Health Impact Assessment of the Demolition of a Lead Painted Bridge Adjacent to a Residential Area

city of CINCINNATI HEALTH DEPARTMENT

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Cincinnati Health Department Health Impact Assessment Committee: Final Draft 2/28/2013

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Abstract

This Health Impact Assessment (HIA) is concerned with the demolition of the Waldvogel Viaduct, a sixty year old bridge encased in lead based paint in Cincinnati, Ohio. The bridge stands to impact a significant number of residents in the Lower Price Hill Neighborhood directly adjacent to the structure. This HIA was initiated by community concern over the possible increase in ambient air lead and ground dust lead levels. This study asseses the relationship between construction methods used, current lead clean-up methods prescribed in construction contracts, air (ambient) and ground dust lead levels during the demolition and construction process and the possible health impacts. Currently there is little information about the air quality impact from the demolition of a lead painted bridge in close proximity to residences and schools.

Of particular concern is the timing of the demolition for October, 2012 because of the newly renovated Oyler School, located at 2121 Hatmaker Street, and serves pre-school through 12th grade students. The school was reopened when teachers reported to school on August 20, 2012. The first day of school for students was August 22, 2012. Oyler houses the Robert and Adele Schiff Early Learning Center, and day care and after school program run by the Cincinnati Early Learning Centers, Inc (CELC). Cincinnati Public Schools is leasing this space to CELC. The Oyler School building is located over 700 feet away from the bridge demolition project. Also, recreation baseball fields are located in close proximity to the Viaduct and will be open and operating during the demolition phase.

In addition to assessing potential for ambient lead and lead dust fall increase during construction and demolition, this HIA also reviews the potential increase in air borne particulate matter (PM) and petroleum and petroleum byproduct soil contamination. Petroleum can also contain lead and exposure to many of the byproducts of crude oil may cause cancer. A 2000, site assessment of the project area found petroleum deposits in rail yard that was in use for the past 100 years (BHE Environmental Inc., 2000). Particulate matter, both PM 2.5 and PM 10 is of concern because the easily inhaled particles have an adverse effect on cardio-pulmonary health diseases and can trigger asthma.

The HIA recommendation highlights include the following: 1) the City of Cincinnati or the Contractor should conduct air quality monitoring during demolition, including real time monitoring if available, and the results should be shared to allow adjustment of demolition practices if needed. Real time monitoring results can also inform future demolition of a lead painted bridge, 2) the Contractor should control dust coming off of the site, contain the work area as necessary to reduce dust contamination by employing dust control measures and follow the OAC Air Quality 3745-17-08 Restriction of Emission of Fugitive Dust regulations, 3) agencies should notify residents in advance of the planned demolition, via door to door contact, as well as through grocery stores, local churches, community centers, notices on the water bill, and the City and ODOT public information officers, 4) residents should be informed of recommended housekeeping protocol during construction and demolition.

As our country's infrastructure ages, this HIA can be used as a reference when demolishing structures containing lead or coated with lead paint in or near residential areas.

Introduction

The Waldvogel Viaduct is located in the neighborhood of Lower Price Hill, Cincinnati, Ohio. It is the steel support substructure portion of the Viaduct that is of concern in this HIA. The steel substructure is encased with lead paint due to multiple paintings of the structure over time. Lead paint on the steel substructure was confirmed in February, 2012 with a hand held x-ray florescence (XRF) Spectrometer. The Viaduct is located in close proximity to residential housing, schools, churches, and small retail shops as well as local businesses and industry. In fact, one of the viaduct's concrete pillars bisects an existing building that houses an active business. The close proximity of the Viaduct to a variety of neighborhood uses and populations makes this demolition project unique. Responding to community concerns, this study will evaluate the potential for lead dust contamination of nearby residences, businesses, streets, and sidewalks during demolition (deconstruction of the bridge) and removal of the refuse and debris from the area.

Photo: Cincinnati Health Department, September, 2012

The demolition of the steel support structure is expected to be a dry process and is not expected to generate any waste water. A review of the 2009 site assessment update documents, commissioned by the City of Cincinnati, reveals lead contaminated soil at the corner of Burns Street and River Road (BHE Environmental, 2009). Soil borings in this area showed a lead concentration of 1,100 ppm, “exceeding the 1,000 ppm City Cut and Fill Limit.” This same study recommends a management plan for potentially contaminated soils that includes identification, segregation, and disposal of petroleum contaminated soil. The area south of River Road has been used as a rail yard for over 100 years where contamination from petroleum products may have occurred. The Site Assessment recommended the same management plan mentioned above if contaminants are encountered during construction. This HIA also encompasses a review of lead contaminated soil.

The demolition of the Viaduct is part of an overall transportation improvement of the 6th Street Expressway that joins the Viaduct and operates as an east/west connector from downtown Cincinnati to the western neighborhoods. The improvement project is a joint collaboration of the City of Cincinnati and the Ohio Department of Transportation (ODOT) with a total project cost of $54 million. The improvement project has wide spread support of Lower Price Hill leaders because the newly designed expressway will greatly improve the confusing on and off ramps that exist today.

It is anticipated that the end result is also likely to improve bike and pedestrian circulation and safety, with pedestrian friendly walkways and bike-ways for Lower Price Hill neighborhood residents, students, and workers. The site design of the completed project includes preservation of the right of way on the north side of the railroad tracks for a future bike trail. Neave and Burns Streets will be cul-de-sacs as a part of street calming, and this has the support of community members involved in the design of the new viaduct. At the outset of the project a Community Aesthetics Committee was formed. The completed Viaduct area will include locations for 3 sculptures and the Aesthetics Committee also chose a terra cotta color for the completed bridge. A future connection to the riverfront was referenced in a 2007 Health and Safety Action Plan, “the reconstruction also makes the idea of transforming the riverfront into a recreational use much more realistic” (Community Building Institute, 2007, p11).

Purpose of a Health Impact Assessment (HIA) and the HIA Process

A Health Impact Assessment (HIA) is used to objectively evaluate the potential health effects of a project or policy before it is built or implemented. HIA can provide recommendations to increase positive health outcomes and minimize adverse health outcomes. The HIA framework is used to bring potential public health impacts and considerations to the decision-making process for plans, projects, and policies that fall outside of traditional public health arenas, such as transportation and land use.

The HIA has a focus on health outcomes such as obesity, physical inactivity, injuries, chronic disease, mental health and social equity. The HIA follows six steps: (1) screening - identify projects or policies for which an HIA would be useful, (2) scoping - identify which health effects to consider, (3) assessing risks and benefits, (4) developing recommendations, (5) reporting - presenting the results to decision-makers, and (6) evaluating to determine the effect of the HIA on the decision. Implementations of HIA recommendations are voluntary.

Scope of the Assessment

Geographic - The Lower Price Hill Neighborhood is one of 52 neighborhoods in Cincinnati, Ohio. It is bounded by a rail yard on the east, the Ohio River at the south, and hillsides on the west (Map 1). The site area that is subject of this study is located in the southern portion of the Lower Price Hill neighborhood and is bounded by 8th Street (North), Evans Street (East), Ohio River (South), and State Street (West) (Map 2).

The Viaduct itself is approximately ½ mile long and its highest point is 60', however the height from the deck to road below varies along the ½ mile length.

Health Impacts - Health impacts studied are related to lead exposure from airborne lead from the construction and demolition process, and the tracking of lead inside of the home from outdoor surface areas as a result of lead dust fall from demolition activity. Lead in the air, soil, and lead dust fall are of concern because lead poisoning is associated with damage to the central nervous system in children. Lead poisoning can cause cognitive and behavioral disorders, birth defects and even lead to death. Long term exposure of adults to lead can also result in damage to the central nervous system, urinary, reproductive systems, and kidneys.

Also studied was the impact of Particulate Matter (PM). PM is currently regulated by the US EPA as a criteria air pollutant due to the potential health impacts of exposure to ambient (air borne) levels of PM 2.5 and PM10. PM is of concern because the easily inhaled particles have an adverse effect on cardio-pulmonary diseases and can trigger asthma. Vehicles to transport workers, demolition debris, and construction materials will likely increase PM in the environment due to combustion exhaust and dust generated by tires.

The 2009 Site Assessment Update found petroleum hydrocarbons in the soil of the former Amtrak Station and L. Levine Structural Steel Company located at 1899 River Road (BHE Environmental Inc., 2009). The petroleum hydrocarbons measured above the City Cut and Fill Limit of 100ppm. Direct contact or inhalation of petroleum hydrocarbons is highly toxic and can cause DNA damage. Petroleum can also contain lead. Many of the byproducts of crude oil cause cancer.

Research Methods

The discovery process used in this assessment includes the review of literature and research related to lead dust fall from: 1. demolition of single family housing 2. large multi-family housing demolition and 3. correlation of lead dust fall and elevated lead levels in children living in areas within 1 census block of housing demolition. In addition, in collaboration with the Cincinnati Health Department Childhood Lead Poisoning Prevention Program, dust wipes from the sidewalks under the Viaduct and adjacent to the demolition site were taken and measurement of lead in the surface paint, both gray paint and yellow paint, was taken from steel supports of Viaduct.

Lower Price Hill Neighborhood Profile

The Lower Price Hill Neighborhood is well defined with natural boundaries: hillsides on the west side and the Ohio River on the south side. The east side boundaries are the Mill Creek and the CSX rail yard.

The neighborhood has a mix of residential, educational, recreational and commercial uses in close proximity; however, the area is also characterized by having heavy industrial uses adjacent to residences, schools and recreation ball fields. The existence of the heavy industrial uses and railroads within the neighborhood boundaries goes back 100 years. The 2007 Lower Price Hill (LPH) Health and Safety Action Plan states that, "The most striking anomaly in Lower Price Hill neighborhood's land use can be found on the Burns Street corridor amid the Oyler Community Learning Center and adjacent residential community. On the east side of the road are educational institutional and residential uses and on the west side of the road are heavy industrial uses. These uses next to one another have created concerns for the health of children and adults in the neighborhood" (Community Building Institute, 2007, p 7). The 2007 Plan proposes to create solid blocks of residential areas and consolidate commercial uses through relocating residential uses over time. It also proposes to create a green buffer for the Oyler School by relocating a heavy industry operation, located across the street from the school, to a new area of the neighborhood that will become a business/office/light industrial park. The 2007 Plan recognizes that the heavy industrial uses are a part of the fabric of the neighborhood and provide employment for residents. Hence, the plan incorporates industrial uses in the neighborhood by recommending green area buffers and using the business district as a buffer between heavy industry and residences.

A brownfield site is located in the Lower Price Hill neighborhood. The US Environmental Protection Agency (US EPA) defines brownfields as sites that are "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (US EPA, 2012). In 2007, the City of Cincinnati received a $3 Million Clean Ohio Revitalization Fund (CORF) grant for the Metro West Commerce Park to assist with environmental remediation and building demolition costs. The project was ranked number 1 by the Clean Ohio Council out of 17 projects submitted state-wide. The property is approximately 18 acres in size and is located in Lower Price Hill, southwest of the intersection of Gest and Evans Streets. It includes portions of the former Queen City Barrel property.

The population of the Lower Price Hill neighborhood has decreased since the 1980s. In 1980, the Lower Price Hill neighborhood population was 2,155 and by 2000 the population was 1,309. The 2010 census combined the Lower Price Hill neighborhood and the Queensgate neighborhood into one census tract (number 263). In 2010 the population was 1,217 in the combined census tract (US Census Bureau, 2011).

According to the 2010 US Census, nearly half of the Lower Price Hill/Queensgate population was under 19 years of age and 291 residents were below the age of 9. The median household income was $15,257. Many of the residents (49.7%) with household income are below the poverty line have children less than 18 years of age. Most people (83.9%) in the community rent their homes.

The majority of residents are employed in the fields of manufacturing, construction, food service, educational services, retail, and management services. Of the population 25 years and over, 36.8% have less than a high school diploma, 36.6% are high school graduates, 14.5% have some college, 4.7% an associate's degree, and 2.4% a bachelor's degree.

Lower Price Hill has grown in diversity over the years. Since 1990, there has been an increase in the number of residents of Hispanic, Latino or Spanish origin. In the 2010 Census, 150 residents indicated they are of Hispanic, Latino or Spanish origin. In terms of race, 66.5% of residents are white alone or in combination, 29.3% are African American alone or in combination, 3.5% are Native American or Alaskan Natives alone or in combination and 0.4% are Asian alone or in combination.

Oyler School is a neighborhood school in Lower Price Hill. Students are assigned to their neighborhood schools according to home addresses. Oyler currently has 716 students for the 2012-13 school year. Oyler School was recently renovated. Renovation and new construction at Oyler was complete in August 2012 and the school has earned Leadership in Energy and Environmental Design (LEED) Silver certification from the US Green Building Council. This LEED certification was issued based on environmentally friendly elements that increase the use of natural light, improve indoor air quality, and reduce consumption of energy and water, that were incorporated into the design for the renovated school building and new gymnasium (Cincinnati Public Schools, 2012). Racial and ethnic diversity of the students is similar to that of the neighborhood of Lower Price Hill. The student body is comprised of 26.2% African Americans, 67% whites, and 4.3% mixed race. The majority of students (85.4%) come from an economically disadvantaged household (Ohio Department of Education, 2010-2011 School Year Report Card).

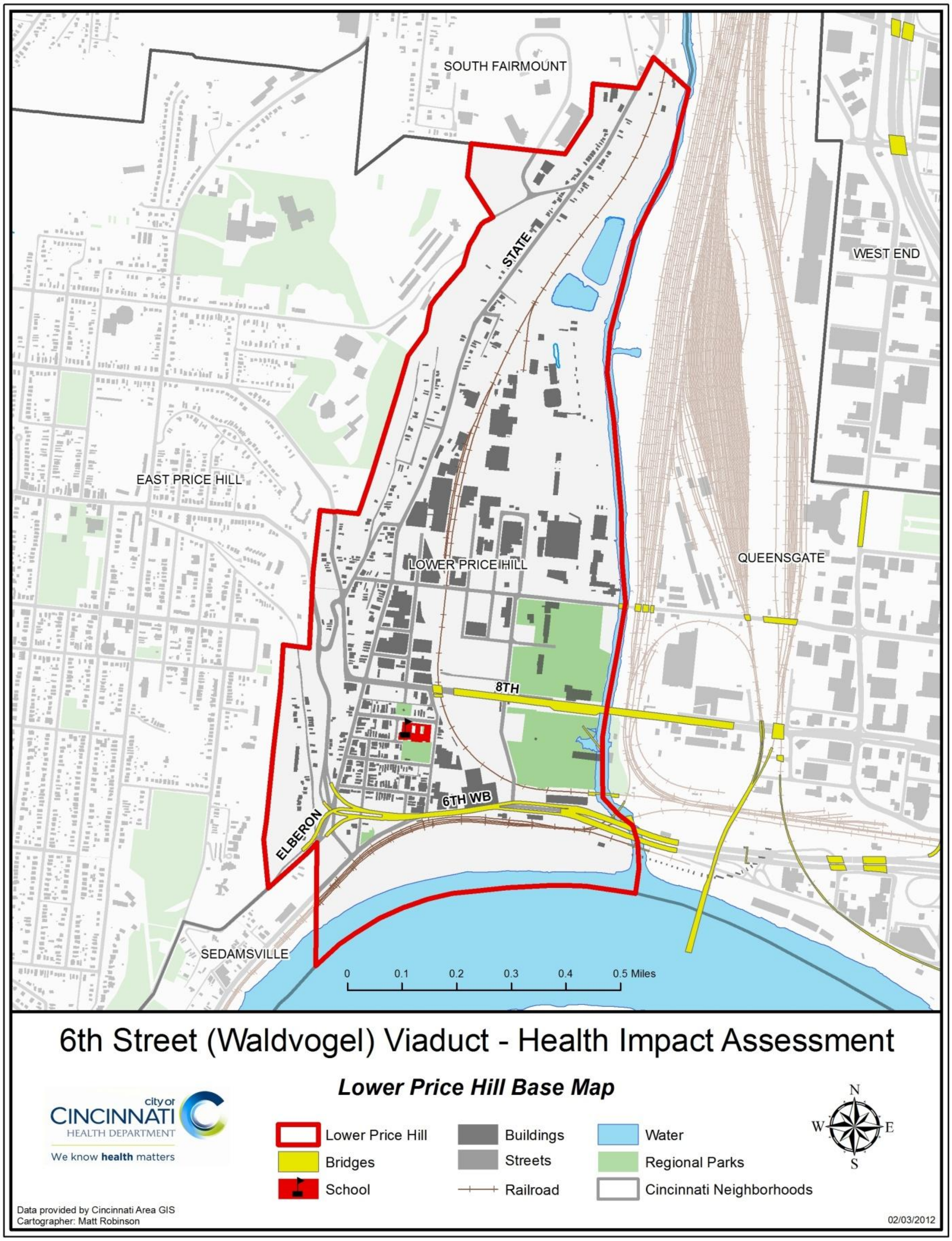
School health records have provided a wealth of information about the health status of the students from Oyler School. Most students receive medical insurance via Medicaid (93%), while 2% have private insurance and 5% of the students have no form of insurance at all. Immunization compliance was one of the highest rates in Cincinnati schools, at 91.93%. Oyler School has a school-based health center staffed by a nurse practitioner. Excellent school health screenings and exams have helped to keep children healthy for the school year and provide treatment quickly with early screenings. The top five acute problems detected during school exams included head lice, asthma, upper respiratory infection, ear infection, and sore throat.

Chronic illness has also been identified through the school health program. Of the 716 students, 447 students (62%) have been identified with chronic illnesses including asthma, food allergies, other allergies, drug allergies, seizure, diabetes, sickle cell anemia, ADD/ADHD, behavioral conditions, other chronic, and dental problems. Asthma is the top chronic illness reported, with a little over 1/6th of Oyler School children affected. ADD/ADHD and behavioral problems combined are a total of 145 students (Cincinnati Health Department, 2012).

In accordance with Ohio law, CPS does not provide bus transportation to students who live within 1 mile of the school they attend, therefore any student living within 1 mile of Oyler is responsible for their own transportation to the school. The Schiff Early Learning Center is located inside the Oyler school building. The day care program will serve 41 children, aged 6 weeks to 5 years old, and the after school program will serve 65-75 kindergarten through third grade children and 100 fourth through eighth grade children from the local YWCA.

The St. Michael's Community School is an adult education center where students attend to earn a GED. Cincinnati State College is a participant in training students and the Community School operates a food pantry. The Community School has 450 students, however, there are up to 150 people in the building at any given time. Their on-site childcare center accommodates 5-6 children per day St. Michaels' Community School is one block from the Viaduct.

Adjacent to the St. Michaels' Community School and housed in the old St. Michael's Church complex is an interfaith hospitality network homeless center. This is a day center where families can go during the day to attend classes with their children. The children remain under the care of their parents during classes.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QUEENSGATE
8TH
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ELBERON
SEDAMSVILLE
0 0.1 0.2 0.3 0.4 0.5 Miles
6th Street (Waldvogel) Viaduct - Health Impact Assessment
Lower Price Hill Base Map
city of CINCINNATI HEALTH DEPARTMENT
We know health matters
Lower Price Hill
Bridges
School
Buildings
Streets
Railroad
Water
Regional Parks
Cincinnati Neighborhoods
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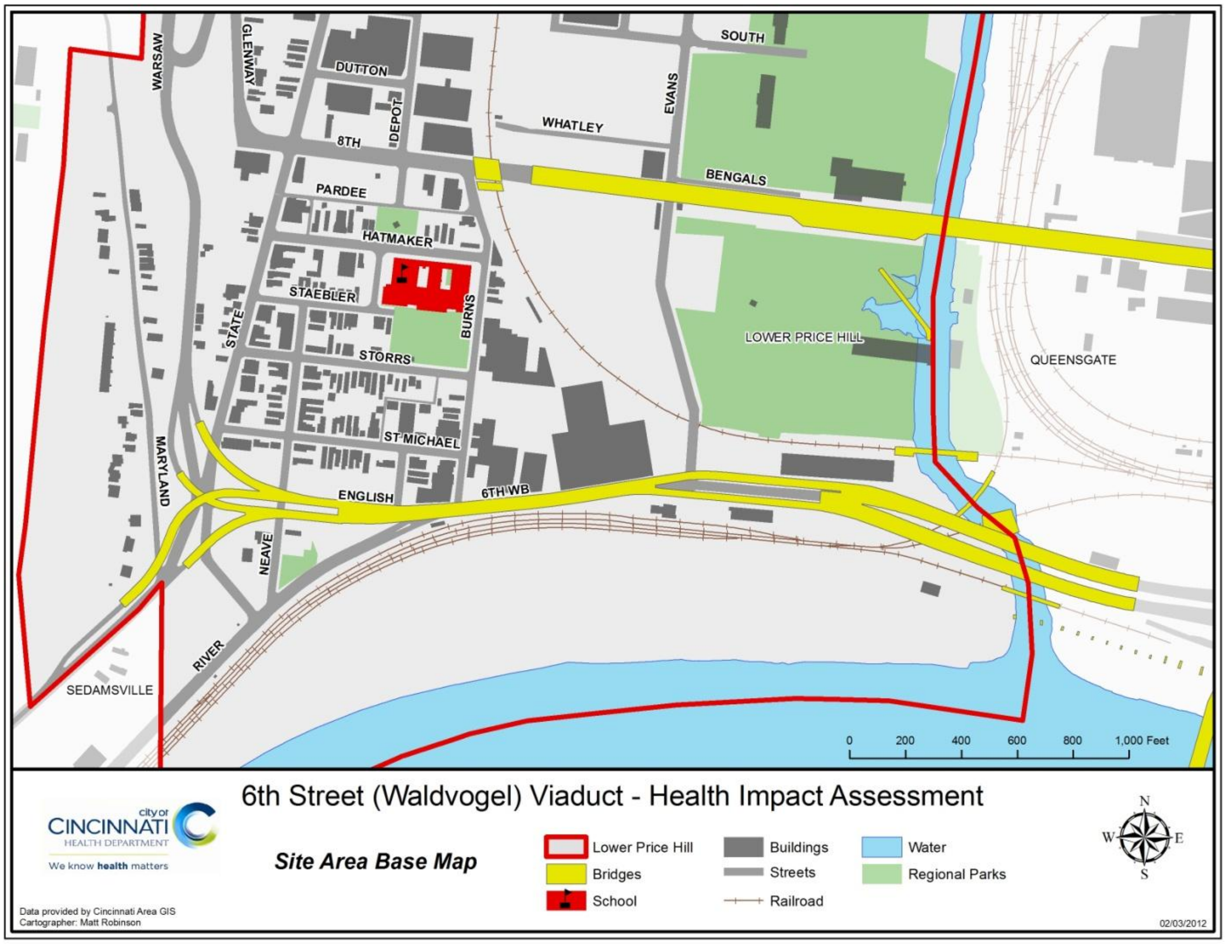
Data provided by Cincinnati Area GIS
Cartographer: Matt Robinson
02/03/2012

Map 1.


SOUTH
DUTTON
GLENWAY
WARSAW
DEPOT
8TH
WHATLEY
EVANS
BENGALS
PARDEE
HATMAKER
STAEBLER
BURNS
STATE
STORRS
LOWER PRICE HILL
QUEENSGATE
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0
200
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6th Street (Waldvogel) Viaduct - Health Impact Assessment
city of CINCINNATI
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Data provided by Cincinnati Area GIS
Cartographer: Matt Robinson
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Map 2.

Assessment

Environmental Site Assessment Summary

A 2009 report, Phase I Environmental Site Assessment (ESA) Update by BHE Environmental provided an update of the 2000 site assessment which was commissioned by the City of Cincinnati (BHE Environmental, 2009). The Phase I Update found the following items exceeding allowable standard:

1. Lead based paint (LBP) on the Waldvogel Viaduct "may have resulted in uncontrolled distribution of LBP wastes."
2. Soil samples from a former junkyard on the northeast corner of Burns Street and River Road contain lead concentration of 1,100 parts per million (ppm), exceeding the 1,000 ppm City Cut and Fill permit limit.
3. Total petroleum hydrocarbons and diesel range fraction of total petroleum hydrocarbons were present above the City Cut and Fill limit of 100 ppm in the area of the former Amtrak and Levine Steel facility.
4. The rail yard on the south side of River Road has been used for over 100 years and is a Recognized Environmental Concern (REC). A REC is the presence or likely presence of any hazardous substances or petroleum products on a site that indicate an existing or past release.

The Phase I ESA Update concludes that measures should include "provisions for the identification, segregation, and disposal of hazardous and petroleum-contaminated soils, if encountered." The Cincinnati Health Department confirmed that the Waldvogel Viaduct is coated with lead based paint on February 3, 2012. X-ray fluorescence (XRF) instrument readings were taken of the gray and yellow paint on the bridge and the reading exceeded the upper limit of the XRF of 9.99 micrograms/cubic meter. Any value over 1 microgram/cubic meter is of concern. This information is consistent with older steel constructed bridges and viaducts. The use of lead based paint was common practice in the past to inhibit rusting and corrosion. It has been estimated that there are 90,000 bridges in the United States in need of repair and are coated with lead based paint (Clark, 1998).

Air Quality and Lead Dust Fall

Ambient air lead data was collected in the Lower Price Hill neighborhood (LPH) in 2002 and 2003 by the Hamilton County Department of Environmental Services. The air monitors are located on top of the firehouse, 2101 West 8th. In Table 1 below, the high reading represents the highest actual monitored value during the year. The data from the Taft and Middletown sites are included for comparison purposes. The Taft site is located approximately 5 miles from Lower Price Hill and Middletown is located approximately 38 miles distance. The average reading is for all samples collected over 2 years. The National Ambient Air Quality Standard (NAAQS) is the standard set by the USEPA that insures protection of public health. The highest monitored values of ambient lead were found at the Lower Price Hill site; however, the average is still well below the NAAQS limit of 0.15 ug/m^3 (rolling 3 month average).

Table 1: Measured Lead Levels in Ambient Air

Site	Year	High Reading	Avg. Reading	NAAQS
Taft	2002	.011 ug/M3	.0053 ug/M3	0.15 ug/M3
Taft	2003	.004 ug/M3	.0028 ug/M3	0.15 ug/M3
LPH	2002	.035 ug/M3	.0085 ug/M3	0.15 ug/M3
LPH	2003	.124 ug/M3	.0084 ug/M3	0.15 ug/M3
Middletown	2010	.0057 ug/M3	.0048 ug/M3	0.15 ug/M3

Lead contaminated soil and dust on streets and sidewalks serve as a pathway for lead tracked into homes, schools, and day cares, and are an exposure pathway for lead, particularly for children. In 2012, the Cincinnati Health Department performed analysis of the lead content of dust on two different sidewalks in Lower Price Hill. These sidewalk dust sample measurements showed lead content of 167.0ug/ft^2 located at the corner of River Road and Burns Street and 324.7ug/ft^2 on the actual street at the same corner. These two sites show a dust lead content, but were much lower than measurements taken on downtown Cincinnati streets that exceeded 1000 ug/ft^2 in some locations. Indoor floor and window sill dust lead content levels are considered dangerous above 40ug/ft^2 and 250ug/ft^2 respectively. The sidewalk readings will be used as baseline to compare with future readings during and after demolition of the bridge which is scheduled to start in October, 2012.

<u>City of Cincinnati and the Ohio Department of Transportation (ODOT) Team Together to Fund Construction of the New Viaduct</u>

The City of Cincinnati's (City) Transportation and Engineering Department funded the design of the new Viaduct. The City then applied for and received federal funds for the project. Ultimately ODOT has control over the construction and demolition contract cost and implementation. Anything over and above the demolition and construction cost will be the City's responsibility; therefore the City will pay for the aesthetic aspects of the Viaduct design. The entire project is scheduled to take more than 3 years with a projected completion date of 10/31/2014. This date also accommodates the improvement of 6th Street which is an extension on the east end of the Viaduct into the downtown central business district. Currently the viaduct and River Road transportation corridor accommodates about 50,000 vehicles per day.

Viaduct Demolition Process

The Great Lakes Construction Company (Contractor) is the contractor for construction and demolition on the Viaduct. The Viaduct will be taken down in stages. First the concrete roadbed will be removed, followed by the metal substructure that will be cut in sections by torch cut. The torch will cut a 1 inch cross section of the steel. The tall struts of the Viaduct pieces will be laid on the ground where safe. Most of the Viaduct pieces will be loaded directly onto a container.

Bridge repainting requires a curtain. However, bridge demolition does not require a curtain and none will be utilized. Workers on the bridge and below the bridge will use respirators. According to information from ODOT, the contractor will use water to control the dust. The contractor plans to utilize a street sweeper to collect paint chips that have fallen from the bridge during demolition activity. The petroleum contaminated soil at the project site was recovered and sent to Bavarian Waste in Kentucky. It is the Contractor's responsibility to keep the public safe.

Photo: Cincinnati Health Department, September, 2012

Contract Requirements for Lead Containment

There are no specific provisions for lead containment in the contract with Great Lakes Construction Company. The contract does not anticipate lead dust distribution as a result of demolition, particularly ambient lead dust, primarily due to the method of demolition which will utilize torch cutting. Torch cutting may vaporize any lead based paint. However, the width of the torch cut is narrow. Water to suppress dust is the only mitigation activity included in the contract.

Dust Generating Activities

This HIA has identified the following activities that could potentially cause air quality disturbance. These activities include: 1. demolition process, 2. method of handling and removal of debris, 3. Travel of cars and trucks on River Road stirring up dust from the roadway, 4. contractor trucks and heavy equipment tracking and stirring up dust from the construction and demolition site and 5. disturbance of soil.

Fugitive Dust Regulations

According to the US EPA, "no person shall cause, suffer, allow, or permit fugitive dust to be emitted in such a manner to exceed five (5) minutes per hour or twenty (20) minutes per day as to produce a visible emission beyond the property line of the property on which the emission originates, excluding malfunction of equipment as provided in Chapter1200-3-20 (US EPA, ref for fugitive dust)."

The Southwest Ohio Air Quality Agency monitors compliance status of businesses with air pollution sources. Air quality inspectors "conduct facility inspections and reviews, initiate enforcement actions and respond to air quality complaints" (Hamilton County Department of Environmental Services, 2010). Inspectors respond to dust complaints with on-site inspections. The 24 hour air quality complaint hotline number is **513-946-7777**.

Industry Standard for Lead Containment during Construction and Demolition

A 1987 study, conducted by researchers in the Netherlands, studied workers involved in the demolition of a steel railway bridge that was coated with lead paint (Spee & Zwennis, 1987). The workers utilized torch cutting to demolish the bridge. Laser torch cutting is the same process that the contractor will use to section off portions of the steel supports for the Waldvogel Viaduct. In the 1987 study, air in the breathing zone (10 inch radius of nose and mouth) contained from 2 to 38 mg of lead/m^3. At that time the Dutch exposure limit before requiring respirators was 0.15 mg/m^3. Upwind, the exposure was below the limit. Downwind the exposure was 10 times the limit. Upwind and downwind measurements were taken at a distance of 50 cm of the torch.

Workers that utilized filtering face pieces had lead concentrations on average of 4.5 umol/l. However, after termination of the exposure to the breathing zone of the torch cutting there was a fast decrease of lead in the blood in these workers. From this study it was recommended that workers should stay upwind during torch cutting. A half-mask respirator rather than a filtering mask is also recommended. (Spee & Zwennis, 1987)

OSHA Standards

In the past, lead based paint was commonly used to coat steel structures such as bridges, railways, and ships. Construction workers are exposed to lead when working on these types of lead painted structures. Lead is most commonly absorbed into the body by ingestion or by breathing lead dust, fumes, and/or mist. Work that leads to higher risk for lead exposure includes demolition work. The highest risk of lead exposure is from abrasive blasting, welding, cutting and burning on steel structures, lead burning, power tool cleaning without dust collection systems, and manual demolition of structures (OSHA, 2003). Common symptoms of lead overexposure include: "loss of appetite, constipation, nausea, excessive tiredness, headache, fine tremors, abdominal pain, metallic taste in the mouth, weakness, nervous irritability, muscle and joint pain, anxiety, pallor, insomnia, numbness and dizziness," (OSHA, 2003). In addition, workers exposed to lead dust can expose their families to lead which can harm their children's development. Long term lead exposure can result in damage to the reproductive system.

OSHA has two exposure limit standards: the permissible exposure limit (PEL) is an airborne concentration of 50 micrograms of lead per cubic meter (50ug/m^3) of air averaged over an eight-hour period and the action level (AL), regardless of respirator use, is an airborne concentration of 30ug/m^3 averaged over an eight hour period.

Initially for any job where an employee exposure can exceed the PEL, the employer must establish and implement a written compliance program to reduce exposure to or below the PEL. This program must be reviewed and updated at least every six months or when planned construction methods are altered.

If lead exposure is at the action level then the employer must begin specific compliance activities that include hazard assessment, medical surveillance, medical removal provisions, and recordkeeping provisions.

Particulate Matter (PM) Health Effects Literature Summary

To date there are numerous of studies that link exposure to particulate matter with health effects. An extensive review of the literature was conducted by the US Environmental Protection Agency as part of their integrated science assessment for PM (US EPA, 2009). Short term 24 hour exposure to PM 2.5 was linked to a number of health outcomes including cardiovascular and respiratory effects and mortality. Epidemiological studies reported consistent associations between exposure to PM 2.5 and increased cardiovascular emergency department visits and hospital admissions. Positive associations between short-term exposure to PM 2.5 and all-cause, cardiovascular and respiratory related mortality was also consistently reported in the literature. US EPA concluded that there is a casual relationship between short-term exposures to PM 2.5 and cardiovascular effects and mortality. Studies examining the relationship between exposure to PM 2.5 and respiratory emergency department visits and hospital admissions for chronic obstructive pulmonary disease (COPD) and respiratory infections also reported positive associations. Results were not fully consistent across studies, however, the US EPA considers the evidence sufficient to conclude that a casual relationship is likely to exist between short-term PM 2.5 exposure and respiratory effects. Currently, there are National Ambient Air Quality Standards (NAAQS) for PM 2.5 based on long-term and short-term exposures: annual average 15.0 $\mu g/m^3$ and 24-hour average 35 $\mu g/m^3$. A concern for demolition of the Waldvogel Viaduct is that dust created by the demolition activities may increase ambient air PM 2.5 levels above the 24-hour NAAQS in the Lower Price Hill neighborhood.

Lead Dust Fall Literature Summary

Studies examining demolition as a source of lead in ambient dust and the association of demolition activities with blood lead levels have focused on the demolition of housing in urban neighborhoods. *Currently, there are no studies in the published literature that examine the potential for lead exposure of people living in neighborhoods due to demolition of adjacent steel structures, such as bridges, that are coated with lead-based paints.* Even though the process of demolition of a steel bridge or viaduct is different than the process of demolition of housing, the results of housing demolition studies indicate that there is still cause for concern. Communities living in close proximity to demolition activities of aging transportation infrastructure may be at risk for increased levels of lead in ambient dust and an associated increase in blood lead levels.

Demolition of older homes in urban areas is potentially a large source of dispersed lead in neighborhoods due to the presence of lead in paint and dust in these structures (Jacobs, et al. 2002). Increases in exterior dust fall attributable to demolition may lead to higher levels of residential dust loadings via airborne routes or tracking of exterior dust and soil into the home (von Lindern et al., 2003). Lead in soils and house dust is recognized as a pathway of lead exposure in young children (Farfel et al., 2005; von Lindern et al., 2003). Understanding the contribution of housing demolition to increased ambient dust fall is a critical component of mitigating exposures to residents living in neighborhoods with active demolition. During 1999 to 2001, a study of three residential demolition sites in Baltimore, Maryland was conducted to evaluate changes in exterior dust fall loadings relative to demolition activities (Farfel et al., 2003). Dust fall lead loadings and concentrations were measured in close proximity to demolition sites (within 10 m). Increases from baseline levels of lead dust fall rates was approximately 40 fold during demolition activities and approximately 6 fold during debris removal. Levels of lead dust fall were on the average highest at sampling locations closest to demolition sites and at sampling locations downwind on certain days. Authors noted that site wetting during demolition had limited effectiveness and that little to no wetting occurred during debris removal.

During the same time period and at the same housing demolition sites in Baltimore, settled exterior dust was collected from streets, sidewalks and alleys within a 100 m radius of study sites (Farfel et al. 2005). Samples were collected before demolition and immediately after demolition and removal of debris. Demolition of housing typically took 1 to 2 days and removal of debris 1 to 2 weeks. Dust loadings, dust lead loadings and dust lead concentrations were reported for all samples. Overall the study showed that there were increases in dust loadings and dust lead loadings with little change in actual concentration of lead in the dust.

In addition to the potential exposure of residents to lead due to increased dust during demolition, there is also a concern for exposure to volatilized lead due to flame-torch cutting of the steel structure of the viaduct. To dismantle the steel structure, crews will use high temperature flame-torches to cut sections of the bridge. This approach may produce lead fumes due to the lead-painted steel and increase the potential for lead exposure of workers and residents. In a study to assess the levels of lead during flame-torch cutting of a steel structure coated with lead-based paint, air samples were taken within the breathing zone of the worker and 50 cm upwind and downwind of the torch (Spee & Zwennis, 1987). Results for the breathing zone samples indicated lead concentrations 30 times the Dutch exposure limit of 0.15 mg/m^3 lead (time-weighted average over 8 hr). While upwind measurements were below the limit (0.06 – 0.08 mg/m3) and downwind levels exceeded the exposure limit (1.7 – 14.0 mg/m^3).

Given the results of the housing demolition studies and the Dutch worker study, there is evidence for potential increased exposure of Lower Price Hill residents to lead during the demolition of the Waldvogel Viaduct. Monitoring of ambient lead during demolition activities coupled with aggressive dust suppression measures is recommended to mitigate the potential risk of lead exposure.

Plan to Monitor Ambient Lead, PM2.5 and PM 10

As mentioned above, the removal of the existing viaduct will be through a dismantling process. First, the existing lights and railing will be removed. Then, the concrete deck will be saw cut into large slabs and lifted out. The Contractor will use crushers to break down big pieces of concrete. Finally, the steel substructure will be systematically cut into large pieces and removed. To ensure that the viaduct is removed in a safe manner the City Department of Transportation and Engineering has contracted with ATC Associates, a professional industrial hygiene company, that will review the contractor’s proposed removal process and will then perform air monitoring in the Lower Price Hill community both in advance and during the removal of the viaduct.

Demolition Timing with the Oyler School Opening

The viaduct demolition is scheduled to begin after the opening of the newly rehabbed Oyler School. Typically, in Cincinnati, air quality is at its worst during July through September. Demolition is scheduled to start October, 2012. The additional demolition dust may overload the MERV 8 filters at the Oyler School. Therefore, these filters will need to be monitored, and may need to be changed more frequently during demolition.

Students with asthma at the Oyler School and Early Learning Center, and children in the area home daycares should be closely monitored during the three to six months of demolition work.

Tracking of dust into homes and the school building and community facilities should be mitigated and lessened by daily sidewalk and street washing, similar to what the City of Cincinnati provides for the downtown. Also, school personnel and families can reduce dust infiltration into buildings by utilizing: 1) low pile mats and/or tacky mats, 2) HEPA vacuums, 3) keeping windows closed, 4) limiting student and family members movement outside of the building during active demolition work, 5) frequent wet wiping of surfaces including floors, window sills and window wells, and stoops in the school and homes, and 6) removing shoes at the door before entering private homes. Frequent washing of hands, particularly before eating or preparing food, is also recommended.

Areas of the Neighborhood where Children will be Concentrated

Children 0-6 years old are very susceptible to adverse health impacts of having lead in their system. Young children can take lead in their system by ingestion and by breathing small dust particles that contain lead. Lead exposure causes cognitive damage and lower Intelligence Quotient (IQ).

During the three to six month demolition period, children will be concentrated in the following areas: Oyler School and school grounds (716 students); the Cincinnati Early Learning Center preschool and outside play area (41 children during the day and up to 175 in the late afternoon to early evening); the St. Michael's Community School childcare center (5-6 children); and the interfaith hospitality network day center (adults are welcome to bring their children to classes); Children and adults may also be present in parks and recreation areas including: the Cincinnati Recreation Department Evans ball field; the pocket park on Neave Street between Staebler and Storrs Streets; and the Cincinnati Recreation pocket park at 2122 Hatmaker Street.

Conclusion

There is little information about the demolition of lead painted bridges in close proximity to housing, or about the air quality impact of a demolition similar to the 6th Street (Waldvogel) Viaduct. However, we conclude from housing demolition studies and the Dutch worker study that there is evidence for potential increased exposure of Lower Price Hill residents to lead and dust during the demolition of the Waldvogel Viaduct. Therefore recommendations to reduce resident exposure to dust and lead dust are below. In addition, we include recommendations that can reduce exposure for the students at Oyler School.

Finally, we are grateful that the City of Cincinnati's Transportation and Engineering Department has implemented an air quality monitoring plan to document baseline lead dust and ambient lead levels, to quantify exposure associated with demolition, and to assess whether air quality has returned to baseline. These measures will provide data for increasing community safety during the demolition and recommending mitigation activities for future, demolition of similar lead painted bridges.

Mitigation Recommendations

a. City

i. City of Cincinnati will contract to establish baseline air quality measurements and to obtain measurements during and after demolition to determine if the air quality has returned to baseline.

ii. Residents should be told where to find the air quality index (AQI) and encouraged to take the recommended precautions listed in the public service announcements. People who are more vulnerable to the effects of poor air quality (i.e., people with heart or lung disease, older adults and children) should take a higher level of precaution than what the AQI recommends.

iii. The Evans Athletic Field should be covered or closed during demolition, or tested for lead content in the dust and if needed cleaned after construction and demolition.

iv. If the air quality measurements show an increase in particulate matter (PM), then the Public Services Department should increase the frequency of wet street cleaning to decrease dust that can be churned by wind or vehicular traffic.

v. If there is a documented increase in lead exposure from dustfall, then residents should be referred to the Cincinnati Health Department's Lead Poisoning Prevention and Control Program to apply to the HEPA vacuum loan program, and to receive educational materials on preventing and/or controlling exposures to lead contaminated dust.

b. **Contractors**

i. Conduct air quality monitoring throughout the construction and demolition of the lead painted steel structures that are in close proximity to residential housing.

ii. Contractor should provide residents with low pile nylon mats with rubber backing or tacky mats to catch dust. When demolition is completed, provide residents with new mats.(Source: East Baltimore Development, Inc (EBDI))

iii. Contractor should post warning signs that tell the public not to stand or play near the construction site.

iv. Control dust coming off of the demolition site. Contain the work area as necessary to reduce dust contamination by employing dust control measures. (Source: EBDI)

v. Contractor will follow the OAC Air Quality 3745-17-08 Restriction of Emission of Fugitive Dust regulations.

vi. To control dust from wind, the contractor shall keep all dumpsters and containers covered with impermeable plastic after placement of debris and ensure that all dumpsters and containers remain covered, when not in use. (Source: EBDI)

vii. After demolition of the old viaduct and construction of the new viaduct, any areas of bare soil should be covered with native ground cover and trees to decrease dust.

viii. If monitoring efforts detect increased airborne particulate matter, the contractor should implement additional measures to suppress airborne particulate matter including power washing construction vehicles before leaving the demolition site.

c. Other Agencies

i. Notify residents in advance of the demolition, via door to door contact and through grocery stores, local churches, community centers such as Santa Maria, notice on water bill, and the City and ODOT public information officers.

ii. Inform residents of recommended housekeeping protocols during construction and demolition (Agency: Cincinnati Health Department Childhood Lead Poisoning Prevention Program, Santa Maria or Talbert House).

iii. Provide residents with Air Quality Hotline refrigerator magnets along with information on how to 1) report fugitive dust, and 2) how to decrease household exposure packet similar to those used in Baltimore.

iv. School recess should be held inside during the bridge demolition process to decrease exposure to particulate matter.

v. Since we do not know the full risks of the bridge deconstruction we would have recommended that the preferred option would be to delay opening of the Oyler School. We do recommend that in the future, deconstruction in neighborhood areas should include a HIA early in the planning process.

vi. MERV 8 air filters at the school should be monitored and changed more frequently as needed during demolition.

d. General Recommendation

i. The Southwest Ohio Air Quality Agency should monitor the site with daily PM 2.5 and ambient lead measurements and verify contractor data.

ii. Open a demolition education office, similar to the one at John Hopkins to monitor demolition permits and provide community education around protocols to mitigate the potential negative health effects of nearby demolition activities (Agencies: University of Cincinnati and City of Cincinnati).

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Maps

Map 1. – Lower Price Hill Base Map
Map 2. – Site Area Base Map