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Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, California 92132-5190

CONTRACT NO. N68711-98-D-5713
CTO NO. 0073

RADIOLOGICAL SURVEY PLAN

Revision 0
March 26, 2004

CERCLA TIME-CRITICAL REMOVAL ACTION
HISTORIC OUTFALL 4S
AT THE FORMER
MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA
DCN: FWSD-RAC-04-1371

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SUBJECT: RADIOLOGICAL SURVEY PLAN FOR OUTFALL 4S, CTO 73, TIME CRITICAL REMOVAL ACTION MARINE CORPS FIRING RANGE, FORMER MARE ISLAND NAVAL SHIPYARD, VALLEJO, CALIFORNIA

Reference: Contract N68711-D-5713, Environmental Remedial Action Contract for Sites in Southern California, Arizona, New Mexico and Southern Nevada

Dear Mr. Alhajjar,

The attached plan details our proposed radiological survey plan and procedures to be performed for removing radioactive point sources or contamination from the Historic Outfall 4S area. This plan supplements the guidance provided in the Site-Specific Health and Safety Plan, the Final Work Plan, and TtFW's Corporate Radiological Protection Plan and provides detailed field guidance for the execution of this work. Please let us know if you concur with this plan or believe we should make any changes. If you have any questions, please do not hesitate to contact me at (619) 471-3532.

Sincerely,

Kent Weingardt
Project Manager

Attachments:
RADIOLOGICAL SURVEY PLAN

Copy to:
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ABBREVIATIONS AND ACRONYMS

α	alpha
β	beta
γ	gamma
μR/hr	microroentgens per hour
ALARA	as low as reasonably achievable
cm^2	square centimeters
cpm	counts per minute
CRL	Corporate Reference Library
DON	Department of the Navy
dpm	disintegrations per minute
HPS	Director, Health Physics Services
MCRF	Mare Island Closed Small Arms Firing Range
MEC	munitions and explosives of concern
MINS	Mare Island Naval Shipyard
NaI	sodium iodide
PESM	Program Environmental Safety Manager
PPE	personal protective equipment
RASO	Radiological Affairs Support Office
RCT	Radiological Control Technician
RSP	Radiological Survey Procedures
SAP	Sampling Analysis Plan
SHSP	Site-Specific Health and Safety Plan
SHSS	Site Health and Safety Specialist
SOP	Standard Operating Procedure
TCRA	time critical removal action
TtFW	Tetra Tech FW, Inc.
UXO	Unexploded ordinance

1.0 INTRODUCTION

This Radiological Survey Plan (RSP) supplements the guidance provided in the Site-Specific Health and Safety Plan (SHSP), Standard Operating Procedure One for MEC (SOP-1) (found as Appendix H of the Work Plan), and the Tetra Tech FW Corporate Radiological Protection Plan (found as RP1-1 in the Corporate Reference Library [CRL]). This RSP details the radiological procedures to be performed to support a time-critical removal action (TCRA) for removing radioactive point sources or contamination from the Historic Outfall 4S at the former Mare Island Naval Shipyard (MINS) also known as Mare Island, Vallejo, California.

The RSP will be used as a procedural document by field personnel engaged in the implementation of the Work Plan. Included in this RSP are field surveillance procedures, sampling procedures, decontamination procedures, release requirements, and data gathering methods that will be used during the implementation of this RSP.

Tetra Tech FW, Inc. (TtFW) personnel will conduct the radiological survey and removal activities. Personnel performing work will be trained in general radiation safety practices.

The radiological survey/removal will be performed in conjunction with the unexploded ordinance and munitions and explosives of concern (UXO/MEC) survey/removal. Both UXO/MEC and radiological anomalies exist in the same defined area of Historic Outfall 4S and the procedures are sufficiently similar to be performed simultaneously.

1.1 OBJECTIVES

The specific objectives for this RSP are as follows:

- Address the radiological survey procedures to be implemented during the implementation of the Work Plan.
- Address the radiological material removal, reporting and waste management procedures.
- Address decontamination procedures.
- Identify radiological controls to be put into place during the performance of this Work Plan.
- Identify the release levels for equipment and personnel.

2.0 BACKGROUND

This section presents the description and background for the Mare Island Closed Small Arms Firing Range (MCFR) and Outfall 4S.

2.1 SITE DESCRIPTION

Mare Island is located approximately 30 miles northeast of San Francisco in Vallejo, California (see Figures 2-1 and Figure 2-2), and is separated from the city of Vallejo by the Mare Island Strait. Mare Island is only accessible through two entranceways. The main entrance is located at Tennessee Street and Wilson Avenue via the Causeway, and the other entrance is from Highway 37 at the northern end of the island.

The TCRA area includes a MCFR at the former MINS. Within the MCFR footprint, there is an historic dredge pond outfall area, Historic Outfall 4S, located adjacent to the Rifle Range. This radiological survey focuses on Outfall 4S.

The source, nature, and extent of contamination at the Historic Outfall 4S includes:

- The source of contamination at the Historic Outfall 4S is from the dredge spoils transported from the Mare Island Channel across the island through underground piping.
- The nature of the contamination at Historic Outfall 4S is metals associated with MEC and radiological items contained within the dredge spoils.
- The extent of the MEC and radiological contamination at Historic Outfall 4S is confined to two restricted areas that are approximately 200-foot by 200-foot by 6-foot deep; each area is immediately adjacent to the former outfall within remaining dredge debris.

2.2 HISTORY

MINS was established by the Department of the Navy (DON) in 1854 and was closed under the Base Reorganization and Closure (BRAC) program in April 1996. The primary mission of MINS was to build, maintain, and repair Navy ships and submarines. The Dredge Spoils Ponds are comprised of seven active and three inactive dredge ponds on Mare Island covering a total area of 476 acres. The dredge ponds were created between 1914 and 1965 using dredged sediments pumped across Mare Island during maintenance dredging of the channel and MINS facilities along Mare Island Strait. Material that had been discarded overboard from berthed ships – including ordnance and radiological items along with other scrap – was picked up by the dredge system and transported along with the dredge sediments to the dredge ponds.

An analysis of surface soil samples from the dredge ponds for radiological contamination was completed in 1995 to support the closure of MINS. No additional action appeared warranted at that time based on the sample results (Weston, 2001). The first indication of the presence of radiological material in a dredge pond was the recovery in January 1999 of a radium "button" during screening of outfall debris in support of the dredge pond UXO/MEC investigation. The first radiological items were visually identified by a former MINS radiological survey technician while sorting outfall material for ordnance. Subsequent ordnance work that began in May 1999 at the Historic Outfall 4S was continuously monitored for radiological anomalies. Between May 1999 and December 2000, over 400 radiological anomalies were found (Weston, 2001). Due to the large amount of ordnance found and the time constraints placed on the 2001 Weston radiological investigation, the Outfall 4S work was not completed at that time, but deferred to be coupled with the small arms range clean-up project. Attachment 1 provides a detailed summary of recovered radiological material at MINS since January 1999.

3.0 RADIATION SAFETY ORGANIZATION, RESPONSIBILITIES AND TRAINING

TtFW is committed to maintaining a Radiation Protection Plan (found as RP1-1 in the CRL) for the protection of TtFW employees, subcontractor personnel, visitors to the site, and the general public. Every individual involved in work within the restricted area of Outfall 4S has the responsibility for radiation safety and proper performance of their assigned operational duties. This section describes these basic responsibilities and specific training requirements.

3.1 RADIATION PROJECT ORGANIZATION

The organizational lines and responsibilities for radiation protection originate with the individual worker and go through the Site Health and Safety Specialist (SHSS) to the Project Superintendent, the Project Manager, the Program Manager, the Program Environmental Safety Manager (PESM) who must be a Certified Industrial Hygienist, the Director, Health Physics Services (HPS) who must be a Certified Health Physicist, and the Director of Environmental, Health and Safety. In addition to the personnel listed in the Site Specific Health and Safety Plan (SHSP), the Radiological Controls Technician (RCT) and the HPS contribute to the organization of the radiological procedures outlined in this document.

3.1.1 Individuals

Each individual is responsible for demonstrating familiarity with the Radiation Protection Program, for strict adherence to the radiation protection rules and regulations, and for minimizing radiation exposure to the maximum extent possible. Flagrant or willful disregard of radiological protection rules, regulations, or practices may result in disciplinary action. Individual's basic responsibilities are:

- All individuals working in any restricted area will have a working knowledge of site radiological protection rules, regulations and procedures. This will be accomplished by training commensurate with the individual's work assignment.
- Individuals shall know the specifics of the task or job that they are to perform. This should be accomplished through the use of drawings, diagrams, plans, technical manuals, standard operating procedures, or instructions from supervisory personnel.
- Individuals will understand and follow the radiological protection requirements. Individuals should acquaint themselves with the radiological status of the areas they are assigned to work in.

- Individuals will discontinue work on a job or task whenever problems arise that may adversely affect the overall radiation exposure received from the job or the radiological status of the job. The individual will notify the SHSS to reassess the situation.
- Individual workers are not expected to be experts in radiological controls, consequently, radiological controls supervisor personnel (e.g., the RCT or the SHSS) will always be available while work in affected areas is in progress. Individuals will follow direction of the RCT or the SHSS to the maximum extent possible.
- Individuals are required by federal regulations to report promptly to management any condition that may lead to or cause a violation of the radiation protection rules or regulations or unnecessary exposure to radioactive materials. Individuals will make these reports to their immediate supervisor, health physics personnel, the SHSS or the PESM

3.1.2 Radiological Controls Technician

TtFW will provide a RCT to implement the health physics monitoring and surveys required by regulations, TtFW's programs, and this plan. The RCT provides additional support to the SHSS. The RCT will:

- Implement the Radiation Protection Program under the direction of the SHSS, the PESM, and the HPS.
- Perform and interpret, in consultation with the PESM or the HPS, all required monitoring and surveys.
- Implement and enforce radiological protection requirements under their control.
- Stop work when necessary to maintain a safe radiological and industrial work area.

The RCT for this project is Lance Humphrey and can be contacted at (619) 471-3519.

3.1.3 Health Physics Services Director

The HPS or designee will advise the PESM, the SHSS, and the RCT as necessary to ensure the radiological and technical aspects of the project meet all federal and state standards. The HPS will:

- Make recommendations to the PESM and SHSS for the control and elimination of existing and potential radiological hazards.
- Function in an advisory capacity to assist personnel in carrying out their radiation protection responsibilities.

- Request that work stop if conditions indicate that a potential for unanticipated excessive radiation exposure to site personnel or the general public exists or if an individual violates the radiation protection rules, regulations, or procedures which may adversely affect personnel working at the site of the general public.
- Ensure adequate and sufficient training of site personnel in radiation protection requirements.
- Coordinate and assist the PESM on the oversight of any bioassay and dosimetry program to ensure proper monitoring of internal and external exposures.

The HPS for this project is TBD and can be contacted at TBD.

3.2 TRAINING REQUIREMENTS

3.2.1 General Training Requirements

All TtFW and subcontractor employees working within or near Outfall 4S, and have the potential for exposure to radiation or radioactive materials will complete General Employee Radiological Training as described in procedure RP2-11 in the CRL. Training will be documented in the daily production reports on the day that training was provided and kept in the project field office. Training will be conducted by the SHSS and the RCT. The general training includes, but is not limited to, the following:

- Fundamentals of Health Protection
  - The radiological and toxic hazards of exposure to radioactive materials
  - How radioactive materials enter the body
  - Why exposures to radioactive materials should be kept ALARA
  - Personal Hygiene on Site
  - Wearing protective clothing
  - Eating, drinking, smoking, and chewing only in designated "clean" areas
  - Using proper methods for decontamination
  - Site-Specific Control Systems
  - Standard operating procedures
  - Site control procedures
  - Security and access control to designated areas
  - Hazards specific to this site

- Health Physics Protection Measurements
- Measurements of airborne radioactive materials
- Possible bioassays to detect radioactive materials
- Surveys to detect contamination of personnel and equipment
- Personnel dosimetry and dose limits

3.2.2 TtFW Radiological Controls Technician

The RCT will be approved by the HPS and will meet the TtFW RCT Training requirements as outlined in Section 5.4 of RP2-11, Radiation Safety Training, including training topics to the extent appropriate dependent on prior training, work assignments, and degree of exposure to potential radiological hazards. The HPS will approve the RCT by letter addressed to the Project Manager and the SHSS. The training topics for this project are to include, but not limited to:

- Basic mathematics and algebra
- Unit analysis and conversion
- Physical sciences
- Sources of radiation
- Biological effects of radiation
- Radiological protection standards
- As Low As Reasonably Achievable (ALARA)
- External exposure control
- Internal exposure control
- Radiation detection theory
- Radiological documentation
- Contamination control
- Radioactive source control
- Environmental monitoring
- Personnel decontamination
- Radiation survey instrumentation and techniques
- Contamination monitoring instrumentation and techniques.

3.2.3 TtFW Health Physics Services Director

The HPS is appointed by the TtFW ESH and is responsible for reviewing project plans that involve the use or handling of radioactive materials. At a minimum, the HPS is required to ensure the RCT meets the training listed above. Additional training may be needed dependent on

the nature of the procedures for this project – the HPS or designee will specify and administer any additional training requirements.

3.3 ALARA

The basic concept in radiation protection specifies that exposures to ionizing radiation and releases of radioactive material should be managed to reduce collective doses to workers and the general public ALARA. It is the intent of this RSP to take into consideration the concepts of ALARA during the course of the work carried out by the Work Plan (TtFW) for Historic Outfall 4S.

4.0 INSTRUMENTATION

4.1 RADIATION DETECTION INSTRUMENTATION

During the performance of this RSP, different instrumentation will have to be used to detect the various forms of radioactive material that may be present. Table 4-1 identifies the instrumentation that may be used for the RSP objectives. Each instrument is explained in further detail in the following sections.

TABLE 4-1

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

Measurement/ Technique	Type of Instrumentation		Typical Background	Typical Efficiency (%)	Detection Sensitivity
	Detector	Meter			
Surface gamma scans	NaI 2-inch x 2-inch Scintillation Ludlum Model 44-10	Ludlum Model-2350-1 Data Logger	1000 to 12,000 cpm; varies with work location γ	N/A	200 cpm-2000 cpm γ. Varies with location
Static and surface alpha/beta scan and contamination frisks	Large-area scintillation, Ludlum Model 43-89 ($100cm^2$)	Count rate meter Ludlum Model-2360 Data Logger	100-200 cpm β 5-10 cpm α	~6 β total efficiency ~12 α total efficiency	~ 110 dpm/$100cm^2$ β ~ 20 dpm/$100cm^2$ α
Direct Measurement Static gamma	NaI 2-inch x 2-inch Scintillation Ludlum Model 44-10	Ludlum Model-2350-1 Data Logger	1000 to 12,000cpm; varies with work location γ	N/A	200 cpm-2000 cpm γ. Varies with location
Exposure Rates	NaI Scintillation Micro R Meter Ludlum Model-19	(Same as detector)	7-8 µR/hr	N/A	2 µR/hr

Notes:

α – alpha
β – beta
γ – gamma
µR/hr – microRoentgens per hour
cm^2 – square centimeters
cpm – counts per minute
dpm – disintegrations per minute
N/A – not applicable
NaI – sodium iodide

4.2 INSTRUMENT FOR ALPHA/BETA SURVEYS

Surveys for gross alpha / beta radiation will be performed using a Ludlum Model 2360 Scaler/Ratemeter Data Logger equipped with a logging command device as well as a Ludlum

Model 43-89 probe. The instrumentation measures alpha and beta radiation levels and presents data in a scaler (digital display) or rate meter (analog display) mode. Static measurements for particulate radiations are instantaneously recorded by the rate meter after positioning the detector, a scintillation probe, directly over a designated surveillance surface and recording "scan" ranges or collecting "static" measurements. Scan measurements are obtained by traversing an area at a maximum speed (scan rate) of approximately 0.25 feet per second (ft/s) and slowly sweeping the detector assembly over the area to be surveyed, while maintaining the detector approximately 0.25 inches above the area surveyed. Static measurements will be collected by holding the detector steady over a location for approximately 30 to 60 s and recording the reading. Once the actual background levels are established, the static time requirement will be calculated.

4.3 INSTRUMENT FOR GAMMA SURVEYS

Surveys for gross gamma (photon) radiation will be performed using a Ludlum Model 2350-1 Data Logger equipped with a command device and a Ludlum Model 44-10 scintillation detector, which utilizes a "2 x 2 inch" NaI crystal. Capable of detecting gamma photon energies ranging from 60 kiloelectron volts to 3 megaelectron volts, the instrument is programmed to respond to the full spectrum of gamma photon energies. Static photon measurements require positioning the detector assembly approximately 6 inches above the designated surveillance surface and completing a stationary 60-second survey. Scan measurements are obtained by traversing a path at a maximum speed (scan rate) of approximately 2 ft/s and slowly sweeping the detector assembly in a serpentine (snakelike, S-shaped) pattern, while maintaining the detector 6 inches above the area surveyed. NaI scintillation detectors are very sensitive to gamma radiation and are ideal for locating elevated radiation levels above background.

4.4 INSTRUMENT FOR EXPOSURE RATE SURVEYS

Exposure rate surveys, obtained approximately 3 ft from contact with area surfaces, are conducted with use of a Ludlum Model 19 MicroR meter. Compatible with anticipated exposure rates, the instrument is equipped with an internally mounted "1x1 inch" NaI scintillation detector that is integral to the meter housing. The MicroR meter provides optimum performance in measuring low-level gamma photon radiation readings, which are readily provided on the meter face in units of μR/hr. Readings will be obtained after allowing the instrument to stabilize for approximately 1 minute.

5.0 SURVEY PROCEDURES

The following protocol will be used for the purpose of conducting radiological surveys.

5.1 GENERAL PROCEDURES

At a minimum, the following steps will be used in conducting the radiological survey at Historic Outfall 4S. Additional steps are included in subsequent portions of this RSP.

1. Perform daily (when used) instrument operational checks by visually inspecting the equipment for damage, confirmation of current calibration by inspecting the attached calibration sticker, perform a battery check, and background and calibrated source response check.
2. On a monthly basis, the 3-sigma value, lower limit of detection and minimum detectable concentration (MDC) will be calculated for all field radiation survey meters, using the results of the average background described in 5.2.1, and recorded in the radiological logbook and on the appropriate TtFW form. Note: This is not a requirement for instruments used solely for performing personnel contamination surveys when exiting contamination areas.
3. All daily instrument check and background measurements shall be documented on the appropriate TtFW forms.
4. Personnel performing the surveys will typically wear Level D personal protective equipment (PPE) (hard hat, steel-toed boots, reflective vest, eye protection, and gloves).
5. When monitoring for gross alpha or beta the surface area of the equipment or material shall be surveyed. Technicians should move slowly (less than 0.05 m/s) over the surface, keeping the detector probe approximately 0.25 inches from the surface.
6. When monitoring for gross gamma the RCT maintains the detector approximately 6 inches above the surface, moving the detector in a serpentine pattern at a rate of approximately 2 ft/s.
7. In addition to the generation of field surveillance documentation, survey results will be documented in the radiological field logbook. Personnel performing the surveys will manually enter results in the radiological logbook.
8. Personnel leaving a posted contaminated area shall perform a whole body frisk. Qualified personnel shall survey, in a pre-designated low background area, their hands, feet, and clothing before leaving the work area. Personnel that are not qualified to self-survey will be surveyed by a qualified technician. Any clothing or skin contaminated above the values listed in Table 5-1 will be decontaminated by the RCT to levels at or below the values listed in Table 5-1. If decontamination efforts are not successful, the clothing will be removed and placed into a waste bag and stored with

the other waste pending further characterization. Surveys will be performed using a calibrated alpha/beta scintillation detector.

TABLE 5-1

CONTAMINATION LIMITS

Radionuclide	Fixed (dpm/100 cm^2)	Loose (dpm/100 cm^2)
Alpha	100 α	20 α
Beta (Strontium-90)	1,000 β^-	200 β^-
Beta / Gamma	5,000 β^-, γ	1000 β^-, γ

5.2 RADIOLOGICAL FIELD PROCEDURE

The purpose of the radiological field survey is to identify, locate, and remove radioactive anomalies in the soil excavated from the Historic Outfall 4S. The radiological field procedure consists of the following step-wise approach:

1. Background determination (all field radiation survey instruments)
2. In-situ (Surface) Screening/Excavation/Repeat (2x2 NaI and MicroR meter)
3. Ex-situ spot check (alpha/beta scintillation detector and 2x2 NaI)
4. Stockpile

5.2.1 Background Determination

An average site soils background will be determined monthly for each field survey instrument utilized on this project, by performing at least 10 measurements at different locations within the designated background reference area in the 20-acre MCFR. The site was previously divided into 50-ft by 50-ft grids in support of the rifle and pistol ranges excavation activities. Using this same grid, a random number generator will be used to pick 10 locations. These locations will be surveyed for background radiation at the center of these grids.

The NaI 2-inch by 2-inch scintillation detector should be held approximately 6 inches from the surface. The detector should be allowed to stabilize for at least 30 seconds before a background count is taken. For a gross alpha/beta scintillation detector the probe will be held approximately 0.25 in. from the surface. The microR meter will be held approximately waist high.

The average of all of the counts taken will be the monthly soil background for each instrument. Once the average background activity level has been calculated, the supporting data and average results will be submitted to the HPS, for review prior to establishing the official monthly background level for the project work.

5.2.2 In-Situ Survey/Excavation

To perform the UXO/MEC excavation/removal action at Outfall 4S, a 20- by 20- ft grid network will be established encompassing all areas to be surveyed and excavated according to Section 2.1.2 of the SOP-1, Appendix H of the project Final Work Plan. To accomplish the concurrent radiological survey, a temporary, additional grid network of approximately 3- by 3-ft grids will be installed on each 20- by 20-ft grid, resulting in 36 grids within each 20 by 20 ft grid, using line or surveyor's tape. The line (or tape) will be pre-cut into 20-ft lengths and laid out across the first grid in their approximate locations, 3 ft apart. Two technicians will take stations at opposite ends of the grid and will use yardsticks to measure approximately 3 ft from the marked grid intersection. Using lawn staples or tent pegs, they will anchor their ends of the line in the ground, then measure the next 3 ft and anchor the next line. The process will be repeated on both grid axes until the 36, 3- by 3-ft grids are established.

The RCT will take an exposure rate gamma radiation survey instrument and measure the radiation in the center of each 3-ft grid cell. Then, using a 2x2 NaI, the RCT will perform a serpentine survey of the grid. Any readings over background plus 3 times the standard deviation (or 3 sigma) will be marked. When all the grid cells have been surveyed, the marked grids will be hand-excavated until the source of radiation is located. The location of the radiological item will be recorded. Once the in-situ survey and subsequent removal of any radiological items is complete, the topsoil over the 20 x 20 ft grid will be excavated in 6-inch lifts. This process of in-situ survey/excavation will be repeated within the grid network for each lift until the targeted depth of excavation (4 feet) has been reached.

When the targeted depth (4 feet) is reached in the excavated areas, a final in-situ radiological survey of the bottom of the excavation will be conducted. Any sources detected that are greater than 3 standard deviations above the average background level reading will be marked with pin flags. All areas marked with pin flags will be investigated to determine the source of the radiation, and to remove it. After each source of elevated gamma activity is removed, an additional 1 foot of soil surrounding the source will also be removed. If gamma radiation levels above the 3 sigma value persist after identifiable point source items are removed, additional soil excavation will be required in those areas to expose, locate, and remove the contamination. Again, since this work is done in conjunction with the UXO/MEC survey/removal – further excavation may also be required due to UXO/MEC identification – if that is the case, further radiological surveying will also be performed in those areas in accordance with the above procedure.

No in-situ survey will be performed on the pre-existing stockpiles generated from earlier work at Outfall 4S (WESTON).

5.2.3 Ex-Situ Survey

Excavated debris and soil from Outfall 4S (including the pre-existing stockpiles) will be placed in dump trucks and hauled to either a screening pad, trommel screening plant, or some combination of the two. A 15-foot by 75-foot pad (or pads) for spreading excavated soils and debris will be constructed on the project site. The pad will be used to examine the soil/debris for radiological sources.

At the screening pad, an ex-situ radiological survey of the material will be performed to identify radiologically contaminated materials. To perform the ex-situ survey, the soil will be spread across the screening pad in a 6-inch layer and then surveyed with a 2x2 NaI detector. An RCT will walk the length of the screening pad and screen the soil with handheld detector for radiological anomalies. The RCT should move slowly (less than 2 ft/s), keeping the detector probe approximately 6 inches from the surface. A second survey, using the gross alpha/beta scintillation probe, will also be performed holding the probe approximately 0.25 inch from the surface for alpha radiation. Data analysis will be performed as it is received and questionable areas (where surface radiation levels are greater than 3 sigma) will be investigated to determine the source of the radiation. Areas confirmed as containing radiation levels greater than 3 standard deviations above the "mean" background level established for the site will be physically marked and the associated anomalies removed. After being screened on the pad, the excavated soil will be placed in stockpiles for further processing.

Based on equipment compatibility with site soils, a Trommel screen may be used in place of or in combination with the screening pad to execute the ex-situ radiological screening. In this case, the excavated soil will be fed into the Trommel screen by conveyor. The incoming soil will be segregated based on mesh screen size (1/2-inch or 3/8-inch). Any objects greater than the mesh screen size will be ejected to a single pile. These objects will be inspected by hand held scintillation probes. Radioactive objects will be marked and properly packaged. Soil that passes through the mesh screen will be intermittently screened for non-discrete sources of radioactivity prior to relocation to the stockpile containment pads.

5.2.4 Stockpile

After inspection on the screening pad or processing with the trommel screen, excavated soil will be placed on 120-ft-wide by 150-ft-long stockpile containment pads.

5.3 EQUIPMENT AND PERSONNEL SURVEYS

5.3.1 Incoming Equipment Surveys

In addition to the general procedures set forth in this document, incoming equipment and materials will be subject to the following guidelines. Surveys will be performed using a calibrated gross alpha/beta scintillator.

1. Equipment will be surveyed for existing contamination levels prior to being placed into service.
2. Surveys will consist of 100 percent scan for alpha/beta contamination. Should the levels exceed those listed in Table 5-1, the equipment will not be permitted to be placed into service and will be requested to be returned to the source.

5.3.2 Personnel Surveys

Personnel conducting fieldwork in a potential or posted contamination area shall have a whole body survey ("frisk"), by a qualified technician, in a pre-designated low background area, before leaving the work area. See 5.1 item 8 for handling of identified contamination.

A qualified technician, in a pre-designated low background area will also survey tools, materials and equipment before being removed from the work area each day. Surveys will be performed using a calibrated alpha/beta scintillator.

5.3.3 Outgoing Equipment Surveys

In addition to the general procedures set forth in this document, outgoing equipment and materials will be subject to the additional guidelines.

1. A release survey will be performed prior to the equipment and/or materials leaving MCFR. All surveys will be documented on the appropriate TtFW form and given a unique survey number.
2. Surveys will consist of a 100 percent scan for gross alpha/beta contamination. Should the levels exceed those listed in Table 5-1, the equipment will not be permitted to leave the site, and appropriate decontamination methods will be taken.

5.4 DECONTAMINATION PROCEDURES

Surveillance results may at times dictate the gross decontamination of equipment and materials. In such instances, to prevent the uncontrolled spread of loose contaminants, any materials or equipment initially identified as radiologically contaminated will be immediately secured. The assigned RCT will also ensure that all relevant personnel are promptly informed of the situation. Prior to transport of such materials or equipment to a designated decontamination pad, such processes will first be evaluated for radiological impact. Instructions unique to such transfer, including the actual decontamination process, will be outlined in a separate job-specific Radiological Work Permit with pre-job brief requirements.

5.5 POINT SOURCE AND CONTAMINATED MATERIAL REMOVAL PROCEDURE FOR SOILS

Should surveys identify a discrete point source, or levels of contamination are found to be present that exceed those specified in Table 5-1, the source or material will be removed per the procedure detailed below.

1. All removal and storage of any point sources or contaminated materials will be performed under the supervision of a qualified RCT.
2. Personnel performing removal of point sources and/or contaminated materials will wear modified Level D PPE (Tyvek coveralls and booties, gloves, hard hats, and eye protection).
3. When a point source has been identified, the source will be removed and placed into an appropriately sized clear plastic bag. The source will be given a unique identification number and recorded in the radiological logbook. All point sources will be stored in a separate steel drum from other contaminated materials found and removed during the surveys.
4. In the case of radiologically contaminated materials or debris not associated with a point source, such materials will be removed and placed into a lined 55-gallon drum.
5. All bags and drums will be marked with a unique identification number that will be assigned and recorded in the radiological logbook.
6. Any filled 55-gallon steel drum(s) generated during this process will be placed in storage awaiting turnover to Radiological Affairs Support Office (RASO).
7. A description and photographic detail of any point sources or contaminated objects, related activity (in counts per minute) and disposition shall be entered in the radiological field logbook.
8. Radioactive material generated during this project will be stored in a designated and posted radioactive materials storage area. The drums will be covered with plastic sheeting to provide protection from the elements. The covered drums will be posted with a "Caution – Radioactive Materials" sign. The radiological items will be stored until completion of the survey, at which time, they will be turned over to RASO for disposal.

TtFW will maintain records of identified radiological anomalies. RASO will be notified of the presence of the anomalies by letter with an attached table detailing the findings. Attachment 2 provides a sample letter and attachment 3 provides a reporting table.

6.0 SITE RESTORATION

After excavation is completed, a land survey of the excavation will be performed. This information will be used to assess the volume of material excavated, assess the excavation contours, and assess whether any additional backfill material will be required.

Non-hazardous, uncontaminated soil (as confirmed through in-situ or ex-situ site soil sampling/analysis as detailed in the Sampling and Analysis Plan (SAP)) from the site will be used to backfill the excavation. If imported fill is required for any reason, testing requirements are discussed in the project SAP.

Backfill will be placed in the excavation in 12-inch lifts. Where possible, the backfill material will be compacted to approximately 90 percent of the maximum dry density using a roller compactor, or equivalent. The final 6 inches of backfill will not be compacted, but will be graded to match its surrounding elevation for site restoration. The DON may elect to let the surrounding plants naturally take over the area to simplify the management of vegetation at the site.

7.0 REFERENCES

Roy F. Weston, Inc. (Weston). 2001. Radiological Investigation, Dredge Spoils Ponds, Mare Island, Vallejo, California, Final Summary Report. December 4.

Tetra Tech FW, Inc. (TtFW). 2003. Final Action Memorandum, CERCLA Time-Critical Removal Action, Marine Corps Firing Range and Historic Outfall 4S at the Dormer Mare Island Naval Shipyard, Vallejo, California. September16.

ATTACHMENT 1

SUMMARY OF RECOVERED RADIOLOGICAL MATERIAL SINCE JANUARY 1999

Attachment 1

Summary of Recovered Radiological Material Since January 1999*

Item	Dredge Pond	Outfall	Date Found	Radiation Level (uR/hr)	Description	Remarks
1-1	3W	Historic	8-Jan-99	400	1½" radium button	Note 1.
2-1	3W	South	15-Jan-99	1,000	1¾" strontium button	Note 2.
2-2	3W	South	19-Jan-99	2,000	1½" radium button	Note 2.
2-3	3W	South	21-Jan-99	20	6 lbs rocks and dirt	Note 2.
2-4	3W	South	21-Jan-99	2,500	1½" x 1½" small metal bar	Note 2.
2-5	3W	South	22-Jan-99	400	1¾" strontium button	Note 2.
2-6	3W	South	23-Jan-99	1,000	1" diameter rock	Note 2.
2-7	3W	South	24-Jan-99	20	1½" diameter glass window	Note 2.
2-8	3W	South	24-Jan-99	1,000	¾" radium button	Note 2.
2-9	3W	South	26-Jan-99	4,000	sound-powered telephone box	Note 2.
2-10	3W	South	27-Jan-99	30	½" diameter rock	Note 2.
2-11	3W	South	27-Jan-99	10	4" x 4" x 1½" rock	Note 2.
2-12	3W	South	3-Feb-99	100	2" diameter x 2" lond gear	Note 2.
2-13	3W	South	5-Feb-99	1,400	¾" radium button	Note 2.
2-14	3W	South	5-Feb-99	20	4½" diameter metal gage face	Note 2.
2-15	3W	South	8-Feb-99	1,000	¾" radium button	Note 2.
2-16	3W	Historic	8-Feb-99	900	¾" radium button	Note 2.
2-17	3W	Historic	8-Feb-99	45	1 lb - rock debris	Note 2.
2-18	3W	Historic	8-Feb-99	1,600	¾" radium button	Note 2.
2-19	3W	Historic	8-Feb-99	2,400	1¾" strontium button	Note 2.
2-20	3W	Historic	8-Feb-99	70	1" diameter rock	Note 2.
2-21	3W	Historic	8-Feb-99	1,200	¾" radium button (imbedded inside 1¼" hex bolt)	Note 2.
2-22	3W	Historic	8-Feb-99	130	½ lb rock debris	Note 2.
2-23	3W	Historic	8-Feb-99	11	¾" radium button glass window, frame, and gasket	Note 2.
2-24	3W	Historic	9-Feb-99	600	¾" radium button	Note 2.
2-25	3W	Historic	9-Feb-99	30	6" diameter metal plate	Note 2.
2-26	3W	Historic	1-Mar-99	4,500	1½" radium button	Note 2.
2-27	3W	Historic	1-Mar-99	900	3" length of wire	Note 2.
3-1	3W	Historic	17-May-99	7	14" length of white plastic cord (radium rope)	Note 3.
3-2	3W	Historic	17-May-99	7	¾" radium button	Note 3.
3-3	3W	Historic	17-May-99	8	gage face	Note 3.
3-4	3W	Historic	17-May-99	7	1½" strontium button	Note 3.
3-5	3W	Historic	17-May-99	7	1" length of white plastic cord (radium rope) attached to connector	Note 3.
3-6	3W	South	17-May-99	7	white plastic cord (radium rope) tied in loop	Note 3.
3-7	3W	South	17-May-99		1½" radium button (busted in soil)	Note 3.
3-8	3W	South	17-May-99	7	1½" radium button	Note 3.
3-9	3W	Historic	20-May-99	7	¾" radium button	Note 3.
3-10	3W	Historic	20-May-99	8	¾" radium button	Note 3.
4-1	4S	North	30-Jan-01	800	½" radium button	Note 4.
4-2	3E	Current	30-Jan-01	600	8" radium plastic rope	Note 4.
4-3	3E	Current	30-Jan-01	5,000	1½" radium button	Note 4.
4-4	3E	Current	30-Jan-01	800	12" radium plastic rope	Note 4.
4-5	3E	Historic	30-Jan-01	3,000	1½" radium button	Note 4.
4-6	3W	South	31-Jan-01	30	3" square metal mass	Pond 3W Berm Road. Note 4.
4-7	4M	Current	30-Jan-01	2,000	1½" radium button	Note 4.
4-8	3W	South	01-Feb-01	35	soil and grass	Note 4.
5-1	3W	South	31-Jan-01	2,100	1½" radium button	Note 5.
5-2	3W	South	31-Jan-01	400	1½" radium button	Note 5.
6-1	3W	South	17-May-01	90	soil (found 3' deep)	Note 6.
6-2	3W	South	17-May-01	9	soil (found 4' deep)	Note 6.
6-3	3W	South	17-May-01	15	soil (found 3' deep)	Note 6.
6-4	3W	South	17-May-01	12	soil (found 3' deep)	Note 6.
6-5	3W	South	17-May-01	24	soil (found 3' deep)	Note 6.
6-6	3W	South	17-May-01	14,000	wire/rope (found 2' deep)	Note 6.
6-7	3W	South	17-May-01	1,200	rock (found 3' deep)	Note 6.

Attachment 1

Item	Dredge Pond	Outfall	Date Found	Radiation Level (uR/hr)	Description	Remarks
6-8	3W	South	17-May-01	400	rock/metal (found 3' deep)	Note 6.
6-9	3W	South	17-May-01	200	mud/rock (found 3' deep)	Note 6.
6-10	3W	Historic	16-May-01	5,000	button (found 5' deep)	Note 6.
6-11	3W	South	18-May-01	2,000	soil/metal (found 5' deep)	Note 6.
6-12	3W	South	18-May-01	20	soil/mud (found 5' deep)	Note 6.
6-13	3W	South	18-May-01	29	soil/mud (found 5' deep)	Note 6.
6-14	3W	South	18-May-01	750	soil/mud (found 5' deep)	Note 6.
6-15	3W	South	18-May-01	12,000	soil/mud (found 5' deep)	Note 6.
6-16	3W	South	23-May-01	<1,000	soil/mud (found 5' deep)	Note 6.
6-17	3W	South	23-May-01	<1,000	soil/mud (found 5' deep)	Note 6.
6-18	3W	South	23-May-01	<1,000	soil/mud (found 5' deep)	Note 6.
6-19	3W	South	23-May-01	1,200	soil/mud (found 5' deep)	Note 6.
6-20	3W	South	23-May-01	1,200	soil/mud (found 5' deep)	Note 6.
6-21	3W	South	23-May-01	1,600	soil/mud (found 5' deep)	Note 6.
6-22	3W	South	23-May-01	16,000	soil (found 1' deep during winter 2000 survey)	Note 6.
6-23	3E	Current	25-May-01	<1,000	soil (found 3" deep during soil cap survey)	Note 6.
6-24	3E	Current	5-Jun-01	1,000	button (found 18" deep)	Note 6.

Legend

* This list does not include radiological material found in the outfall located just oustside Dredge Pond 4S, where the Marine Corps Rifle Range is located.

Note 1 Item recovered from South Shore near Dyke 14.

Note 2 Item found at the Industrial Waste Treatment Plant (IWTP) while breaking up large masses of soil.

Note 3 Item found during the Global Positioning System (GPS) Survey of the three (3) outfall located in Dredge Pond 3W in May 1999.

Note 4 Item found during the Global Positioning System (GPS) Survey between November 2000 and February 2001.

Note 5 Item found during the survey of contaminated soil from three (3) ordnance excavation sites, January 2001.

Note 6 Item found during the radiological screening of excavated soils, May 2001.

ATTACHMENT 2

SAMPLE LETTER

Attachment 2
Sample Letter

5090.4
Ser 06CM.JD/
January 24, 2001

From: Commander, Southwest Division, Naval Facilities Engineering Command

To: Officer in Charge, Naval Sea Systems Command Det Radiological Affairs Support Office

Subj: Disposal Request for Radiological Material Unexploded Ordnance Intrusive Investigation at the Dredge Spoils Ponds, Mare Island, Vallejo, CA

Encl: (1) Radiological Material Awaiting Disposal at Mare Island Naval Shipyard as of January 2002

1. Enclosure (1) lists the radiological material recovered during remediation activities. This material requires disposal and is forwarded to your office for action and coordination based on discussions with personnel in your office.

2. Please coordinate disposal of these items with our office. Should you have any questions concerning this document or if you need additional information, please contact Mr. Mike Bartunek (707) 562-3077.

JERRY DUNAWAY
By direction

ATTACHMENT 3

REPORTING TABLE

ATTACHMENT 3 – REPORTING TABLE

THIS ATTACHMENT IS NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY NAVFAC SOUTHWEST RECORDS OFFICE TO LOCATE THE MISSING ATTACHMENT. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEM BE LOCATED.

FOR ADDITIONAL INFORMATION, CONTACT:

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