FINAL

GREAT KILLS PARK TIME CRITICAL REMOVAL ACTION COMPLETION REPORT

Great Kills Park

Staten Island, New York

Contract No. W912BU-13-C-0010

Prepared for:

NATIONAL PARK SERVICE

and

U. S. ARMY CORPS OF ENGINEERS

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June 2015

By their specific signature, the undersigned certify that this Gamma Survey Data Analysis Report was:

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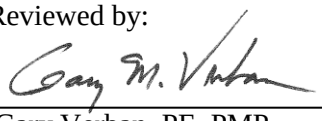

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

%	Percent
^{226}Ra	Isotopes of radium: radium-226
ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHMM	Certified Hazardous Material Manager
CHP	Certified Health Physicist
DOE	Department of Energy
DOHMH	Department of Health and Mental Hygiene
DPT	Direct Push Technology
DQCR	Daily Quality Control Reports
DQO	Data Quality Objective
DTSR	Daily Toolbox Safety Reports
EPA	U.S. Environmental Protection Agency
FOV	Field of View
Ft	Foot
GATE	Gateway National Recreation Area
GKP	Great Kills Park
GM	Geiger-Mueller
IDW	Investigative Derived Waste
IRA	Interim Response Action
mR/hour	milliRoegten per hour
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPS	National Park Service
NYPD	New York City Police Department
OSHA	U.S. Occupational Safety and Health Administration
PM	Project Manager
PMP	Project Manager Professonal
RPP	Radiation Protection Plan
RSP	Radiation Safety Program
TCRA	Time Critical Removal Action
TIDEWATER	Tidewater, Inc.
uR/hr	microRoentgen per hour
USACE	United States Army Corps of Engineers

1.0 INTRODUCTION

Tidewater, Inc. (TIDEWATER) was contracted by the U.S. Army Corps of Engineers (USACE) Philadelphia, under Contract No. W912BU-13-C-0010 to perform a Time Critical Removal Action (TCRA) at the Great Kills Park Site (GKP or the Site). Great Kills Park is located within the Staten Island Unit of Gateway National Recreation Area, New York (GATE) (**Figure 1**).

The TCRA was undertaken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §§ 9601 *et seq.*, and its associated regulations, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. The National Park Service (NPS) has been delegated CERCLA response authority to respond to releases or threatened releases of hazardous substances on or from a facility under the jurisdiction, custody or control of NPS. NPS is the lead CERCLA agency for this and other response actions taken or to be taken at the Site. Based upon conditions at the Site and the NCP criteria for evaluating whether a removal action is appropriate, outlined in 40 CFR § 300.415(b)(2), NPS determined that the release of hazardous substances at the Site posed a threat to public health, welfare, and the environment and that removal action should be implemented as soon as possible. Under an interagency agreement, the NPS tasked the USACE to assist in managing the TCRA at the Site.

The TCRA Action Memorandum, signed July 31, 2012, authorized the following response actions:

- Cutting back vegetation to perform a gamma survey over 100% of the accessible waste filled areas of the park.
- Performing a gamma survey designed to identify the presense of orphan sources[1] and areas with elevated radioactivitiy or hot spots.[2]
- Excavating orphan sources and storing and transferring them to a permitted disposal facility.
- Removing radioactively-contaminated surface and shallow subsurface soil associated with the hot spots identified during the radiological surveys.

The TCRA met the Action Memorandum short term goals of reducing risk to human helath and the environment. As described in more detail in this report, based on the results of the TCRA investigation future response action at the Site is necessary. The TCRA is one phase of an ongoing CERCLA response action at the Site.

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[1] ^{226}Ra sources are termed “orphan sources", which refers to sealed sources of radioactive material contained in a small volume in any of the following conditions:

a. In an uncontrolled condition that requires removal to protect public health and safety from a radiological threat;

b. Controlled or uncontrolled, but for which a responsible party cannot be readily identified;

c. In the possession of a person, not licensed to possess the material, who did not seek to possess the material (NRC, 2010).

[2] Hot spots are areas with gross external gamma radiation readings greater than two times the background radiation level.

1.1 Site Description

GATE is a 26,607 acre National Recreation Area in the New York City metropolitan area comprising three separate units: Jamaica Bay Unit (Brooklyn and Queens), Staten Island Unit, and Sandy Hook Unit, which is located on the northern shore of New Jersey. The Staten Island Unit is located on the southeast shore of Staten Island within Lower New York Bay and includes Fort Wadsworth, Miller Field, Hoffman and Swinburne Island, and Great Kills Park.

Great Kills Park comprises approximately 523 acres in the vicinity of the Raritan and Lower Bays of Great Kills Harbor, in the borough of Staten Island. In 1933, under the direction and administration of the Commissioner of the City of New York Department of Parks, the City initiated the Marine Park Project to develop the Great Kills Harbor and vicinity as a shorefront recreation area. In conjunction with the Marine Park Project, the City created, and the New York Department of Sanitation ("DSNY") operated the waste filled area between November of 1944 and July of 1948. During its operation, DSNY transported by barge and truck and disposed at the waste filled area approximately 15 million cubic yards of waste. The waste filled area was then capped with clay and sludge reclaimed from City sewage.

After completing landfilling operations at waste filled area, the City operated Great Kills Park as a City park until the property was transferred to the United States in 1972 and became part of the Staten Island Unit of Gateway National Recreation Area under the jurisdiction of NPS. The waste filled area footprint comprises approximately 265 acres of Great Kills Park. Of those 265 acres, 47 acres are owned by the City of New York.

Great Kills Park contains recreational activities for members of the public, including but not limited to, a beach house, hiking and biking trails, fishing areas, boat launch ramp and associated parking areas. Swimming beaches are located along the southeastern and southwestern portions of the park. A marina is located at the western side of the park.

Overall annual visitation at the park had been approximately 155,000 visitors prior to the discovery of radiological contamination discussed in Section 1.2. Great Kills' NPS Park Rangers led an average of 120 programs including 55 school groups, for 6,550 participants (3,360 children). The park provided multiple trails for running, bicycling, and walking, sports fields, a model airplane flying field, areas for dog walking, fishing and nature observation.

Approximately 330 species of birds have been observed throughout Gateway National Recreation Area. The location of the park along the Atlantic flyway at the base of the Hudson corridor makes it a significant site for migratory species in particular. A number of other animal species inhabit Gateway National Recreation Area as well, including approximately 27 species of mammals, and 25 species of reptiles and amphibians.

Figure 1. Site Location and Grid System

1.2 Previous Investigations and Site Activities

A chronology of previous investigations and Site activities is below. The TCRA is one phase in NPS's ongoing response action under its delegated CERCLA Section 104 authority.

August 2005, the New York City Police Department (NYPD) and the U.S. Department of Energy (DOE) conducted an aerial survey of New York City to develop a baseline radiological map of the city. The NYPD survey identified an elevated radiation reading in a densely vegetated area of Great Kills Park. NYPD, DOE, and NPS immediately conducted an on-site investigation and determined there was no apparent law enforcement or security issue. As a precautionary measure, NPS closed the area to the public pending further investigation.

- On August 3, 2005, in response to the aerial discovery, the U.S. Environmental Protection Agency (EPA) conducted a radiological survey confirming that an area along the park's "fire break" had above-background, but relatively low-level, radiation readings. This survey also identified the source of the readings as radium-226. NPS further restricted access to the area by erecting a fence and allowing the area to revegetate.

- In November 2006, NPS initiated a CERCLA Preliminary Assessment (PA) Report for Potential Radiological Contamination at the Site.

- In March 2007, while that PA was in progress, there was a brush fire at the Site. Following that fire, NPS surveyed the burned area and found an additional area with elevated radiation readings. NYPD and DOE confirmed those readings.

- April 2007, NYC Department of Health and Mental Hygiene (DOHMH) conducted a limited gamma radiological survey of the public access areas in the Park. NYC DOHMH identified three more areas with elevated readings. NPS installed additional fencing to isolate the newly identified areas.

- On May 25, 2007, the Agency for Toxic Substance and Disease Registry (ATSDR) completed a consultation to evaluate potential hazards to public health posed by the radiological contamination at the Site. The ATSDR report concluded that the areas posed an "Indeterminate Public Health Hazard." ATSDR also reported that past exposures were not expected to be a health hazard for several reasons, including: the significant drop in readings three feet away from the peak readings, the unlikelihood that anyone would remain on any of the hot spots for an extended period of time (i.e., three hours or more), and the fact that only five distinct areas were identified with elevated readings.

- August 2007,NPS completed the Preliminary Assessment (PA). The PA concluded that the radiological contamination at the Site appeared to be focused in five locations and comprised radium-226 and its decay products. It further concluded that the radiological contaminants identified were not likely to pose an immediate health risk to park users, particularly because NPS had limited access to the five suspect areas with fencing. The PA recommended that the identified radiologically-contaminated material be removed and disposed, with follow-up confirmatory screening, and that any future detections of radiological contamination be handled in a similar fashion.

- In January 2009, NPS conducted an interim response action consisting of performing further radiological surveys and removing radiological materials. This action identified a total of

fourteen hot spots. Seven of these hot spots were in the five areas previously identified and discussed above. The other seven were new discoveries. Seven hot spots were prioritized for removal based on accessibility by the public and highest survey results. During excavation two radium sources were recovered. Due to the discovery of these additional hot spots and the subsequent removal of two radium sources in public-use areas, NPS closed the area to all public access.

- On October 14, 2010, NPS issued an Approval Memorandum to conduct an Engineering Evaluation and Cost Analysis (EE/CA) at the Site to evaluate non-time critical removal action alternatives. An EE/CA is performed to determine the nature and extent of contamination, assess the risks posed to human and ecological receptors from the contamination, identify and evaluate removal action alternatives to address unacceptable risk, and identify a recommended removal action alternative that best meets the evaluation criteria.

- On February 2, 2012, NPS staff were cutting back vegetation along Wetland Road, east of Buffalo Street for fire protection. Following established safety procedures, the work area, equipment, and employees were checked for elevated radiation readings. Three distinct hot spots were identified in an area east of Buffalo Street and south of Wetland Road. Subsequent testing of this area by U.S. Army Corp of Engineers (USACE) confirmed the three readings and located a fourth within the same area. The source of the readings was identified as radium-226.

- June – August 2012, At NPS request, USACE conducts walk-over gamma surveys of the multi-use path along Buffalo Road, trails around the Education Field Station, Bulkhead Road and Bulkhead Road fishing area. No additional elevated readings were found and these public use areas remain open.

- On July 31, 2012, National Park Service, Northeast Regional Director, signed an Action memorandum approving the decision to conduct a time-critical removal action (TCRA) at Great Kills Park. The EE/CA would be put on hold in order to conduct a TCRA to expedite the identification and removal of radioactive contamination which posed an immediate risk to human health and the environement. Once the TCRA is completed, the NPS would evaluate if futher action is warranted at the Site.

- December 2012, USACE awarded a contract to TIDEWATER to conduct the TCRA at the Site. This report documents the activities completed by TIDEWATER and their subcontractors under this contract.

2.0 SUMMARY OF EVENTS

Table 1 below provides a summary of the work performed as a part of the TCRA.

Daily Quality Control Reports (DQCRs) and Daily Toolbox Safety Reports (DTSRs) are provided in **Attachments A** and **B**, respectively, which detailed the daily activities performed on-Site. **Attachment C** provides Incident Reports which occurred during field activities.

Table 1. TCRA Summary of Events

Activity	Period	Comment
Shrub and Phragmites Clearing	January 2013 – March 2013	Prior to performance of gamma surveys, heavy undergrowth was required to be removed to provide access for the gamma survey. NPS personnel were consulted to assure that sensitive habitats such as the tidal creek and wetlands, and important plant species were not damaged or destroyed. Only brush under two inches in diameter at breast height was cleared. Flagged and NPS-listed protected trees were not damaged. Progress maps were submitted to the USACE periodically to show progress of brush clearance activities. Initial clearing of Site was primarily focused in the central portion of the Site. Obstructions including large debris (eg. concrete forms, abandoned car) and clusters of downed trees caused delays in clearing the vegetataion. Brush clearing was suspended in March to prevent disturbance of bird nesting areas.
Security Fencing	January 2013 – March 2013	Fencing was installed along roadways and access points along the perimeter of the waste filled area to preclude entry. Warning signs were posted on the fence line to notify the public of potential risks associated with the Site. **Attachment G** provides a map of the location of fencing installed around the Site.
Surface Scanning	January 2013 – May 2013	Drive over and walkover gamma surveys were performed over the portions of the Site cleared of vegetation. This initial survey data showed widespread presence of elevated radioactivity, most readings were less than 2 mR/hour on contact but above two times background.
Fill Area Delineation	July 2013	Thirty-five (35) soil borings were accomplished along the northern, eastern, and southern sides of the Site. The borings went four (4) to eight (8) foot below ground surface using direct push technology (DPT) to determine the lateral extent of the waste fill area (**Attachment F**).
Technical Project Planning Meeting	July 30 – 31, 2013	The Project Management Team met to clarifiy actions needed for completion of TCRA based on the changes in

Table 1. TCRA Summary of Events

Activity	Period	Comment

		Site conditions including; the significant number of obstructions inhibiting the gamma survey and the widespread nature of the readings of elevated radioactivity. Based upon the meeting, the Project Management Team determined that:
		• Continued vegetation clearing and downed tree removal in select locations to decrease data gaps;
		• Completion of gamma survey;
		• Determination of excavation locations prioritization based on following critera:
		  • Locations exceeding greater than 2mR/hr.
		  • Removal of approximately 30 to 35 locations within the fenced area in areas adjacent to roadways in order to reduce risk to emergency response personnel, park staff, and trespassers.

Shrub and Phragmites Clearing	January 2014 – March 2014	Completion of the vegetation clearing of the Site.
Tree Clearing	March 2014	Several hundred downed trees were moved from their locations to allow for gamma survey of those areas. Stumps were left in their current locations and were not transported with the whole of the tree. Downed tree trunks were chipped onsite or consolidated in various locations within the Site. A total quantity of 1200 CY of woodchips were generated from the downed trees. Generated mulch was sampled, analyzed, and placed onsite, along Fire Road for road base.
Surface Scanning	January 2014 – May 2014	Drive over and walkover gamma surveys were completed over the remaining areas. Due to the various data collection methods used, data were normalized using a Z-score approach based upon a 1 acre grid system (Figure 1). Individual grid data packages, which include individual grid results, statistics, charts, z-score plots, and kriging plots, are provided in **Attachment B** to this report.
Decontamination Pad Installation	April 2014	Quarried stone was imported and placed at four locations throughout the Site. The areas were covered with visqueen or similar material and then covered with the quarried stone. The locations were set up for use by emergency response vehicles in the event vehicles and or equipment had entered the contaminated area and require decontamination.

Table 1. TCRA Summary of Events

Activity	Period	Comment
Dose Assessment Study	May 2014	After completion of excavation and removal of radioactive objects, a risk assessment was performed for firefighters, park rangers/law enforcement, maintenance workers, requiring routine limited access to the waste filled area, and for members of the public who might occupy areas adjacent to the waste filled area and trespassers. Five general locations were selected for sampling of soil, roots, and vegetation to determine potential plant uptake of radiological contamination. Locations were selected based upon gamma survey data showing elevated levels of gamma radiation. Additional dose measurements were collected at various points throughout the Site at contact and at waist height to determine potential dose to receptor. See section 5.2 for a summary of the report findings. The full Dose Assessment Report has been included as **Attachment L** to this report.
Additional Security Fencing & Gates	May 2014	Fencing was installed in areas south of the Education Building and three gates were installed at various access points to preclude entry. Warning signs were posted on the fence line to notify the public of potential risks associated with the Site.
Public Meeting	May 2014	An informational public meeting was held for the public to provide updated information of project activities. Public meeting included scanning results, contamination identification, and planned future activities/program for the Site.
Fill Area Delineation	July 2014	Sixteen (16) additional soil borings were performed along the eastern boundary of the Site to determine the lateral extent of the waste fill beyond the NPS legistlative boundary on New York City property. (Attachment F)
Source Removal Actions	February 2013 June 2014 – July 2014	Two locations exceeding the dose limit of 2 mR/hr were excavated and stored on-site. Based upon the gamma scanning evaluation, thirty (35) locations were selected for source recovery. Five (5) locations where dose measurements exceeded 2 mR/hour on contact and an additional 30 locations were selected using the criteria developed in the TPP (see TPP). Locations of elevated levels were excavated to a depth of 3 ft below ground surface or until the source of radiological

Table 1. TCRA Summary of Events

Activity	Period	Comment
		contamination was identified and removed. Confirmation surveys and sampling was performed post-removal. Waste characterization samples were collected to establish waste profiles.
Wastse Disposal	January 2015	Investigation derived waste (IDW) from recovery operations was re-packaged, labeled, and shipped to an appropriate disposal facility. **Attachment P** provides information regarding waste disposal.

3.0 QUALITY CONTROL/QUALITY ASSURANCE

All work was performed under the supervision of the US Army Corp of Engineers New York and Baltimore. DQCRs and DTSRs were submitted to USACE and NPS as a means of tracking progress and quality of work.

3.1 Construction Quality Control/Quality Assurance

All equipment used for the purpose of brush clearance was inspected prior to use. **Attachment D** provides the equipment inspection forms.

Areas where brush clearance was completed were inspected by the USACE representative prior to approval to proceed with radiological surveys. **Attachment N** provides the sign-off forms by the USACE representative.

3.2 Radiological Quality Control/Quality Assurance

Instrumentation used to perform radiological surveys was subject to Radiation Protection Plan prepared by TIDEWATER. Instrumentation used was response checked prior to use. **Attachment E** provides the instrument quality control checks.

3.3 Off-Site Laboratory Quality Control/Quality Assurance

Samples collected from the Site and sent to accredited off-site labs were subject to validation. **Attachment Q** provides associated reports from the laboratory.

4.0 PLANS AND REPORTS

All work was performed in accordance with approved work and safety plans. Work was performed in accordance with TIDEWATER's Radiation Protection Plan (RPP), and other applicable health and safety regulations including TIDEWATER's *Radiation Protection Program* (RPP), and those of the U.S. Nuclear Regulatory Commission (NRC), New York State Department of Health, and U.S. Occupational Safety and Health Administration (OSHA). TIDEWATER's standard operating procedures referenced in the Accident Prevention Plan and the Site-Specific Health and Safety Plan were implemented. TIDEWATER provided the Field Site Manager, Site Safety and Health Officer, and the Site Radiation Safety Officer during all activities. Based upon changes in approach and conditions, plans were revised as necessary. Project plans are provided in **Table 2** below.

Table 2. TCRA Plans

Plan	Revision	Date of Issue
TCRA Work Plan	1	January 2014
TCRA Site-Specific Health & Safety Plan	3	January 2014
TCRA Accident Prevention Plan	3	January 2014
TCRA Radiation Protection Plan	1	January 2014

4.1 Radiological Data Analysis Report

The radiological survey performed under this TCRA was conducted in the winter of 2013 and finished during the winter of 2014. Lessons learned during the first phase of the survey conducted in winter 2013

were applied to the completion of the survey in winter 2014. As a result, differing methods and instrumentation was used. As a way of normalizing the data, USACE contracted TIDEWATER to evaluate the different radiological survey data packages completed under the TCRA at Great Kills Park. The basis of the evaluation was for the purpose of determining completeness for the TCRA objective of the identification of orphan sources, such as radium needles. The TCRA was based upon the detection/identification of the orphan sources, which may have contained potentially 1 or greater milligrams of ^{226}Ra. The TCRA radiological survey approach was designed to detect ^{226}Ra source material to a depth of 3 feet below ground surface (bgs).

The analysis included the evaluation of:

- Detector field of views (FOVs) for detection of differing levels and depths of ^{226}Ra activity for the various methods and instrumentation.
- Establishment of a statistical boundary grid.
- Statistical evaluation of data subsets by grids.
- Normalization of data subsets.
- Graphical evaluation of normalized data sets.
- Determination of data gaps.

Based upon the statistical analysis, it was determined that the results were skewed from normal bell shaped distribution due to contaminated area surveys and differing material matrices. The majority of the grids contained statistical outliers indicating contaminants in excess of background.

Graphical analysis performed of the data sets based upon the parameters established for the study were accomplished using two methods (classed post and kriging).

The class post (color coded post based upon data ranges) and kriging plots (plots based upon interpolated data) were used in conjunction for the identification of elevated radiological locations and to determine the completeness of the survey coverage. **Attachment D** to the report provides a summary of the number discrete areas identified for each grid based upon these plots. The identification of discrete areas was a subjective task and open to interpretation.

The Radiological Data Analysis Report has been included as **Attachment H** to this report.

4.2 Dose Assessment Report

TheDose Assessment Report provides a post- TCRA dose assessment for firefighters, park rangers/law enforcement officers, maintenance workers, nearby residents, and trespassers from residual radioactivity at the Site. The methodology is conservatively representative of current Site conditions after removal of isolated areas of elevated activity from surface/near-surface locations. Additional data from the samples collected from the removal actions across GKP were used to represent an upper bounding of the existing radioactive concentration. Additionally, ten locations were selected as those areas with the best potential to demonstrate the uptake by vegetation and samples were analyzed by gamma and alpha spectroscopy to identify the Radionuclides of Concern (ROC). ROCs were identified as radium-226, natural uranium, and thorium-232. The natural uranium was assumed to be ore grade material, the radium was chemically separated at least 100 years ago, while no assumptions as to the physical or chemical properties of the thorium were made although ingrowth of decay progeny was assumed for all ROCs.

Doses were calculated for three exposure pathways: external, inhalation, and ingestion for five critical groups, summed for one year. The report describes the parameters and assumptions such that a dose recalculation may be made to accommodate any other scenario.

- Radiological doses from fires were calculated with the sample result data and conservative atmospheric models for the firefighter and the nearby resident to GKP.

- The assumptions for the trespasser are conservative as it is assumed that a trespasser disobeys all fencing/signage, spends 250 hours in a contaminated area, stays on established roads and trails, and does not do intrusive activities over the course of a year. This trespasser represents the worst case developed with a resultant dose of less than 10 mrem accumulated in a year.

- A Gaussian Dispersion Model was used in the dose assessment for the off-site resident. As the dispersion model has a minimum required distance from the fire of 100 meter, a box model was developed for the fireman who is routinely very near the fire and potentially in smoke.

- An assumption was made that the maintenance worker would be restricted from digging, performing excavations, or making entry into confined spaces such as the storm sewer system. Confined spaces entry should be restricted as no radiological data is available.

- The soil concentration averages used in this report do not represent an average for the Park as samples collection was targeted at the higher dose rate locations. Actual soil and vegetation averages will be much less and the doses calculated represent a worst case conservative estimate.

Given the conservative parameters and assumptions used in this report, it is not probable that under current Site restrictions (including no intrusive activities), a Fire Fighter, a Maintenance Worker, or Park Ranger/Law Enforcement Officer, a nearby resident, or trespasser will exceed the Nuclear Regulatory Commission's (NRC) regulatory limit of 25 mrem in a year above natural background. It should be noted that concentration levels of the magnitude which would have resulted in a dose of 25 mrem in a year would have been detected and removed during the TCRA as both the required concentration and its surface proximity would have made the radioactive materials readily identifiable by the TCRA gamma survey process.

The full Dose Asssment Report has been included as **Attachment L** to this report.

5.0 KEY PROJECT PERSONNEL

The key personnel associated with the TCRA, their responsibilities, and contact information are shown below in **Table 3**.

Table 3. TCRA Key Project Personnel

NAME	RESPONSIBILITY	E-MAIL
Kathleen Cuzzolino	NPS Environmental Protection Specialist	Kathleen_Cuzzolino@nps.gov
Sterling Johnson, PMP	USACE Project Manager	Sterling.H.Johnson@usace.army.mil
Michelle Bertolin	USACE Contracting Specialist	Michelle.J.Bertoline@usace.army.mil
Chris Hallam, CHMM	USACE Health Physicist	chris.hallam@usace.army.mil
Rodrigue Noel	USACE Project Engineer	Rodrigue.Noel@usace.army.mil
Bruce Reynolds, CHMM	Program Manager, TIDEWATER	bruce.reynolds@tideh2o.net
Clif Gray	Project Manager, TIDEWATER	clif.gray@tideh2o.net
Claude Wiblin, CHP	Corporate RSO	claude.wiblin@tideh2o.net
Bennie Cole, III.	Site Rad Safety Lead	bcole@siasolutionsllc.com
Shane Reese	Site Safety Lead	shane.reese@tideh2o.net

6.0 APPROPRIATE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Section 300.415(j) of the NCP provides that removal actions shall, to the extent practicable considering the exigencies of the situation, attain applicable or relevant and appropriate requirements (ARARs) under federal environmental or state environmental or facility siting laws. 40 CFR 300.415(j). The TCRA Action Memorandum identified potential ARARs for the TCRA, primiarly focusing on standards for protection against radiation. It was not practicable given the exigencies of the situation -the scope of the TCRA and the widespread nature of the contamination- to achieve the ARARs for protection against radiation. Although these actions are protective of public health in the short term, additional investigation concerning the nature and exent of the radiological contamination and a thorough evaluation of alternatives is needed in order to ensure the remedy selected will be fully protective of human health and the environment. In order to protect public health in the short term, NPS excavated 37 hot spots and put site controls in place to restrict access to the remaining contaminated areas. The potential identified ARARs from the TCRA Action Memorandum will be evaluated through the course of the future and more comprehensive response actions at the Site.

7.0 CONCLUSIONS

The TCRA is one phase in NPS's ongoing response action under its delegated CERCLA Section 104 authority. Based upon field investigations, the next phase of the response action, or a remedial investigation (RI) and feasibility study (FS), is required at the Site. The RI will fully characterize the

nature and extent of contamination, including radiological and chemical constituents, and assess potential risks to human health and the environmental associated with exposure to the contamination. The FS will develop and evaluate appropriate remedial alternaitves to address potential risks to human health and the environmental and attain ARARs related to the hazardous substances at the Site. This conclusion is based upon the following reasons:

- **Waste Filled Area Delineation** –The southeast waste filled area boundary of the Site has not been delineated south of Chesterton Ave as access was limited by a creek bed and terrain.
- **Radiological Surface/Near-Surface Survey Results** – Once vegetation was cleared, the gamma surveying evaluation identified more than 1,200 discrete areas of elevated radiological readings. More than 100 of these locations produced measurements greater than 0.1 mR/hour at ground surface; five locations produced measurements greater than 2 mR/hour with the highest surface reading of 20 mR/hour, or more than 20,000 times the natural background dose rate for GKP of 0.010 mR/hr. Of the 297 one acre grids evaluated, only 22 grids had results equivalent to natural background. The widespread nature of elevated radioactitvity at the Site warrants further investigation and evaluation.
- **Radioactive Materials At Depth** –Locations were selected for source recovery based upon elevated dose rates at the surface. In several locations surface dose rates were between 25 and 50 microrem per hour (urem/hr) but upon removal of surface cover (six inches), the dose rate increased and in at least 2 locations exceeded 10 mR/hour. One location, E9-09, contained several hundred individual radium markers. These markers were approximately 0.75 inches in length, white in color and an elongated oval shape and the resulting dose rate of the excavation (three feet below ground surface) was greater than 20 mR/h. The observed potential for significantly increased radioactivity at depth where only moderate increases in surface measurements were indicated should be further investigated and evaluated.
- **Contaminants of Concern** – During the source recovery activities, waste characterization, and dose assessment study, additional potential contaminants of concern were identified. These included lead, natural uranium, and thorium-232. The full nature and extent of these contaminants have not been determined.
- **Security -** Currently, the NPS has restricted public access to the Site by implementing a four (4) foot tall fence with "Danger Hazardous Area" signs posted every 25 feet as a site control. The fence has been cut or pushed over in places along its length that has allowed access to restricted areas of the Site containing hazardous substances. During on-Site activities, contractors observed unauthorized entry to the restricted area by members of the public who bypassed barricades, fences, and warning signs (including cutting the fence) to enter the Site. In one instance, workers observed a member of the public operating a metal detector and disturbing the ground within the restricted area. The contractor instructed the individual to leave the restricted area, provided the individual with contact information for NPS, and called US Park Police to report the incident. In addition, unauthorized entry has resulted in the theft of contractor property from within the restricted area.

  In response to the frequent trespasses, NPS regularly monitors the fence line, makes repairs to broken fence, and replaces signs. NPS replaced barricades used to block entrances to the restricted area with chain link gates. However, based upon the observations of continued trespassing, incident of theft, and the future activities to be performed for the characterization of the Site under the remedial investigation (RI), it is recommended that a more substantial barrier be installed to prevent access by members of the public. Increasing site security and restricting public access during the RI through a more substantial barrier will minimize risks posed to public

health from releases or threats of releases of hazardous substances at the Site. Additionally, a more substantial barrier will reduce the likelihood for unauthorized access to contractor equipment and materials stored on-Site during the RI.

8.0 REFERENCES

NPS 2012 Action Memorandum, National Park Service to Department of Interior, Letter dated June 22, 2012.

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