the soil.

PUBLIC HEALTH ACTION PLAN

Currently, EPA is working with Ryland Homes and Lexington Manor, Inc. to define the extent of contamination in the Lexington Manor subdivision and to develop plans to remove soils with lead levels above 400 ppm. EPA and HAS have committed to meeting with the residents on a regular basis to keep residents up to date on site activities and to answer any health-related questions. EPA has also committed to holding public meetings, usually centered on a specific site milestone, to keep the entire community aware of activities that are occurring at the site. HAS will continue to provide educational materials to residents in the community. HAS will also continue to be available to the community to answer health-related questions. HAS will review any additional environmental and/or medical data to determine if residents are being exposed to lead or arsenic at levels of health concern.

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REFERENCES

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Tetra-Tech EM Inc. Site assessment report for the Lexington Manor Lead Site. Liberty Township, Butler County, Ohio. 2003 May 14.

CERTIFICATION

This Lexington Manor Subdivision Lead Contamination Health Consultation was prepared by the Ohio Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

Technical Project Officer, SPS, SSAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Chief, State Program Section, SSAB, DHAC, ATSDR