US Army Corps of Engineers®
Buffalo District

FUSRAP

Preliminary Assessment

Former Harshaw Chemical
Cleveland, Ohio

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1.0 INTRODUCTION

A Preliminary Assessment was performed, by the United States Army Corps of Engineers (USACE), on the Former Harshaw Chemical Company under the authority of the Comprehensive Environmental Response, Compensation and Liability Act. The purpose of this assessment was to review information to determine the need for further action by USACE, under the Formerly Utilized Sites Remedial Action Program (FUSRAP), to ensure the protection of human health and the environment. The scope of the assessment included a review of existing information on the site and a site visit.

The former Harshaw Chemical Company, located in Cleveland, Ohio, was contracted by the Manhattan Engineering District (MED) and later the Atomic Energy Commission (AEC) to support the Nation's early atomic energy program.. From 1944-1959, various forms of uranium were processed in Building G-1 (formerly known as Plant C) for isotopic separation and enrichment at Oak Ridge, Tennessee. In 1960, the site was released for unrestricted use by the AEC, following decontamination efforts by Harshaw, under the guidance of the AEC.[1]

In 1974, the FUSRAP was created to ensure radioactive residuals from activities associated with the Nation's early atomic energy program, met current guidelines. Under this program, the U.S. Department of Energy (DOE) determined the site is eligible for inclusion into the FUSRAP on June 3, 1999. Under the Memorandum of Understanding between the U.S. Army Corps of Engineers (USACE) and the DOE, once this determination has been made by the DOE, responsibility for action is transferred to USACE. The USACE has undertaken this preliminary assessment as the first step in the CERCLA process.

2.0 SITE DESCRIPTION, OPERATIONAL HISTORY, AND WASTE CHARACTERISTICS

2.1 Location

The Former Harshaw Chemical Company site is located at 1000 Harvard Avenue, Cuyahoga County, which is approximately 5 miles southwest of downtown Cleveland, Ohio.

Average annual temperature in the greater Cleveland area is 49.7^{o}F. Average annual rainfall is 35.4 inches. Average annual snowfall is 53.6 inches. The predominant wind direction is from the west and south (B.Koh 1998).

2.2 Site Description

The site encompasses 40 acres in a predominately industrial setting bordering the Cuyahoga River. The site includes industrial buildings and approximately 90% paved and 10% vegetated open space. Some buildings have been demolished and removed and in some cases the foundations of the former buildings are still present (B.Koh 1998). The site, currently owned by Engelhard Corporation and Chevron Chemical Company, LLC (Chevron)[2], is surrounded by a chain link fence and is equipped with a security system.

The site is basically flat, with a slope of <1% toward the east and the Cuyahoga River. The highest elevation at the site is 594 feet above mean sea level (msl) in the northern part of the site. Elevations decrease from that point to approximately 593 feet msl at the east border. The Cuyahoga River

[1] As stated in the Argonne National Laboratory report dated April 1984, a review of AEC records concluded documentation was insufficient to determine that the decontamination performed in 1960 was adequate.

[2] More specifically, BGD Inc., a wholly owned subsidiary of Chevron Chemical Company, LLC, owns Building G-1 and its associated real estate, while Engelhard Corporation owns the remainder of the site. Both Chevron and Engelhard own various parcels adjacent to and near the site.

elevation is approximately 575 feet msl. Big Creek, a tributary of the Cuyahoga, is the southern border of the site.

Surrounding properties are used for general commercial and industrial activities. LTV Steel, Inc., is approximately 1,000 feet to the northeast, and an ALCOA plant is approximately 1,300 feet to the east. About one quarter mile to the west and south are residential communities (B. Koh 1998).

2.3 Operational History and Waste Characteristics

Chemical operations have been performed at the site from the early 1900's through the 1960's. The operations included the production of specialty chemicals and metal salts (B. Koh 1998). Information regarding the site operations from 1960 to present includes the general knowledge that from 1960 to 1994 ownership of the plant changed several times. During this timeframe a wide array of chemicals were produced as well as the manufacturing of various metals. From 1994 to the present, several buildings are being used as a warehouse and the remainder of the plant is vacant.

During the Manhattan Engineer District/Atomic Energy Commission (MED/AEC) era, the Harshaw Chemical Company processed large quantities of uranium in support of MED/AEC activities. The principle building involved with the uranium processing activities was Building G-1 (then known as Plant C). Building G-1 was used primarily for refining yellow cake [3] into uranium orange oxide, though some of the work consisted of reducing orange oxide (UO_3) to brown oxide (UO_2); fluorination of brown oxide to green salt (UF_4); and fluorination of green salt to hexafluoride (UF_6). This work was done under contract to MED/AEC. Liquid sulfate solution was handled in the southwest area of the first floor of Building G-1. Tin fluoroborate was handled on the second floor. The uranium processing complex was decontaminated by Harshaw under AEC guidance and was released from AEC control in 1960 (B. Koh 1998).

Records of correspondence between Harshaw Chemical and the Atomic Energy Commission, in February 1952, from a report by Chevron in December of 1997 refers to leaking equipment, spills and process releases to the environment from Building G-1, as well as correspondence that refers to stack emission releases to the environment (Chevron 1997). The correspondence indicates these problems occurred with the processes involved in reducing orange oxide to brown oxide.

As stated in the *Site Characterization Report*, by B. Koh & Associates, Inc. in August 1998, the principle radionuclide of concern on the site is "processed natural uranium that has not undergone isotopic separation." The site was a RCRA Treatment, Storage and Disposal Facility (TSDF) which leads to the potential for mixed waste at this site.

3.0 SOIL EXPOSURE AND AIR PATHWAYS

3.1 Physical Conditions

The average soil thickness, found above a shale bedrock, at the site is 12.4 feet, with a minimum and maximum thickness of 5.5 and 20 feet, respectively. Soils encountered during a Geoprobe investigation, completed by B. Koh and Associates in 1995 under contract by Engelhard Corporation, were of variable composition and stratiography. Soils closer to the surface were brown. Deeper in the soil column, soils were either gray or a variegated brown and gray. Soils closest to the shale bedrock are gray in color. Site soils consist of silts, clayey silts and fine sand. Beds of debris, fine gravel, fine sand, medium sand, clay and silt were found at various depths within the thick bed of clayey silt (B. Koh 1998).

3.2 Soil Exposure and Air Pathways

[3] Yellow-cake (U_3O_8) was shipped to Harshaw Chemical from various uranium milling locations in Colorado, New York, Pennsylvania and Radium City, Canada.

The potential receptors for this site are one on-site worker and a child trespasser. However, these receptors can be considered conservative in nature. The on-site worker is utilized for warehouse duties which do not involve the disturbance of potential contamination. The child trespasser scenario is also unlikely due to the security system utilized at this location and the presence of perimeter fencing.

B. Koh & Associates, Inc. collected a total of 215 surface soil samples (0-6") on the site north of Harvard Avenue. The sample results ranged from 1.6 to 342.0 pCi/g total uranium. Thirty-five surface soil samples were collected on the south side of Harvard Avenue around the perimeter at roughly 10 meter intervals. Additional samples were taken at random locations on the slope of the river bank and creek bank, on the south side of Harvard Avenue, in the vicinity of two samples that exhibited concentrations of total uranium (492 pCi/g and 158 pCi/g total uranium). The results of these samples indicated concentrations of total uranium ranging from 4.2 pCi/g to 2,548 pCi/g. (B. Koh 1998)

North of Harvard Avenue a total of 241 subsurface soil samples were collected from 117 boreholes and analyzed. The depth of coverage was 0-6 feet with results ranging from 4.6 pCi/g to 4,760.0 pCi/g total uranium. Forty-two subsurface samples were collected from 31 bore holes south of Harvard Avenue. The depth of coverage was 0-8 feet with sample results ranging from 5.0 pCi/g to 452 pCi/g total uranium. (B. Koh 1998)

During initial scan surveys, B. Koh & Associates, Inc. determined that a layer of asphalt had been placed on top of concrete south of the Building G-1. When asphalt was removed at random locations, the underlying concrete scan surveys ranged from 92 dpm/100cm^2 to 56,833 dpm/100cm^2 beta-gamma activity. The background beta gamma activity in this area is 4,447 dpm/100cm^2.

During their investigation, B. Koh & Associates, Inc also identified a contaminated soil cutting taken from a new well installation, south of Harvard Avenue, along the upper banks of the Cuyahoga River and Big Creek. The soil cutting exhibited readings of approximately 500 gross counts per minute versus the 50 gross counts per minute background level. This sample also resulted a 248 pCi/g total uranium level via gamma spectroscopy. (B. Koh 1998)

Levels of U-238 and Th-232 were discovered within small sections of Parcel A and C, respectively. Both parcels are owned by Chevron Chemical Company, LLC. Parcel A is located near the intersection of Harvard Avenue and Jennings Road. Ten surface soil samples, analyzed for U-238 via gamma spectroscopy, exhibited results ranging from < 2.8 pCi/g to 611 pCi/g.

Parcel C encompasses approximately 5 acres near the intersection of Jennings and Bradley Road, which is approximately 600 feet south of the current boundaries of the Harshaw Chemical Site. This area is potentially a location used as a landfill for Harshaw Chemical during the same timeframe of uranium processing (B. Koh 1999). Thirty surface soil samples were analyzed via gamma spectroscopy. Assuming the Thorium 232 concentrations are in equilibrium with the Actinium-228 concentrations, the results ranged from < 1.00 pCi/g to 996 pCi/g Th-232. According to available information, there is no indication radiological materials / wastes were stored or disposed in areas outside of the former Harshaw Chemical site borders.

Perimeter and personnel breathing zone air sampling was performed by B. Koh & Associates, Inc. on personnel conducting the site investigation. There were no indication of airborne emissions that would constitute an unacceptable risk to human health or the environment under current site conditions (B. Koh 1998).

3.3 Soil Exposure and Air Pathway Conclusions

In conclusion, there is potential for the presence of MED / AEC related waste, at the former Harshaw Chemical site, based on numerous sample results of surface and subsurface soil. Release to air pathways is not likely due to the non-disturbance of loose contamination.

4.0 GROUND WATER PATHWAY

4.1 Hydrogeologic Setting

Aquifers within Cuyahoga County include various glacial deposits and underlying sandstone and shale. In general, Cuyahoga County does not possess extensive high-yield aquifers. Test drilling is usually required to find aquifers with sufficient yields for commercial uses. For example, the Cuyahoga Formation, the highest yielding aquifer consists of silty shales and shaley sandstones underlying silty clay beds. Wells installed in this system exhibit poor yields even for domestic uses. Wells drilled in this unit generally yield between 3 and 10 gallons per minute (gpm). The higher yielding aquifers in northeastern Ohio are the Berea and Cussewago aquifers, which both exhibit yields up to 25 gpm. Use of these aquifers in Cuyahoga County occurs in isolated pockets in the southern and eastern portions of the county (B. Koh 1998). The former Harshaw Chemical Company site is located in the northern portion of Cuyahoga County.

Permeable unconsolidated sediments provide the best well yields in Cuyahoga County. These aquifers occur in thin bands in the central and eastern portions of the county. Wells drilled in these sediments may yield more than 300 gpm. The highest-yielding aquifer is located in Maple Heights (approximately 5 miles southwest of the Former Harshaw Chemical Company site) in permeable sand and gravel deposits. Wells drilled in this aquifer may yield up to 1,500 gpm. High-yielding sand and gravel deposits may also be found from Cleveland to the southeast, near Newburgh Heights, along the Cuyahoga River. Wells drilled in this narrow zone may yield up to 250 gpm. Three narrow zones of permeable sand and gravel deposits may yield up to 100 gpm. These zones are located near Garfield and Maple Heights, Bedford Heights and Independence.

Site hydrogeology was assessed during the 1998 site characterization using boring data from previous geohydrological investigations of the site along with Geoprobe investigation and well installation/retrofitting performed as part of the site characterization. The hydrogeology assessment of the site found groundwater flow to be complex. Groundwater contours of the site area north of Harvard Avenue include a series of apparent groundwater sinks (isolated areas of low groundwater elevations) and sources (isolated areas of high groundwater elevations) (B. Koh 1998).

During the 1998 geohydrological investigation, B. Koh & Associates, Inc. collected data which showed a less obvious gradient groundwater flow to the north than found in previous reports. Groundwater gradients toward the north were observed; however, gradients toward the interior of the site were also observed. Groundwater gradients appeared to converge near the sanitary sewer and it is believed the sanitary sewer may be acting as a groundwater sink.

4.2 Ground Water Pathways

Approximately 204,643 people live within about 4 miles of the site, including about 35,992 children between the ages of 5 and 17. The nearest residential area is about one quarter mile from the site. The nearest hospital (Metro Health Center) is about 1 mile from the site. No schools are located within approximately 1 mile of the site (B. Koh 1998). Approximately 63,200 people are served by groundwater in Cuyahoga County (1990 Water Use). Although there are several groundwater wells within the vicinity of the site, water is supplied to the area by the Cleveland City Water Department.

Analytical results from 6 of the 13 groundwater wells sampled on the north side of the site exhibited concentrations of total uranium. The results for the 13 sampled wells ranged from 0.05 pCi/L to 721.5 pCi/L total uranium. Only one well, DM-14, located 100 feet inside of the property line, exhibited levels of uranium. The results for DM-14 ranged from 1.67 to 149.00 pCi/L total uranium. B. Koh & Associates, Inc., performed quarterly groundwater monitoring one year, under contract by Engelhard Corporation. Refer to Figure 2-13, 3-5A, 3-8 and 3-9 in the *Site Characterization Report, Harvard Denison Site*, Revision 0, of August 1998, by B. Koh & Associates for well locations.

4.3 Ground Water Conclusions

Based on existing data from monitoring wells, hydrogeologic conditions at the site and analysis of the groundwater pathway, there is potential that CERCLA hazardous substances are present at the former Harshaw Chemical site. However, usage of the groundwater is limited due to the water service provided by the City of Cleveland.

5.0 SURFACE WATER PATHWAY

5.1 Hydrologic Setting

The site is basically flat with a slope of <1% toward the east and the Cuyahoga River which is approximately 593 feet mean sea level at the east border of the site. Big Creek, a tributary of the Cuyahoga, is the southern border of the site.

The 1998 site characterization report by B. Koh & Associates, Inc. indicates that two process/storm sewers discharge into the Cuyahoga River, outfall 007 on the north side of the site and outfall 005 on the south side. Both outfall 005 and 007 are potential sources of contamination.

The ANL radiological survey report reported that traces of "yellow cake" were visible on the river bank east of Building K-1 on the south side of the site (ANL 1984). Refer to Figure 1.1.

5.2 Surface Water Pathways

Surface water originating at the site can reach the Big Creek and Cuyahoga River through drainage and process / stormwater discharges. From the confluence of the two waterways, the Cuyahoga River exhibits a direction of flow to the north. Approximately 5 miles downstream, the Cuyahoga River reaches Lake Erie.

Sampling and analysis of surface water, from the Cuyahoga River, showed that uranium concentrations were indistinguishable from background (B. Koh 1998).

Sampling and analysis of sediments, from the Cuyahoga River and the Big Creek (including outfall 005), showed uranium concentrations were indistinguishable from background. Due to B. Koh & Associates, Inc. inability to collect sediment samples from the Cuyahoga River in the vicinity of the outfall 007 discharge, future investigation in this area is warranted.

Based on direct measurements and sampling of sediments from sewers and related manholes north of Harvard Avenue, one process / stormwater sewer near building G-1 exhibited 116 pCi/g total uranium (B. Koh 1998).

5.3 Surface Water Conclusions

Existing data from process / stormwater sewers, hydrologic conditions at the site and analysis of the surface water pathway indicate the potential for CERCLA hazardous substances to exist at this site.

6.0 BUILDING EXPOSURE PATHWAYS

6.1 Physical Conditions

According to a radiological survey conducted by Argonne National Laboratory (ANL) in April 1984, although large quantities of uranium were processed at the site, only a few buildings in the complex were involved with the use of radioactive materials. Presently, there are only 5 buildings remaining on-site, as shown in Figure 1.1. The remaining buildings (Warehouse, Foundry, Garage and Boiler House), as shown in Figure 1.1, exhibited readings twice the background level, during the 1978 and 1979 radiological survey described in the report titled *Formerly Utilized MED/AEC Sites Remedial Action Program,*

Radiological Survey of the Harshaw Chemical Company, Cleveland, Ohio, by Argonne National Laboratory in April 1984. These readings were taken at various points within each structure. The Foundry, Warehouse and Garage were decontaminated by Engelhard Corporation and released for unrestricted use by the Nuclear Regulatory Commission on March 20,1998. Any contaminated materials removed from buildings in the last five years, by Engelhard Corporation, have been properly packaged and are being stored on-site in the secured Boiler House. (NRC Letter 03/98)

The fifth remaining structure, the principal building involved with the uranium processing, was Building G-1, the refinery building. Building G-1 is located within a fenced area of approximately 1.6 acres within the site. The company-owned building was built and added to at various times over the period 1945 – 1949 and consists of brick and steel, with one, two, and three story sections, a concrete floor, and a pre-cast concrete slab roof. The total approximate floor areas are as follows: first floor 45,100 ft^2, mezzanine 3,700 ft^2, second floor 14,590 ft^2, and third floor 3,200 ft^2. The building was divided into 50,240 ft^2 of operating area and 16,350 ft^2 of standby-plant area (ANL, April 1984).

Visual observations of Building G-1 taken at the USACE site visit on December 8, 1999, show distinct signs of failing structural integrity.

As shown in Figure 1.1, the demolished buildings were associated with the Engelhard Corporation project initiated in 1990. According to Engelhard Corporation, several of the demolished structures exhibited radiological contamination. These areas were removed from the buildings, prior to demolition, properly packaged and stored in the Boiler House. Contaminated portions of buildings M-1 and P-1 were disposed of in 1992 at the Hanford site in Richland , Washington. All clean building debris was sent to local landfills.

6.2 Building Targets

Currently, there is one warehouse employee onsite, however , the buildings with potential for existing contamination are inaccessible. Internal building contamination poses no threat to the environment. External building contamination consists of the potentially contaminated building foundations that may be present on site with fixed surface contamination. It is unlikely this type of contamination could be released to the environment.

The most significant contamination was found in Building G-1 while levels of contamination were also found in 16 other buildings at 32 exterior locations. Many of these buildings are no longer present as shown in Figure 1.1. The findings of the scan survey showed interior surface contamination levels reaching 400,000 dis/min-100cm^2 beta-gamma and up to 150,000 dis/min-100cm^2 alpha. Exterior contamination levels ranged up to 400,000 dis / min-100 cm^2 beta-gamma and 2,000 dis / min-100 cm^2 alpha.[4] The highest levels of contamination found in Building G-1 were direct contact readings with the end window beta-gamma probe to 3 mR/hr. (ANL, April 1984)

6.3 Building Conclusions

Based on numerous sample results and radiological monitoring, there is the potential for the presence of CERCLA hazardous substances to exist on building surfaces.

7.0 SUMMARY AND CONCLUSIONS

Based on the review of existing information on the Former Harshaw Chemical Company, the United States Army Corps of Engineers has determined there is no imminent threat to human health or the environment. However, surface soils, subsurface soils, concrete slabs/foundations, site structures and buildings, asphalt pavement, process/stormwater sewers near Building G-1 and south of Harvard Avenue,

[4] Background levels for normal uranium, used during the 1978 and 1979 radiological surveys, are 3,750-5000 dpm/100 cm^2 beta-gamma and 0-150 dpm/100 cm^2 alpha.

and groundwater north of Harvard Avenue have been found with total uranium concentrations above background and /or screening levels.

Specific recommendations include, but are not limited to, the following:

- It is recommended air monitoring be required at Harshaw Chemical during future activities that may disturb potentially contaminated areas.

- It is also recommended Building G-1 undergoes testing to assess the structural integrity of the building prior to entry. Contamination of existing structures should be evaluated as well as potentially contaminated exposed foundations of preexisting buildings.

- A groundwater monitoring program should be developed to determine groundwater flow and to determine the impact received from radioactive residuals.

- Bedding material for the drains and sewers should be further evaluated to determine if leaks have occurred in the past.

- Parcels A and C should be investigated to determine the extent of contamination and the relation of these locations to the uranium processing that occurred at Harshaw Chemical.

It is recommended that the Former Harshaw Chemical Site proceed to the next phase of the CERCLA Process (Site Inspection), under FUSRAP. The Site Inspection will further characterize radioactive residuals, from contaminants associated with MED / AEC activities, impact to soil, groundwater, surface water and air.

ATTACHMENT A
SITE MAP

Figure 1.0: Former Harshaw Chemical – Site Location

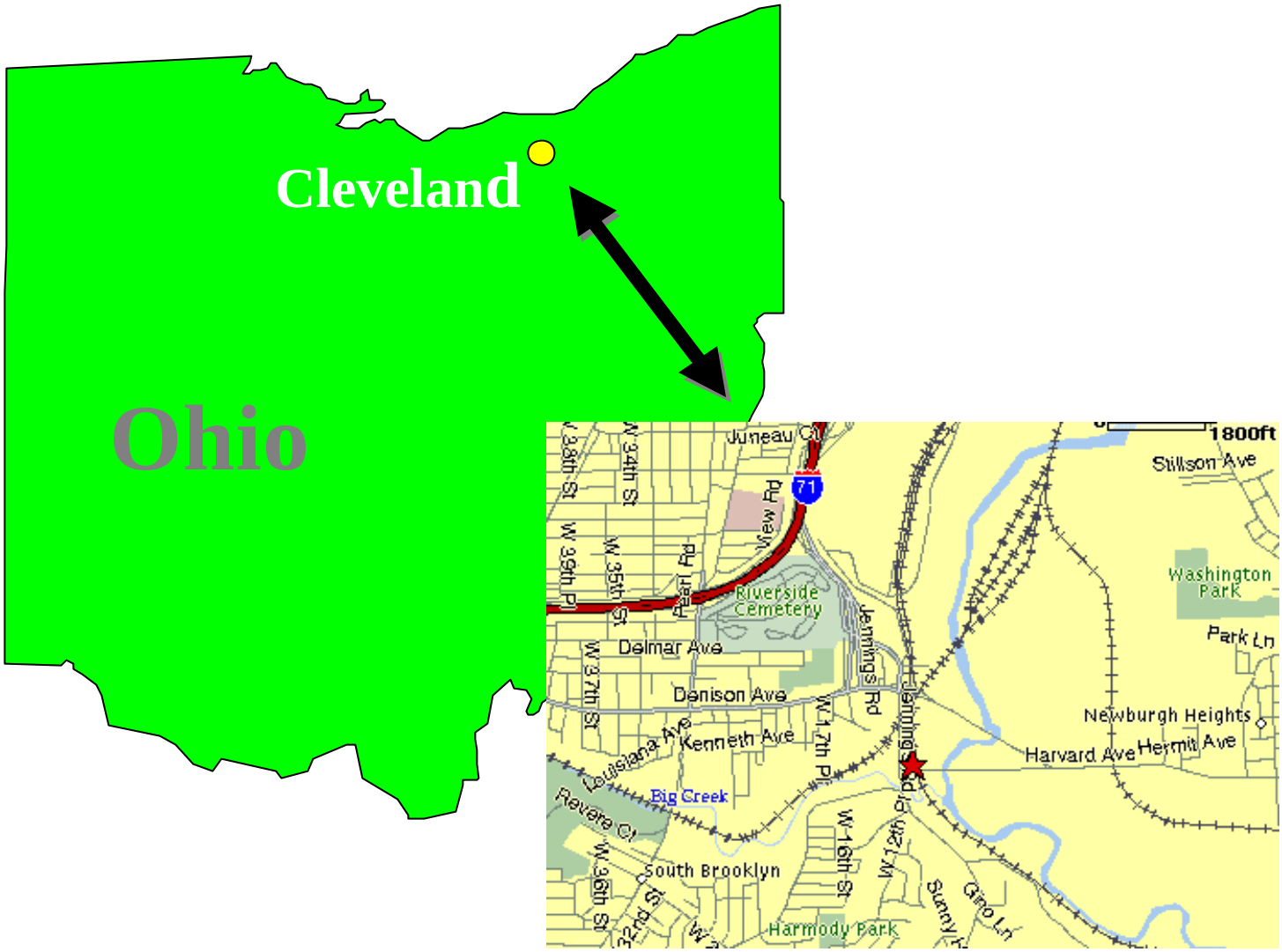
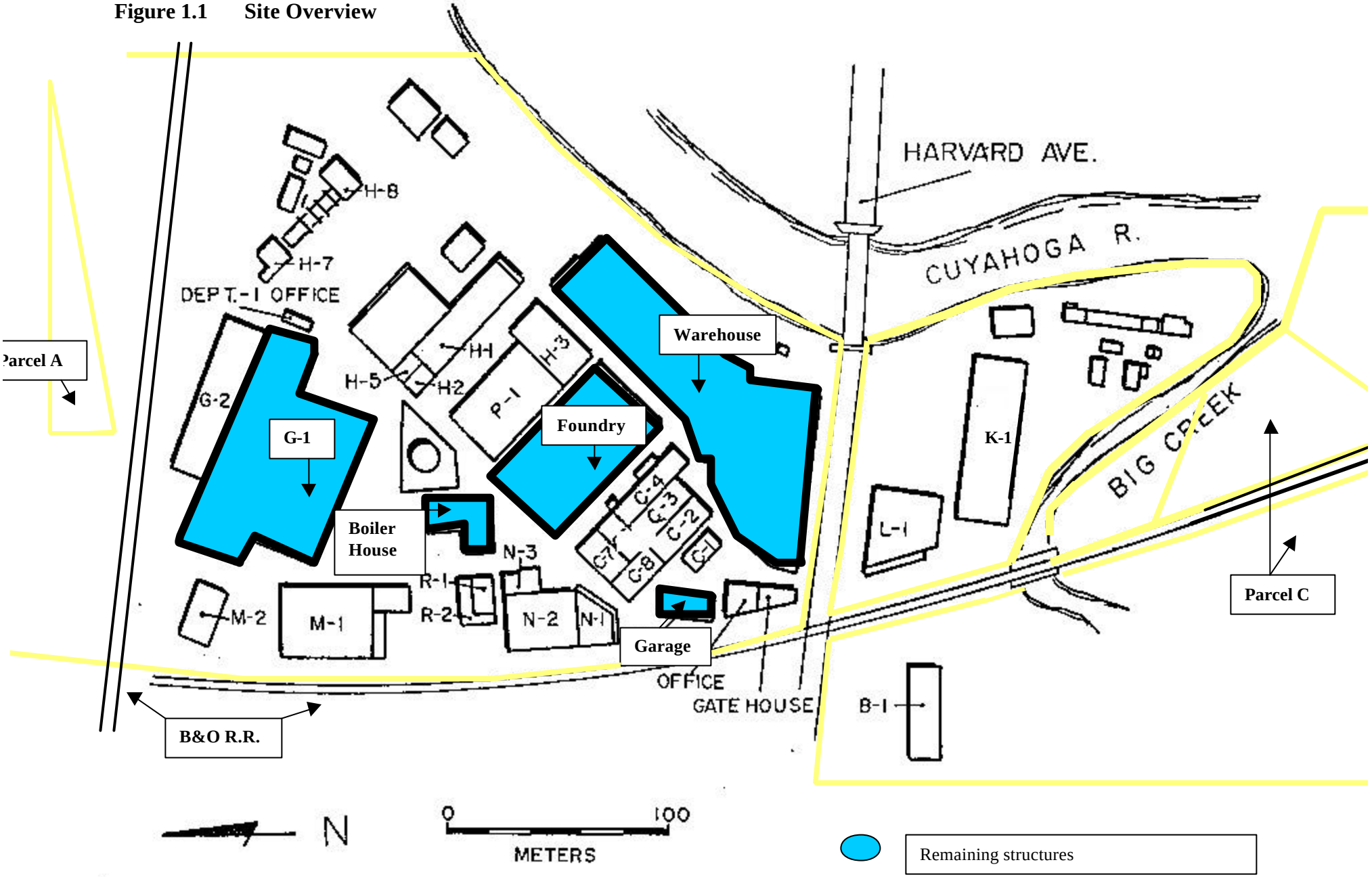


Figure 1.1 Site Overview



- The above map is a modified version of the site maps found in B. Koh

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ATTACHMENT B
REFERENCES

REFERENCES

1. B. Koh 1998. *Site Characterization Report*, Harvard-Denison Site, 1000 Harvard avenue, Cleveland, Ohio, Revision 0, B. Koh & Associates, Inc., August 1998

2. Chevron 1997. *United States Government Responsibility for Decontamination and Remediation of the Former Harshaw Chemical Company, Cleveland, Ohio*. Presented by: Chevron Chemical Company on behalf of Kewanee Industries, Inc., December 1997

3. ANL 1984. *Formerly Utilized MED/AEC Sites Remedial Action Program, Radiological Survey of the Harshaw Chemical Company*, Cleveland, Ohio, Argonne National Laboratory, April 1984

4. EPA 1991. *EPA Guidance for Performing Preliminary Assessments Under CERCLA*, Publication 9345.0-01A, September 1991

5. B. Koh 1999. *Survey and Sampling Plan for Parcels A and C*, B. Koh and Associates, December 1999.

6. Topographic Map. http://www.topozone.com/map.asp?s=25&size=s&lat=41.4503&lon=-81.6827

7. 1990 Water Use. Cuyahoga County. http://water.usgs.gov/cgi-bin/wuhuc?huc=04110002

8. NRC Letter 03/98. Letter from the Nuclear Regulatory Commission dated March 20, 1998 with the subject being: Confirmatory Surveys of Selected Engelhard Corporation Buildings, Cleveland, Ohio (Inspection Report 999-90063/97007 (DNMS).