From: Slack, Matthew L CIV SEA 04 04N
To: Lord, Jacques P CTR NAVFACHQ, BRAC PMO
Cc: Dick Dubiel; Reisig, Mark
Subject: RE: Draft Scoping Survey Report FSA RW V1.doc
Date: Friday, February 03, 2012 17:17:39
Attachments: CDPH Pictures removed Draft Scoping Survey Report FSA RW V1.doc

---

Jacques,
FYI, I am resending this file with the figures and photos removed because I got a file too large message from Dick and Mark's email.

Matt

-----Original Message-----
From: Slack, Matthew L CIV SEA 04 04N
Sent: Thursday, February 02, 2012 20:26
To: Lord, Jacques P CTR NAVFACHQ, BRAC PMO
Cc: 'Dick Dubiel'; 'Reisig, Mark'
Subject: FW: Draft Scoping Survey Report FSA RW V1.doc

FYI

-----Original Message-----
From: Wilson, Robert (CDPH-DDWEM) [mailto:Robert.Wilson@cdph.ca.gov]
Sent: Wednesday, February 01, 2012 17:16
To: Slack, Matthew L CIV SEA 04 04N
Subject: Draft Scoping Survey Report FSA RW V1.doc

Hi Matt,

Please see comments in the attached subject document.

RED COMMENTS are during the first round of discussion we had.

GREEN COMMENTS are the second round (we have not had a chance to discuss, yet) and a continuation of the RED COMMENTS.

Hope this helps - send me a "corrected" version and, please, keep the color of the corrections the same as the initial comments, such as RED, or GREEN. This will help speed up the verification process and I can change the final color back to BLACK and send it back to you.

Hope this helps.

Robert

Draft

Scoping Survey Report
Former Smelter Area

Alameda Point
Alameda, California

December 19, 2011

Prepared for:
Department of the Navy
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared by:
ChaduxTt, a Joint Venture of St. George Chadux Corp. and Tetra Tech EM Inc.
1230 Columbia Street, Suite 1000
San Diego, California 92101

Prepared under:
Naval Facilities Engineering Command Southwest
Contract Number: N62473-07-D-3213
Delivery Order: 0025

DRAFT

SCOPING SURVEY REPORT
FORMER SMELTER AREA

ALAMEDA POINT
ALAMEDA, CALIFORNIA

December 19, 2011

Prepared for:
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Program Management Office West
1455 Frazee Road, Suite 900
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Contract Number N62473-07-D-3213
Delivery Order 0025
Document Control Number: CHAD-3213-0025-0065

REVIEW AND APPROVAL

Mark R. Reisig
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December 19, 2011
Date

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TABLE OF CONTENTS

REVIEW AND APPROVAL i

ACRONYMS AND ABBREVIATIONS vi

EXECUTIVE SUMMARY ES-1

1.0 SITE DESCRIPTION 1

- 1.1 SITE LOCATION AND DESCRIPTION 1
- 1.2 PRIOR HISTORICAL USE 1
- 1.3 CURRENT AND FUTURE BUILDING OR LAND USE 1
- 1.4 REPORT OBJECTIVES 2

2.0 HISTORICAL RADIOLOGICAL ASSESSMENT 2

- 2.1 OPERATING HISTORY 2
- 2.2 MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION MANUAL CLASSIFICATION 2
- 2.3 RADIONUCLIDES OF CONCERN 3

3.0 RELEASE CRITERIA 3

- 3.1 UNRESTRICTED RELEASE CRITERIA 3
- 3.2 INVESTIGATION LEVELS 4

4.0 SURVEY DESIGN 4

- 4.1 OBJECTIVE OF SURVEYS 4
- 4.2 SURVEY UNITS 4
- 4.3 REFERENCE AREAS 4
- 4.4 STATISTICAL TESTS 5
- 4.5 DETERMINING THE NUMBER OF DIRECT MEASUREMENTS 6

5.0 FIELD ACTIVITIES 7

- 5.1 MOBILIZATION 7
- 5.2 INITIAL CLEARANCE WORK AND SURVEY MARK OUT 7
- 5.3 SCOPING SURVEY ACTIVITIES 7

6.0 SURVEY INSTRUMENTATION 8

- 6.1 INSTRUMENT CALIBRATION AND QUALITY ASSURANCE PROCEDURES 8
- 6.2 INSTRUMENT OPERATIONAL CHECKS 8
- 6.3 INSTRUMENTS FOR THE MEASUREMENT OF ALPHA AND BETA SURFACE ACTIVITY 9

6.3.1 Instruments for the Static Measurement of Alpha and Beta Surface Activity 9
6.3.2 Instruments for the Scan Measurement of Alpha and Beta Surface Activity 9
6.3.3 Determination of Instrument Efficiency for Alpha and Beta Surface Activity Measurements 10
6.4 INSTRUMENT FOR THE MEASUREMENT OF EXPOSURE RATES 11
6.5 INSTRUMENT FOR MEASURING SWIPE SAMPLES 11
6.6 INSTRUMENT FOR GAMMA WALK-OVER SURVEY 11
6.7 DETECTION SENSITIVITIES 12

7.0 SURVEY PROCEDURES 12
7.1 REVIEW OF DATA QUALITY OBJECTIVES 12
7.2 SCAN MEASUREMENT TECHNIQUE 14
7.3 DIRECT MEASUREMENT TECHNIQUE 14

8.0 RESULTS AND ANALYSIS 14
8.1 DIRECT MEASUREMENTS 15
8.1.1 Alpha Direct Measurements 15
8.1.2 Ambient Gamma Dose Rates 16
8.1.3 Removable Contamination (Smears) 17
8.1.4 Analysis of Direct Measurements 17
8.2 SCANNING MEASUREMENTS 17
8.2.1 Alpha Scans 17
8.2.2 Analysis of Alpha Scan Measurements 18
8.2.3 Beta Scan Measurements 18
8.2.4 Analysis of Beta Scan Measurements 19
8.3 GAMMA WALK-OVER SURVEY 19
8.4 SOIL SAMPLES 20
8.5 SEDIMENT SAMPLES 20

9.0 CONCLUSION 21

10.0 REFERENCES 22

FIGURES

Figure 1 Alameda Point Map 24

Figure 2 Former Smelter Area CIRCA 2004 25

Figure 3 Classifications and Survey Units 26

Figure 4 Photograph of Surface Contamination Monitor.....27

Figure 5 Photograph of Gamma Walk-over Survey in Survey Unit-3 looking South 28

Figure 6 Former Smelter Area Survey Unit 4 Beta Survey Cumulative Frequency Distribution Plot.....29

Figure 7 Screen Capture of Snooper Results of Alpha Survey of Survey Unit 4 30

TABLES

Table 1 Former Smelter Area Classifications.....32

Table 2 Detection Sensitivities 33

Table 3 Summary of Former Smelter Area Direct Survey Results.....34

Table 4 Summary of Smear Test Results.....35

Table 5 Former Smelter Area Gamma Walk-over Data Survey Units 1 and 2 36

APPENDICES

A Task Specific Plan (on CD)

B Instrument Information (on CD)

C Direct Survey Data (on CD)

D Scan Survey Results (on CD)

E Gamma Walk-Over Survey Results (on CD)

F Soil Sample Results (on CD)

ATTACHMENTS

1 1949 Proposed Turbo Jet Overhaul Facility Drawing

2 Aerial Photograph Overlay Current Buildings and the Footprint of the Former Smelter

ACRONYMS AND ABBREVIATIONS

α	Alpha
β	Beta (Check these with CD version)
σ	Sigma
ε_i	Instrument efficiency
μR/hr	Microroentgens per hour
Bi-214	Bismuth 214
BRAC	Base realignment and closure
CFD	Cumulative frequency distribution
cm	Centimeter
cm^2	Square centimeters
Co-60	Cobalt 60
cpm	Count per minute
Cs-137	Cesium 137
dpm	Disintegration per minute
DQO	Data quality objective
EPA	U.S. Environmental Protection Agency
ERG	Environmental Restoration Group
FSA	Former Smelter Area
FSS	Final status survey
HRA	Historical radiological assessment
LBGR	Lower bound of the gray region
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
MDL	Minimum detection level
MSI	Millennium Services, Inc
N	Number of data points
NaI	Sodium iodide
NAS	Naval Air Station
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission

pCi/g	Picocuries per gram
PSPC	Position sensitive proportional counter
Pu-239	Plutonium 239
RASO	Radiological Affairs Support Office
Ra-226	Radium 226
ROC	Radionuclide of concern
RSOR	Radiation Safety Officer Representative
Sign ρ	Random measurement probability (Check this with CD version)
SCM	Surface contamination monitor
SIMS	Survey information management system
SOP	Standard operating procedure
Sr-90	Strontium 90
SU	Survey unit
TSP	Task specific plan
UO_2	Uranium oxide
VSP	Visual sample plan
Weston	Weston Solutions, Inc.
Z	Decision error level

EXECUTIVE SUMMARY

The Former Smelter Area (FSA) is a 40,000-square-foot area east of Building 66 at the former Naval Air Station Alameda, California. Much of the area identified as the smelter area in early site drawings is now occupied by Buildings 398 and 399 and associated support equipment. A concrete pad west of Building 399 is identifiable in aerial photographs that show the smelter location in the late 1940s and in later photographs that show the site during the late 1950s. The Historical Radiological Assessment (HRA) Volume II (Weston Solutions, Inc. [Weston] 2007), notes the possibility that radium components were melted down at the smelter, along with other metal components. The primary isotope of concern is radium 226 (Ra-226), but other isotopes such as cobalt 60 (Co-60), strontium 90 (Sr-90), cesium 137 (Cs-137), plutonium 239 (Pu-239), and uranium oxide (UO_2) may be present. Include a reference stating the possible presence of "other isotopes" .

This scoping survey was performed to evaluate whether radionuclides of concern are present in accessible areas at levels in excess of the *release criteria* (?) and to provide information to assist in identifying future actions. A scoping survey of the area previously occupied by a smelter was performed to determine if there is any indication of residual (?)radioactivity that may be caused by direct smelter operations, dispersed materials from the smelter exhaust, or storage of staged materials. The survey included a gamma walk-over survey and soil sampling in areas exposed by removal of surface asphalt and concrete. The scoping survey also included sediment sampling in storm drains. Alpha and beta surface scanning measurements, direct measurements at defined and random locations of alpha, beta, and gamma radiations, and smear surveys were performed on the concrete pad adjacent to the smelter location.

The results of the FSA scoping surveys indicate that only background levels of Ra-226 that are well below the release criteria for that isotope are present in the exposed soil. The data are indistinguishable from background. No evidence of residual radioactivity from historical Navy activities was found in the exposed soil. Concentrations of Cs-137 in sediment are consistent with levels found in the area and throughout the United States resulting from fallout from weapons testing and nuclear plant accidents (Nuclear Regulatory Commission [NRC] 1998). A concrete pad at the FSA has been identified as the only existing feature from the former smelter footprint. The concrete pad showed only background levels of alpha and beta activity and no removable radioactivity (What about gamma activity?). The data were of sufficient type, quality, and quantity, (based on what level of quality was used to validate this statement?) The statement may be too general. All measurements were obtained in accordance with the task specific plan (TSP) and standard operating procedures (SOP) as presented in the work plan (ChaduxTt 2010). Quality assurance checks of all instruments were performed throughout the survey process in accordance with the TSP and SOPs. Only data that were validated by successful quality assurance checks were used to demonstrate compliance with the release criteria. Therefore, the results of the scoping survey did not identify any radioactivity in soil or the concrete pad that can be associated with the Navy's former smelter operations and no further actions are necessary. ***Can the FSA be classified as "non-impacted"? If so, please include this classification in this Executive Summary.***

1.0 SITE DESCRIPTION

Naval Air Station (NAS) Alameda was an active military installation from the 1930s to the l990s, primarily providing facilities and support for fleet aviation activities. NAS Alameda was selected for closure by Congress in September 1993 and was officially closed in April 1997. NAS Alameda is now known as Alameda Point.

1.1 SITE LOCATION AND DESCRIPTION

A smelter operated at NAS Alameda during the 1940s and early 1950s and was removed before the mid-1950s. The Former Smelter Area (FSA) is a 40,000-square-foot area east of Building 66. Much of the area identified as the smelter is occupied by new Buildings 398 and 399 and support equipment. A 1949 drawing identifies a proposed Turbo Jet Overhaul facility to be constructed in the area occupied by the smelter and is presented in Attachment 1. The Turbo Jet Overhaul facility was never built, however. By 1954, Buildings 398 and 399 were shown on the station map in the location where the proposed Turbo Jet Overhaul facility was to be constructed, with the smelter no longer present. Attachment 2 presents an aerial photograph overlay that shows the current buildings and the footprint of the former smelter area. A concrete pad west of Building 399 is identifiable in photographs that show the smelter location and in later photographs that show the site during the late 1950s. The concrete pad appeared to be a storage location for metal bins. The concrete pad has been identified as the only existing feature from the former smelter footprint; it is currently fully exposed and present at the FSA site. The location of the FSA relative to existing site buildings is shown in Figure 1. A more detailed drawing of the smelter area relative to Buildings 398 and 399 is shown in Figure 2.

1.2 PRIOR HISTORICAL USE

The Historical Radiological Assessment (HRA) Volume II (Weston Solutions, Inc. [Weston] 2007) notes the possibility that radium components were melted down in this area along with other metal components. Historical information of smelter operations involving material containing radiological components, most likely radium, was unknown. Since this information was not available to ascertain if the site was considered radiologically "impacted", the Navy conservatively assumed a premise that radioactive contamination could be present due to identical smelter operations at other naval sites which did identify the presence of such contamination. It was concluded that a future scoping survey would need to be performed in order to define radiological conditions and determine if any further actions are required. Slag from the smelter operation would likely have been disposed of in Installation Restoration Site 1. Metal bins were used to store feed materials for the smelter.

1.3 CURRENT AND FUTURE BUILDING OR LAND USE

The FSA is currently occupied by Buildings 398 and 399 and support equipment. Building 398 is leased for commercial use, and Building 399 is vacant. Much of the area around the buildings

is asphalt paved, with concrete covering the rest of the ground. The support equipment consists primarily of coolers and associated piping. Future use of the FSA is unknown.

1.4 REPORT OBJECTIVES (IMPACTED OR NON-IMPACTED?)

This report details the results of the scoping survey performed to assess whether residual activity from smelter operations exists *above the established release criteria?* in accessible areas and to evaluate further actions that may need to be taken in the vicinity.

2.0 HISTORICAL RADIOLOGICAL ASSESSMENT

The history of the FSA was obtained from the HRA performed by the Navy (Weston 2007). Additional information was reported in the task specific plan (TSP), attached as Appendix A. These documents supplied most of the historical information presented in this report.

2.1 OPERATING HISTORY

As discussed above, the smelter may have been used to process metals containing radium 226 (Ra-226) or other radioactive materials. The area of the smelter is identified in the 1949 photograph shown in Figure 2 and Attachment 2. The smelter was removed in the early 1950s. Currently, the area is occupied by Building 399 and portions of Building 398. The area between the buildings and around Building 399 contains equipment, such as coolers and piping in support of Building 399 operations. The remainder of the area has been paved with asphalt. At present, there are three storm drains in the area to collect stormwater runoff. The storm drains empty to the Sea Plane Lagoon. A 12-foot-wide concrete pad extending several hundred feet west of Building 399 has been identified to be the pad identifiable in the 1949 photograph of the smelter area. The pad is assumed to be a storage area for bins of metal staged for smelting or for slag from the smelter.

2.2 MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION MANUAL CLASSIFICATION

Surveys were limited to areas where the pavement could be removed without affecting the building structures or the support equipment and their pedestals. The exposed areas of soil available for survey were divided into Class 1, Class 2, and Class 3 areas. Although a scoping survey was performed, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) survey unit classification was used in the design layout of the survey units. The survey was not designed to obtain a free release of the site, but instead to assess whether any contamination was present in the accessible surfaces of the site.

The Class 1 area is located on the east side of Building 399. A 10-foot Class 2 buffer area surrounded the Class 1 area. A Class 3 area was located west of Building 399. The surface of the concrete pad was surveyed as a Class 2 area. The classification and survey unit (SU) identifications are shown in Figure 3.

Gamma walk-over surveys using a sodium-iodide (NaI) detector were performed in all classification areas with exposed soil. Gamma walk-over surveys are not quantitative, but establish relative values across the exposed soil areas. The gamma scan values were used to evaluate the presence of outliers. Outlier locations, if present, would be used to bias soil sampling. Gamma scan methods are further discussed in Section 6.6.

Surface scans for alpha and beta emitting radionuclides were performed on the concrete pad. More than 50 percent of the Class 2 surface area was scanned. Soil samples were obtained in each Class 1, 2, and 3 area at systematic data collection points. Using a random start point, systematic data collection locations (N) were laid out in a triangular grid pattern for the SUs using the computer process provided by Visual Sample Plan (VSP) (Gilbert and others 2001). Locations for data collection for soil sampling and direct surface measurements on the concrete pad are provided in Appendix A.

2.3 RADIONUCLIDES OF CONCERN

As identified in the HRA (Weston 2007), the isotopes of concern are Ra-226, cobalt 60 (Co-60), strontium 90 (Sr-90), cesium 137 (Cs-137), plutonium 239 (Pu-239), and uranium oxide (UO_2).

3.0 RELEASE CRITERIA

Limits on residual contamination for the radionuclides of concern (ROC) are discussed below. These limits, or release criteria, refer to standards for release of the FSA from radiological controls.

3.1 UNRESTRICTED RELEASE CRITERIA

The release criteria for ROCs in soil are as follows: Ra-226, 1 picocurie per gram (pCi/g) above background; Co-60, 0.0361 pCi/g; Sr-90, 0.331 pCi/g; Cs-137, 0.113 pCi/g; Pu-239, 2.59 pCi/g; and UO_2, 0.398 pCi/g. Surface activity limits for ROCs are as follows: Ra-226 and Pu-239, 100 disintegrations per minute (dpm) per 100 square centimeters (cm^2) total surface activity; Sr-90, 1,000 dpm/100 cm^2 total surface activity; UO_2, 488 dpm/100 cm^2 total surface activity; and Co-60 and Cs-137, 5,000 dpm/100cm^2 total surface activity (Navy 2006). The removable contamination release criteria are one-fifth of the total activity limits (Navy 2006).

Can we re-write this section to use a term that would adequately support the conclusion? A scoping survey should not be used to determine if a site can, or cannot be "released, even though MARSSIM guidelines were used in planning the scoping survey. A Final Status Survey and its report will be used to support the release of a remediated site.

3.2 INVESTIGATION LEVELS (ACTION LEVELS??)

Investigation levels were equal to the release criteria for both soil sampling and concrete surface contamination surveys, including both direct surveys and removable activity surveys. Investigation levels for gamma walk-over surveys were set at the 3 sigma (σ) value for each data set, or if individual outliers were identified in the survey of the FSA.

4.0 SURVEY DESIGN

The scoping survey consisted of a gamma walk-over survey and soil sampling at specified locations in areas of exposed soil. Surveys of the concrete slab consist of alpha and beta scanning, direct measurements at defined and random locations of alpha, beta, and gamma radiations, and removable alpha and beta radioactivity. Survey methods are described in the TSP, attached as Appendix A. There were no deviations from the TSP.

4.1 OBJECTIVE OF SURVEYS

The objective of the scoping surveys was to evaluate whether residual radioactivity levels from historical Navy activities in the accessible areas of the FSA are less than the predetermined release criteria??. Access to soil in the FSA was made possible by removing the asphalt and concrete surfaces that were not housing support equipment for Building 398 or 399. Neither Building 398 nor 399 was disturbed to gain additional access to soils. Survey results are used as input to assess whether further actions are needed.

4.2 SURVEY UNITS

A layout drawing indicating classification and SUs is provided as Figure 3. SUs are listed in Table 1. Detailed drawings of each SU are shown in Appendix A.

4.3 REFERENCE AREAS

The reference area was selected in consultation with the Navy Radiological Affairs Support Office (RASO). Reference data for naturally occurring Ra-226 were obtained from the survey project report abstract (Tetra Tech EC Inc. 2010). Eighteen reference area samples from an area west of Building 3 and south of Building 4 were obtained, analyzed, and reported in the abstract. This area was not identified in the HRA as impacted. The analytical results for Ra-226 are summarized in Table 3-3 of the reference area document (Tetra Tech EC Inc. 2010). Background activity *(Is this activity the **mean** "Background Activity"??)* for Ra-226 was 0.5602 pCi/g, resulting in a release criterion?? of 1.5602 pCi/g. The analytical procedure used to measure Ra-226 activity may have introduced a small non-conservative factor. The non-conservative value was applied for this scoping survey. However, the results of soil samples discussed in Section 8.4 indicate all values well below the release criteria, such that the non-conservative value does not alter the conclusions. ***Include summary statistics for the above***

Tetra Tech background measurement results (mean, median, minimum, maximum and standard deviation.

The following is a COMMENT and is not to be included in the text of the scoping survey. The intent of the comment is to support the aforementioned request to include summary statistics in the scoping survey report:

The inclusion of summary statistics will help provide evidence to support the conclusion of this scoping report by establishing an upper limit of background. This upper threshold can be an aid to determine if the scoping survey results indicate that residual radioactivity does or does not exceed background.

Gamma walk-over surveys were performed in areas west of Building 3 and south of Building 4 to measure the relative response of the process in a known non-impacted area. The results of the walkover surveys in the reference area give an average of approximately 7,000 counts per ***second***? (420,000 counts per minute?). The reference area is open land, consisting of soil with a slight grass covering. The material under the asphalt removed at the FSA is soil with stone and gives an average of approximately 4,200 counts per second?. Therefore, the reference area was not used as a comparison to the survey areas at the FSA, but only to validate the data collection capability of the survey instrumentation.

Reference areas inside Building 112 were initially selected to define a "background" activity level associated with the concrete pad. Building 112 has no history of radioactive material use (Weston 2007). Reference survey methods are discussed in the reference document *Alameda Point Basewide Radiological Surveys Final Status Survey Reports Reference Area Survey Results* (Millennium Services, Inc. [MSI] 2011a). However, the concrete pad at the FSA has been exposed to weather for more than 60 years and more aggregate appeared to be exposed than in the finished concrete within Building 112. Measurements of alpha activity from direct surveys of the concrete pad indicated a higher than expected response. An outdoor concrete reference area was identified along the south side of Building 114, outside the fenced area identified as impacted. The concrete was also weathered, with aggregate appearing on the surface. The result of a long count in the reference area is used as the background value for the concrete pad. The reference area survey documentation is included in Appendix C. Additional evaluations and survey points were identified to aid in evaluating the reasonableness of applying the reference area to the concrete pad. The evaluations are discussed Section 8.1.1.

4.4 STATISTICAL TESTS

Gamma walk-over survey results were evaluated for average and standard deviation for each strip of data collected in the background area and the FSA SUs. Cumulative frequency distribution (CFD) plots of each data set were generated to identify the presence of outliers. More information on the CFDs is included in Section 8.2.3. The maximum 100 cm^2 reading and the area representing that reading are reported for scan data of the concrete if release criteria have been exceeded. In addition, color-coded plots were generated for surveys obtained with the

surface contamination monitor (SCM). The plots show count rates by location in the SU. More information on these plots is presented in Section 8.2.1.

Sample analysis and direct readings at defined and random locations were compared with the release criteria, discussed in Section 3.1.

4.5 DETERMINING THE NUMBER OF DIRECT MEASUREMENTS

Although some of the ROCs are found in background, the majority are not. Therefore, the minimum number of soil samples was selected based on contaminants not present in background. Equation 4-2 of the work plan (ChaduxTt 2010) was used to select the number of direct measurements, N, to be taken per SU when the contaminant was not present in background:

Equation 4-2 from the work plan (ChaduxTt 2010)

$$N = \left(\frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4(Sign\ \rho - 0.5)^2} \right)(1.2)$$

Where:

N = Number of data points

$Z_{1-\alpha}$ = Type I decision error level, 1.645

$Z_{1-\beta}$ = Type II decision error level, 1.645

Sign ρ = random measurement probability, 0.945201

1.2 = 20 percent increase in number of samples over the minimum

The values used in the calculation were from MARSSIM guidance (Nuclear Regulatory Commission [NRC 2000]) and were based on a recommended value for the lower bound of the gray region (LBGR) of 1.6. Type I and Type II decision errors were based on 0.05 false negative and 0.05 false positive rates. The associated *Z* values were obtained from MARSSIM Table 5.2 (NRC 2000). The random measurement probability, *Sign* ρ, is from MARSSIM Table 5.4 (NRC 2000).

The calculation resulted in a value of N = 16.38. Therefore, a minimum of 17 soil samples or direct measurements were obtained in each SU. The scanning minimum detectable concentrations (MDC), discussed in Section 6.6 and presented in Table 2, are below the release criteria; therefore, recalculation of the value of N was not required in accordance with MARSSIM guidance, Chapter 5, Figure 5-3.

Were the number of soil samples sufficient for the given statistical test, and how was this confirmed?

5.0 FIELD ACTIVITIES

Other field activities were carried out in addition to the radiological surveys. They include quality control and health and safety clearance. All activities are discussed in this section.

5.1 MOBILIZATION

Mobilization for the FSA scoping survey began in October 2010 by Millennium Services, Inc. (MSI), the survey contractor. The final TSP for the survey, provided in Appendix A, was reviewed by survey staff during the initial training. Survey staff received training on the safety plans and a briefing by the project Radiation Safety Officer Representative (RSOR), who also provided dosimetry for project personnel.

5.2 INITIAL CLEARANCE WORK AND SURVEY MARK OUT

As noted previously, the smelter was removed in the early- to mid-1950s. Buildings 398 and 399 occupy a significant portion of the smelter area footprint. The area surrounding Building 399 consists of asphalt pavement and concrete. Asphalt within the boundary of the survey was removed to expose soil. The concrete areas are designed pedestals for large equipment or to control leakage from process piping. Concrete that was not serving as a pedestal for equipment was also removed. Were surveys performed on the portions of asphalt which were in contact with removed soil? If not, then state reason(s) for not performing such surveys.

Using a random start point identified in the TSP, the systematic data collection fixed-point locations were laid out in a triangular grid pattern for the SUs, using the computer process provided by VSP software (Gilbert and others 2001). Soil sample locations were marked with flags; concrete pad locations were marked using indelible markers. The total number of soil sample locations exceed 17 in the following survey units:

- SU 2 19 locations
- SU 3 18 locations

Why were additional sampling locations needed for SUs 2 and 3?

5.3 SCOPING SURVEY ACTIVITIES

The scoping survey consisted of a gamma walk-over survey of soil exposed by the removal of asphalt and concrete in SU 1, SU 2, and SU 3. Soil samples were obtained at each of the predetermined locations in those three SUs. The scoping survey also consisted of alpha and beta scanning of SU 4. The SU 4 required survey was performed with scan coverage of 50 percent for a Class 2 area. Direct measurements were made at predetermined locations in SU 4 for:

- Alpha, beta, and gamma radiation

- Removable alpha and beta radioactivity
- Gamma exposure rate.

In addition, three storm drains in the vicinity of the FSA were evaluated for potential sediment sampling. The storm drains were not within any of the SUs. Two of the storm drains contained sediment, one north of Building 399 and one south of Building 399. The third storm drain, east of SU 2, did not contain sufficient quantities of sediment for sampling.

6.0 SURVEY INSTRUMENTATION

Instruments selected for this survey were appropriate for the physical and environmental site conditions as discussed in the final TSP. The instruments and selected measurement methods used were able to detect the ROC or radiation type of interest and were, in relation to the survey or analytical technique, capable of measuring levels equal to or less than the release criteria.

6.1 INSTRUMENT CALIBRATION AND QUALITY ASSURANCE PROCEDURES

Hand-held survey instruments were initially calibrated to National Institute of Standards and Technology (NIST)-traceable sources by the instrument vendor. Ludlum direct measurement instruments were calibrated by Ludlum within a year prior to this survey. In addition, MSI personnel performed ROC-specific efficiency determinations for each instrument after it arrived on site. The NaI system used for the gamma walk-over survey was calibrated by the Environmental Restoration Group, Inc. (ERG). The SCMs were also calibrated to NIST-traceable sources on site. The SCMs were calibrated at the start of the project using MSI's approved calibration procedures. Calibration records are shown in Appendix B.

6.2 INSTRUMENT OPERATIONAL CHECKS

Radiation detection instruments used in the survey were maintained and calibrated to operate within manufacturer's specifications so that the required sensitivity and precision were maintained. Survey instruments were source-checked twice daily, before and after each survey. Procedures were followed for all field instrumentation to verify that the instruments were operating properly and that the data were valid with instrument calibrations that were NIST-traceable. These procedures included functional operational checks, routine maintenance, calibration procedures, and operational instructions.

The operational checks ensured that the instruments were within the ±20 percent acceptance criterion established when the baseline information was established. If an instrument did not meet this specification, it was removed from service, tested, repaired or replaced and recalibrated. Appendix B shows a typical quality control chart for the SCM, demonstrating that the selected instrument has remained in calibration.

6.3 INSTRUMENTS FOR THE MEASUREMENT OF ALPHA AND BETA SURFACE ACTIVITY

Various gas-filled detectors were used to measure alpha and beta surface activities. Details are provided in the following sub-sections.

6.3.1 Instruments for the Static Measurement of Alpha and Beta Surface Activity

SU fixed-point locations were measured with the Ludlum 43-68 gas flow proportional detectors coupled to a Ludlum 2221 ratemeter. The counting gas used was P-10.

6.3.2 Instruments for the Scan Measurement of Alpha and Beta Surface Activity

SU 4 was scanned with the SCM. The SCM uses a gas flow position sensitive proportional counter (PSPC). The PSPC uses P-10 as the counting gas. As with any proportional counter, voltage plateaus are established for the detection of alpha or alpha-plus-beta particles. High voltage appropriate for the type of particles to be detected is applied to the single anode wire that runs the length of the detector. The SCM computer compares the pulse heights of pulses sensed at each end of the anode wire and establishes the location on the anode wire where the nuclear particle was sensed. Although the available resolution is greater than 2,000 locations on the anode wire, the SCM computer "bins" the data in 5-centimeter (cm)-wide increments along the length of the wire.

The SCM was operated in either a dynamic "rolling" mode or a static "corner" mode. In the dynamic mode, the system uses a direct current-powered drive motor affixed to a cart that contains the necessary electronics and computer hardware. The detector assembly is mounted to the front of the cart. The SCM is shown in Figure 4. The SCM's design focuses on eliminating human performance issues associated with surveys of large areas. The system is designed such that surveys are performed at constant speed, the detector is held at a fixed distance from the surface being surveyed, and survey data are recorded automatically. In the dynamic mode, a precision wheel encoder is mounted to the cart axle to measure distance traveled by the cart. The encoder can measure to a small fraction of a cm and is used to trigger the computer to capture data for every 5 cm of travel of the SCM cart. The result is count data (counts) for every 5 cm "bin" for every 5 cm of travel, or a matrix of 25 cm^2 "pixels" of data.

In the static mode, a preset time is applied to the collection of data from a stationary detector. Data are binned in a manner similar to the dynamic mode.

Data are transferred from the SCM to a processing station that contains the Survey Information Management Systems (SIMS) software via removable media. SIMS software is used to "stitch" the individual blocks of data to create a single survey of the entire area. The data collected in 25 cm^2 pixels are summed with adjacent pixels in a manner that results in an evaluation of every

possible 100 cm^2 area. In measuring activity, each 25 cm^2 "pixel" is 25 percent of four overlapping 100 cm^2 areas. This process ensures that small areas of activity above limits are not missed through grid registration errors.

The SCM in the dynamic mode is operated with a recount detector for alpha surveys with low release criteria. A second detector is hard mounted behind the first at a constant distance. Both detectors perform complete surveys as discussed above. SIMS will generate a survey for each detector. The individual detector surveys will display activity from a source if present, but also counts that result from background activity. SIMS applies "coincidence logic" to the two surveys to avoid false positives caused by background radioactivity. The recount detector survey is superimposed on the primary detector survey. Each 100 cm^2 area is evaluated against a threshold number of counts. If both detectors are above the threshold value, the results are averaged and the activity is evaluated against the release criteria. If either the primary or recount detector is below the threshold, the counts are considered to be from background, and a null value is incorporated in the coincidence logic report.

In the static mode, a second count is obtained at each static measurement location. The second count is considered the recount survey. The SIMS coincidence logic described above is applied to determine if activity is present or if the observed counts are caused by background. The coincidence logic applied within the SIMS software described in Appendix J of MARSSIM (NRC 2000) and is designed to reduce the large number of false positives typically obtained when the release criteria are low, as in alpha surveys.

6.3.3 Determination of Instrument Efficiency for Alpha and Beta Surface Activity Measurements

Instrument efficiency (ε_i) is defined as the ratio between the net count rate (in counts per minute [cpm]) of the instrument and the surface emission rate of the calibration source for a specified geometry. Instrument efficiency was calculated by obtaining static counts from a detector positioned over a calibration source that features a NIST-traceable surface emission rate. The gamma walk-over survey is a qualitative assessment. Therefore, efficiency determination of the NaI-based data collection system was not required.

Additional considerations that control overall instrument efficiencies include the following:

- Calibration Sources: Selected calibration sources feature alpha and beta emission energies similar to those expected from contaminants in the field (same as or similar to ROCs). An adjustment for radiations per disintegration may be applied.
- Source Geometry Factors: Geometry factors may be applied based on a calibration source area greater than the area of the probe.
- Source-to-Detector Distances: Calibration is performed at a "source-to-detector" distance consistent with the "detector-to-surface" distance used in the field.

- Window Density Thickness: Calibration is performed using a detector window density thickness identical to that used in the field.

- Detector-Related Factors: The SCM is able to increase efficiency by using a 10-cm-deep detector to survey a 5-cm bin (see Section 6.3.2 above). This detector geometry allows the 5-cm section to be passed over twice and increases the instrument efficiency by a factor of 2.

6.4 INSTRUMENT FOR THE MEASUREMENT OF EXPOSURE RATES

The Ludlum Model 19 instrument, which contains an NaI detector, was used to measure ambient gamma exposure rates. NaI scintillation detectors are sensitive to photon gamma radiation and are ideal for locating radiation levels above background when gamma scans and static measurements are collected.

6.5 INSTRUMENT FOR MEASURING SWIPE SAMPLES

Swipe samples were collected for the analysis of removable contaminants. Swipe samples, also referred to as smear samples, were obtained at the discrete surveillance points in the SUs. All samples were processed using a Ludlum Model 2929 low-background, alpha/beta counter. This counter uses a dual phosphor scintillation detector.

6.6 INSTRUMENT FOR GAMMA WALK-OVER SURVEY

Gamma walk-over surveys were conducted using a 2-inch-by-2-inch (diameter and thickness) NaI detector coupled to a ratemeter and data recorder. Data were recorded at timed intervals during the scan. The ratemeter was operated in the open window (no electronic discrimination) mode. The walk-over survey was conducted by walking the area in lanes of 1 meter width at approximately 0.5 meter per second with the detector approximately 10 cm (4 inches) from the soil surface while the detector is moved in a serpentine (S-shaped) fashion. Output from the ratemeter was recorded automatically on a hand-held personal digital assistant and later transferred to a processing computer. Output from the gamma scan was evaluated by analyzing the data in a CFD plot. Outliers identified as departures toward extreme values would be linked to the time of data collection, which in turn would be linked to location. Those areas would be used to bias the soil sampling. Since the walk-over gamma readings were used as relative values, system sensitivity and MDC values are not critical and are therefore not discussed. If this is the case, then please explain the inclusion of survey specifics, such as, a walking "speed" of 0.5 meter per second, or a distance of 10 cm from the soil surface? If these values are worth mentioning in this report then the values can be considered critical enough for further discussion in the section. In addition, the lack of discussion in the section (6.6) may contradict the discussion of information expressed in Section 8.3 of this report. The walk-over gamma survey instrumentation and process are shown in Figure 5.

6.7 DETECTION SENSITIVITIES

The final TSP (Appendix A) presents detection sensitivities of the detectors and discusses them in detail. Table 2 summarizes the results of sensitivity calculations. Some have been recalculated where actual field parameters differ from the TSP assumptions. These recalculated values are noted in Table 2. Resulting instrument sensitivities for the FSA scoping survey are more than sufficient to detect the ROCs at the applicable release criteria. The gamma walk-over surveys were conducted with an NaI-based system to measure relative response while the detector traverses the survey area, noting outliers. As such, system sensitivity was not critical to the process and therefore was not determined.

7.0 SURVEY PROCEDURES

This section provides a review of the survey procedure and how the procedure met data quality objectives (DQO). This section includes site-specific discussions of techniques for gamma walk-over surveys, scanning, direct radiation, and removable contamination surveys of the FSA. The general procedure for surface scanning surveys at the FSA, and other areas within the scope of the Alameda Point Basewide Radiological Survey program, is described in *Alameda Point Radiological Survey Methods: Surface Contamination Monitor (SCM) Surveys Supported by Hand-held Instrumentation* (MSI 2011b).

7.1 REVIEW OF DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements developed to define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data. These outputs are used to develop a data collection design that meets all performance criteria and other design requirements and constraints. The U.S. Environmental Protection Agency (EPA) has developed a seven-step process to develop DQOs.

Step One – State the Problem

The problem can be stated as, "Can the available areas in the FSA be shown to demonstrate compliance with the release criteria?" Determine if the surveyed area (FSA) is radiologically impacted or non-impacted and if further action is required.

Step Two – Identify the Goal of the Study

The primary use of the data from this survey is to provide input into requirements for further actions at the FSA. Therefore, the decision to be made can be stated as, "Do the results of the survey meet the release criteria for the site-specific ROCs?"

Step Three – Inputs to the Decisions

Radiological surveys designed to support the scoping survey of the FSA include:

- Walk-over gamma survey of 100 percent of the exposed soil in Class 1, Class 2, and Class 3 areas.
- A minimum of 17 soil samples each from SU 1, SU 2, and SU 3 analyzed for the ROCs.
- Alpha and beta scan survey of 50 percent of the surface of the Class 2 concrete slab.
- A minimum of 17 alpha and beta direct measurements, smear surveys and gamma exposure measurements of the surface of the concrete slab, SU 4.
- Sediment samples from storm drains in the vicinity of the survey area.

Step Four – Identify the Boundaries of the Study

The lateral and vertical spatial boundaries for this survey effort are confined to the area specified as the FSA as shown in Figure 3. Did the survey include obtaining subsurface soil samples?

Step Five – Identify the Decision Rules

If the presence of the site-specific ROCs in soil samples or on the concrete slab surface or in swipe samples is less than the release criteria, then no further measurements are required. If the results of the survey exceed the release criteria, then the data will be used to characterize the site-specific ROCs with the intent to design and implement remediation in the future. No additional surveys to determine extent?

Step Six – Set Limits on Decision Errors

Limits on decision errors are set at 5 percent, as specified in the work plan (ChaduxTt 2010).

Step Seven – Optimize the Study Design

Operational details for the radiological survey process have been developed. The theoretical assumptions are based on guidelines in MARSSIM (NRC 2000). Specific assumptions regarding types of radiation measurements, instrument detection capabilities, quantities and locations of data to be collected, and investigation levels are contained in the TSP and the work plan (ChaduxTt 2010). The TSP was reviewed and approved by the Navy, both Base Realignment and Closure (BRAC) and RASO staff. Is an "Attachment" for TSP included in this scoping survey document?

7.2 SCAN MEASUREMENT TECHNIQUE (CONTINUATION FROM JAN. 26 EMB REVIEW)

Scanning assessments were conducted using the SCM in conjunction with an automated information management system. This arrangement allowed computer analysis of large volumes of survey measurements acquired in relatively short time periods, resulting in easily interpretable graphical displays of survey results. The survey technology was employed for scanning measurements. The SCM is shown in operation in Figure 4.

The SCM system uses a patented PSPC that is capable of establishing where along the detector a decay event occurs. This capability allows a long detector to be divided electronically into a continuous array of small, virtual detectors that are similar in efficiency to other counters, but that have backgrounds associated with small area detectors. This division results in improved sensitivity because of the low background and specific identification of the location of the radioactivity. In scanning mode, the SCM logged information in 25 cm^2 bins by logging data for each 5-cm width of the PSPC and for every 5 cm of forward travel. Scan speed is motor controlled, and the distance the SCM travels is measured by a precision wheel encoder. Data were recorded in 25 cm^2 pixels over the entire surface surveyed; thus, the SCM records 400 measurements for every square meter it traverses. Controlling the survey speed and automatically logging the location of the data obtained using a wheel encoder eliminate typical errors and uncertainties associated with hand-held detectors.

7.3 DIRECT MEASUREMENT TECHNIQUE

Direct measurement locations were first selected using VSP software. Locations generated by VSP are listed in Appendix A. After these locations had been found and marked, the following measurements were performed:

- Two-minute alpha count with the Model 43-68 detector
- One-minute beta count with the Model 43-68 detector
- Gamma exposure rate measurement with the Model 19 detector
- Swipe measurement for removable contamination, analyzed with the Model 2929 counter.

8.0 RESULTS AND ANALYSIS

This section presents the results of the direct measurements at pre-determined locations and the scanning measurements.

8.1 DIRECT MEASUREMENTS

Direct measurement results at pre-determined, random locations are summarized in Table 3, and the raw data are listed in Appendix C.

8.1.1 Alpha Direct Measurements

The 17 direct measurements obtained on the concrete pad, SU 4, exhibit higher count rates then recognized in the reference area. The measurements ranged from 4 to 15 cpm, higher than the 1.1 cpm average alpha count rate in the concrete reference area within Building 112. The average count rate on SU 4 is 9.25 cpm with a standard deviation of 3.4 cpm. All direct measurements on SU 4 concrete are within 2 standard deviations of the average. SU 4 is a concrete pad that has been exposed to traffic and weather for at least 60 years. The application of the reference area background value obtained for the Building 112 concrete is not considered representative of the FSA are concrete pad. A similar situation exists in the Building 114 Courtyard area. (Please clarify the "similar situation": Is the situation at Building 114 similar to Building 112 or SU-4?) Concrete ramps that have been exposed to weather for several decades have a different appearance from the reference area concrete. Much of the finished concrete has been eroded, exposing more of the aggregate. A similar area of concrete on the south side of Building 114, outside any impacted area, was identified as a reference area for the (SU-4??) concrete ramps. The reference area concrete has an average alpha measurement of 9.9 cpm. Further investigation into the reasonable alpha background was conducted as described below.

First, re-survey alpha measurements at all 17 locations was performed. Elevated values, within statistical variability of the initial measurements, were again recorded. Comparing the original 17 locations measured with the re-survey at the identical locations shows the measurements obtained in each specific location vary greatly, but within the same range as the initial measurements. However, the locations of the highest readings during the initial survey produced some of the lower readings when they were re-surveyed. In addition to the 17 measurement locations, five measurements were obtained at the extreme southern end of the concrete pad, approximately 100 feet from the survey unit. Those measurements show values consistent with the values obtained in SU 4. The additional five locations at the south end of the concrete pad ranged from 5.5 to 9 cpm.

Second, the average alpha activity from SCM scans has been evaluated. The SCM scan of the FSA concrete pad indicated randomly distributed low-level counts across the entire pad. The coincidence logic applied to the data indicates the pad to be free of activity in the range of the release criteria. The SCM records the counts in each 25 cm^2 area as the scan is conducted. The computer clock, measuring the time interval for the collection of each data point, converts the counts to cpm. The process for assessing compliance with release criteria for alpha activity is described in Section 7.2 and in Section 8.2.1. Processing the data collected by the SCM in the SIMS allows for determination of average activity in any selected region of interest for a specific scan using a sub-routine "Snooper."

Snooper is a data processing subroutine investigation tool that allows the SIMS operator to evaluate statistical information for a selected region of the data set. Using the mouse, the operator can define a region of interest by "rubber banding" the area directly on the image. Once the region of interest is identified, a two-by-two summing filter is block- processed through the 25 cm^2 data, which results in 100 cm^2 data. The system then calculates the highest 100 cm^2 data point and average all 100 cm^2 data points within the region of interest. That data, along with the size and position of the region of interest, are reported to the operator in the Snooper window. The Snooper investigation tool was used on the entire image of both the primary and the recount detectors for the scan data obtained on the SU 4 concrete pad. The results of the investigation are an average value of 12.1 cpm from the primary detector and 10.7 cpm from the recount detector. The Snooper output images, obtained from screen capture, are shown in Figure 7.

Finally, the investigation included a comparison of the data generated by a single SCM detector, the primary detector, from three separate surveys. The surveys include asphalt from the Building 114 Courtyard, concrete from the Building 66 interior, and the FSA concrete pad. The Building 114 Courtyard asphalt exhibited slightly higher background than the reference area, 5 cpm compared with 1.1 cpm in the reference area. The Building 66 alpha surveys were similar to the reference area surveys for both direct readings and SCM scan surveys. The FSA survey is from SU 4, the concrete pad.

A comparison of the three areas is reported in Appendix C. The scale for activity is in dpm, adjusted for both the short count time, 8 seconds, and system efficiency, 50 percent with no background subtraction. The same parameters are applied to all three CFDs. The shape of the CFD plots for alpha surveys reflects the low number of counts in each 100 cm^2 area. A large number of areas have zero counts, and many have 1 count. As a point of comparison, the 90th percentile value for all three surveys is identified on the CFD plot. Both the Building 114 Courtyard asphalt and the concrete surfaces inside Building 66 show a 90th percentile value of approximately 40 dpm/100 cm^2. The concrete pad at the FSA value for 90th percentile is approximately 80 dpm/100 cm^2. The shape of the CFDs is consistent with no indication of outliers in any of the three areas. The values are provided to demonstrate a relative comparison between the surfaces.

Based on the investigation, the basis for the elevated measurements is a higher alpha background on the surface of the FSA concrete pad. Please include a brief discussion as to the reason(s) for the elevated alpha measurements. Using the reference area background value from the area south of Building 114, outside the fenced area, a background of 9 cpm is a reasonable value to be applied to the concrete in SU 4. Table 4 reflects the results of the SU 4 direct measurements with a background of 9 cpm applied.

8.1.2 Ambient Gamma Dose Rates

Gamma dose rates varied very little on the FSA concrete pad. They ranged from 4 to 5 microroentgens per hour (μR/hr), averaging 4.8 μR/hr, consistent with values found in the reference area (Identify the reference area used). Readings from specific monitoring points are

shown in Appendix C and are consistent with values measured in area walk-over surveys discussed in Section 5.2.

8.1.3 Removable Contamination (Smears)

Removable contamination surveys were performed in accordance with the TSP and the requirements of standard operating procedure (SOP)-006, Radiation and Contamination Surveys. Areas of 100 cm^2 were swiped and the location and swipe number recorded. Swipes were counted using a Ludlum Model 2929 instrument, which uses a dual phosphor detector, in accordance with RP-OP-017, Operation of the Ludlum Model 2929 Dual Scaler. When in use, a daily background and source check was performed on the instrument. A 20-minute background check was performed to ensure that contamination from swipes has not entered the chamber. NIST-traceable planchet sources were used to determine the efficiency of the Ludlum Model 2929. The system efficiency for alpha activity was 41 percent and beta activity 32 percent. Minimum Detectable Activity (MDA) was calculated daily using Equation 7-10 of the work plan (ChaduxTt 2010). The MDA values for the Ludlum Model 2929 ranged from 9 to 12 dpm for alpha activity and from 78 to 84 dpm for beta activity.

Seventeen smears were collected on the concrete in SU 4. The maximum activities were 4.9 (alpha) and 37.0 (beta) dpm/100cm^2 as reported in Table 4. These maxima are less than the release criteria for removable contamination. The removable contamination release criterion for surfaces is 1,000 beta dpm per 100 cm^2 for Cs-137 and Co-60. The criterion for UO_2 is 98 dpm alpha/100 cm^2 (Navy 2006). The release criterion for Sr-90 is 200 dpm beta/100 cm^2 and for Ra-226 and Pu-239 is 20 dpm alpha/100 cm^2.

8.1.4 Analysis of Direct Measurements

Direct measurement results were compared with the release criteria. All results were less than the applicable release criteria. No further analysis is required, since no readings exceeded the release criteria.

8.2 SCANNING MEASUREMENTS

Scanning measurement results are summarized in Table 3 and presented in detail in Appendix D. More than 50,000 measurements were made with the SCM using relatively short count times. The information available from the large number of measurements is presented in two-dimensional color graphic plots in Appendix D.

8.2.1 Alpha Scans

The SCM was configured in the recount mode for alpha scans, using two detectors. The primary and recount detectors collect data independently in this mode. The offset between the detectors is constant because the detectors are in a rigid mount. Processing software then superimposes the recount detector data over the primary. The processor then applies "coincidence" logic to

detect very low levels of radionuclides. This logic accepts events only where both detectors register a threshold number of counts exceeded in the same 100 cm^2 area — in this case, three counts or greater. This re-count approach allows for detection of low-level alpha contamination while suppressing false positives caused by background. Background activity will rarely register counts above the threshold in both detectors (less than 1.0×10^{-4} probability).

The maximum alpha activity detected in SU 4 was 22 dpm/100 cm^2. Alpha scan results are shown in Appendix D. The three color-coded maps in the appendix show results from the primary detector, the recount detector, and points where the "coincidence" threshold is met. The activity shown on the third map is the average reading from the two detectors. Only one 100 cm^2 area exceeded the "coincidence" threshold. (Please specify the location in Appendix D.)

8.2.2 Analysis of Alpha Scan Measurements

Not all of the color-coded maps in Appendix D are true maps of the area. Data from multiple SCM surveys indicating "This survey is not position correlated" are posted in the figure at approximate locations. However, points of interest can be re-located by searching the raw data files and locating the individual SCM measurements. Those measurements are coded, and the codes are marked on the floor where the measurements occurred.

Scan measurement results were compared with the investigation level and release criteria. All results were less than the applicable limit. No further analysis is required, since no readings exceeded the criteria.

8.2.3 Beta Scan Measurements

Beta scan results are shown as a CFD in Figure 6. Corrected for background, the average readings (cumulative probability = 0.5) are close to zero, demonstrating that there was no net radioactive activity and that the reference area was appropriate for the SU. Straight-line CFDs demonstrate normally distributed data as found in areas without contamination. Normally distributed data are observed in the CFDs reported in the reference area survey results (MSI 2011a). Areas that indicate radioactivity beyond that expected from normally distributed activity would appear as outliers at the high end of the CFD. To meet the sensitivity requirements of the survey, the SCM must show the high end of the normally distributed data to be less than the release criteria. Then, areas that meet or exceed the release criteria will be identifiable and can be investigated. Deviations from normally distributed, straight-line CFDs were not observed in the FSA SU 4 survey.

The maximum 100 cm^2 area is 3,532 dpm/100 cm^2 in SU 4, which is less than the release criterion for Co-60. Beta scan survey reports are presented in Appendix D. Appendix D contains information regarding the survey name, technicians who performed the survey, background and efficiency values, and release criteria. Both a color graphic two-dimensional plot and a CFD are included. The two-dimensional plots include a color bar indicating activity

measured. The identification of hot spots or distributed activity indicated by patterns is apparent if activity beyond that of background distributions is present in the survey unit.

Background values are based on the type of material, type of detector, and data obtained from the reference area surveys (MSI 2011a). Although background is a variable, defined by a Poisson distribution, a single value — the average — is applied. If the reference area is appropriate for the surface within the survey unit and the area is free of added radioactivity, the 50th percentile of the survey unit data with background subtracted will be near zero. The CFD for the beta survey of the concrete pad, SU 4, is presented in Figure 6.

8.2.4 Analysis of Beta Scan Measurements

More than 24,000 scan measurements were obtained in SU 4 on the concrete pad in accordance with the TSP and SOPs. The quality of the field measurements was assured through quality checks performed in accordance with procedure, both before and after data were obtained with the SCM. Scan measurement results were compared with release criteria. All results were less than the applicable limits. For beta scans, the CFD plots indicate that the 50th percentile is near zero when applying the average background value from the reference area, indicating the reference area to be reasonable for the materials of construction of the concrete pad. No further statistical analysis is required for SU 4, since no readings exceeded *the criteria*.

8.3 GAMMA WALK-OVER SURVEY

A description of the gamma walk-over survey is provided in Section 6.6. The walk-over pattern covered both SUs because of the limited area in SUs 1 and 2. SU 3 was surveyed separately. The data were collected in 1-second intervals for each strip. The data for each strip and the composite data were analyzed for the presence of outliers that may indicate a localized high activity source. Data were compared to the 3σ value above the average (Where did the 3 sigma value originate from?) for each strip. The data were also displayed as CFDs for each strip as well as the composite for the two areas. Although a few individual 1-second values slightly exceed the 3σ value, no outliers were evident in the CFDs. Investigations in the areas of the highest readings did not identify any abnormalities (Where are these investigation located within this document?) Concrete pedestals supporting building equipment may be the cause of the slightly higher readings. Only a single measurement was above the value in each strip with a data point exceeding the average + 3σ value. Other measurements before and after the lone value were within the range of the average + 3σ. The composite CFDs for both the SU 1/SU 2 and SU 3 areas do not identify any outliers. With the 17 required samples within relatively small areas, no additional samples were considered necessary.

The average NaI detector count rate, standard deviation, 3σ value, and maximum reading for all data strips and the two reference area strips are reported in Table 5. The strip mapping and the CFDs are reported in Appendix E.

8.4 SOIL SAMPLES

Seventeen or more soil samples were obtained from each of SUs 1, 2, and 3, for a total of 54 samples. Samples were sent for analysis at an off-site laboratory, Test America, Inc. All samples were analyzed for gamma-emitting radionuclides. Duplicate analysis, part of the laboratory quality control program, was performed on every tenth sample, resulting in five additional analyses. Ra-226 concentrations were measured by allowing equilibrium to be established with Ra-226 progeny and determination of Ra-226 based on the ratio of gamma emitting progeny bismuth 214 (Bi-214). Analysis for Sr-90 and Pu-239 was to be performed if any soil samples indicated Cs-137 above the release criteria.

Analysis results for Ra-226 in soil reported no sample greater than the release criterion. The maximum value reported was 0.75 pCi/g. The average Ra-226 concentration was 0.32 pCi/g. Gamma-emitting radionuclides, Co-60 and Cs-137, are reported less than the release criteria for all samples. Only two samples indicated results greater than the minimum detection level (MDL) for Cs-137. Both results were slightly above the MDL of the analytical method, and well below the release criterion. Sample results are reported in Appendix F (Highlight this reference; see "Appendix F" in the next section)..

8.5 SEDIMENT SAMPLES

Two of the three storm drains in the vicinity of the FSA contained adequate amounts of sediment for sampling. Those drains are on the north and south sides of Building 399. The drain east of Building 399 did not contain sufficient sediment volume to sample. Laboratory analysis for gamma-emitting radionuclides was performed on each of the samples in a manner identical to the soil samples. Each of the sediment samples contained Ra-226 at 0.39 pCi/g, consistent with the soil sample data. Co-60 activity was less than the MDL. The Cs-137 concentration in each sample exceeded the release criterion. The results, reported in Appendix F, are similar:

North Drain	SME-SED-055	0.222 pCi/g
South Drain	SME-SED-056	0.212 pCi/g

The Cs-137 concentrations are consistent with typical background levels reported in most portions of the United States (NRC 1998). Concentrations are reported to be between 0.1 pCi/g and 1.0 pCi/g in non-drainage areas with higher concentrations typically found in drainage areas. The Cs-137 activity is a result of fallout from atmospheric testing in the United States and elsewhere throughout the 1950s, 1960s, and 1970s. Additional Cs-137 activity in soil is the result of the nuclear plant emergency at Chernobyl. Based on the low values in drains that will naturally concentrate sediment and the similarity to the reported background levels, no further radiological analysis have been performed.

9.0 CONCLUSION

This scoping survey was performed to evaluate whether radionuclides of concern are present in accessible areas at levels in excess of the release criteria and to provide information to assist in identifying future actions. A scoping survey of the area previously occupied by a smelter was performed to determine if there is any indication of (residual?) radioactivity that may be the result of direct smelter operations, dispersed materials from the smelter exhaust, or storage of staged materials. (Please explain how this particular area was determined to be an area "previously occupied by a smelter") The survey included a gamma walk-over survey and soil sampling in areas exposed by removal of surface asphalt and concrete. The scoping survey also included sediment sampling in storm drains. Alpha and beta surface scanning measurements, direct measurements at defined and random locations of alpha, beta, and gamma radiations, and smear surveys were performed on the concrete pad adjacent to the smelter location.

The results of the FSA scoping surveys indicate that only background levels of Ra-226 that are well below the release criterion for that isotope are present in the exposed soil. The data are indistinguishable from background. No evidence of residual radioactivity from historical Navy activities was found in the exposed soil. Sediment Cs-137 concentrations are consistent with levels found in the area and throughout the United States resulting from fallout from weapons testing and nuclear plant accidents (NRC 1998). A concrete pad at the FSA has been identified as the only existing feature from the former smelter footprint. The concrete pad showed only background levels of alpha and beta activity and no removable radioactivity. The data were of sufficient type, quality, and quantity (in accordance with ???). All measurements were obtained in accordance with the TSP and SOPs as presented in the work plan (ChaduxTt 2010). Quality assurance checks of all instruments were performed throughout the survey process in accordance with the TSP and SOPs. Only data that were validated by successful quality assurance checks were used to demonstrate compliance with the release criteria. Therefore, the results of the scoping survey did not identify any radioactivity in soil or the concrete pad that can be associated with the Navy's former smelter operations and no further actions are necessary. Is the area considered **"not impacted"**?

10.0 REFERENCES

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FIGURES

Figure 1. Alameda Point Map

Figure 2. Former Smelter Area CIRCA 2004

Figure 3. Classifications and Survey Units

Figure 4. Photograph of Surface Contamination Monitor

Figure 5. Photograph of Gamma Walk-over Survey in Survey Unit-3 looking South

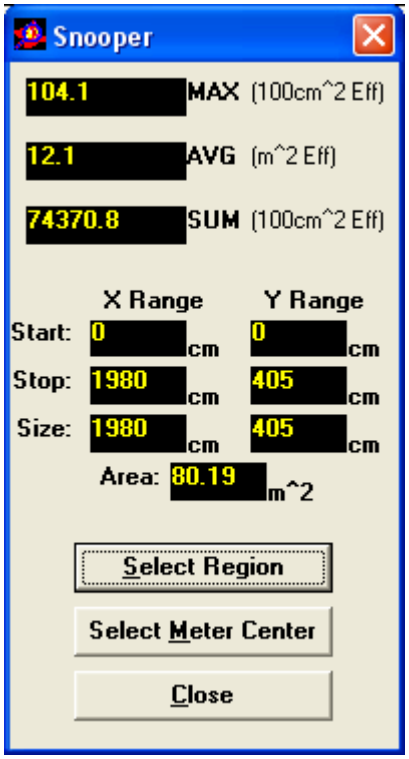
Figure 6. Former Smelter Area Survey Unit 4 Beta Survey
Cumulative Frequency Distribution Plot

Cumulative Frequency Distribution (CFD) of surface activity in 100 cm^2 areas. The horizontal scale is in dpm per 100 cm^2.

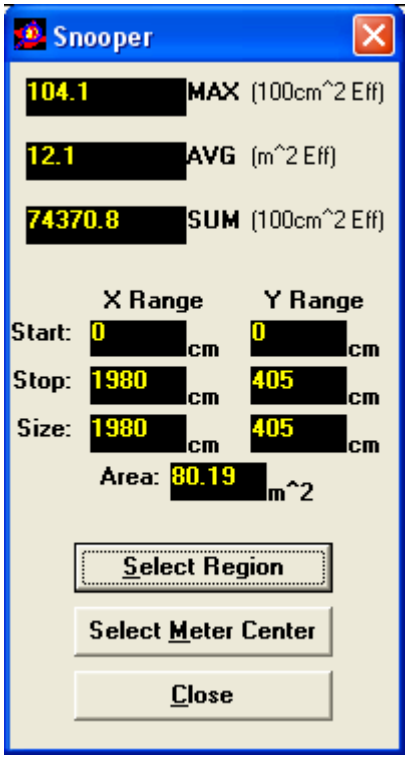
Notes:

CFD	Cumulative frequency distribution
Cm^2	Centimeter squared
Dpm	Disintegrations per minute
UCL	Upper confidence level

Figure 7. Screen Capture of Snooper Results of Alpha Survey of Survey Unit 4



Snoop of Primary Detector



Snoop of Recount Detector

Note: Please reference location in the scoping survey report that provides explanations of the above screen captures.

TABLES

TABLE 1: FORMER SMELTER AREA CLASSIFICATIONS

Survey Unit	Area or Rooms	Class	Area	ROC
SU 1	East of Building 399	1	Soil	Ra-226, Gamma Emitting Radionuclides
SU 2	Buffer Around SU 1	2	Soil	Ra-226, Gamma Emitting Radionuclides
SU 3	West of Building 399	3	Soil	Ra-226, Gamma Emitting Radionuclides
SU 4	Concrete Pad	2	Concrete Surface	Ra-226, Co-60, Cs-137, Sr-90

Notes:

Co-60 Cobalt 60
Cs-137 Cesium 137
Ra-226 Radium 226
ROC Radionuclide of concern
Sr-90 Strontium 90
SU Survey unit

TABLE 2: DETECTION SENSITIVITIES

Survey Type	Detector	Sensitivity (dpm/100 cm^2)	TSP Section
Alpha Scan	SCM	99.47% probability of seeing at least 100 dpm/100 cm^2 (Note 1)	2.7
Alpha Static	43-68	76.5 (Note 2)	2.8
Beta Scan	SCM	3700 (Note 3)	2.7.2
Beta Static	43-68	1200 (Note 4)	2.8.2

Notes:

1. Sensitivity is *a posteriori* for "coincidence" counting with a threshold of 3 counts or greater. Note that calculations were done for the investigation level (100 dpm). See Section 8.2.1 for discussion.
2. Sensitivity is *a posteriori* for a higher actual instrument efficiency (39.4 percent), and a 1-minute count time.
3. Sensitivity is *a posteriori* based on the CFD. Note that background is higher than expected.
4. Sensitivity is *a posteriori* for a higher actual instrument efficiency (33 percent), and a 1-minute count time.

cm^2 Centimeter squared
dpm Disintegrations per minute
SCM Surface contamination monitor
TSP Task specific plan

TABLE 3: SUMMARY OF FORMER SMELTER AREA DIRECT SURVEY RESULTS

Building	Former Smelter Area
Survey Unit	Concrete Pad SU4
Class	2
Model 2221	190181
Detector 43-68	149768
Date	3/3/2011
Static Count Time (min)	2.0 α 1.0 β
Background Count Time (min)	10.0
α Efficiency- Instrument	0.370
α Efficiency- Surface	0.25
β Efficiency- Instrument	0.390
β Efficiency- Surface	0.5
Area Correction Factor	1.00

Measurement Number.	**Material**	**Reference Background (cpm)**		**Static Counts (cpm)**		**Static Results (dpm/100 cm^2)**	
		α	**β**	**α**	**β**	**α**	**β**
1	Concrete	9	126.4	7.0	121.0	-21.6	-27.69
2	Concrete	9	126.4	9.0	148.0	0.0	110.77
3	Concrete	9	126.4	15.0	141.0	64.9	74.87
4	Concrete	9	126.4	7.0	136.0	-21.6	49.23
5	Concrete	9	126.4	12.0	127.0	32.4	3.08
6	Concrete	9	126.4	8.0	133.0	-10.8	33.85
7	Concrete	9	126.4	10.0	156.0	10.8	151.79
8	Concrete	9	126.4	11.0	135.0	21.6	44.10
9	Concrete	9	126.4	8.0	138.0	-10.8	59.49
10	Concrete	9	126.4	9.0	137.0	0.0	54.36
11	Concrete	9	126.4	9.0	150.0	0.0	121.03
12	Concrete	9	126.4	8.0	159.0	-10.8	167.18
13	Concrete	9	126.4	10.0	168.0	10.8	213.33
14	Concrete	9	126.4	6.0	137.0	-32.4	54.36
15	Concrete	9	126.4	4.0	151.0	-54.1	126.15
16	Concrete	9	126.4	6.0	127.0	-32.4	3.08
17	Concrete	9	126.4	8.0	132.0	-10.8	28.72

Notes:

cm^2 Centimeter squared
cpm Counts per minute
dpm Disintegrations per minute

NOTE: WHERE DOES THIS TABLE APPLY WITHIN THE TEXT?

TABLE 4: SUMMARY OF SMEAR TEST RESULTS

Survey Unit	Maximum Alpha	Maximum Beta
4	2.4	52
Release Criteria	20	1,000

DPM?

TABLE 5: FORMER SMELTER AREA GAMMA WALK-OVER DATA SURVEY UNITS 1 AND 2

Strip Number	Average	Standard Deviation σ	Average + 3σ	Maximum Value
FSA1-1	4,070.40	321.71	5,035.16	5,115
FSA1-2	4,406.76	532.21	6,018.38	6,202
FSA1-3	4,373.05	447.52	5,715.61	5,754
FSA1-4	3,712.15	236.6	4,421.94	4,303
FSA1-5	4,206.34	251.97	4,962.25	4,831
FSA1-6	4,210.35	360.54	5,291.97	5,024
FSA1-7	4,551.99	275.93	5,379.78	5,170

Former Smelter Area Gamma Walk-over Data Survey UNIT 3

Strip Number	Average	Standard Deviation σ	Average + 3σ	Maximum Value
FSA3-1	4,565.67	435.27	5,871.48	5,671
FSA3-2	4,744.44	322.50	5,711.93	5,503
FSA3-3	4,065.20	339.36	5,083.27	5,095
FSA3-4	4,019.29	475.78	5,449.64	5,225
FSA3-5	3,872.80	289.56	4,741.49	4,511
FSA3-6	4,469.86	578.51	6,205.38	5,655
FSA3-7	3,842.57	491.10	5,315.88	4,904
FSA3-8	3,908.12	381.68	5,053.17	4,543
FSA3-9	4,374.48	508.57	5,900.10	5,806

NOTE: What is the unit of measure?

APPENDIX A (CD ONLY)
TASK SPECIFIC PLAN

APPENDIX B (CD ONLY)
INSTRUMENT INFORMATION

APPENDIX C (CD ONLY)
DIRECT SURVEY DATA

APPENDIX D (CD ONLY)
SCAN SURVEY RESULTS

APPENDIX E (CD ONLY)
GAMMA WALK-OVER SURVEY RESULTS

APPENDIX F (CD ONLY)
SOIL SAMPLE RESULTS

ATTACHMENT 1
1949 PROPOSED TURBO JET OVERHAUL FACILITY DRAWING

ATTACHMENT 2
AERIAL PHOTOGRAPH OVERLAY CURRENT BUILDINGS AND THE FOOTPRINT OF THE FORMER SMELTER