# Timeline of Activities at the Former Harshaw Chemical Site

## From 1905 to 2009

***1905***
Purchased by the Harshaw, Fuller & Goodwin Company; manufactured chemical solvents, metal salts, fluorides, hydrofluoric acids, and other chemical products.

***1942***
Harshaw Chemical Company (HCC) began production activities for the Manhattan Engineer District (MED) in support of the United States' early atomic weapons program to process and develop uranium compounds.

***1944***
New uranium production plant built consisting of three units including Building G-1.

***1951-1954***
Uranium production had slowed and/or ceased depending on compound. Production plants were placed on standby.

Generally, two types of uranium refining processes were used during this time: the "dry" process and the "wet" process. The dry process included the conversion of uranium oxide ($U_3O_8$) feed material to Uranium Hexafluoride ($UF_6$). The wet process used chemical solvent extraction to produce purified uranium compounds earlier in overall production when compared to the dry process. The wet process became the preferred method of uranium refining.

**1957-1973**
Historical documents indicate the HCC held numerous AEC licenses authorizing the use and possession of specific radioactive materials. As part of the AEC licensing program, the HCC was required to maintain radioactive material control and management procedures.

**1959**
Final release and assignment of the primary uranium compound production contract from the Atomic Energy Commission (AEC).

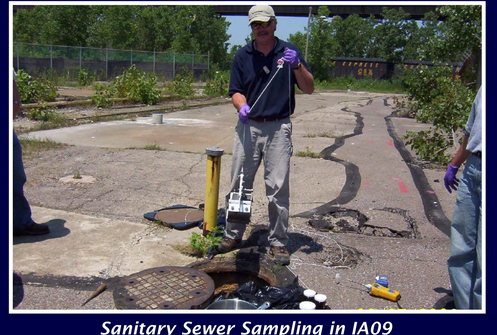
***1960***
Building G-1 Complex, Plant C, was decontaminated by HCC to levels that were considered clean by AEC at that time and therefore no further AEC oversight or controls were necessary. Building G-1 remains standing but is still contaminated based on current standards.

***Building G-1, a processing plant at the Former Harshaw Chemical Site***

***Ground-Penetrating Radar (GPR) surveys were used to further refine potential subsurface***

***Hollow-Stem Auger Setup in IA05 used to collect subsurface soil samples***

***Well Development in Progress in IA04***



***Sanitary Sewer Sampling in IA09 (North of Harvard Avenue)***

***1976-1979***
Previous investigations conducted at the Former Harshaw Chemical Site primarily addressed radiological contamination associated with government-contracted production operation.

Intermittent surveys of the uranium refining operation at the HCC were conducted by MED and AEC to monitor worker safety. Additional radiation surveys were conducted by AEC upon termination of government work at the site.

***1990-1997***
Contamination studies performed on buildings allowed non-contaminated buildings to be razed.

***1997***
Congress transferred management of Formerly Utilized Sites Remedial Action Program (FUSRAP) to the USACE.

***1998***
Environmental investigations were conducted for soil, sediment, surface water, and groundwater sampling to characterize radiological conditions associated with past HCC operations. Results are documented in the Site Characterization Report.

***1999***
The U.S. Department of Energy determined that the Former Harshaw Chemical Site was eligible for inclusion into FUSRAP.

***2001***
Preliminary Assessment completed for the Former Harshaw Chemical Site by the Corps.

***2002-2004***
Remedial Investigation initial phases complete.

***2006***
*Former Harshaw Chemical Site Remedial Investigation Report, Revision 0* released.

***2006-2008***
All phases of the Remedial Investigation completed.

***2008***
Feasibility Study groundwater monitoring well installation and sampling initiated.

***2009***
*Remedial Investigation Report* was revised and published.

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*Current site photograph of the Former Harshaw Chemical Site.*

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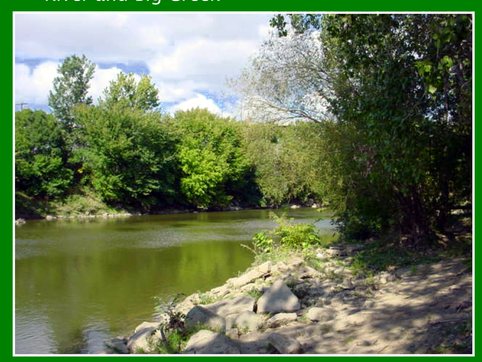
# Remedial Investigation & Baseline Risk Assessment

## What was the Remedial Investigation at the Former Harshaw Chemical Site?

The Remedial Investigation included sampling and data collection to characterize the nature and extent of radiological and chemical impacts from Manhattan Engineer District (MED)/Atomic Energy Commission (AEC)-related activities. Additionally, it evaluated the fate and transport of contamination at the site.

## What was investigated?

- ✓ Surface and subsurface soils on the site
- ✓ Groundwater under the site
- ✓ Underground utilities
- ✓ Contamination on building surfaces
- ✓ Sediment and surface water in the Cuyahoga River and Big Creek



*Cuyahoga River that borders the Former Harshaw Chemical Site to the east.*

## Was contamination found at the site?

Evidence of FUSRAP-related residual contamination was found at the site, including radium, uranium, and thorium (radioisotopes), lithium and molybdenum (metals), and kerosene (solvent).

## Why was a Baseline Risk Assessment conducted?

The Baseline Risk Assessment was conducted to evaluate risks to human health and the environment by contamination associated with past MED/AEC activities at the site, and meets the National Contingency Plan (NCP) requirement that a Baseline Risk Assessment be performed as part of the response action at the site.

*Sampling of sediment and water from sewers during the Remedial Investigation.*

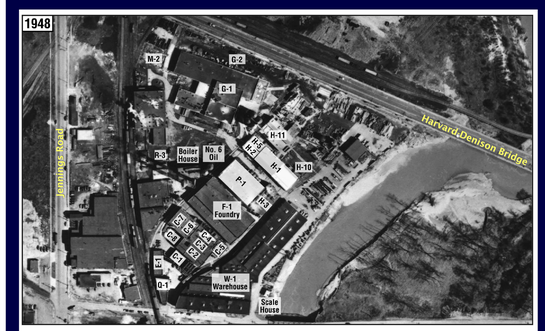
## What are the health risks at the site?

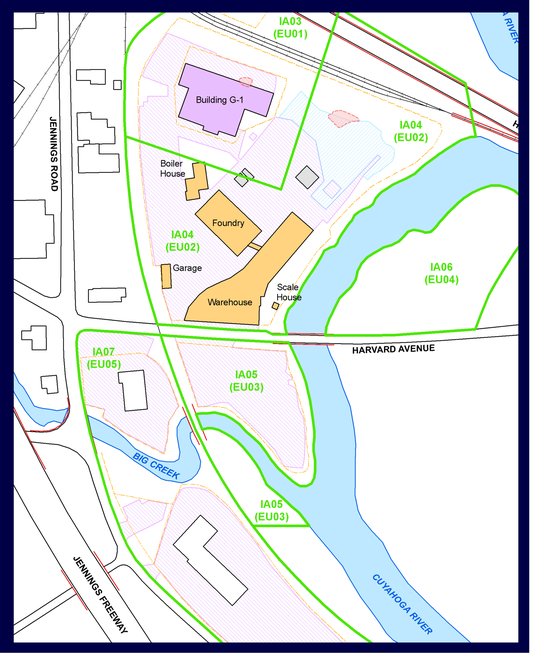
Based on the site's current use, the levels of radiological contamination found do not pose an immediate risk to human health or the environment.

However, over a person's lifetime, with 25-30 possible years of daily exposure on the site the risk modeling indicates that there is the potential for long-term health risks related to the radiological contamination.

Future use of the site may require that contamination be cleaned up to be protective of human health and the environment.

# Former Harshaw Chemical FUSRAP Site





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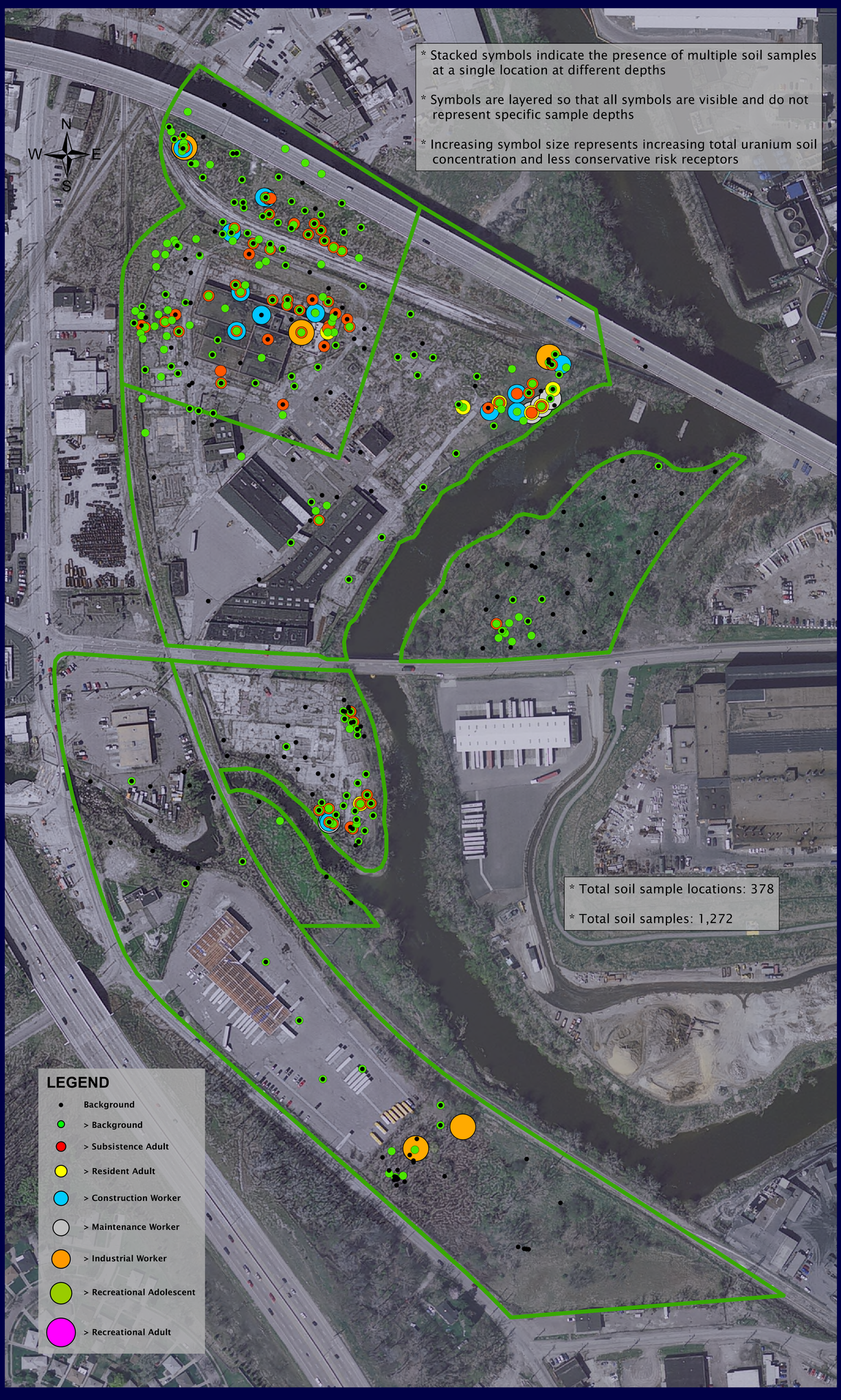
# Sitewide Remedial Investigation Soil Results
# Preliminary Remediation Goal Screening

## Total Uranium




This poster presents Remedial Investigation soil sample results for total uranium for all sample depths

The colored symbols represent the grouping of the total uranium result for each soil sample for the risk receptors shown in the Legend above

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# Summary of Potential Unacceptable Dose
# Existing Buildings
# Former Harshaw Chemical Site

The radiological dose associated with exposure to building surfaces is considered to be unacceptable when it is greater than 25 mRem/year.

The modeled receptor(s) associated with unacceptable dose are shown for exterior and/or interior work performed for each building.

*Slug test setup at existing (historical) groundwater monitoring well during the Remedial Investigation.*

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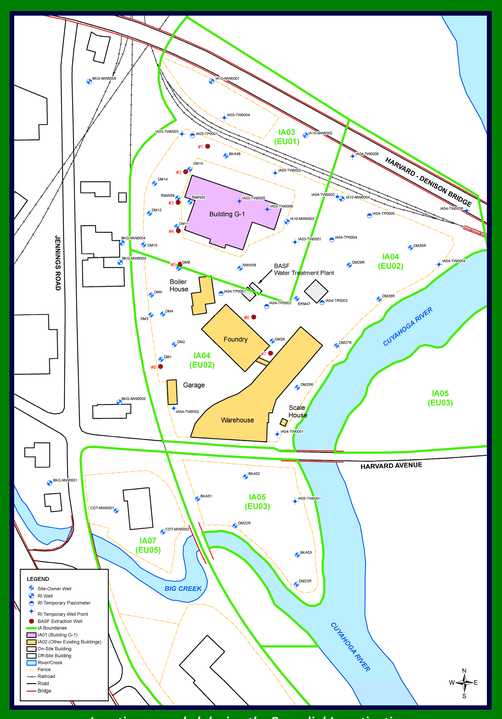
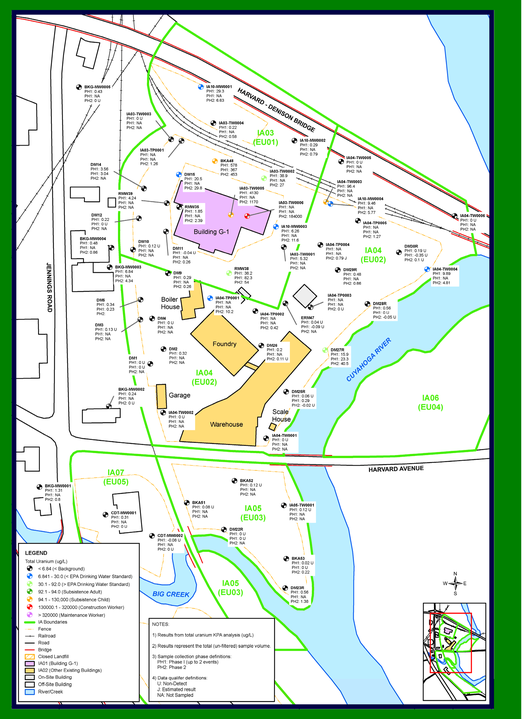
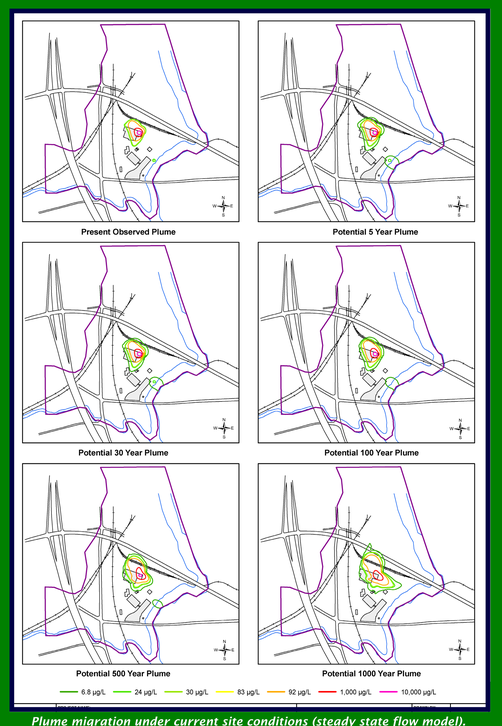
# Groundwater at the Former Harshaw Chemical Site




*Locations sampled during the Remedial Investigation.*




*Plume migration under current site conditions (steady state flow model).*

During the Remedial Investigation, groundwater samples were collected to characterize site groundwater conditions and to define the extent of contamination from the Manhattan Engineer District (MED)/Atomic Energy Commission (AEC).

Groundwater characterization was performed through monitoring well, temporary piezometer, and temporary well point installation; groundwater level measurements; slug testing; and groundwater sampling.

The Remedial Investigation determined the groundwater flow pattern across the majority of the site is in an eastward direction. The following were identified as Significant Constituents of Potential Concern for groundwater: total uranium (chemical), lithium; and, thorium-230.

Above-screening level chemical total uranium results in groundwater appear to be concentrated both inside and around Building G-1.

A numerical groundwater flow, particle tracking, and solute transport model of IA03, IA04, IA05, and a portion of IA07 was compiled by the Corps' Buffalo District to estimate near-term and future risks to groundwater from site contaminants.

The contaminant transport analyses indicate that the plume near Building G-1 will migrate towards the Cuyahoga River. If no site remediation occurs, above-background uranium discharges could reach the Cuyahoga River in about 900 years.

*Low-flow groundwater sampling setup at existing (historical) groundwater monitoring well during the Remedial Investigation.*

**The results of groundwater sampling and modeled contaminant movement beneath the surface performed during the Remedial Investigation identified areas that require ongoing monitoring of groundwater at the Former Harshaw Chemical Site.**

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# *Human Health Risk Assessment at the Former Harshaw Chemical Site*

## Hazard Identification

What potentially hazardous contaminants are located where and at what concentrations?

Samples were collected and analyzed for chemical and radiological contamination from the following media:

- ✓ soil
- ✓ groundwater
- ✓ surface water
- ✓ sediment
- ✓ sewers
- ✓ building surfaces

## Exposure Assessment

What is the reasonable maximum exposure to contaminants by current and potential future human receptors?

Exposure pathways modeled include: ingestion, inhalation, dermal contact, external radiation, and uptake through the food chain.

Exposure for current workers and trespassers, and hypothetical exposure for potential future users such as: workers, recreational users, and residents.

## Toxicity Assessment

What are the potential cancer and other, non-cancer, health effects of contaminants based on EPA-approved studies?

- ✓ Radiological contaminants were evaluated for their ability to cause cancer.
- ✓ Chemical contaminants, including uranium as a metal, were evaluated for their ability to cause other health effects such as kidney damage.

## Risk Characterization

Exposure and toxicity are combined to estimate risk to potential receptors. Three measures of risk are calculated:

- ✓ Cancer risk: expressed as a probability of developing cancer.
- ✓ Radiological dose: expressed as an average annual dose for comparison to acceptable dose levels.
- ✓ Hazard index: expressed as a ratio of estimated chemical exposure to an acceptable exposure to avoid toxic effects.

On the Harshaw Site estimated risks do not exceed acceptable State and Federal limits for:

- ✓ Current trespassers and future recreational users across the entire site.
- ✓ All modeled current and future receptors potentially exposed to contaminants in surface water and sediment.

On the Harshaw Site estimated risks exceed acceptable State and Federal limits for:

- ✓ Hypothetical current and future maintenance workers at the G-1 building and outside the old foundry building.
- ✓ Potential future workers associated with industrial redevelopment and hypothetical future residents at the property.

## Radiation Exposure Pathways Example

**Risk assessments provide an estimate of potential long-term effects on human health and the environment.**