

## **The Patroon Creek Contamination Migration Investigation**

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### **ABSTRACT**

Shaw performed a Site Investigation (SI) for sediment within the Unnamed Tributary of the Patroon Creek, a section of the Patroon Creek, and the Three Mile Reservoir as part of the overall contract with the United States Army Corps of Engineers (USACE) to remediate the Colonie Formerly Utilized Sites Remedial Action Program (FUSRAP) Site. The Unnamed Tributary formerly flowed through the former Patroon Lake, which was located on the main site property and was used as a landfill for radiological and chemical wastes. The objective of the investigation was to determine the absence/presence of radioactive contamination within the three Areas of Concern (AOC). In order to accomplish this objective, Shaw assembled a team to produce a Technical Memorandum that provided an in-depth understanding of the environmental conditions related to the Patroon Creek. Upon completion and analysis of the Technical Memorandum, a Conceptual Site Model (CSM) was constructed and a Technical Planning Program (TPP) was held to develop a Sediment Investigation Work Plan and Sediment Investigation Sampling and Analysis Plan. A total of 32 sample locations were analyzed using on-site direct gamma scans with a Pancake Geiger-Mueller (PGM) instrument for screening purposes and samples were analyzed at on-site and off-site laboratories. The highest interval from each core scan was selected for on-site analysis utilizing a High Purity Germanium (HPGe) detector. Eight of these samples were sent off-site for gamma/alpha spectroscopy confirmation. The data collected during the SI indicated that the U-238 cleanup criterion was exceeded in sediment samples collected from two locations within the Unnamed Tributary but not in downstream sections of Patroon Creek or Three Mile Reservoir. Future actions for impacted sediment in the Unnamed Tributary will be further evaluated. Concentrations of U-238 and Th-232 in all other off-site sediment samples collected from the Unnamed Tributary, Patroon Creek, and the Three Mile Reservoir indicate that no further action is required in these areas. The data was also compared to ecological screening criteria. None of the contaminants of concern (U-238, Th-232, and U-235) had concentrations exceeding the screening values. The evaluation indicates no adverse impacts to ecological receptors.

## **INTRODUCTION**

Shaw performed a Site Investigation (SI) for sediment within the Unnamed Tributary of the Patroon Creek, a section of the Patroon Creek, and the Three Mile Reservoir as part of Shaw's overall contract with the United States Army Corps of Engineers (USACE) to remediate the Colonie Formerly Utilized Sites Remedial Action Program (FUSRAP) Site. The Unnamed Tributary formerly flowed through the former Patroon Lake, which was located on the main site property and was used as a landfill. The objective of the investigation was to determine the absence/presence of radioactive contamination within the three Areas of Concern (AOC).

### **Site History**

Industrial operations on-site began in approximately 1923 when the Embossing Company purchased a portion of the present day site to construct a facility to manufacture wood products and toys. In 1927, Magnus Metal Company, Inc. purchased the property and converted the facility to a brass foundry for manufacturing railroad components. Magnus Metal Company, Inc. cast the brass components in sand molds and manufactured brass bearing housings with surfaces of babbitt metal (an alloy of lead, copper and antimony).

In 1937, National Lead Industries (NL) purchased the facility and continued the brass foundry operations initiated by Magnus Metal Company, Inc. At some point before 1941, NL purchased an adjacent lot that contained a portion of Patroon Lake and began filling Patroon Lake with used casting sand, which contained high levels of lead and other metals. After World War II, the plant began casting aluminum parts and frames for aircraft. In 1958, the nuclear division of NL began producing items manufactured from uranium and thorium under a license issued by the Atomic Energy Commission (AEC). NL discontinued its brass foundry operations in 1960.

From 1958 through 1984, NL carried out a number of processes using radioactive materials consisting primarily of depleted uranium but also of thorium and enriched uranium. The plant handled enriched uranium from approximately 1960 to 1972. From 1966 to 1972, NL held several contracts to manufacture fuel from enriched uranium for experimental nuclear reactors. Operations were conducted at the plant to reduce depleted uranium-tetrafluoride to depleted uranium metal, which was then fabricated into shielding components, ballast weights for airplanes, and armour piercing projectiles.

Other processes conducted at the plant included an electroplating operation for plating uranium with nickel and cadmium. Chemicals used in the plating operation included nickel sulfamate, sodium cyanide, ferric chloride, nitric acid, silicate phosphate, iridite (chromium brightener), cadmium metal, nickel metal, boric acid, and tetrachloroethene (also known as perchloroethene, or PCE). NL letters indicate that under an AEC license, approximately 42 cubic meters (m<sup>3</sup>) of graphite, slag, refractory, uranium oxide, insoluble oil, metal scrap, and combustible trash were buried in the former Patroon Lake area in 1961. Chemical wastes and packaged chemicals used at the site had included acids, bases, degreasing agents, carbon tetrachloride, benzene, polychlorinated biphenyls (PCBs), cyanide, and asbestos. The chemicals present on the Resource Conservation and Recovery Act (RCRA) Part A application permit were removed from

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the Colonie Site as part of this facility's closure as a designated "interim RCRA storage facility." This closure was documented in the 1995 RCRA Closure Report certified by both the Department of Energy (DOE) and an independent New York State Professional Engineer.

New York State officials closed NL in 1984 at which time Congress authorized the DOE to remediate the property. In February 1984, the Secretary of Energy accepted an offer from NL to donate the land, buildings, and equipment to the DOE in order to help expedite the cleanup. In 1985 the DOE acquired a portion of the Niagara Mohawk (NiMo) property bordering the Colonie Site and subsequently designated it as part of the Colonie Site. The "Keyhole" portion of the site is that part of the site that resembles a "keyhole" in a door and is the irregular shaped, western most portion of the site through which the Unnamed Tributary flows before entering the storm-water culvert.

From 1984 to 1988, remedial efforts were completed by the DOE for 53 of the 56 Vicinity Properties. From 1992 to 1996, the remaining NL Site buildings were demolished by DOE. In 1997 the FUSRAP program was moved by congress from the DOE to USACE. Various debris, waste materials and machinery associated with demolition of the main buildings were left on-site at the time USACE and their contractors initiated their remedial efforts. [1]

In 1998, under the direction of the USACE, site remediation activities began with:

- Removal and disposition of building material and equipment
- Removal of building slabs, foundation, and asphalt pavement
- Excavation of landfilled materials in the former Patroon Lake
- Excavation of contaminated surface materials

Additional support activities included:

- Removal and replacement of a major stormwater drainage channel that bisected the landfill area associated with stream diversion
- Design and operation of a water treatment facility with State Pollution Discharge Elimination System monitoring and reporting requirements
- Perimeter air monitoring on a 24/7 basis
- Relocation of power lines that transected the landfill area

Through July 2005 USACE has achieved the following key accomplishments on the project:

- Excavation of 130,392 tonnes of mixed RCRA and radiological wastes
- Off-site transportation of 139,276 tonnes
- On-site water treatment of 96,913,177 liters of contaminated storm water and groundwater
- Completed Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) certification for 19 survey units and placed 97,934 m<sup>3</sup> of off-site backfill material into these completed units with 6 on site survey units remaining.

As of November 2005, only one Vicinity Property, CSX Transportation (formerly Conrail) remains to be addressed. The expected completion date of the main site remediation and the CSX VP is September 2006.



Fig. 1. Colonie FUSRAP site aerial photo

### **Rationale and Objective for the Sediment Investigation**

Sediment data had previously been collected from 1984 to the present from the Unnamed Tributary, Patroon Creek, and the Three Mile Reservoir by the U.S. Department of Energy (DOE), USACE, the U.S. Environmental Protection Agency (USEPA), and State University of New York (SUNY) at Albany. This data indicated that uranium and thorium contamination, originated from the NL Industries site, was present in the sediments. An SI was conducted to determine the absence/presence of radiological contamination above levels that might pose a significant threat to human health or the environment within the waterways adjacent and downstream of the main site.

### **TECHNICAL MEMORANDUM**

A Technical Memorandum was developed to aid in the construction of a Conceptual Site Model (related to the AOCs), and in the production of a comprehensive Work Plan, and Sediment Investigation Sampling and Analysis Plan.

In preparing the Technical Memorandum, an in-depth exploration and analysis of the history and role of the Patroon Creek Watershed allowed for the examination of the relationships to present day conditions. The Technical Memorandum consisted of developing a comprehensive physical description of the creek, a historical survey of the use of the creek, a survey and analysis of the known sediment and water quality data, a survey of known discharge sources to the creek, and an overview of construction activities associated with the creek.

### **Description of Patroon Creek and Historical Survey**

The Patroon Creek Watershed includes approximately 33 km<sup>2</sup> and is drained by Patroon Creek and its tributaries. The creek generally flows from west to east in the towns of Colonie and Guilderland and eventually empties into the Hudson River in the City of Albany (Figure 1). The area surrounding Patroon Creek is a mixture of residential, commercial and light industrial properties. Patroon Creek is designated as a Class C Water Body (suitable for primary / secondary contact recreation and suitable for fish propagation and survival) in the New York State Section 303(d) List of Impaired Waters.

The Unnamed Tributary of Patroon Creek enters on the western side of the Colonie FUSRAP Site, and is conveyed approximately 45 m to the south and east within a channel lined with rip rap before it enters a culvert headwall and is directed underground across the site in a 1.2 m concrete culvert. The culvert drainage exit is located south of the site, which is directly south of the CSX railroad property. Downstream from the railroad track and Yardboro Avenue, the Unnamed Tributary is an open channel, approximately 180 m, before it intersects Patroon Creek.

Patroon Creek originates in the Pine Bush Natural Area northwest of Albany, New York. In the 17th Century the creek served as a source of power for a number of grist and saw mills and it became a major source of water for the growing Albany population. In the early eighteen hundreds, the privately owned Water Works Company created Tivoli Lakes using a portion of the watershed area of Patroon Creek as part of their water supply system for the City of Albany.

In the mid to late nineteenth century, three additional surface reservoirs were constructed by the City of Albany Water Department along the Creek for water supply purposes. The Creek originates at the western most of these reservoirs known as Rensselaer Lake or the Six Mile Reservoir. The creek is approximately 11 km from its headwaters to where it discharges into the Hudson River. Patroon Creek is a perennial stream. The U.S. Geological Survey (USGS) measured the base flow in Patroon Creek from 1978 to 1980 at a location approximately 0.6 kilometers downstream of the Colonie Site. The base flow measurements ranged from 152 l/s to 391 l/s.

Approximately half way along the length of the creek, the creek passes through Patroon Reservoir, also known as Russell Road Reservoir, the I-90 Pond, or Three Mile Reservoir. This system of reservoirs would remain a source of water for the City of Albany until the early 1920's. Due to contaminant issues associated with the proximity of the railroad and sanitary and stormwater runoff, the City of Albany discontinued the use of the reservoir systems in the early 1920's and began to utilize other water supply sources.

Between 6-Mile Reservoir and 3-Mile Reservoir there are two tributaries to the Creek. The western most of these tributaries is known as the North Branch of the Patroon Creek. The second tributary is unnamed and will be referred to as the Unnamed Tributary for the purpose of this paper. This Unnamed Tributary formerly flowed through the former Patroon Lake located on the NL site.

Review of aerial photographs from 1942, 1968, and 1977 for the Three Mile Reservoir area indicates that the Three Mile Reservoir was originally composed of two basins. A dividing dam and spillway separated one basin located to the west from a second basin located to the east. It is apparent when comparing the 1942 and 1968 photographs that I-90 has been built across Three Mile Reservoir, destroying the western basin and significantly reducing the size of the eastern basin. New York State Department of Transportation (NYSDOT) construction drawings for I-90 confirm that the dam and gate of the western basin have been removed, and I-90 was constructed over approximately 75 percent of the western basin and approximately 50 percent of the eastern basin.

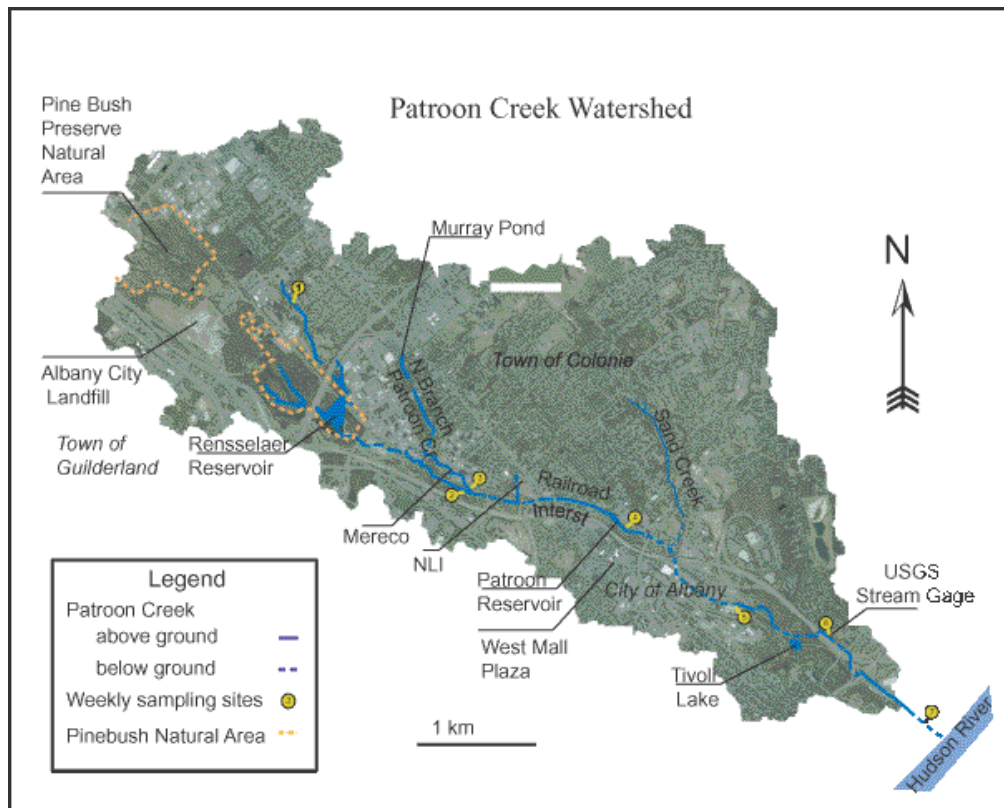


Fig. 2. Patroon Creek Watershed

The Unnamed Tributary of Patroon Creek drains an area of approximately 1.2 square kilometers in the Town of Colonie. During the early 1900s, a dam was constructed on the Unnamed Tributary within the NL Industries site to form Patroon Lake, which was used as a landfill by NL. In the 1960s, a 97-meter section of the Patroon Creek was relocated by the construction of I-90. [2]

### **Sediment and water quality data on Patroon Creek**

In the early 1980s, due to ongoing environmental concerns, the NYSDEC designated the Patroon Creek as a Class C Water Body in the New York State Section 303 (d) List of Impaired Waters. Portions of the Patroon Creek watershed have also been designated as AOCs by the NYSDEC. Four sediment investigations have previously been conducted at Patroon Creek in the vicinity of the Colonie FUSRAP Site, including:

- USDOE/USACE investigations of the Colonie FUSRAP Site (1984 – present);
- USEPA investigation at the Mercury Refining Site (2001)
- SUNY-Albany investigation at the Three Mile Reservoir (1999); and,
- NYSDEC investigation of Patroon Creek (1980s).

The results of the USDOE/USACE sediment sampling from 1984 through 1998 were relatively consistent. The upstream (background) locations had levels in the range of 0.68 – 6.5 picocuries per gram (pCi/g) for total Uranium. The on-site locations in the Patroon Lake area had the most elevated levels, with levels of 278 pCi/g in 1989 and 158.4 pCi/g in 1990. The downstream locations all had levels below 35 pCi/g, except for a sample taken in 1992 by USDOE, immediately downstream of the site in the Unnamed Tributary which had a total Uranium level of 128.3 pCi/g at a depth of 0.45 m–0.76 m. The results from the USACE 2001 Sediment Sampling Report (6 upstream locations, 6 downstream locations) show an upstream uranium-238 (U-238) range of .261 – .841 pCi/g and a downstream range of .195 – 7.06 pCi/g.

Radiological sampling was not performed during USEPA's 2001 investigation at the Mercury Refining Site.

In 1999 the State University of New York (SUNY)-Albany collected one 3 m long sediment core from the downstream end of the Three Mile Reservoir below a water column depth of approximately 2.5 m. SUNY's sample results indicated total uranium concentrations ranging from 1 milligram per kilogram (mg/kg) to 320 mg/kg, with the highest concentration detected at a depth of approximately 1.6 m below the creek bottom. During the SUNY-Albany investigation, split samples were also provided to NYSDEC. The highest U-238 concentration detected in the split samples provided to NYSDEC was 39.5 pCi/g at a depth of 1.67 m below the creek bottom. [2]

### **Summary of known discharges to Patroon Creek**

To determine what environmentally active sites were located within a one (1) mile radius of the NL Site, Shaw obtained and reviewed the commercially available reports for the property located at 1130 Central Avenue (NL Site) which provided an extensive compilation of listed sites within a 1.5 km radius of the target property. Shaw reviewed the hazardous sites that may have had a substantial impact to the sediments within the Patroon Creek. The two primary sites identified included the Mercury Refining Site and the former NL Site. [2]

### Historic construction activities related to 3-Mile Reservoir.

Aerial photographs were obtained for the area of 3-Mile Reservoir for the years of 1942, 1968 and 1974. Review of the earliest of these photos indicated that 3-Mile Reservoir was originally composed of two basins, one to the west and a second to the east that were separated by a dividing dam and spillway. It is apparent when comparing the 1942 and 1968 photographs that Interstate 90 (I-90) had been built across 3-Mile Reservoir, destroying the western basin and significantly reducing the size of the eastern basin.

On June 11, 2003, interviews were held with the City of Albany Water Department to gain an understanding of the historic use of 3-Mile Reservoir and how it may have been altered by the construction of I-90 and other storm water management projects. The Water Department confirmed that Patroon Creek and 3-Mile Reservoir was used for water supply purposes in the late 1800's and the western basin was designed to act as a sedimentation basin to reduce sedimentation rates in the eastern basin where water was collected for use. The Water Department indicated that they were not sure whether or not the construction of Interstate 90 included the dredging of 3-Mile Reservoir. The New York State Department of Transportation (DOT) was also contacted and interviewed concerning the construction of I-90. Through DOT records, Construction Drawings for I-90 along Patroon Creek were obtained. Based on the review of these drawings it was confirmed that the dam and gate of the western basin was removed, and I-90 was constructed over approximately 75% of the western basin and approximately 50% of the eastern basin. [2]

### Conceptual Site Model (CSM)

**Exhibit 1-3  
Patroon Creek Conceptual Site Model**

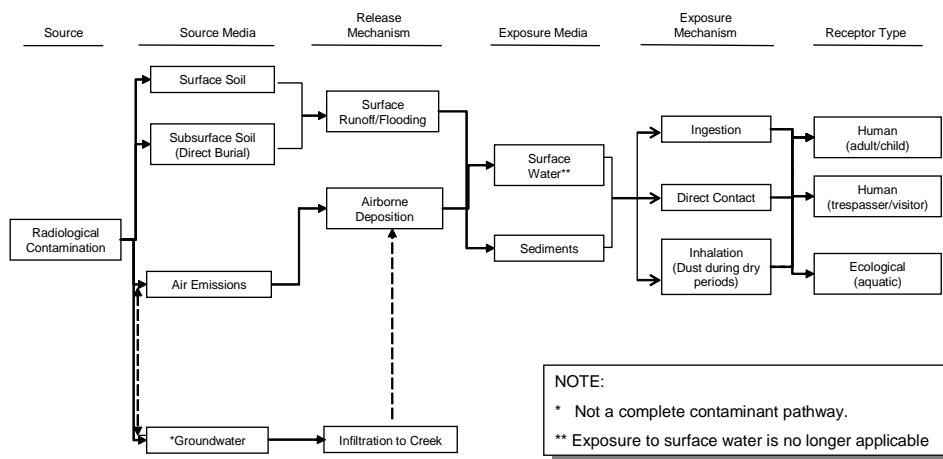


Fig. 3. Patroon Creek conceptual site model



## **TECHNICAL PROJECT PLANNING**

The SI field efforts were developed during a Technical Project Planning (TPP) meeting held in Colonie, New York, on July 16, 2003, between USACE – New York District, USACE – Baltimore District, USACE Hazardous, Toxic, and Radioactive Waste Center of Expertise (HTRW CX), the New York State Department of Environmental Conservation (NYSDEC), USEPA, the County of Albany Department of Health (DOH), and SUNY-Albany. The TPP was held to develop the basic input for a comprehensive Work Plan and Sediment Investigation Sampling and Analysis Plan.

## **SITE INVESTIGATION SAMPLING**

The field effort included the collection and analysis of sediment sample cores for radiation using from the following locations:

- Patroon Creek Upstream of Colonie Site: One sample (CSD-US1) was collected upstream of the Colonie FUSRAP Site.
- Unnamed Tributary of Patroon Creek: A total of seven samples (CSD-UT1 through 7) were collected from locations along the Unnamed Tributary that crosses the Colonie FUSRAP Site. Two sets of three transects (samples CSD-UT1/2/3 and CSD-UT5/6/7) were collected to represent a cross-section of the creek to account for various flow/sedimentation conditions.
- Patroon Creek: A total of four samples (CSD-PC1 through 4) were collected from locations along Patroon Creek. One sample was collected at the point where the Unnamed Tributary meets Patroon Creek. One sample was collected at a point between the convergence of the Unnamed Tributary meets Patroon Creek and before the sedimentation pool. One sample was collected from the sedimentation pool before Central Avenue and one sample was collected between Central Avenue and Three Mile Reservoir).
- Three Mile Reservoir: Samples were collected from a total of fifteen sample locations (CSD-3MR1 through 15). Transect locations were selected near the dam as that is where the previous core sample showed contamination and at the beginning of the transition section between Patroon Creek and Three Mile Reservoir where the old sedimentation basin was located and where the wetlands begin. In addition, two transects (CSD-3MR5/6/7 and CSD-3MR9/10/11) were selected as midpoints between the other two transects. Single sampling points (CSD-3MR4, CSD-3MR8 and CSD-3MR12) were located between transects along the path of the main flow. It was anticipated that the transects and individual points would provide information to determine the absence/presence of radiological contamination.
- Downstream of Three Mile Reservoir: A total of two samples (CSD-DS1 and CSD-DS2) were collected from locations downstream of the dam at the Three Mile Reservoir. The sample locations were selected in areas of sedimentation to determine if the material had moved downstream of Three Mile Reservoir.

Sediment samples from the upgradient location, Unnamed Tributary, Patroon Creek, and downgradient of Three Mile Reservoir were acquired from each location using a hand held Vibracore consisting of a back pack mounted 2 cycle engine concrete vibrator that attached to a sample coring device. A 5 cm diameter Lexan tube was used to core into the sediment. A dedicated tube was used for each sample location. From the Three Mile Reservoir, the sediment samples were collected using a barge mounted Rossfelder P-3 Vibracore. The Vibracore was equipped with a 10 cm diameter carbon steel barrel with a 10 cm Lexan inner barrel lined with a disposable polybutyrate liner. Capping and sealing of the cores was completed on the boat used for sample collection. Samples were screened using a Pancake Geiger-Mueller detector for radiological contamination. Samples were screened for radiological contamination over the entire core collected at 15 cm intervals. If detected, samples for off-site radiological confirmatory analysis were composited over the 15 cm area of the core detected with the highest radiological contamination. Samples for waste characterization were also collected from the interval exhibiting the highest radiological contamination. The radiological confirmation samples were collected first, followed by the waste characterization samples. If a sediment sample came back with less than 70% recovery, the sample location was moved over roughly one foot and a replacement sample taken, unless there was a definite detectable radioactive signature on the first core. Sampling depths in the upgradient locations, Unnamed Tributary, Patroon Creek, and downgradient of the Three Mile Reservoir were a minimum of 15-30 cm below organic top layer to ensure the collection of a representable sample. Samples were taken until the depth of refusal or a maximum depth of 0.9 m, whichever occurred first. For sampling in the Three Mile Reservoir, the sampling depth was a maximum of 2.7 m and a minimum of 2 m. A continuous core through the layer of interest was collected. [3]

## RESULTS

A total of 32 sediment samples were collected for field screening using a Pancake Geiger-Mueller (PGM) instrument. Results of the field screening using the PGM analysis were compared with 1.5 times the instrument background (recorded for each measurement) to aid in the selection of sediment samples for on-site High Purity Germanium (HPGe) analysis ( $\gamma$  spectroscopy) and off-site confirmatory analysis. Based on the PGM analysis, a sample was collected from each of the 32 sediment cores from the 15 cm interval exhibiting the highest PGM reading and analyzed on-site using an HPGe Gamma Spectrometry System. Eight of the 32 samples were also selected for off-site confirmatory analysis using  $\alpha$  and  $\gamma$  spectroscopy. Analytical results from the off-site confirmatory analysis were compared with NRC screening levels to determine the absence/presence of radiological contamination. Results from on-site HPGe analysis ( $\gamma$  spectroscopy) were not compared with screening criteria because the on-site analytical method over estimates the activity of U-238. The ranges of U-238 and Th-232 concentrations detected during the SI at various study areas from both the on-site HPGe and off-site confirmatory analyses are presented in Table I and Table II.

The SI generally reported U-238 and Th-232 concentrations that were similar to those detected at the upstream sample location CSD-US1, which represents sediment quality minimally impacted by storm water/sediment discharges from the Colonie FUSRAP Site. The only exceptions were two samples (CSD-UT2 and CSD-UT3) collected from the Unnamed Tributary, immediately downstream of the site, that exhibited U-238 levels of 141 pCi/g and 185 pCi/g, respectively,

based on off-site  $\alpha$  spectroscopy analysis. The levels detected at CSD-UT2 and CSD-UT3 were more than an order of magnitude higher than those detected at the upstream location (0.273 pCi/g). The Th-232 levels at these two locations (1.45 pCi/g and 1.33 pCi/g) slightly exceeded the Th-232 levels detected at the upstream location (0.637 pCi/g). Two locations (CSD-UT4A and CSD-UT44B) sampled downstream of CSD-UT2 and CSD-UT3 define the extent of the contamination at this location. At location CSD-UT1B, the detected U-238 concentration of 9.8 pCi/g was an order of magnitude lower than that detected during the 1992 USDOE investigation. Th-232 was detected at CSD-UT1B at a concentration of 0.8 pCi/g.

Elevated levels of U-238 were detected in the Eastern Basin of the Three Mile Reservoir within an area extending from sample locations CSD-3MR5/6/7 up to and including CSD-3MR9/10/11. Samples collected from this area generally exhibited U-238 concentrations (9.5-24.5 pCi/g) twice those detected at the upstream location (7.8 pCi/g) for the on-site analysis. However, the concentrations detected in the off-site analysis for U-238 (8.33-16.6 pCi/g), which were based on  $\alpha$  spectroscopy and hence more sensitive, were more than an order of magnitude higher than those detected at the upstream location (0.273 pCi/g).

The sediment cores at CSD-3MR9, CSD-3MR10, and CSD-3MR11 are located in the general vicinity of the previous sample collected by SUNY-Albany that had indicated the presence of U-238 at 39.5 pCi/g. During the SI, the highest U-238 concentration observed in this area was 24.5 pCi/g, which was detected at CSD-3MR10 at a depth interval of 4-4.5 ft bgs. Elevated levels of radiological parameters were not observed beyond the CSD-3MR9/10/11 transect within the Three Mile Reservoir or downstream of the reservoir dam. [4]

Table I. NRC Screening Level Analysis

<b>Sample ID</b>		CSD-US1-010	CSD-UT2-015	CSD-UT3-020	CSD-PC1-005
<b>Depth</b>		0.30m - 0.45m bgs	0.45m - 0.61m bgs	0.61m - 0.76m bgs	0.30m - 0.45m bgs
<b>Date Collected</b>		11/7/2003	11/5/2003	11/6/2003	11/5/2003
<b>Sample Type</b>		Sediment	Sediment	Sediment	Sediment
<b>Analyte</b>	<b>Units</b>	SOR=%	SOR=1848%	SOR=2104%	SOR=26%
U-238	%	0.0	1000.3	1314.6	0.0
Th-232	%	0.0	67.3	56.4	26.4
U-234/235	%	0.0	780.4	733.3	0.0
<b>Sample ID</b>		CSD-3MR-05A-060	CSD-3MR-07A-035	CSD-3MR-10A-040	CSD-DS1-005
<b>Depth</b>		1.83m - 1.98m bgs	1.07m - 1.22m bgs	1.36m - 1.53m bgs	0.30m - 0.45m bgs
<b>Date Collected</b>		10/30/2003	10/30/2003	10/29/2003	11/3/2003
<b>Sample Type</b>		Sediment	Sediment	Sediment	Sediment
<b>Analyte</b>	<b>Units</b>	SOR=54%	SOR=138%	SOR=154%	SOR=%
U-238	%	52.6	95.3	111.7	0.0
Th-232	%	0.0	0.0	0.0	0.0
U-234/235	%	1.7	42.5	42.5	0.0

Table II. Data Comparison with Cleanup Criteria

<b>Sample ID</b>		CSD-US1-010	CSD-UT2-015	CSD-UT3-020	CSD-PC1-005	Colonie FUSRAP Site Cleanup Criteria <sup>2</sup>	
<b>Depth</b>		0.30m - 0.45m bgs	0.45m - 0.61m bgs	0.61m - 0.76m bgs	0.30m - 0.45m bgs		
<b>Date Collected</b>		11/7/2003	11/5/2003	11/6/2003	11/5/2003		
<b>Sample Type</b>		Sediment	Sediment	Sediment	Sediment		
<b>Analyte</b>	<b>Units</b>	Result	Result	Result	Result		
U-238	pCi/g	-0.7	140.0	184.0	-0.6		35
Th-232	pCi/g	-0.1	0.7	0.6	0.3		2.8
U-235	pCi/g	0.0	5.0	4.7	0.0	--	
<b>Sample ID</b>		CSD-3MR-05A-060	CSD-3MR-07A-035	CSD-3MR-10A-040	CSD-DS1-005	Colonie FUSRAP Site Cleanup Criteria <sup>2</sup>	
<b>Depth</b>		1.83m - 1.98m bgs	1.07m - 1.22m bgs	1.36m - 1.53m bgs	0.30m - 0.45m bgs		
<b>Date Collected</b>		10/30/2003	10/30/2003	10/29/2003	11/3/2003		
<b>Sample Type</b>		Sediment	Sediment	Sediment	Sediment		
<b>Analyte</b>	<b>Units</b>	Result	Result	Result	Result		
U-238	pCi/g	7.4	13.3	15.6	-0.8		35
Th-232	pCi/g	-0.3	0.0	-0.1	0.0		2.8
U-235	pCi/g	0.0	0.3	0.3	0.0	--	

## CONCLUSIONS

The data collected during the SI indicated that the U-238 site soil cleanup criterion was exceeded in sediment samples collected from two locations within the Unnamed Tributary (CSD-UT2 and CSD-UT3) just down stream of the site. Concentrations of U-238 and Th-232 in all other off-site sediment samples collected from the Unnamed Tributary, Patroon Creek, and the Three Mile Reservoir indicate that no further action is required at these areas. Future action from impacted sediment at the Unnamed Tributary will be further evaluated. It is important to note that the comprehensive sampling performed by Shaw was not able to reproduce the results of the single sample collected by SUNY and differences in results are attributed to sampling techniques.

To address NRC requirements for a site-specific dose assessment when contamination levels exceed screening criteria, the off-site analytical data from the SI were compared with the site-specific cleanup criteria developed for the Colonie FUSRAP Site. The dose-based assessment for the Colonie FUSRAP site using an urban resident exposure scenario indicates that U-238 and Th-232 cleanup criteria of 110 pCi/g and 2.6 pCi/g meet NRC requirements for unrestricted release. The Colonie FUSRAP Site dose-based criteria are based on exposure to surface soil and are, therefore, a conservative comparison with contaminants detected in sediment. The concentrations of U-238 and Th-232 observed in most of the off-site analytical data are less than the dose-based criteria developed for the Colonie FUSRAP site.

To be consistent with previous USDOE commitments, USACE is remediating the Colonie FUSRAP site soils to a U-238 concentration of 35 pCi/g, which is less than the dose-based criterion. The U-238 and Th-232 site soils cleanup criteria used at the Colonie FUSRAP Site represent values in excess of the established background values for these contaminants (0.96 pCi/g and 0.71 pCi/g, respectively (BNI, 1992)). The concentrations of U-238 and Th-232 observed in most of the off-site analytical data are less than the cleanup criteria selected for the Colonie FUSRAP Site.

The data were also compared to ecological screening criteria. None of the contaminants of concern (U-238, Th-232, and U-235) had concentrations exceeding the screening values. The evaluation indicated no adverse impacts to ecological receptors.

## **REFERENCES**

1. USACE, July 2005, *Operations Work Plan, Colonie FUSRAP Site*
2. Shaw Environmental & Infrastructure, July 2003, *Technical Memorandum, An Overview of the Patroon Creek Watershed, Albany, New York*
3. USACE, October 2003, *Site Investigation Sampling and Analysis Plan, Unnamed Tributary of Patroon Creek, Patroon Creek, and Three Mile Reservoir*
4. USACE, September 2004, *Site Investigation Report, Unnamed Tributary of Patroon Creek, Patroon Creek, and Three Mile Reservoir*