



**US Army Corps  
of Engineers®**  
Buffalo District

**FUSRAP**

---

# **Preliminary Assessment**

**Runnymede Playhouse  
Dayton Unit IV  
Dayton, Ohio**

**Prepared by:**

**U.S. Army Corps of Engineers  
Buffalo District  
1776 Niagara Street  
Buffalo, NY 14207-3199  
September 5, 2000**

## TABLE OF CONTENTS

<b>1.0 INTRODUCTION.....</b>	<b>1</b>
<b>2.0 SITE DESCRIPTION, OPERATIONAL HISTORY, AND WASTE CHARACTERISTICS .....</b>	<b>1</b>
2.1 LOCATION.....	1
2.2 SITE DESCRIPTION.....	2
2.3 OPERATIONAL HISTORY AND WASTE CHARACTERISTICS.....	2
<b>3.0 SOIL EXPOSURE AND AIR PATHWAYS .....</b>	<b>2</b>
3.1 PHYSICAL CONDITIONS.....	2
3.2 SOIL AND AIR PATHWAYS.....	2
3.3 SOIL EXPOSURE AND AIR PATHWAY CONCLUSIONS.....	3
<b>4.0 GROUND WATER PATHWAY.....</b>	<b>3</b>
4.1 HYDROGEOLOGIC SETTING.....	3
4.2 GROUND WATER PATHWAYS.....	3
4.3 GROUND WATER PATHWAY CONCLUSIONS.....	3
<b>5.0 SURFACE WATER PATHWAY.....</b>	<b>4</b>
5.1 HYDROLOGIC SETTING.....	4
5.2 SURFACE WATER PATHWAYS.....	4
5.3 SURFACE WATER PATHWAY CONCLUSION.....	4
<b>6.0 SUMMARY AND CONCLUSIONS .....</b>	<b>4</b>
<b>ATTACHMENT A</b>	
FIGURE 1.0: RUNNYMEDE PLAYHOUSE – SITE MAP .....	A-1
FIGURE 1.1: SITE OVERVIEW .....	A-2
<b>ATTACHMENT B</b>	
REFERENCES.....	B-1

## **1.0 INTRODUCTION**

A Preliminary Assessment was performed, by the United States Army Corps of Engineers (USACE), on the Runnymede Playhouse site, also referred to as Dayton Unit IV, 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.

In 1944, the Runnymede Playhouse site, located in the City of Oakwood, Ohio, was formerly used for chemical and metallurgical processing of polonium by the federal government's Manhattan Engineer District, superseded in 1946 by the Atomic Energy Commission (AEC). In 1948, all federal activity at Runnymede Playhouse ceased and was subsequently decontaminated by AEC in 1950 (DOE 1998) (OEPA, July 1998). All buildings were demolished and removed. According to available information the radioactive materials may have been shipped to Oak Ridge Laboratories in Tennessee for burial, and clean fill was brought in to bring the site back to original grade (OEPA, August 1998). In 1950, the site was transferred back to the original owner, the Talbott family. In 1987, there was no indication that residual contamination, if any, exceeded criteria and standards and the site was eliminated from further consideration under FUSRAP by DOE (DOE 1998).

During the "MOUND Environmental Restoration Program," conducted by the Mound Core Team (DOE, EPA and Ohio EPA), this site was identified as Potential Release Site 323. Due to the results of screening samples taken at the former site of the Bonebrake Theological Seminary, a site also eligible for the FUSRAP in Dayton, Ohio, a meeting was prompted between the Ohio Environmental Protection Agency (Ohio EPA), Ohio Department of Health (ODH), the City of Dayton, and the City of Oakwood. After discussing these results it was decided to take screening samples at the site of the former Runnymede Playhouse. Data collected from screening samples, taken by the Ohio EPA indicate concentrations of polonium-210 (Po-210) in soils at greater than expected values (OEPA, July 1998). Due to the elevated readings from the core samples, plus uncertainties in historic drainage patterns and possible exposure from future excavation, the Ohio EPA concluded that further evaluation of the site was warranted (OEPA, August 1998).

In 1974, FUSRAP was created to address sites used during the early atomic energy program that have contamination exceeding current regulatory requirements. Under this program, the U.S. Department of Energy (USDOE) determined the site is eligible for inclusion into the FUSRAP on February 10, 1999. Under the Memorandum of Understanding between the U.S. Army Corps of Engineers (USACE) and the USDOE, once this determination has been made by the USDOE, responsibility for action is transferred to USACE.

## **2.0 SITE DESCRIPTION, OPERATIONAL HISTORY, AND WASTE CHARACTERISTICS**

### **2.1 Location**

The Runnymede Playhouse site is located northwest of the intersection of Runnymede and Dixon Avenue in Oakwood, Ohio. It is the former location of the Runnymede Playhouse, an area utilized by the affluent Talbott family for recreational purposes.

The Montgomery County climate is typical of the continental interior. Summers are moderately warm and humid, and winters are cold and cloudy (ODNR 1995).

NOAA precipitation data for the thirty-year period from 1961 to 1990 averaged 38.82 inches per year at Dayton. May is typically the wettest month and January the driest month (ODNR 1995)

All of Montgomery County is within the Ohio River Drainage basin. The majority of the county is drained by the Great Miami River and its tributaries. Only the southeast corner of the county is drained by tributaries of the Little Miami River (ODNR 1995).

## **2.2 Site Description**

The site is located in a residential area of Oakwood, Ohio on private property. The original property where the chemical and metallurgical processing of polonium took place has been subdivided and is now part of seven private residential properties. The site of the original playhouse structure is presently a professionally landscaped hillside. The remainder of the site is now a combination of asphalt pavement, houses and lawns.

## **2.3 Operational History and Waste Characteristics**

Between 1944 and 1948, two processes were utilized in obtaining polonium-210 (Po-210). The first process involved the extraction of Po-210 from lead dioxide wastes generated by the Port Hope radium refinery, located in Ontario, Canada. After treating the lead dioxide with nitric acid and hydrogen peroxide, and subsequently raising the pH of the solution; a precipitate containing Po-210 was formed (OEPA, July 1998).

The second process, found superior to the lead dioxide process, involved the chemical separation of Po-210 from bricks containing bismuth-209. The bricks were irradiated via neutron bombardment at the Clinton Reactor in Oak Ridge, Tennessee, and shipped to the Runnymede Playhouse for the chemical separation. In 1945, this process became the sole operation utilized for the production of Po-210. (OEPA, July 1998) (DOE 1998)

The potential contaminants of concern derived from the two processes described include Polonium-210 and Lead-210. The inorganic contaminant, lead, may also be associated with these processes.

Operations ceased at Unit IV in 1948 when they were moved to Mound Laboratory, Miamisburg, Ohio, and the Unit IV facility was demolished and removed. According to records referenced by the U.S. DOE in the report, *FUSRAP Authority Review for Former Dayton Plant, Units III and IV*, of November 1998, no materials were buried onsite, sent to city landfills or other disposal facilities. According to available information, the resulting radioactive wastes may have been shipped to Oak Ridge National Laboratories in Oak Ridge, Tennessee for burial. In 1950 the site was transferred back to the Talbot family. (DOE 1998)

## **3.0 SOIL EXPOSURE AND AIR PATHWAYS**

### **3.1 Physical Conditions**

Information on soil characteristics is not available. It is known that fill material was brought to the site after operations ceased.

### **3.2 Soil and Air Pathways**

The previous location of the Runnymede Playhouse, prior to demolition and removal, is currently the location of residential housing. Soil and air targets include the occupants of this residential setting encompassing the location.

According to the *PRS Dayton Unit IV Soil Screening Results Report*, issued by the Ohio Environmental Protection Agency in July 1998, surface and core soil samples were collected and analyzed in May 1998. The samples were analyzed for Po-210 via alpha spectroscopy and gamma emitting radionuclides via gamma spectroscopy.

One of six surface samples resulted in 9.0 pCi/g of Po-210. This result, from sample S5-1 (Refer to Figure 1.1 for location) is slightly above the average result for the remaining surface soil samples analyzed. The core samples were analyzed at varying depths, ranging from 1 foot to greater than 6 feet. The results indicate slightly elevated concentrations of Po-210 present in the soil samples taken at depths greater than one foot. The maximum concentration of Po-210 measured was 16 pCi/g at 2 feet. The remaining core sample analyses ranged from 1.4 pCi/g to 10 pCi/g Po-210.<sup>1</sup> The gamma spectroscopy performed on all samples did not result in elevated levels (OEPA, July 1998).

### **3.3 Soil Exposure and Air Pathway Conclusions**

Potential exposures to radionuclides could occur during disturbance of site soils without proper controls. In conclusion, there is a likelihood of release if soils are disturbed based on sample results of surface and subsurface soil indicating the presence of FUSRAP related waste. Release to air pathways is not likely due to the characteristics of the waste and the non-disturbance of loose contamination.

## **4.0 GROUND WATER PATHWAY**

### **4.1 Hydrogeologic Setting**

Montgomery County lies within the Glaciated Central hydrogeologic region. The county is covered by variable thicknesses of glacial till, lacustrine deposits, and outwash. These unconsolidated glacial deposits are underlain by limestone, shale, and shaley limestone bedrock. Ground water yields are dependent on the type of aquifer and vary greatly throughout the county. Pollution potential indexes are relatively low to moderate in areas of till or lacustrine cover over bedrock. Buried valleys containing sand and gravel aquifers, and areas covered by outwash have moderate to high vulnerabilities to contamination (ODNR 1995).

Dayton Unit IV is located within the Till Plains section of the Glaciated Central hydrogeologic region. The site overlies sand and gravel interbedded in glacial till. This hydrogeologic setting is characterized by a moderate relief and sand and gravel deposits interbedded in glacial till. The till is composed primarily of clay with varying amounts of unsorted silt, sand, and gravel. The sand and gravel may be relatively thin and discontinuous, lens-shaped bodies, or thick layers which cover a large area. The thick units are usually confined to common horizons within the till. Ground water occurs in both the till and the sand and gravel; however, the sand and gravel serves as the principal aquifer. Recharge to the sand and gravel is primarily due to infiltration of precipitation through the till. Depth to water in this region is 30 to 50 feet. Soils are typically described as clay loams. This site is rated lower in the pollution potential index range (ODNR 1995).

### **4.2 Ground Water Pathways**

About 42 percent of Ohio citizens rely on ground water for drinking and household use from both municipal and private wells. Industry and agriculture also utilize significant quantities of ground water for process and irrigation. Over 10,000 rural households depend on private wells in Montgomery County (ODNR 1995). The Montgomery County Water Authority supplies the area encompassing the Former Runnymede Playhouse location. The distance to the nearest well field is approximately 1.5 miles.

Approximately 180,654 people live within about 4 miles of the site, including about 27,935 children between the ages of 5 and 17. The site is situated within a residential area (1990 Census Data).

### **4.3 Ground Water Pathway Conclusions**

Sample results show only slightly elevated soil concentrations of Polonium 210. Based on this

---

<sup>1</sup> Background levels of Polonium 210 were found to be between 1 and 3 picocuries per gram by the Ohio EPA.

data and the site's lower pollution potential index range, there is minimal likelihood of release to groundwater from the migration of contaminants through soil.

## **5.0 SURFACE WATER PATHWAY**

### **5.1 Hydrologic Setting**

The site is a rolling landscape toward the southwest and the Houx Stream, a tributary of the Great Miami River. The site stormwater runoff conveyance consists of a storm sewer system and stormwater swales discharging to the Houx Stream. Houx Stream reaches the confluence with the Great Miami River approximately 1 mile from Dayton Unit IV. From this point, the Great Miami River meanders in a south, southwest direction for greater than 15 miles (Topographic Map).

### **5.2 Surface Water Pathways**

Soil disturbance could result in the potential migration of contaminants from the site into the Great Miami River drainage basin where they could enter the food chain.

During the sampling event on May 5, 1998, The Ohio Department of Health (ODH) performed a walkover survey of the site and surrounding areas. Stormwater swales to the south of the site were surveyed. Particular attention was paid to storm sewer grates (OEPA, July 1998). No areas of elevated activity were identified using direct field measurements.<sup>2</sup>

### **5.3 Surface Water Pathway Conclusion**

In conclusion, there is a slight likelihood of release to surface water based on the ability of the contaminant of concern to reach surface water via stormwater runoff.

## **6.0 SUMMARY AND CONCLUSIONS**

The data collected from the screening samples taken at Runnymede Playhouse report concentrations of Po-210 in soils at greater than background values. Site history and the physics of Po-210 do not corroborate the samples. Based on the sample data and radiological survey conducted by the Ohio Department of Health, Ohio EPA determined that there is no immediate health risk at the site (OEPA, July 1998).

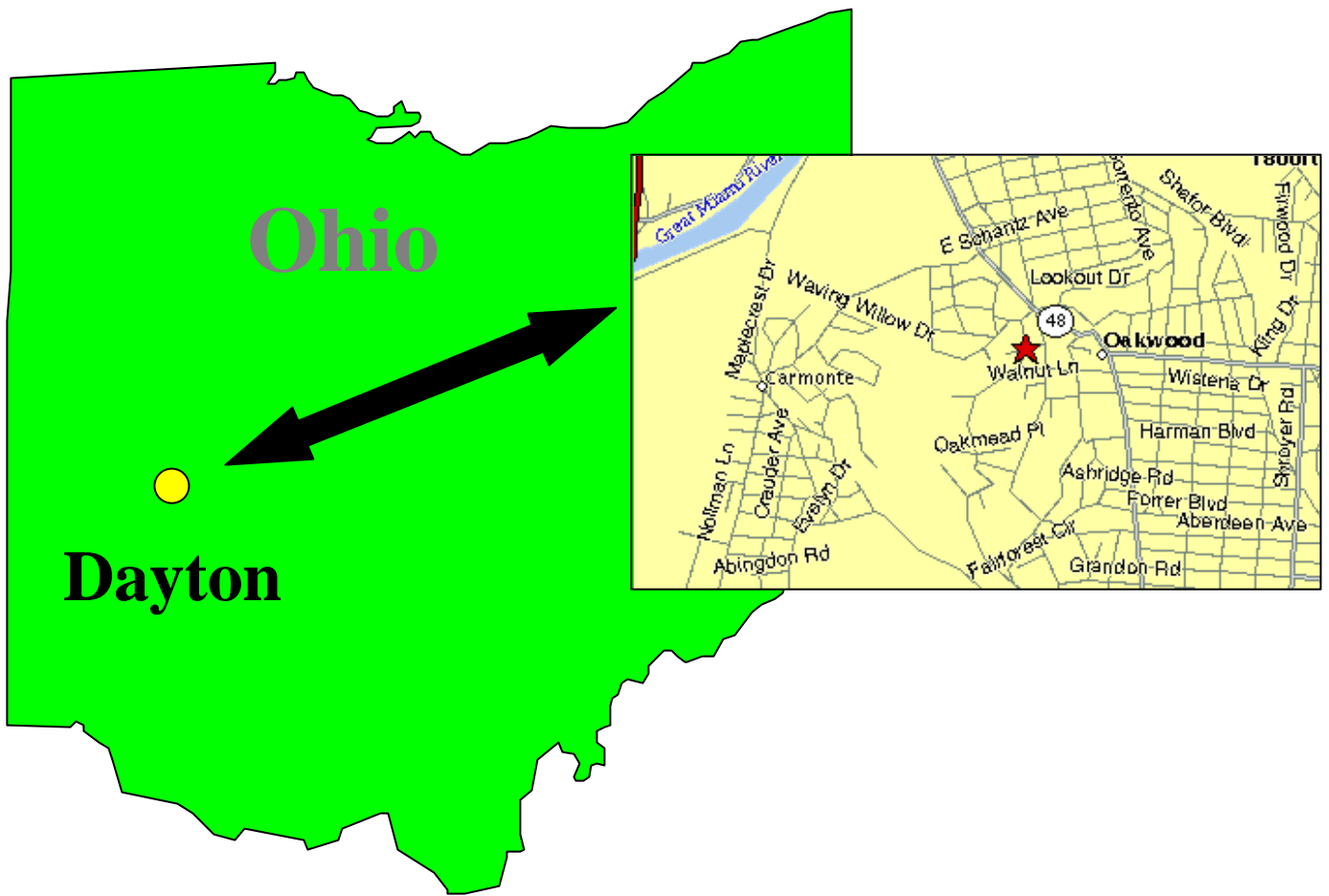
To better evaluate the potential risk to human health and the environment, it is recommended that a Site Inspection of the Runnymede Playhouse site be conducted to determine the type, quantity and extent of contaminants. It is further recommended specific Data Quality Objectives (DQO's) should include the screening for Lead-210, the parent nuclide of Po-210. This DQO will substantiate the activity exhibited by Lead-210, the potential source of Polonium, and model this activity to determine risk to the public. Information collected during the Site Inspection will be used to determine whether or not the former Runnymede Playhouse site requires further investigation and/or remedial action under the Formerly Utilized Sites Remedial Action Program.

---

<sup>2</sup> It is noted by USACE that the sensitivity of direct field measurements is lower than the sensitivity of laboratory analysis in the detection of radionuclide concentrations. This fact will be utilized in the planning for future investigations at Runnymede Playhouse.

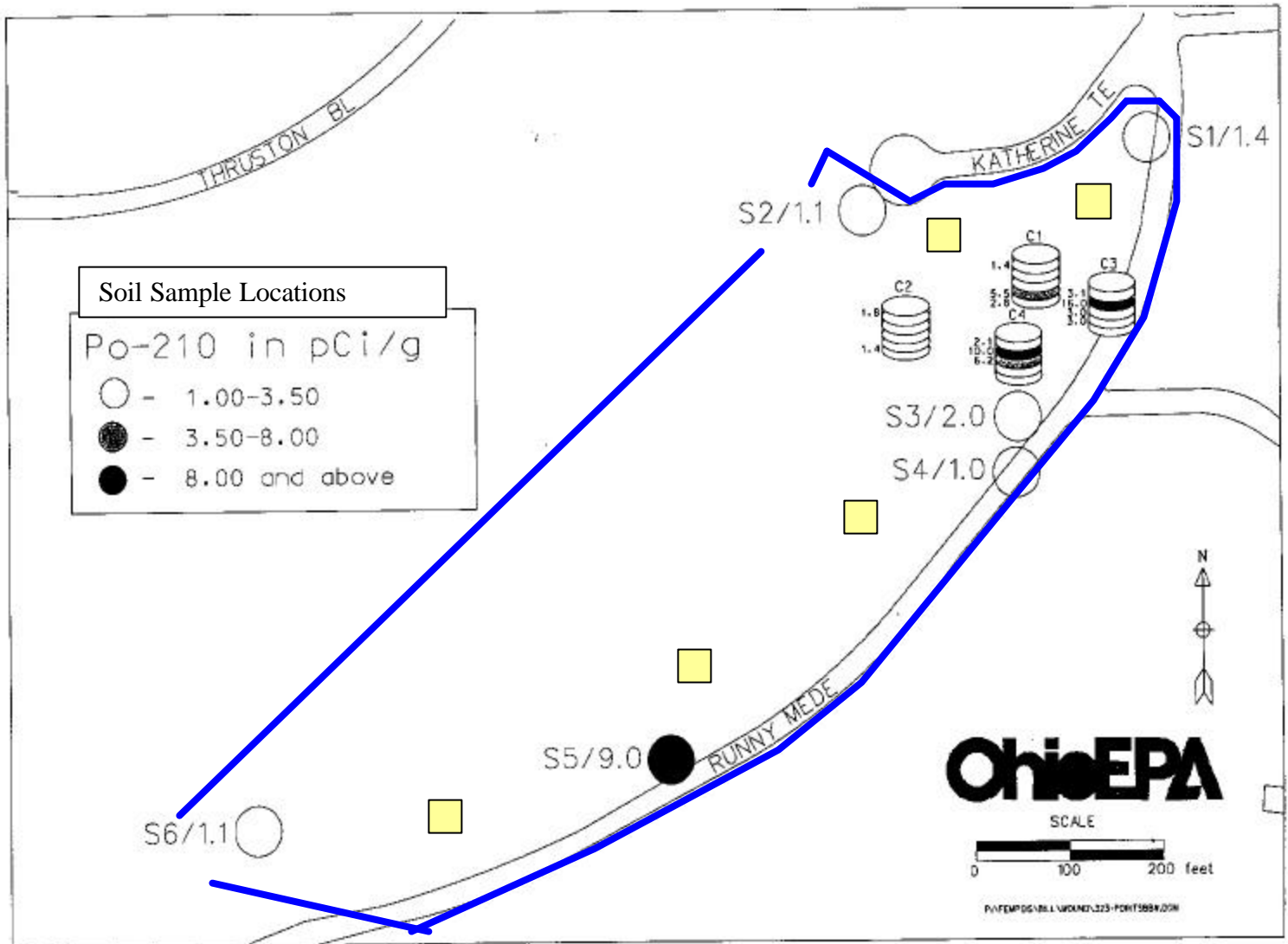
**ATTACHMENT A  
SITE MAP**

**Figure 1.0: Runnymede Playhouse – Site Map**





**Figure 1.1: Site Overview**



- Approximate Site Boundary Line
- Approximate Location of Residential Homes

- Modified version of the Ohio EPA map found in OEPA, July 1998

**ATTACHMENT B  
REFERENCES**

## References

OEPA, July 1998. *PRS 323 Dayton Unit IV Soil Screening Results Interim Report*, Ohio Environmental Protection Agency, July 1998

DOE 1998. *FUSRAP Authority Review for Former Dayton Plant, Units III and IV*, Dayton Ohio, Department of Energy, November, 11, 1998.

OEPA, August 1998. *Citizen Advisory, Ohio EPA Issues Soil Screening Results on Oakwood Site Previously Used to Process Polonium*, State of Ohio Environmental Protection Agency, August 14, 1998

ODNR 1995. *Ground water pollution potential of Montgomery County*, Ohio, Michael Hallfrisch and Michael P. Angle, Ohio Dept. of Natural Resources, Division of Water, Ground Water Resources Section, 1995

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

Topographic Map. <http://www.topozone.com/map.asp?lat=39.7261&lon=-84.1861&s=25&size=s>