CLEAN

Contract No. N62474-88-D-5086

Contract Task Order No. 0285

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ENGINEERING FIELD ACTIVITIES WEST, NAVAL FACILITIES ENGINEERING COMMAND, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

PHASE III RADIATION INVESTIGATION DRAFT FINAL FIELD WORK PLAN

Prepared By

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1.0 INTRODUCTION

PRC Environmental Management, Inc. (PRC), on October 22, 1993, received Contract Task Order (CTO) No. 0285 from the Engineering Field Activity West (EFA West), Naval Facilities Engineering Command, to conduct as part of the Remedial Investigation at Hunters Point Shipyard (HPS) the following activities: (1) perform a field radiation survey of former Naval Radiological Defense Laboratory (NRDL) buildings and sites; (2) complete the surface gamma characterization of the Bay Fill Area (IR-02) begun under CTO 0155; and (3) collect offshore sediment samples for radiological analysis from areas adjacent to the Industrial Landfill (IR-01) and the Bay Fill Area (IR-02).

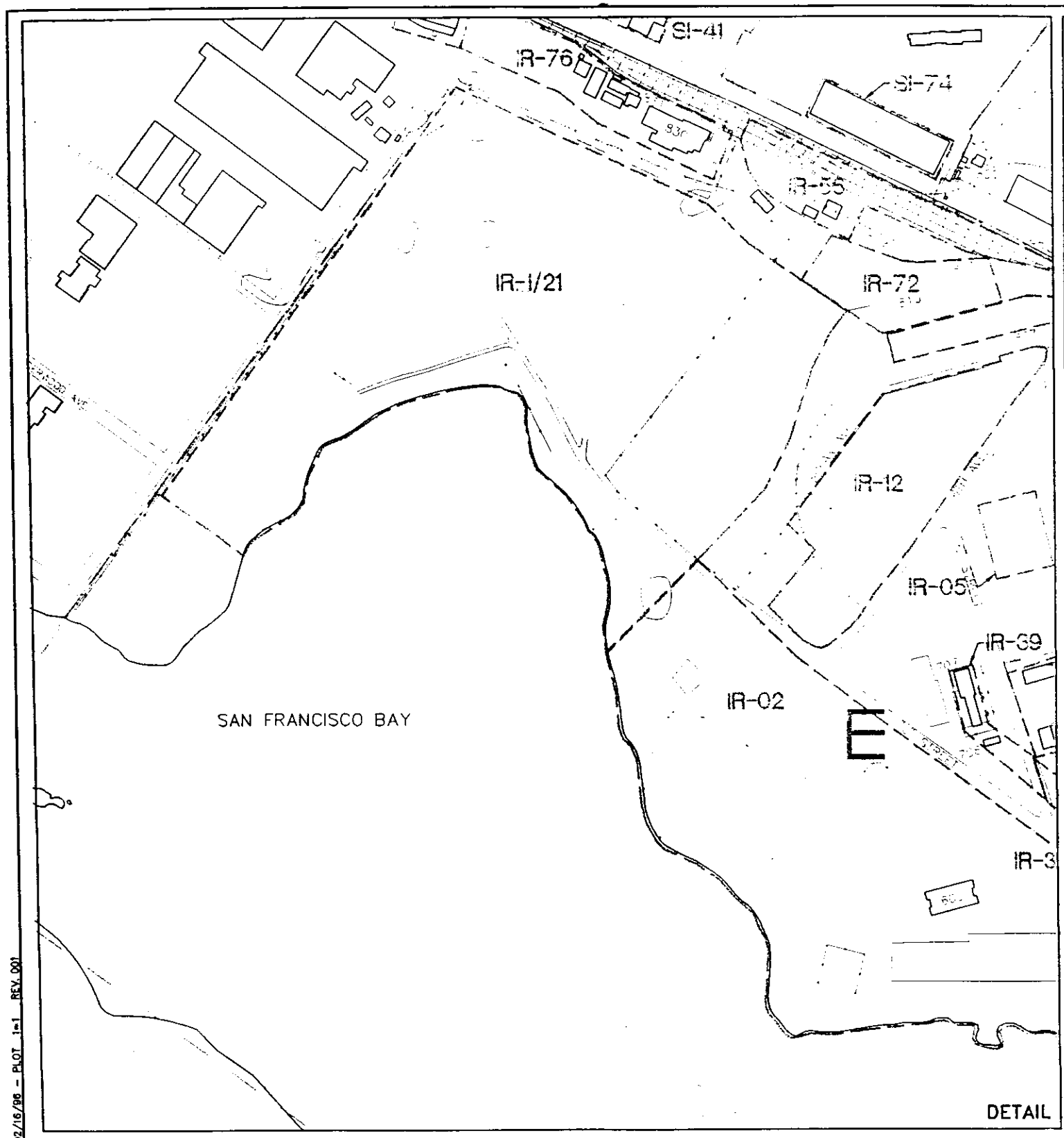
Two phases of the radiological characterization of HPS have been completed. Phase I work, initiated in 1991, consisted of ambient air monitoring to evaluate airborne particulate alpha and beta emitters, a gamma radiation study to establish background levels, and a surface confirmation radiation survey (SCRS). The work performed under Phase I of CTO 0155 resulted in recommendations for further investigation of the distribution of radioactive materials in the landfills and screening at NRDL sites on HPS.

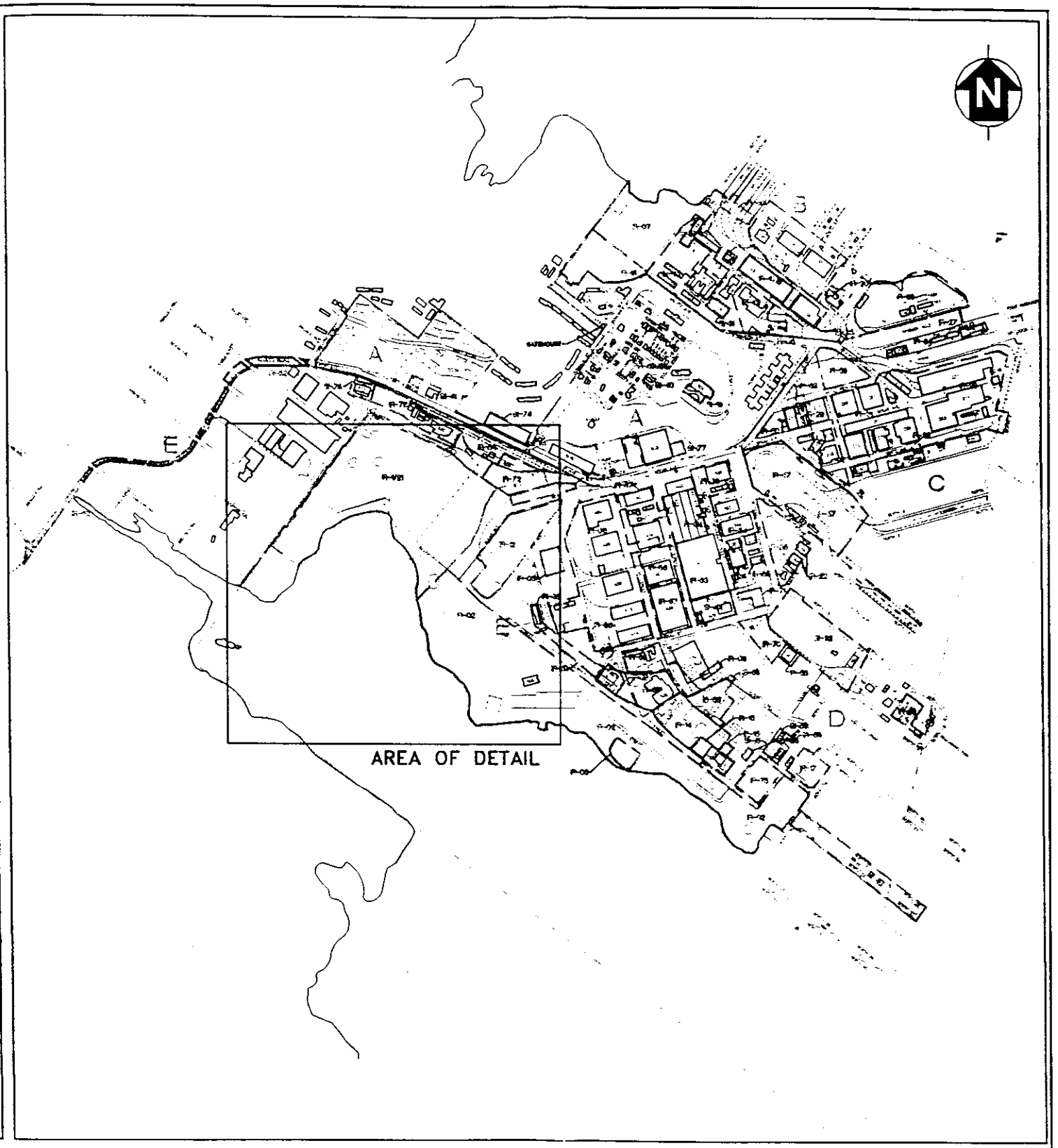
1.1 PURPOSE

The purpose of phase III of the radiation investigation at HPA is to implement recommendations detailed in the SCRS preliminary draft report and the results of the subsurface radiation investigation in Parcel B and E final report (PRC 1992, 1996). Additionally, radiological concerns regarding the former use, storage, and disposal of radioactive material associated with past NRDL operations at HPS. The intent of this phase of the radiation investigation is to determine if all the remaining buildings and sites meet the criteria for free release.

1.2 BACKGROUND

HPS has supported shipbuilding and ship maintenance since 1869. Figure 1 shows an aerial view of HPS. The following sections discuss the general and radiological history of the facility.





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SOURCE: PRC EMI (SF)

EFA WEST

HUNTERS POINT ANNEX SAN FRANCISCO, CALIFORNIA

FIGURE 1
INDUSTRIAL (IR01)
BAY AREA LANDFILL (IR02)
VICINITY MAP

M:\USF\(044-0285)LANDFILL.DWG - 02/16/96 - PLOT 1=1 REV. 001

1.2.1 General History

The land that is now HPA was privately held until 1939 when the Navy purchased the property and leased it to Bethlehem Steel. At the start of World War II in 1941, the Navy took possession of the property from Bethlehem Steel and operated the shipyard until 1974. By then, except for minor facility maintenance, most official Navy activities at HPA had ended. In 1976, Triple A Machine Shops Incorporated (Triple A), a ship maintenance firm, leased the facility from the Navy. Triple A subleased many buildings at HPA to private commercial and light industrial firms (Harding Lawson Associates 1988). Currently many buildings have been leased to private tenants that include drilling subcontractors, artists, and business files storage contractors.

1.2.2 History of NRDL at HPA

HPA was a center of shipbuilding and ship repair during World War II. Pure and applied radiological research also played a major role in HPA's history. In 1948, a group of scientists at HPA formed the NRDL whose mission was to study the effects of nuclear weapons and to develop from them effective countermeasures against radiation. HPA was selected as the preferred West Coast site for NRDL due to its proximity to the University of California (U.C.) Crocker Radiation Laboratory, other Navy facilities, and its drydock capacity. NRDL activities required a cyclotron, a Van de Graaff generator, X-ray machines, radiological laboratories, support offices, and kennels for animals used in radiological studies.

In late 1946, a small group of personnel, comprising U.C. and Navy scientists, was tasked with identifying methods to decontaminate ships that had returned from nuclear weapon tests near Bikini Atoll in the Marshall Islands known collectively as Operation Crossroads (Cook 1988 and U.S. Navy 1949). In 1951, the laboratory became a separate Navy command. To support its mission to study the effects of nuclear weapons and to develop countermeasures for them, staffing was increased to over 100 military and almost 600 civilian personnel.

During the early years of the NRDL, and until about 1955, its operations were conducted throughout HPA. These former NRDL buildings and sites are located within 4 areas that are currently designated Parcels B, C, D, and E.

1.2.3 History of IR-02

In 1991, buried slag-like materials exhibiting low levels of radioactivity were discovered during trenching investigations performed to determine the margins of the landfills at IR-01 and IR-02 sites. The source of radioactivity was identified as radium-226 (^{226}Ra) which is an alpha and gamma radiation emitter. The survey also established the background gamma activity, measured the concentration of radionuclides in soil and groundwater, and tested for any radon gas flux emanating from the soil surface.

Following the discovery of radium-containing materials within approximately the first 12 inches of soil in IR-01 and IR-02, the Navy implemented phase II of the investigation that included a comprehensive survey to determine the lateral and vertical extent of the radioactive material, their composition, and the potential for the material to become airborne during intrusive activities.

1.3 RADIOLUMINESCENT COMPONENTS

It is suspected that radioactive, luminescent dials, gauges, deck markers, and other components of electronic equipment may have been disposed of in IR-02 at HPA. Prior to the 1970s, most radioluminescent equipment used by the military contained ^{226}Ra and a few types contained ^{90}Sr mixed into a phosphorescent paint base. The paint absorbed the radiation particles emitted from ^{226}Ra was induced to emit visible light. The paint was applied to numerals and markers on some equipment so that they could be read in the dark. ^{226}Ra has a half-life of approximately 1,600 years, primarily emits alpha particles, and is the progenitor of radon-222 (^{222}Rn) gas and a series of other radioisotopes that result from its decay.

Although ^{226}Ra emits primarily alpha radiation, the ^{226}Ra present in buried radium-containing materials is always in some variable state of equilibrium with its decay progeny which are sometimes called daughters.

Lead-214 (^{214}Pb), bismuth-214 (^{214}Bi), and lead-210 (^{210}Pb) are among the primary gamma-emitting radium daughters. These daughters produce gamma radiation that can usually be detected if covered with less than 1 foot of soil. Because these buried sources may have corroded, it is possible that the soil surrounding them may contain elevated amounts of ^{226}Ra and its progeny. The radioactive decay of ^{226}Ra produces radioactive daughters that emit easily detectable gamma rays.

1.4 RADIOACTIVE MATERIAL LICENSE

On April 25, 1969 the Navy announced the disestablishment of NRDL with a closure date of about December 31, 1969. As part of the disestablishment of the NRDL was the termination of the radioactive material licenses issued to the Navy by the Atomic Energy Commission (AEC) and later by the Nuclear Regulatory Agency (NRC). The radioactive material was licensed by the AEC under Byproduct Material License Nos. 04-00487-03, 04-13488-01, and 04-00487-09. Also, the Navy obtained a source material licence (License No. SNB-376) allowing possession of natural uranium and thorium. The fifth license issued was a Special Nuclear Material License (License No. SNM-35) that authorized possession of plutonium and other radionuclides.

Between September 15, 1969 and January 30, 1970 a total of 22 visits were made by AEC Division of Compliance personnel for the purpose of conducting confirmation surveys of facilities being vacated by the NRDL. Consequently, all the radioactive material licenses issued to HPS were terminated by the AEC (AEC, AEC_a, and AEC_b). Copies of license termination documentation is provided as an appendix to this work plan.

2.0 TECHNICAL APPROACH

This section discusses radiation survey guidance, general in situ spectroscopic survey techniques, background radiation levels, and naturally occurring radioactive material (NORM) at HPA. Section 3.0 provides the site-specific background information, site reconnaissance information, previous radiation survey results, and the proposed site-specific radiation survey methods, if applicable.

2.1 RADIOLOGICAL SURVEY GUIDANCE DOCUMENTS

Radiological surveys performed at HPA using a combination of field radiation survey techniques that will include surface radiation surveys and soil sample collection and analysis. Radiological surveys will be performed at former NRDL buildings and associated sites to evaluate them for radiological contamination resulting from past activities. All sites will be surveyed for surface radiological contamination using procedures detailed in the Nuclear Regulatory Commission (NRC) *Manual for Conducting Radiological Surveys in Support of License Termination*, NUREG/CR-5849, Draft Report for Comment. The radiological investigation of sites where the structure has been entirely removed will include soil sampling, walkover surveys, and in situ gamma spectroscopic techniques.

2.2 IN SITU GAMMA SPECTROSCOPIC TECHNIQUE

If elevated activity is detected in the field using hand-held instrumentation, additional measurements will be obtained using in situ gamma spectroscopic instrumentation. This will allow the Navy to establish an isotopic inventory of gamma emitting isotopes (including naturally occurring radionuclides) in the surface soils.

Gamma spectroscopy uses detected gamma energies to identify specific gamma-emitting radioisotopes. Each gamma-emitting isotope produces a unique gamma energy spectrum, like a fingerprint, that allows it to be identified using gamma spectroscopy.

The gamma spectrometry system will be calibrated for energy and efficiency using a mixed gamma

standard. That standard will be traceable to a primary standard certified by the National Institute of Standards and Technology (NIST). Each spectrum will be electronically stored on a computer disk for later analysis.

The Navy will not be able to identify non-gamma-emitting isotopes in the field using in situ gamma spectroscopic techniques. If these types of radioisotopes require evaluation, based upon documentation or site history, quantitative radiochemical analysis of the samples will be required at an off-site laboratory. Soil and wipe sampling is the proposed sampling method to evaluate ^{90}Sr concentrations in soil and surface radioactivity levels at potential radiation sites at HPS.

2.3 BACKGROUND RADIATION LEVELS

Background radiation levels are those values outside direct radiological influence of the site under investigation. Background soil samples and measurements were collected during the SCRS performed in phase I of the radiation investigation at HPS. The average background of ^{226}Ra in soils at HPS was approximately 0.5 picocuries per gram (pCi/g). The average gamma count rate observed in the field was approximately 7,500 counts per minute (cpm) using a 2-inch by 2-inch sodium iodide (NaI) detector. Historically the Navy has used 150 percent of the background count rate to identify areas of potential concern at HPS.

Background exposure levels at HPS ranged between 1 and 20 microroentgen per hour (μR/hr), with an average of 10 (μR/hr). This is slightly above background exposure levels when compared to other areas in California. The average background levels found in other areas would be affected by factors such as the sensitivity of the instrument, the geology of the location [which in California ranges from granites that contain higher concentrations of naturally occurring radioactive material (NORM) relative to other rocks], and elevation. The Navy believes that instrument sensitivity, low exposure levels, and an uncharacteristically heterogeneous mix of soils likely account for the increased background levels at HPS relative to other areas in California.

Background count rates will be collected in areas that are identified as unaffected by influence from the suspect radiation site. PRC's SOP for establishing background at a radiation site is provided in Appendix

A. Each detector will establish a background count rate for each site where there may be possible residual contamination. All background measurements will be used to identify areas of potential concern. Areas of elevated activity will be evaluated by collecting and analyzing soil and wipe samples along with using in situ spectroscopic techniques.

2.4 NATURALLY OCCURRING RADIOACTIVE MATERIAL (NORM)

Based on results of previous phases of the radiation investigation performed at HPS and from discussions with the Navy Radiation Affairs Support Office (RASO), radioluminescent equipment appears to be the only radioactive material disposed of at HPS. Most naturally occurring radiation sources are found in soils. Naturally occurring radiation sources include, but are not limited to, uranium, radium, thorium, and potassium isotopes. Soils that make up the islands within the Sacramento Delta region consist largely of river gravels, arkosic sands, clays, and silts. The predominant source of naturally occurring radioactive isotopes in these soils is the arkosic sand fraction. These sands contain feldspars, a source of gamma-emitting potassium-40 and other components of granitic rock. The granitic parent material that comprises a large percentage of sandy soils identified at HPS contain a wide range of naturally occurring Radium-226 concentrations. Analysis of surface soil samples collected from HPS ranged between 0.5 pCi/g to 5.4 pCi/g (PRC 1992).

Previous radiological investigations at HPS (IR-07 and IR-18) found sands that contained approximately 5.0 pCi/g ^{226}Ra (PRC 1992). The U.S. Environmental Protection Agency (EPA) performed a petrographic and gamma spectroscopic analysis on soil samples collected from IR-07 and IR-18. Based on the mineralogy of the sand fraction of the soil samples collected, zircon and monazite appear to account for most of the radioactivity (EPA 1994 and PRC 1995).

2.5 RADIOACTIVE MATERIAL DETECTION AND CALIBRATION

Radiological investigations at HPS and other naval facilities have determined that a ^{226}Ra point source with an activity of approximately 1 microcurie can be detected in soils at depths ranging from 12 to 18 inches below the surface. A detectors response will vary depending on soil and material densities, soil moisture, type and efficiency of the detector, and other factors influencing the ability to detect radioactive material in the field. Measurements were made using a 2-inch by 2-inch sodium iodide (NaI) coupled to a ratemeter/scaler with the detector within a few inches of the surface. The detector was calibrated using a 1 microcurie NIST certified Cesium-137 standard. This was chosen due to its relative proximity to the gamma energies emitted by the decay of Radium-226.

The surface surveys that will be performed under this radiation investigation will include the use of a gamma scintillation detector and calibrated to a NIST certified Cesium-137 standard. Additionally, field personnel will perform instrument operational checks daily according to SOPs provided in Appendix A.

3.0 SITE SPECIFIC SURVEYS

This section provides specific information regarding the types of surveys to be conducted at each site. The sites have been grouped based on whether a survey will be performed by the Navy. Buildings/sites will not be surveyed under the following conditions; 1) the building/site was surveyed by NRDL, RASO, AEC, or NRC personnel and released by the cognizant regulatory agency for unrestricted use, or 2) the radioactive material license has been terminated. Sites where residual contamination is known or radiation surveys were not performed as part of the license termination process (e.g. outside the buildings where radioactive material was used or stored), a radiation survey has been recommended. All buildings under the NRDL program have been free released. Table 1 includes RASO's recommendations regarding former NRDL sites and buildings. RASO's survey recommendations were prepared after review of the radioactive material licenses issued to HPS and historical information regarding former operations at each site.

TABLE 1

SITES AND BUILDINGS WITH POTENTIAL RADIATION CONCERNS

Site/ Building	Former or Current Use	Proposed Investigation
NRDL AND OTHER SITES		
PARCEL B		
IR-42/ Bldg 113	Former Shipyard Analytical Laboratory/ Radioactive Storage Building (occupied by Smith-Emery)	- No survey required
IR-42/ Bldg 113 A	Former Q & RA Non-destructive Test Facility/ Shipyard Analytical Laboratory/ Radioactive Storage Building (occupied by Smith-Emery)	- No survey required
IR-42/ Bldg 114	No evidence of radioactive material use or storage (building in ruins)	- No survey required
IR-23/ Bldg 146	Radioactive Waste Disposal/ Drum Storage Area Lead-lined storage vault for shipyard X-ray source(s)	- No survey required
PARCEL C		
IR- / Bldg 214	Room 105 - Health Physics Counting Room	- No survey required
IR-28/ Bldg 253	Former Shipyard Instrument Calibration Building (unoccupied)	- No survey required
PARCEL D		
IR-35/ Bldg 274	Former Decontamination Training Building (unoccupied)	- No survey required
IR-35/ Bldgs 313/ 313A	Former NRDL Storage Sites (buildings in ruins)	- No survey required

Site/ Building	Former or Current Use	Proposed Investigation
IR-33/ Bldg 365	Former NRDL Photographic Film Laboratory Building (unoccupied)	- No survey required
PARCEL E		
IR-39/ Bldg 708	Former NRDL Biomedical Facility Building (unoccupied)	- No survey required
FUD Sites (Parcel E)		
SI-75/ Bldg 815	Former Main NRDL Building (occupied by Filesafe Storage)	- No survey required
Bldg 816	Former Van De Graaff Generator Building	- No survey required
SI-76/ Bldg 820	Former NRDL Cyclotron Building (occupied by Lowpensky Mouldings)	- No survey required
SI-77/ Bldg 830	Former NRDL Animal Research Facility (occupied by U.C. San Francisco)	- No survey required
SI-77/ Bldg 831	Former NRDL Research Animal Facility (occupied by U.C. San Francisco)	- No survey required
SITES BEING SURVEYED		
PARCEL D		
IR-34/Bldg 351/351A/ 351B	Former Radiac Repair (351A) X-ray unit w/sealed check sources (351B) & Instrument Repair and Calibration Building (unoccupied)	- Wipe sampling of drain pipe required (351A)
IR-34/ Bldg 364	Former NRDL Hot Cell Laboratory Building and Radioactive Effluent Storage Tank Sump Pit (Former laboratory occupied by metalsmith)	- Surface walkover survey outside building - Survey LLRW secondary containment vault - Water/ Wipe Sampling of containment vault

Site/ Building	Former or Current Use	Proposed Investigation
PARCEL E		
IR-14/ Bldg 506	Former NRDL Chemistry Laboratory Site (building in ruins)	- Open Survey - Soil Sampling
SI-38/ Bldg 507	Former NRDL Biological Laboratory Site (building in ruins)	- Open Survey - Soil Sampling
SI-38/ Bldg 508	Former NRDL Health Physics Office Site (building in ruins)	- Open Survey - Soil Sampling
SI-38/ Bldg 509	Former NRDL Animal Irradiation Site Health Physics Office Site (building in ruins)	- Open Survey - Soil Sampling
SI-38/ Bldg 510/510A	Former NRDL Radiation Physics Site (building in ruins)/ 1 MeV X-ray Irradiation Facility	- Open Survey - Soil Sampling
SI-38/ Bldg 517	Former NRDL Cobalt-60 Irradiation Room Site (building in ruins)	- Open Survey - Soil Sampling
IR-14/ Bldg 529	Former NRDL Radioisotope Storage and Cockcroft - Walton Generator Site (building in ruins)	- Open Survey - Soil Sampling
IR-39/ Bldg 707 Concrete Pad	Former NRDL Research Animal Colony Building/ Radioactive Waste Storage Site (unoccupied)	- Open Survey (drum storage pad only) - Soil/ Wipe Sampling

3.1 NONSURVEY BUILDINGS/SITES

The following sites will not require a radiological survey because no radioactive material was ever used or stored at a particular building/site or a radiation survey was performed and the building was released for unrestricted use by the AEC or NRC.

3.1.1 Parcel B Building/Sites

This section details the site background, current site conditions, radiation survey results, and RASO's survey recommendations for buildings/sites in Parcel B.

3.1.1.1 Building 113

Site Background

Building 113 is called the Tug Maintenance and Salvage Shop; Substation B (P.W. Drawing No. 16001-146, Public Works Engineering Division, Code 440, Hunters Point Naval Shipyard, San Francisco, CA, June 30, 1971). It is located on the south side of Lockwood Street directly across from building 123. Historically it was used as a machine shop, a torpedo maintenance shop, and an electrical substation.

Building 113 was later used by the Navy as an analytical laboratory. Only sealed radioactive check sources were used in this portion of the building. When NRDL operations were moved to Building 815, this building was released for unrestricted use as part of the radioactive material license termination process at HPS.

Site Reconnaissance

Currently the building is leased to and occupied by Smith-Emery.

Recommendation

Only check sources to calibrate analytical instrumentation were used in building 113; therefore, a radiological survey is not recommended or proposed.

3.1.1.2 Building 113A

Site Background

Building 113A is called Q&RA Non-destructive Test Facility (P.W. Drawing No. 16001-146, Public Works Engineering Division, Code 440, Hunters Point Naval Shipyard, San Francisco, CA, June 30, 1971). It is also located on Lockwood Street and is an extension of Building 113. Historically it was used as the Radiographers Vault and Waste Disposal/Storage facility. The building was used for the storage of sheet lead removed from Building 364.

Site Reconnaissance

Currently the building is occupied by Smith-Emery.

Radiation Survey Results

A cursory survey performed between September 30 and October 1, 1978 determined there was no residual contamination (AEC, AEC_a, and AEC_b).

Recommendations

The results of RASO's survey in September and October of 1978 found that the aggregate activity was less than the minimum detectable activity (MDA) (AEC, AEC_a, and AEC_b). Therefore, a radiation survey is not recommended.

3.1.1.3 Building 114

Site Background

Building 114 is located immediately east of the junction at English Street and McCann Streets. It was formerly used as office space by NRDL personnel.

Site Reconnaissance

The building has been demolished. The area where it was located has been cleared and no visible signs of the structure remain.

Recommendations

No radioactive material was used or stored in building 114; therefore, a radiological survey is not recommended or proposed.

3.1.1.4 Building 146

Site Background

Building 146 is located at the intersections of Lockwood Street and Donohue Street. Former operations in the building included a waste disposal/waste storage area. On the outside of the building there is a lead-lined vault that may have contained radiation check sources as part of the Navy's radiation monitoring program.

Site Reconnaissance

Currently used as a storage area by a drilling and monitoring well installation contractor.

Radiation Survey Results

Building 146 was surveyed on August 21, 1974 for residual contamination. Results of the radiological survey found there was no detectable activity above background (AEC, AEC_a, and AEC_b).

In addition, the Navy performed a health and safety cursory survey of the building and a lead-lined vault located just outside the building during phase II of the radiation investigation at HPS. This cursory survey was performed to allow naval personnel, contractors, and civilian tenants to enter the building without any potential for exposure to residual radioactive material. No elevated count rates or exposure levels were noted.

Recommendations

The building was surveyed by the shipyard prior to decommissioning (AEC, AEC_a, and AEC_b). Additional surveys are not recommended or proposed.

3.1.2 Parcel C Sites

This section details the site background, current site conditions, radiation survey results, and RASO's survey recommendations for buildings/sites in Parcel C.

3.1.2.1 Building 214 (Room 105)

Site Background

Room 105 in Building 214 was used by the NRDL as a Health Physics Counting Room. This room was adjacent to a records storage area associated with an industrial hygiene laboratory.

Site Reconnaissance

The room is currently unoccupied.

Radiation Survey Results

A radiation survey that included wipe sampling was performed in August 1974 in the counting room in building 214, room 105 . Results of the survey found no detectable activity above background (AEC, AEC_a, and AEC_b). The NRDL performed a radiation survey to release the site for unrestricted use as part of the NRDL's relocation of all operations to Building 815. All radioactive material licenses issued to HPS have been terminated.

Recommendation

The radiological survey performed in Building 214, room 105 by NRDL personnel found no detectable activity above background; therefore, a radiation survey is not recommended or proposed.

3.1.2.2 Building 253

Site Background

Building 253 was known as the Electronics, Optical, and Ordnance shop. This building was generally used for machining, welding, assembly, and painting operations. This building has six floors where various operations where these various operations were performed. Repair, testing and fabrication of a variety of electronic-, optical-, and ordnance-related equipment occurred in Building 253. A main production floor was shared by Building 253 and Building 211, and contained one large and two small paint booths, two large dip tanks, one large vapor degreaser, resin impregnation tanks, and a parts washer.

Radiological activities were carried out in a small detached room on the sixth floor in Building 253. This room was used by NRDL for instrument calibration. The only radioactive material used and stored in this calibration laboratory was sealed check sources used to calibrate instrumentation.

Site Reconnaissance

Building 253 is currently being used as a naval storage area. Most all the original equipment, sinks, and tanks have been removed from the building. The calibration laboratory on the sixth floor is unoccupied and all equipment and materials associated with operations in this room have been removed.

Radiation Survey Results

A radiation survey was performed on August 21, 1974 and found no evidence of radioactivity above background levels (AEC, AEC_a, and AEC_b).

Recommendation

A radiation survey was performed by the NRDL and AEC as part of the relocation of NRDL operations to Building 815 and the termination of the radioactive material licenses issued to HPS; therefore, a confirmation radiation survey is not recommended or proposed.

3.1.3 Parcel D Sites

This section details the site background, current site conditions, radiation survey results, and RASO's survey recommendations for buildings/sites in Parcel D.

3.1.3.1 Building 274

Site Background

Building 274 was formerly used for decontamination training. This building was included in the radiation investigation when a radioactive material sign was found in the building during a Resource Conservation and Recovery Act (RCRA) facility assessment. RASO's records showed that Lanthanum-140 (^{140}La), with a half-life of 1.6 days, was the only radionuclide used in the training exercises. No records were located discussing the use or storage of radioactive material in this building, or that a decommissioning radiation survey had been performed.

Site Reconnaissance

Building 274 is a fairly small building that appears to be a general work area. Other than a small plastic radioactive material sign found on a ledge of a wall, there is no documentation that leads the Navy to believe that this building used any radioactive material other than ^{140}La that was discussed above (AEC, AEC_a, and AEC_b).

Radiation Survey Results

To allow naval personnel, contractors, and civilian tenants to enter the building safely, the Navy performed a health and safety cursory survey of the building. No elevated radioactivity or exposure levels were detected.

Recommendation

Only a very short lived radionuclide was used in building 274. With a half-life of 1.6 days, any residual contamination in the building since operations ended in the late 1960's would no longer exist. A radiation survey is not recommended or proposed for building 274.

3.1.3.2 Buildings 313

Site Background

Buildings 313 is a formerly known by the NRDL as Annex G. The building is located near the intersection of Manseau and Morrell Streets. The ruins of the buildings are currently located within the controlled area surrounding Drydock No. 4, maintained by Mare Island Naval Shipyard.

Site Reconnaissance

The buildings have been demolished and only the foundation remains.

Radiation Survey Results

During the move from Building 313 to Building 815 the building was surveyed and little decontamination efforts were required (AEC, AEC_a, and AEC_b).

Recommendations

Surveys are not required since little or no decontamination efforts were required during the relocation of operations from Building 313 to Building 815.

3.1.3.3 Buildings 313A

Site Background

Building 313A was formerly known by the NRDL as Annex G. This building is located near the intersection of Manseau and Morrell Streets. The ruins of the buildings are currently located within the controlled area surrounding Drydock No. 4, maintained by Mare Island Naval Shipyard. There is no evidence that radioactive material was used or stored in this building.

Site Reconnaissance

The buildings have been demolished and only the foundation remains.

Recommendations

No radioactive material was used or stored in this building, therefore, a radiation survey is not recommended or proposed.

3.1.3.4 Building 351

Site Background

This portion of the building was used as administrative support of NRDL operations. There is no evidence of radioactive material use or storage by NRDL personnel.

Site Reconnaissance

The building is currently unoccupied.

Radiation Survey Results

The Navy performed a health and safety cursory survey of the building to allow naval personnel, contractors, and civilian tenants to enter the building . No elevated activity or exposure levels were observed during the scan of the building.

Recommendation

No radioactive material was used or stored in building 351; therefore, a confirmation survey is not recommended or proposed.

3.1.3.5 Building 351B (Building 366)

Site Background

Building 351B has been renumbered to Building 366 by the Navy. This building was used by the NRDL to house an X-ray unit. Sealed check sources were used as part of their calibration procedures for the unit. The X-ray unit and check sources were removed from the building and relocated to another facility.

Site Reconnaissance

All equipment and instrumentation related to NRDL operations was removed during the relocation of all activities to Building 815. The building is currently occupied by Christian Engineering, a civilian metal fabrication shop.

Radiation Survey Results

No decontamination efforts were required during the move of all NRDL operations to Building 815.

Recommendation

No decontamination efforts were required by the NRDL when all operations were moved to Building 815; therefore, a confirmation survey is not recommended or proposed.

3.1.3.6 Building 365

Site Background

Building 365, the former NRDL photographic film laboratory, is located at the southern end of Cochrane Street in Parcel D. This building was used by NRDL personnel as a dosimetry film development laboratory.

Site Reconnaissance

The building is currently unoccupied and is surrounded by chainlink fencing.

Radiation Survey Results

A cursory radiation survey was performed by NRDL personnel prior to the decommissioning of Building 365 in relation to all operations being relocated to Building 815. Survey results found activity to be less than minimum detectable levels (AEC, AEC_a, and AEC_b).

In addition, the Navy performed a health and safety cursory survey of the building to allow naval personnel, contractors, and civilian tenants to enter the building. No elevated radioactivity or exposure levels were detected.

Recommendation

NRDL personnel performed a radiation survey so that the building could be used for unrestricted use by the Navy. Additionally, the AEC performed routine inspections at this building as part of the agency's oversight of facilities using, storing, or disposing of radioactive material. Based on former NRDL activities in this building and the fact that a cursory radiation survey was performed when all operations were moved to Building 815, a confirmation survey is not recommended or proposed.

3.1.4 Parcel E and FUD Sites

This section details the site background, current site conditions, radiation survey results, and RASO's survey recommendations for buildings/sites in Parcel E and formerly used defense (FUD) sites.

3.1.4.1 IR-02

The remainder of IR-02 that was not surveyed during the SCRS performed in 1991 will not be completed. These were areas within IR-02 that were not accessible during the SCRS and the subsurface investigation because of construction debris and dense vegetation.

The debris and vegetation areas were within the perimeter used to approximate soil volumes, total number of point sources, and the point source to soil volume ratio; therefore, additional surveys in the inaccessible areas within IR-02 would not render additional information that would enhance the Navy's understanding of site conditions. The purpose of the subsurface radiation investigation was to delineate the subsurface extent of the radioactive material and to confirm that the material is exclusively Radium-226 and its progeny. The radiation investigation in IR-02 was not intended to locate all the radioactive material at the site.

3.1.4.2 Building 708

Site Background

Building 708 is the site of a former NRDL Biomedical Facility. The building is located in Parcel E at the approximate intersection of J and R Streets.

Site Reconnaissance

The building is currently unoccupied. It appears to have been used as an instrumentation repair area because field personnel noted that there was various electrical components and general office refuse throughout the building.

Radiation Survey Results

No historical evidence exists that any radiological activities were performed in Building 708.

The Navy performed a health and safety cursory survey of the building to allow naval personnel, contractors, and civilian tenants to enter the building. No elevated radioactivity or exposure levels were detected.

Recommendation

Since there is no documentation or anecdotal information related to radioactive material being used or stored in Building 708, a radiation survey is not recommended or proposed.

3.1.4.3 Building 815

Site Background

Building 815 is located on Crisp Avenue across the street from the railway yard. A range of activities involving the use of radioactive isotopes were performed in Building 815. The critical areas were the sixth

floor occupied by the Nuclear Technology Division, the fifth floor occupied by the Biological and Medical Sciences Division, and Room 1109, the Isotope Storage Room. Activities on the sixth floor included the widespread use of transuranic sources, particularly plutonium. Surveys were made in all rooms with both a beta-gamma G-M survey instrument and an alpha proportional counter type survey meter. All areas, including vacuum lines and sink drains were swiped for possible radioactivity. Eight rooms had some type of contamination. The radioactive components were physically removed and disposed of. No radioactive contamination was detected following completion of the decontamination effort (AEC, AEC_a, and AEC_b).

Site Reconnaissance

The building is currently leased to Filesafe, Inc., a civilian tenant that uses the building as a document storage area.

Radiation Survey Results

The building was decontaminated and resurveyed to meet NRC acceptable surface radioactivity levels prior to decommissioning and release of the building for unrestricted use. Additionally, the radiation surveys were required to terminate the radioactive material licenses issues to HPS.

Recommendation

This building was thoroughly decontaminated and resurveyed prior to decommissioning the building and releasing it for unrestricted use (AEC, AEC_a, and AEC_b). Additionally, the buildings were required to meet the criteria for terminating the radioactive material licenses issued to HPS; therefore, a confirmation radiation survey of Building 815 is not recommended or proposed.

3.1.4.4 Building 816

Site Background

Building 816 contained the 2-MeV Van de Graaff (VDG) accelerator. It is located at the north-west edge of the facility on Crisp Avenue. No radiation sources other than sealed Pu-Be neutron standards were used in this building. The primary source of radiation contamination was from tritium targets used to produce neutrons by bombardment. Radiation surveys were initially made with a portable G-M survey instrument. No radioactive contamination was detected by this method. However, swipes counted with a tritium-carbon scintillation detector showed tritium contamination. The VDG accelerator was found to be contaminated with approximately 200 millicuries of tritium. It was disassembled and shipped as radioactive material to USNAD Crane, Indiana for decontamination and reuse. The tritium was steam cleaned to remove the tritium contamination. Subsequent sampling with wipes showed that the site had been decontaminated to background levels (AEC, AEC_a, and AEC_b).

Site Reconnaissance

Building is currently unoccupied.

Radiation Survey Results

Building 816 was surveyed by NRDL prior to releasing the building for unrestricted use. The building was steam cleaned following the removal of the VDG accelerator and auxiliary equipment. Wipe samples were collected after decontamination of the building was completed. All counts were indicative of background.

An AEC inspection made on 11/19/69 indicated no detectable radioactivity at the site (AEC, AEC_a, and AEC_b).

The Navy collected samples of concrete, asphaltic-concrete, and surface soils surrounding Building 816. The sampling locations were located where there could be possible tritium contamination in surface soils or asphaltic-concrete walkways leading in and out of the building. No tritium contamination was detected in any of the samples submitted for analysis (NAI 1993). Duplicate samples were collected by the Department of Health Services that confirmed the Navy's findings.

Recommendation

Based on the soil, asphalt, and concrete sample results, no additional radiation surveys are recommended or proposed for Building 816..

3.1.4.5 Building 820

Site Background

Building 820 was known by the NRDL as the Cyclotron building. It is located at the north-west corner of the facility on Crisp Avenue, a few hundred feet north-west of Building 830. According to NRDL Report "Health Physics Activities in Connection with the Disestablishment of NRDL: Disposal of Radioactive Material and Termination of AEC Licenses," December 31, 1969, the building never contained any radioactive material (AEC, AEC_a, and AEC_b). The cyclotron was removed from the building and relocated.

Site Reconnaissance

The building is currently occupied by Lowpensky Mouldings.

Radiation Survey Results

AEC clearance was not required since no radioactive material was ever used or stored in Building 820 (AEC, AEC_a, and AEC_b).

Recommendation

Based on no radioactive material being used or stored in Building 820, a radiation survey is not recommended or proposed.

3.1.4.6 Buildings 830 and 831

Site Background

Buildings 830 and 831 are located adjacent to each other on Crisp Avenue in the north-west corner of Hunters Point Annex. Building 820 lies a few hundred feet north-west of them along Crisp Avenue. The buildings were used by the Navy as a kennel for animals associated with NRDL radiological experiments. There is little documentation related to these buildings; however, anecdotal information from former NRDL and RASO personnel familiar with past operations at the site indicated that only "tracer isotopes" were used on animals housed at these buildings. Most of the experiments performed in the late 1950s and 1960s dealt with establishing "death curves" by irradiating animals with high doses of gamma-emitting sources.

Radioactive carcasses were contained in plastic bags with formaldehyde and placed in 20 gallon cans for disposal in accordance with AEC regulations (AEC, AEC_a, and AEC_b).

Site Reconnaissance

The building is currently owned by the University of California at San Francisco.

Recommendation

Based on the relatively short half-life of tracer isotopes, any residual radioactive material would no longer be able to be detected; therefore, a confirmation radiation survey is not recommended or proposed for Buildings 830 and 831.

3.2 SURVEY BUILDINGS/SITES

Based on recommendations provided by RASO, the following sites will require a radiological survey because of former NRDL operations at the site or the site was not surveyed as part of the decommissioning of the NRDL establishment and license termination.

3.2.1 Parcel D Sites

This section details the site background, current site conditions, radiation survey results, RASO's survey recommendations, and proposed survey methods for buildings/sites in Parcel D.

3.2.1.1 Building 351A

Site Background

NRDL records indicate this portion of the building was used as a radiac repair facility.

Site Reconnaissance

The rooms are currently unoccupied and all equipment and instrumentation has been removed. Piping associated with a sink used in what was labeled as a "work area" in room 47 of the building has been removed. The building is currently unoccupied.

Radiation Survey Results

A radiation survey was performed on August 15, 1974 which included wipe sampling and direct reading measurements. The maximum acceptable count rate allowed during decontamination of the building was 200 cpm removable activity. Beta contamination was discovered by NRDL personnel in portions of the drain pipe and there is no record of decontamination efforts. The remaining areas were surveyed by shipyard personnel prior to decommissioning (AEC, AEC_a, and AEC_b).

The Navy performed a health and safety cursory survey of the building. During the scan of the room no elevated activity was detected.

Recommendation

Wipe samples will be collected to determine whether residual beta contamination detected in previous investigations by NRDL personnel remains in the plumbing.

Proposed Investigation

Wipe samples will be collected from the first 2 inches of the pipe associated with the sink area. Additionally, 1 wipe sample from the first catch basin. Additional wipe samples will be collected if conditions allow.

Sample Analysis

Wipe samples will be submitted to an off-site laboratory for gross beta analysis.

3.2.1.2 Building 364 (Exterior)

Site Background

Building 364 was formerly known as the "Hot Cell" and chemistry laboratory under the NRDL program. This building was decontaminated to AEC criteria and the radioactive material license was terminated (AEC, AEC_a, and AEC_b).

A radioactive effluent storage tank housed in a subsurface concrete vault was constructed on the east side of the building. This tank stored radioactive effluent from the laboratory until it could be properly disposed of off site. Utility vaults running from the Building 364 to the tank vault housed the piping that transferred the effluent from the laboratory to the storage tank. Figure 2 presents a graphical representation of the site. Areas that are of a potential concern are the utility vaults, the tank vault, and the asphalt area surrounding the vaults. The vault was surveyed and met the AEC criteria for free release (AEC, AEC_a, and AEC_b).

Site Reconnaissance

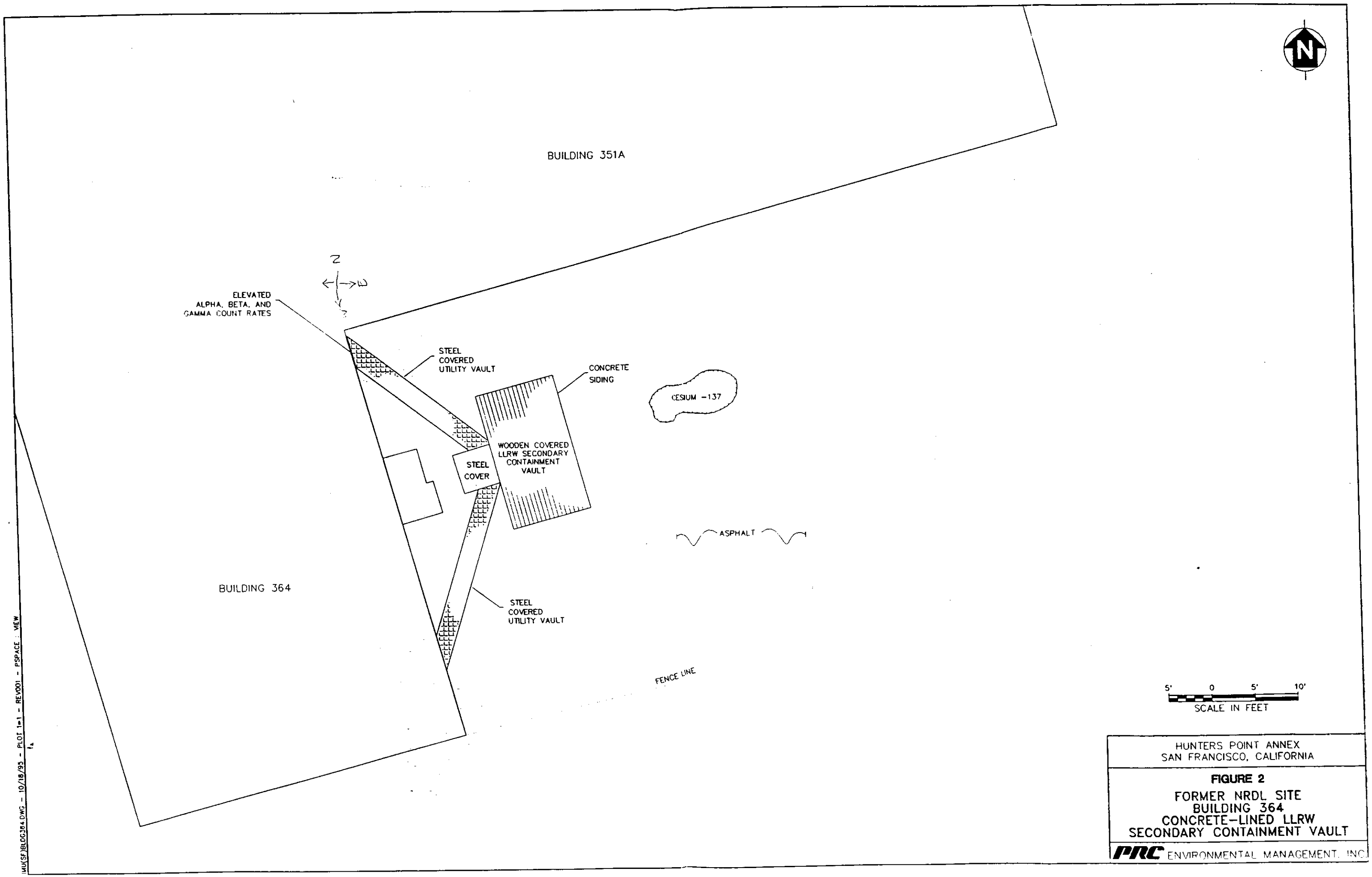
The storage tank(s) have been removed from the concrete tank vault. The tank vault is approximately 70 percent filled with what appears to be rainwater. There is a wooden cover that prevents access into the vault. No odors or oily sheens were observed.

PRC was unable to confirm whether the removal of the piping leading from Building 364 to the holding tanks occurred. The utility vaults were constructed with steel covers.

Building 364 currently is used as a metallurgy shop by a civilian tenant.

Recommendation

Based on the former operations within building 364 and the associated low-level radioactive waste (LLRW) storage tanks, the elevated alpha, beta, and gamma count rates observed in the field, and the



HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA

FIGURE 2

FORMER NRDL SITE
BUILDING 364
CONCRETE-LINED LLRW
SECONDARY CONTAINMENT VAULT

PRC ENVIRONMENTAL MANAGEMENT, INC.

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detection of a ^{137}Cs spill in the area, a surface radiation survey is recommended for the utility vaults, the tank vault, and the area surrounding the tank vault.

Radiation Survey Results

Radioactive contamination was found by NRDL personnel in the holding tanks housed below ground in a concrete secondary vault, the pump shed from which liquid waste was pumped into the holding tanks, and the piping leading from the pump shed and Building 364. These areas were either decontaminated to acceptable levels or disposed of as radioactive material. The holding tanks and associated plumbing were disposed of off-site as radioactive material (AEC, AEC_a, and AEC_b). All contaminated concrete associated with the secondary containment vault was chipped away, packaged, and sent off-site for proper disposal.

A walkover radiation survey was performed in the area surrounding the tank and utility vaults during the SCRS performed in 1991. Elevated alpha, beta, and gamma count rates were observed in a small area where the utility vault meets the building 364 (Figure 2).

The Navy performed a second surface walkover survey in 1993 that identified a second area exhibiting elevated gamma count rates (maximum 40,000 cpm). The elevated activity was detected within a peanut-shaped area approximately 8 feet by 20 feet. This area is located approximately 15 feet from the east side of the tank vault (Figure 2). Gamma spectroscopic analysis of an asphalt sample collected from the area exhibiting the highest count rate found the sample to contain 232 pCi/g of ^{137}Cs.

Proposed Investigation

A water sample will be collected from the tank vault to characterize the water for radiological constituents. Based on the analytical results, the water will be pumped and properly disposed of off site.

A 100 percent surface survey of the utility vaults and the associated steel covers will be performed using a G-M detector, an alpha scintillation detector, and a NaI detector. Areas that exhibit elevated count rates will be delineated, recorded, and a wipe sample will be collected. Also, in situ gamma spectroscopic techniques will be used when elevated count rates are observed to identify any gamma-emitting isotopes on

site. The gamma spectroscopic analysis will provide a radionuclide inventory at the site. This technique will not be used to assess the level of activity at the site.

Exposure rate measurements will be collected on the surface at 3.0 feet above the surface at various locations at the site. Additional measurements will be collected above and within the utility and secondary containment vault and any areas that exhibit elevated activity.

Analysis

Water and wipe samples will be sent to an off-site laboratory for gross alpha, beta, and gamma spectroscopic analysis.

3.2.2 Parcel E Sites

This section details the site background, site reconnaissance information, previous radiation survey results, RASO's survey recommendations, proposed survey methods, and radiochemical analysis of soil and water samples collected from sites in Parcel E.

3.2.2.1 Building 506

Site Background

Building 506 was formerly used by the NRDL as a chemistry laboratory. Most of the early radiochemical analyses were performed in this building. The building was mainly used to house the controls of a low voltage neutron generator. Rooms 35 and 35A were used to store tritium targets. After decontamination procedures within the building were completed, all contaminated equipment was either disposed of a radioactive waste or crated and shipped as radioactive material to an off-site location.

During the time the laboratory was operating a strontium-90 (beta emitter) spill was observed by an NRDL employee just outside the building. The exact location was not identified, however, Mr. Fil Fong of the Department of Health Services who was the former NRDL employee, recalls the spill occurring in the parking lot located just outside the east side of the building.

Fong of the Department of Health Services who was the former NRDL employee, recalls the spill occurring in the parking lot located just outside the east side of the building.

Site Reconnaissance

The building and foundation no longer exist. There is a minor amount of debris scattered throughout the site.

Recommendation

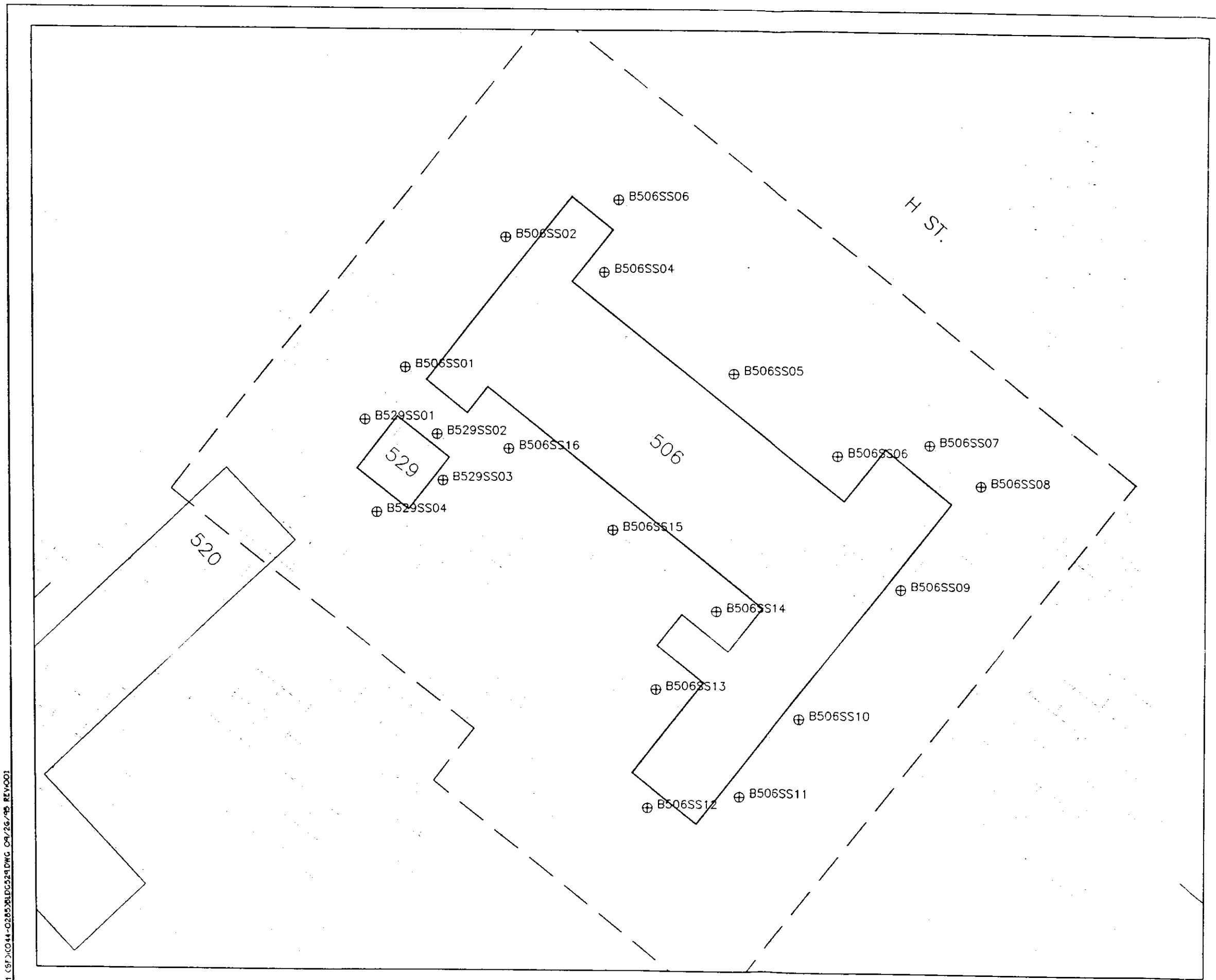
There was a very extensive effort to decontaminate building 506. The building was cleared by the AEC on December 24, 1969 (AEC, AEC_a, and AEC_b). Based on the use and storage of various radioactive materials within the building and since there was a minor ^{90}Sr spill outside the building, a survey and sampling of the surface soils surrounding the building is recommended.

Proposed Investigation

A radiological survey of the surface soil within and surrounding the former building is proposed to identify areas exhibiting elevated count rates and determine if ^{90}Sr has contaminated the soil surrounding the former building. Radiation measurements will be collected at 10 foot by 10 foot grid intersect using a 2-inch by 2-inch NaI detector. One-minute counts will be collected at each grid intersection. Figure 3 shows the grid and approximate boundary of the survey. The grid will be established in the field prior to any survey or sampling activities. All elevated soils will be delineated, recorded, and sampled.

Figure 3 shows the 16 proposed sample locations to evaluate whether ^{90}Sr contamination exists at the site. All sample locations will be identified in the field using global positioning system technology.

All surface soil samples will be collected using a stainless steel trowel and will be contained in a 500 milliliter (ml) polyethylene jar for analysis.



LEGEND:

APPROXIMATE LIMIT OF SURVEY

B506SS01 PROPOSED SOIL SAMPLE LOCATION

15' 0 15' 30'

SCALE: 1" = 30'

HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA

FIGURE 3
FORMER NRDL BUILDINGS
506 AND 529

PRC ENVIRONMENTAL MANAGEMENT, INC.

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Sample Analysis

Soil samples will be sent to an off-site laboratory for ^{90}Sr analysis.

3.2.2.2 Building 507

Site Background

Building 507 is the former site of a NRDL biological laboratory. The site is located within Parcel E at the northern end of an area bounded by H Street to the west, Manseau Street to the North, and Hussey Street to the east. This building was one that went through an extensive decontamination effort prior to moving operations to building 815. This building was cleared by the AEC December 24, 1969 (AEC. AEC_a, and AEC_b).

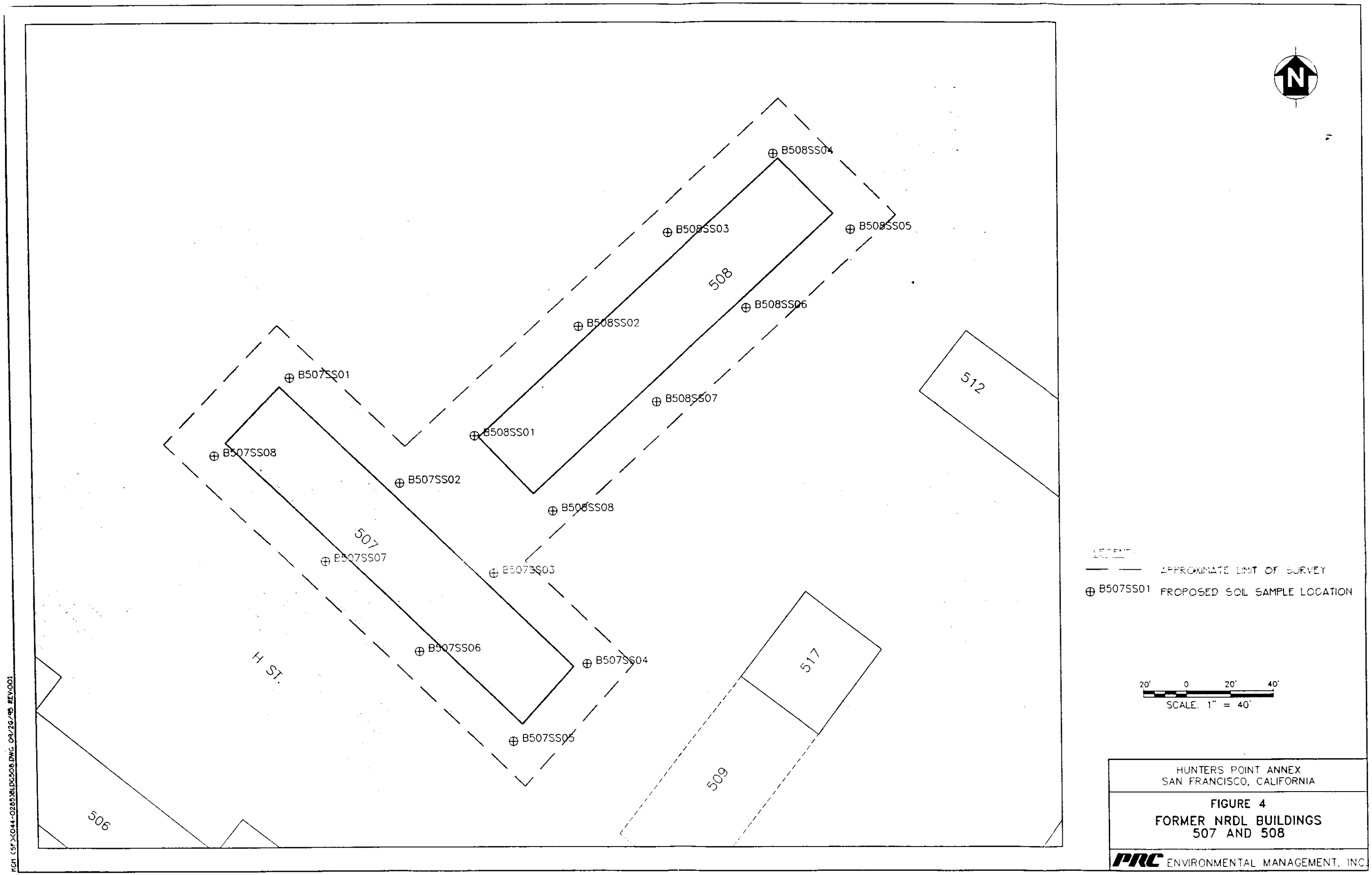
Site Reconnaissance

The building and foundation no longer exist. There is a minor amount of construction debris scattered throughout the site.

Proposed Investigation

A radiological survey of the surface soil within and surrounding the former building is proposed to identify areas exhibiting elevated gamma count rates. Gamma count rates will be collected at 10 foot by 10 foot grid intersects using a 2-inch by 2-inch NaI detector. One-minute counts will be collected at each grid intersection. Figure 4 shows the grid and approximate boundary of the survey. The grid will be established in the field prior to any survey or sampling activities. All soils that exhibit elevated activity will be delineated, recorded, and sampled.

Figure 4 shows the 8 proposed sample locations to evaluate whether gamma emitting radionuclides remain at the site above background. All sample locations will be identified in the field using global positioning system technology.



HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA

FIGURE 4
FORMER NRDL BUILDINGS 507 AND 508

PRC ENVIRONMENTAL MANAGEMENT, INC.

All soil samples will be collected using a stainless steel trowel and will be contained in a 500 ml polyethylene jar for analysis.

Sample Analysis

Soil samples will be sent to an off-site laboratory gamma spectroscopic analysis.

3.2.2.3 Building 508

Site Background

Building 508 is the former site of the NRDL health physics office. The site is located within Parcel E, at the northern end of an area bounded by H Street to the west, Manseau Street to the north, and Hussey Street to the east. Final clearance was issued to building 508 by the AEC on 12/24/69 (AEC, AEC_a, and AEC_b).

Site Reconnaissance

The building and foundation no longer exist.

Recommendation

To determine that no residual contamination associated with former operations in building 508, a radiation survey of the soil surrounding the former building is recommended.

Proposed Investigation

A radiological survey of the surface soil within and surrounding the former building is proposed to identify areas exhibiting elevated gamma count rates. Gamma count rates will be collected at 10 foot by 10 foot grid intersects using a 2-inch by 2-inch NaI detector. One-minute counts will be collected at each grid intersection. Figure 4 shows the grid and approximate boundary of the survey. The grid

will be establisl·ed in the field prior to any survey or sampling activities. All soils that exhibit elevated activity will be delineated, recorded, and sampled.

Figure 4 shows the 8 proposed sample locations to evaluate whether gamma emitting radionuclides remain at the site above background. All sample locations will be identified in the field using global positioning system technology.

All soil samples will be collected using a stainless steel trowel and will be contained in a 500 ml polyethylene jar for analysis.

Sample Analysis

Soil samples will be sent to an off-site laboratory gamma spectroscopic analysis.

3.2.2.4 Building 509

Site Background

Building 509 was the NRDL as an animal irradiation site. This building was cleared by the AEC on 12/24/69 (AEC, AEC_a, and AEC_b).

Site Reconnaissance

The building and foundation have been demolished. Minor amounts of debris is scattered throughout the site.

Recommendation

To determine that no residual contamination associated with former operations in building 509, a radiation survey of the soil surrounding the former building is recommended.

Proposed Investigation

A radiological survey of the surface soil within and surrounding the former building is proposed to identify areas exhibiting elevated gamma count rates. Gamma count rates will be collected at 10 foot by 10 foot grid intersects using a 2-inch by 2-inch NaI detector. One-minute counts will be collected at each grid intersection. Figure 5 shows the grid and approximate boundary of the survey. The grid will be established in the field prior to any survey or sampling activities. All soils that exhibit elevated activity will be delineated, recorded, and sampled.

Figure 5 shows the 5 proposed sample locations to evaluate whether gamma emitting radionuclides remain at the site above background. All sample locations will be identified in the field using global positioning system technology.

All soil samples will be collected using a stainless steel trowel and will be contained in a 500 ml polyethylene jar for analysis.

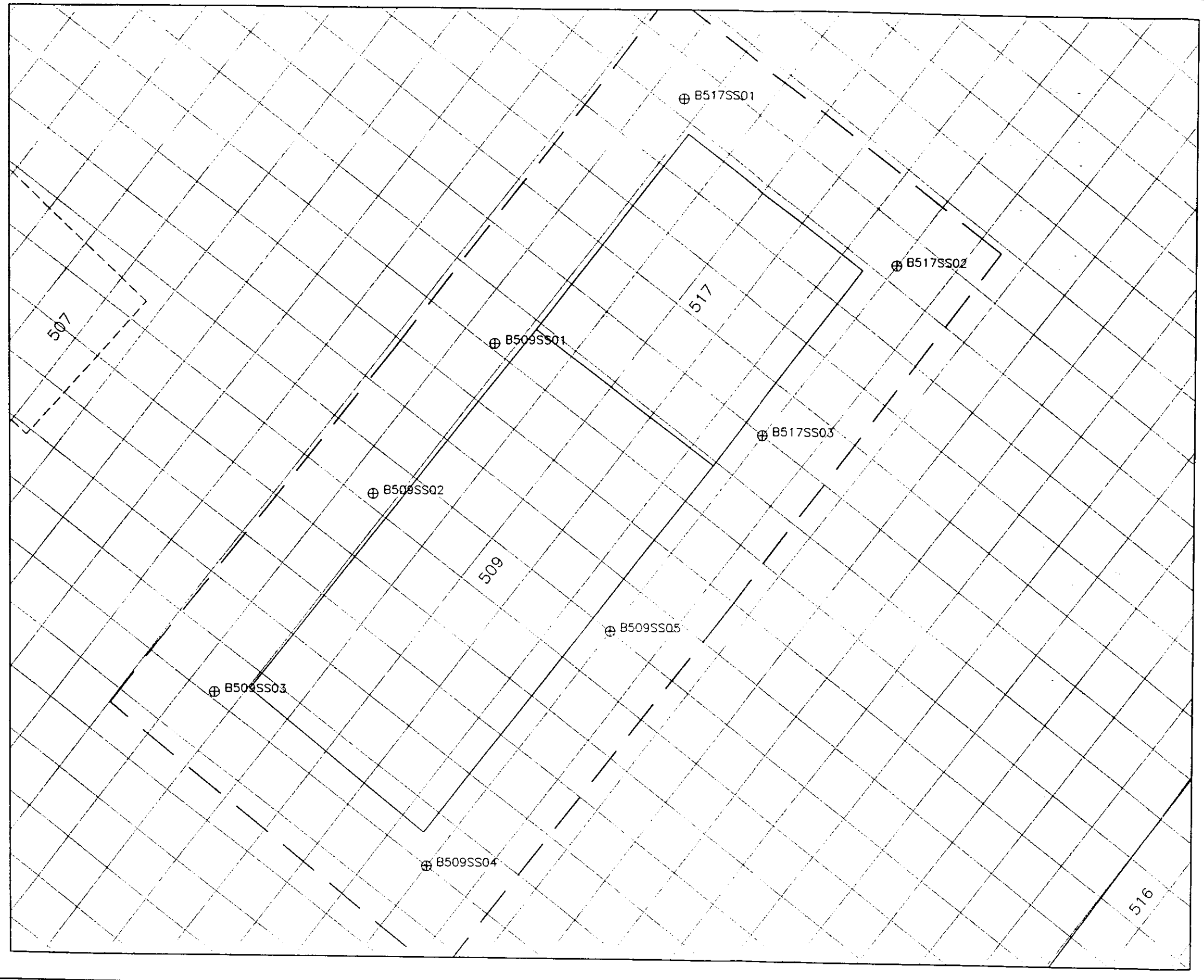
Sample Analysis

Soil samples will be sent to an off-site laboratory gamma spectroscopic analysis.

3.2.2.5 Buildings 510 and 510A

Site Background

Building 510 is the former site of an NRDL radiation physics operation. The site is located within Parcel E at the northern end of an area bounded by H Street to the west, Manseau Street to this north, and Hussey Street to the east. Buildings 510A and 510 were constructed as one building. Operations in building 510A included administrative support for the 1 million electron volt (1 MeV) x-ray laboratory located in building 510. The buildings were cleared by the AEC on 12/24/69 (AEC, AEC_a, and AEC_b).



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LEGEND:

APPROXIMATE LIMIT OF SURVEY

⊕ B5509SS01 PROPOSED SOIL SAMPLE LOCATION

10' 0 10' 20'

SCALE: 1" = 20'

HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA

FIGURE 5
FORMER NRDL BUILDINGS 509 AND 517

PRC ENVIRONMENTAL MANAGEMENT, INC.

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Site Reconnaissance

The building and foundation have been demolished. Minor amounts of debris are scattered throughout the site.

Recommendation

To determine that no residual contamination associated with former operations in buildings 510 and 510A, a radiation survey of the soil surrounding the former buildings is recommended.

Proposed Investigation

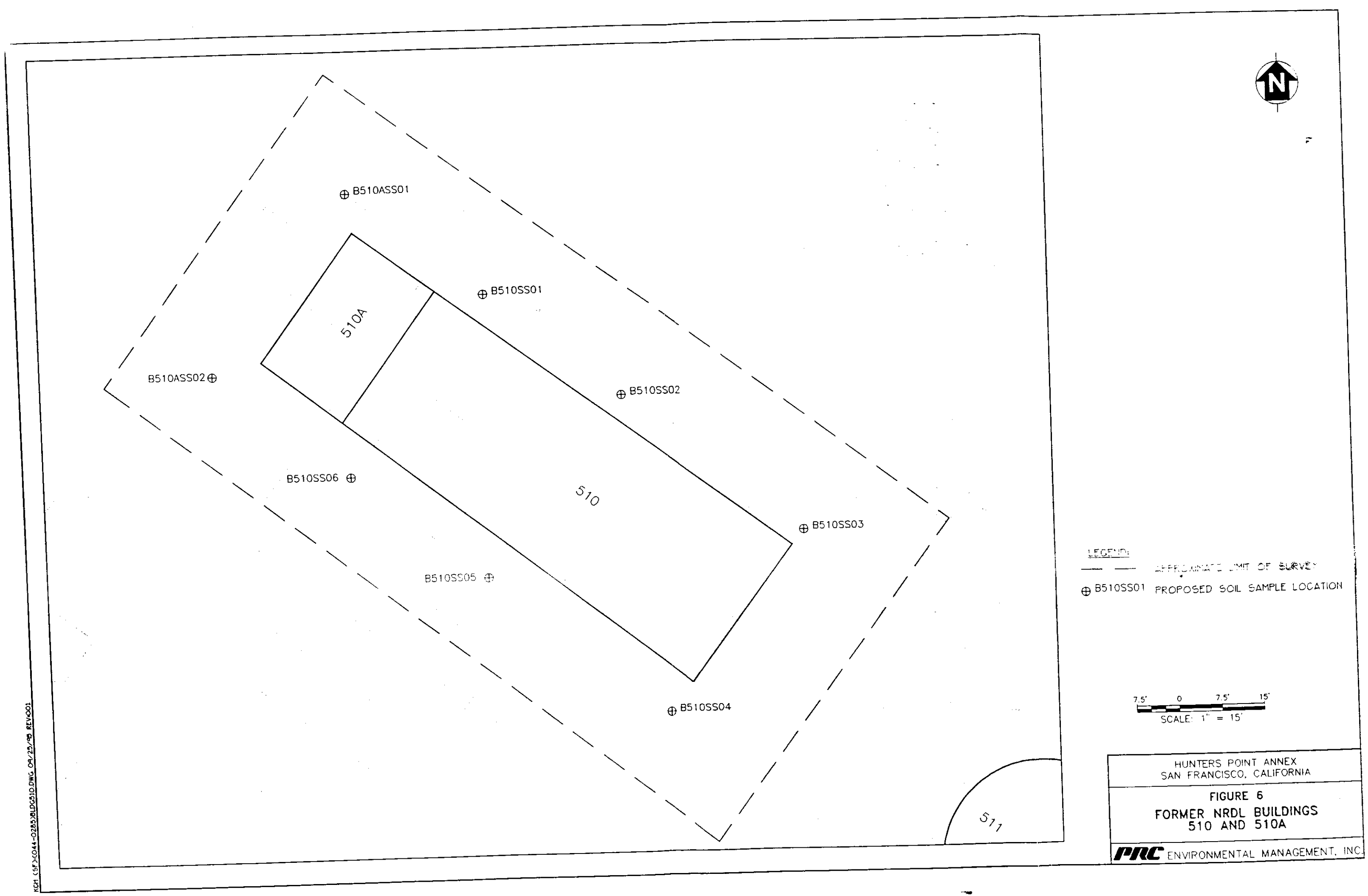
A radiological survey of the surface soil within and surrounding the former building is proposed to identify areas exhibiting elevated gamma count rates. Gamma count rates will be collected at 10 foot by 10 foot grid intersects using a 2-inch by 2-inch NaI detector. One-minute counts will be collected from each grid intersect. Figure 6 shows the grid and approximate boundary of the survey. The grid will be established in the field prior to any survey or sampling activities. All soils that exhibit elevated activity will be delineated, recorded, and sampled.

Figure 6 shows the 5 proposed sample locations to evaluate whether gamma emitting radionuclides remain at the site above background. All sample locations will be identified in the field using global positioning system technology.

All soil samples will be collected using a stainless steel trowel and will be contained in a 500 ml polyethylene jar for analysis.

Sample Analysis

Soil samples will be sent to an off-site laboratory gamma spectroscopic analysis.



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HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA

FIGURE 6
FORMER NRDL BUILDINGS
510 AND 510A

PRC ENVIRONMENTAL MANAGEMENT, INC.

3.2.2.6 Building 517

Site Background

Building 517, the former NRDL annex M site, is located between Manseau and Mahan Streets and is bounded by H and Hussey Streets. The building was formerly used as a marine storage facility (Public Works, June 1971).

Site Reconnaissance

The building and foundation no longer exist.

Recommendation

To determine that no residual contamination associated with former operations in building 517, a radiation survey of the soil surrounding the former building is recommended.

Proposed Investigation

A radiological survey of the surface soil within and surrounding the former building is proposed to identify areas exhibiting elevated gamma count rates. Gamma count rates will be collected at 10 foot by 10 foot grid intersects using a 2-inch by 2-inch NaI detector. One-minute counts will be obtained at each grid intersect. Figure 5 shows the grid and approximate boundary of the survey. The grid will be established in the field prior to any survey or sampling activities. All soils that exhibit elevated activity will be delineated, recorded, and sampled.

Figure 5 shows the 3 proposed sample locations to evaluate whether gamma emitting radionuclides remain at the site above background. All sample locations will be identified in the field using global positioning system technology.

All soil samples will be collected using a stainless steel trowel and will be contained in a 500 ml polyethylene jar for analysis.

Sample Analysis

Soil samples will be sent to an off-site laboratory gamma spectroscopic analysis.

3.2.2.7 Building 529

Site Background

Building 529, previously called the D.P.O. Tape Vault (Public Works, June 1971), is also the former site of the NRDL Radioisotope Storage and Cockcroft-Walton Accelerator. A stainless steel holding tank on the north side of the building was decontaminated. Shipyard personnel removed the tank in December 1969 to be used for boiler feed water storage. Building 529 was cleared by the AEC on 12/24/69 (AEC, AEC_a, and AEC_b).

Site Reconnaissance

The building and foundation no longer exist.

Recommendation

To determine that no residual contamination associated with former operations in building 529, a radiation survey of the soil surrounding the former building is recommended.

Proposed Investigation

A radiological survey of the surface soil within and surrounding the former building is proposed to identify areas exhibiting elevated gamma count rates. Gamma count rates will be collected at 10 foot by 10 foot grid intersects using a 2-inch by 2-inch NaI detector. One-minute counts will be collected at each grid intersect. Figure 3 shows the grid and approximate boundary of the survey. The grid will be established in the field prior to any survey or sampling activities. All soils that exhibit elevated activity will be delineated, recorded, and sampled.

Figure 3 shows the 4 proposed sample locations to evaluate whether gamma emitting radionuclides remain at the site above background. All sample locations will be identified in the field using global positioning system technology.

All soil samples will be collected using a stainless steel trowel and will be contained in a 500 ml polyethylene jar for analysis.

Sample Analysis

Soil samples will be sent to an off-site laboratory for gamma spectroscopic analysis.

3.2.2.8 Building 707 Concrete Pad

Site Background

Building 707 is the site of the former NRDL Animal Colony. The building was used to house dogs used in NRDL experiments. The building was surveyed by NRDL personnel prior to release for unrestricted use (AEC, AEC_a, and AEC_b).

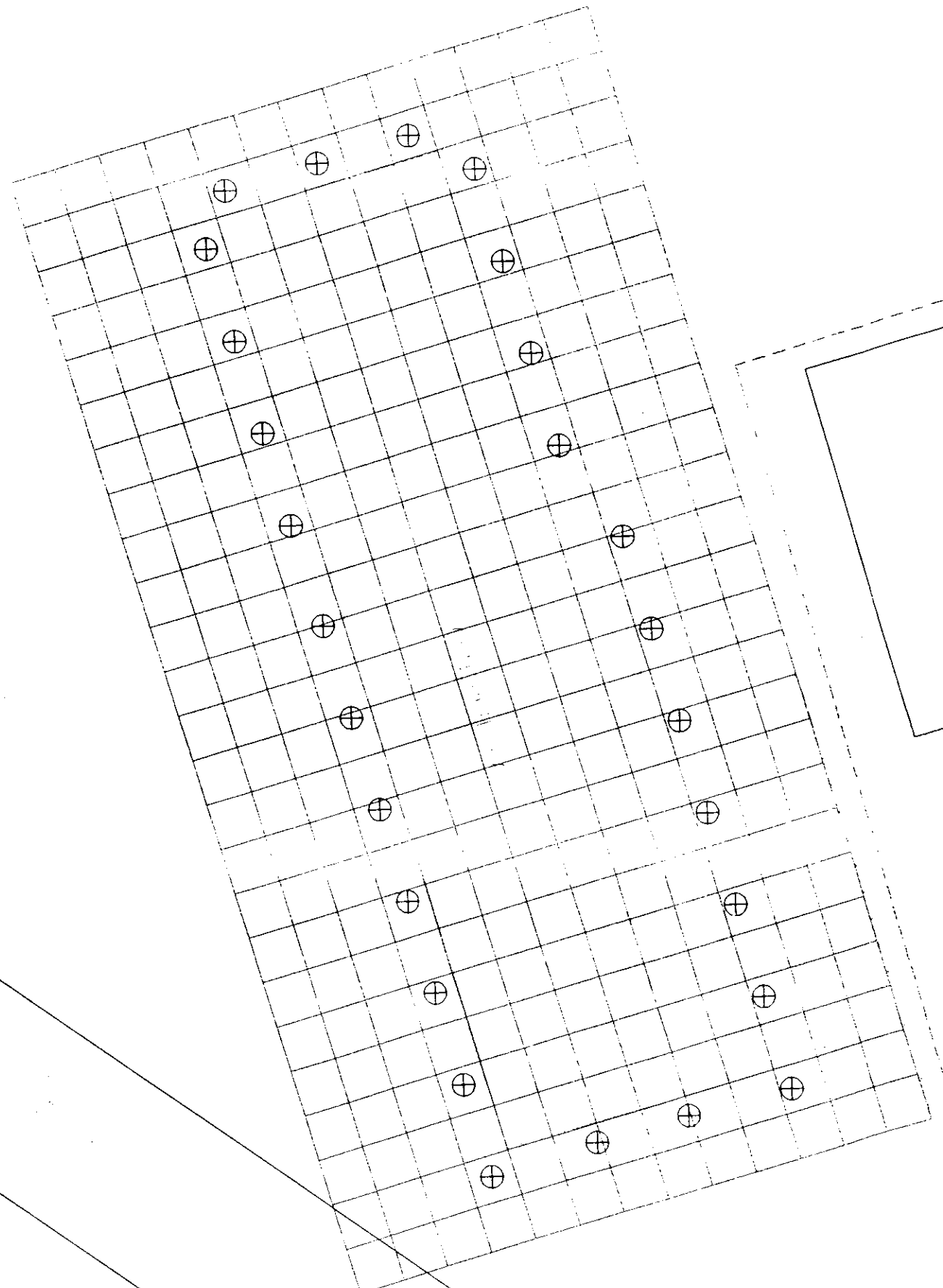
The concrete pad adjacent to building 707 was used by NRDL as a radioactive waste drum storage area. Figure 7 shows the location of the storage pad relative to building 707. Drums of radioactive material were stored on the concrete pad until they could be sent to an off-site disposal facility.

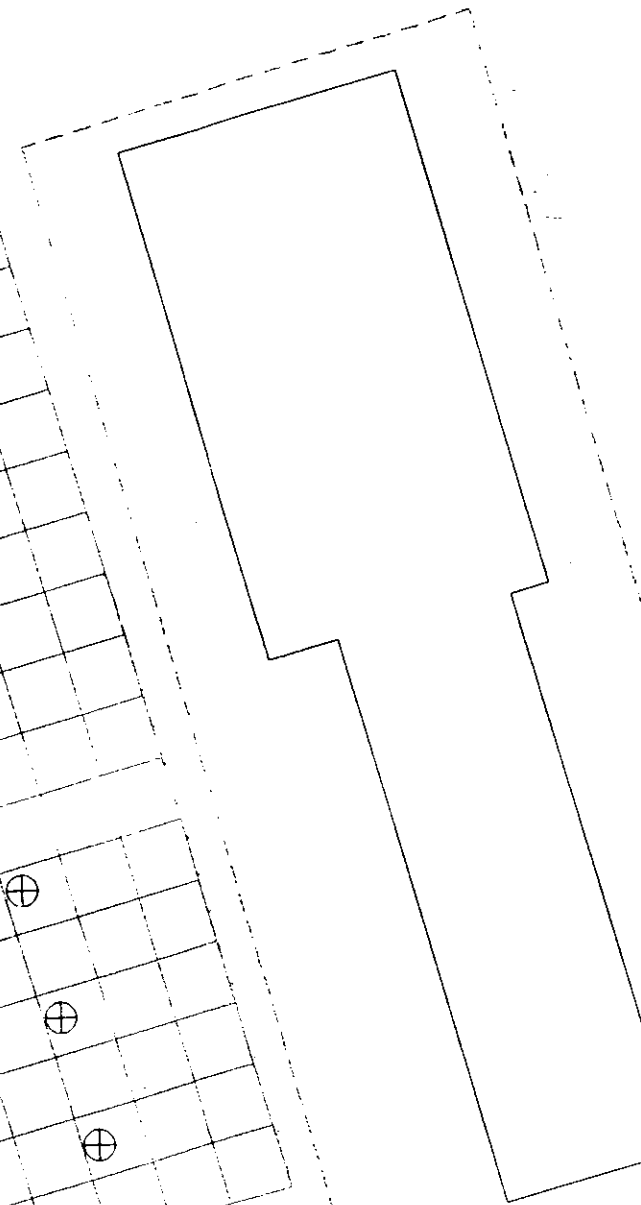
Site Reconnaissance

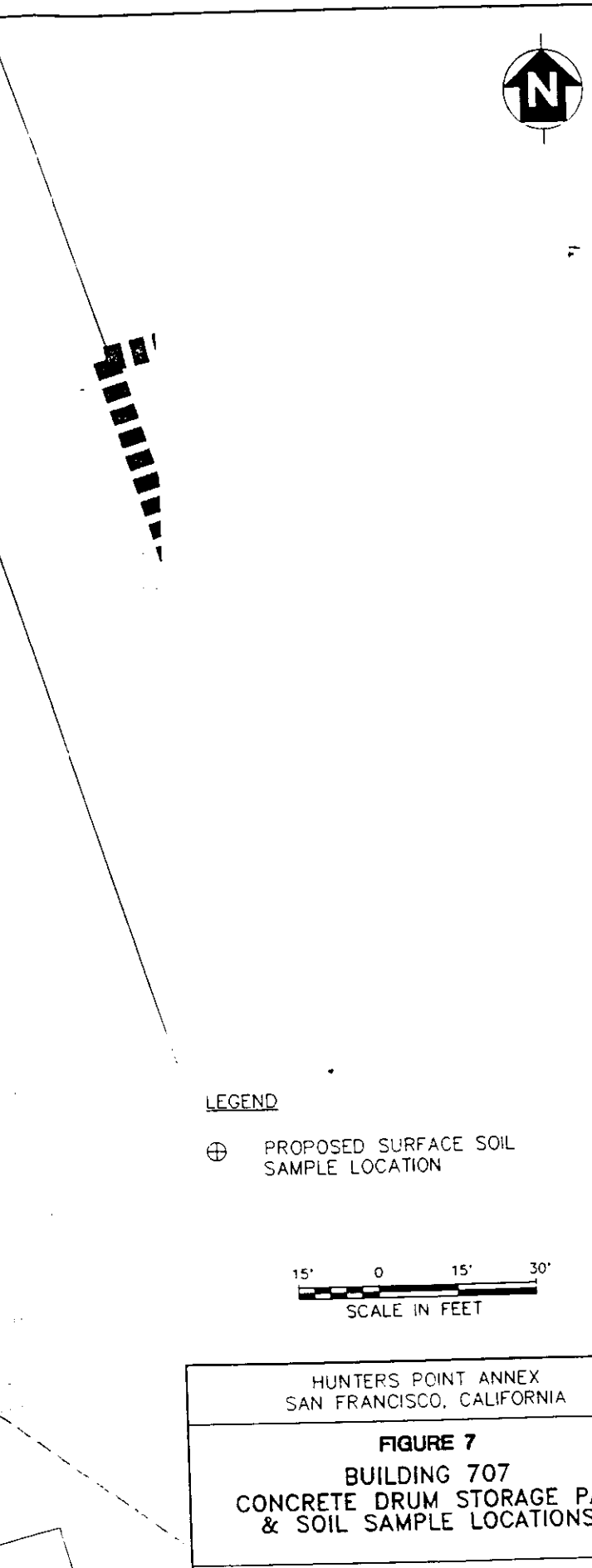
The concrete pad is in fairly good condition. No obvious stains were observed.

Radiation Investigation Results

The Navy has performed a surface walkover survey over and surrounding the drum storage pad as part of the SCRS. No elevated activity was detected on or surrounding the pad.







LEGEND

⊕ PROPOSED SURFACE SOIL SAMPLE LOCATION

15' 0 15' 30'
SCALE IN FEET

HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA

FIGURE 7

BUILDING 707
CONCRETE DRUM STORAGE PAD
& SOIL SAMPLE LOCATIONS

PRC ENVIRONMENTAL MANAGEMENT, INC

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Recommendation

Based on the lack of survey data regarding soils surrounding the concrete drum storage pad, a radiation survey is recommended.

Proposed Investigation

A radiological survey of the concrete drum storage pad and the surface soil surrounding the pad will be surveyed for residual contamination. A 100 percent confirmation surface scan of the concrete pad will be performed using a 2-inch by 2-inch NaI detector. The pad was previously surveyed during the SCRS. The surface scan will be performed with the radiation detection instrumentation in digital rate mode.

The soil surrounding the pad will be evaluated by collecting gamma count rates at 10 foot by 10 foot grid intersects. A one-minute count will be collected at each grid intersect. Figure 7 shows the grid and approximate boundary of the survey. The grid will be established in the field prior to any survey or sampling activities. All soils that exhibit elevated activity will be delineated; recorded, and sampled.

Figure 7 shows the 27 proposed sample locations to evaluate whether gamma emitting radionuclides remain at the site above background. All sample locations will be identified in the field using global positioning system technology.

Soil samples will be collected using a stainless steel trowel and will be contained in a 500 ml polyethylene jar for analysis.

Sample Analysis

Soil samples will be sent to an off-site laboratory for gamma spectroscopic analysis.

4.0 DECONTAMINATION

The following section provides decontamination procedures for the radiation investigation at former NRDL buildings/sites.

4.1 EQUIPMENT AND PERSONNEL DECONTAMINATION

Radiation monitoring will be performed during all field activities associated with this radiation investigation. All equipment and field personnel will be frisked for loose contamination if elevated activity is detected at the site or before any personnel or equipment leaves the site. Decontamination procedures will be in accordance with PRC's Radiation Protection Program. Decontamination procedures will include the following.

- Measurement of gamma exposure rates
- Frisking personnel for radiological contamination
- Frisking equipment, sample containers, and any material removed from the site for radiological contamination

Contamination detected on field instrumentation, sampling equipment, and personal protective equipment (PPE) will be wiped using a moist towlet and refrisked.

4.2 LOW-LEVEL RADIOACTIVE MATERIAL STORAGE

Radioactive material, including contaminated PPE, will be properly contained and stored in the LLRW bin located in building 130 until it can be properly disposed of off-site.

REFERENCES

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APPENDIX A

RADIATION DETECTION DEFINITIONS, CALCULATIONS, ACCEPTABLE SURFACE CONTAMINATION LEVELS, BACKGROUND CALCULATIONS, AND QUALITY CONTROL PROCEDURES

ATTACHMENT X
MINIMUM DETECTABLE CONCENTRATION DISCUSSION

The Minimum Detectable Concentrations (MDC) as discussed in NUREG-1507 will be calculated for each survey configuration and shall be 25-50% of the guideline level. The following is a discussion on the determination of the MDC:

(a) Determination of Instrument Detection Capability. Each configuration of a detector and counting system has a unique detection capability determined by several variables. This discussion pertains to detector capability limitations based on counting statistics only.

(b) Definitions. The definitions relevant to a discussion of counting statistics as they pertain to field instrument detectability are outlined in the following subsections. This terminology is consistent with definitions published in the literature. The 95 percent confidence interval is used in all calculations. Capabilities may be reported in terms of counts and count rates or in terms converted to activity. Count data are converted to activity using a detector efficiency factor, area factor, and a term to account for errors. The correction factor is applied as a multiplier of the count data.

2 sigma

Detection Level. The detection level is the a priori limit and represents the measurement system sensitivity. Detection level is denoted "L_D" and is the value stated in describing a measurement system.

Critical Level. The critical level activity concentration (less than values) is the a posteriori statement of detection, which when exceeded, indicates to some desired degree of confidence that the sample is different from background.

Reporting Data. Each measurement is reported as a net count rate and an error term or standard deviation. When the net count is below the critical level, the sample net activity is reported as less than either sample net activity plus the value of the one-sided 95 percent confidence interval; or the critical level, whichever is greater.

Detection Limits Applied to the Field. The detection level and activity conversion factor yields the minimum detectable concentration (MDC) in areal units with dimensions of activity per surface area. This value is used to set counting times, select detectors, and establish counting room shielding (as necessary).

The critical level or "detection limit" is used in reporting field data. Critical level activity concentration values will be no greater than 50 percent of the RG-1.86 limits, typically they will be lower.

(c) Detection Limits for Scanning. MDCs for scanning will be specified for each instrument configuration for alpha and beta-gamma measurements using manufacturer data for background and detector efficiency. Actual MDCs for scanning will be reported from field data. See Table 2 for estimated scanning detection limits.

Detection Levels for Scanning. Detection limits for scanning are estimated from a perceptible increase in the count rate for a careful surveyor. The product of the instrument background count rate and count to activity conversion factor provides an estimate of the detector-specific "activity background." The detection limit is estimated as a fractional increase above that value as follows using detector slow response:

Background Count Rate (cpm)	Factor (times background)
< 5	4
5-<30	3
30-<50	2.5
50-<100	2
100-1,700	1.5
1,700	1.25

The product of the net percetable increase above background and the activity conversion factor provides the net detection limit.

The net limit listed in Table 2 as Net Limit is the best detection limit for a careful observer using a typical rate meter in slow response mode, holding the probe stationary, and observing meter fluctuation. The Net Alt MDA represents the minimum activity for a careful observer with a moving detector.

Calculated by an alternate method, also suggested by NUREG 5489, substituting the detector time constant for the counting time in its (that is NUREG 5489) MDA formula is also used for comparison in estimating the detection limit for scanning. Table 2 presents scanning limits for all instrument configurations using both methods, and for detector time constants of 3 and 10 seconds. This table reflects that the minimum perceptible increase decreases as a fraction of the count rate with increasing count rate.

TABLE 1
CALCULATION OF DETECTION CAPABILITY

Detection capabilities are calculated from the defined terms as follows:

K_α	=	1.645 (one-sided 95 percent standard deviation)
T_s	=	Sample count time
T_b	=	Background count time (at least 10 T_s)
r_b	=	Background count rate
r_s	=	Sample count rate
a_d	=	Detector area (cm^2)
ϵ	=	Efficiency
cpm	=	Measured net count rate (count per minute)
dpm	=	Source activity or measurement result (disintegration/minute)
L_c	=	Critical level
L_D	=	Detection limit
MDC	=	Minimum detectable concentration

$$L_C = \left(\frac{K_a}{T_s} \right) x \sqrt{T_s r_b \left(1 + \frac{T_s}{T_b} \right)}$$

$$L_D = \frac{K_a}{T_s} + \left[\frac{K_a^2}{T_s} x \sqrt{T_s r_b \left(1 + \frac{T_s}{T_b} \right)} \right]$$

$$\epsilon = \frac{r_{source} - r_b}{dpm}$$

$$\text{Sample cpm} = r_s - r_b \pm \sqrt{\frac{r_s}{T_s} + \frac{r_b}{T_b}}$$

$$\text{MDC (probe measurement)} = \frac{1}{\epsilon} x \frac{100}{a_d} x L_D$$

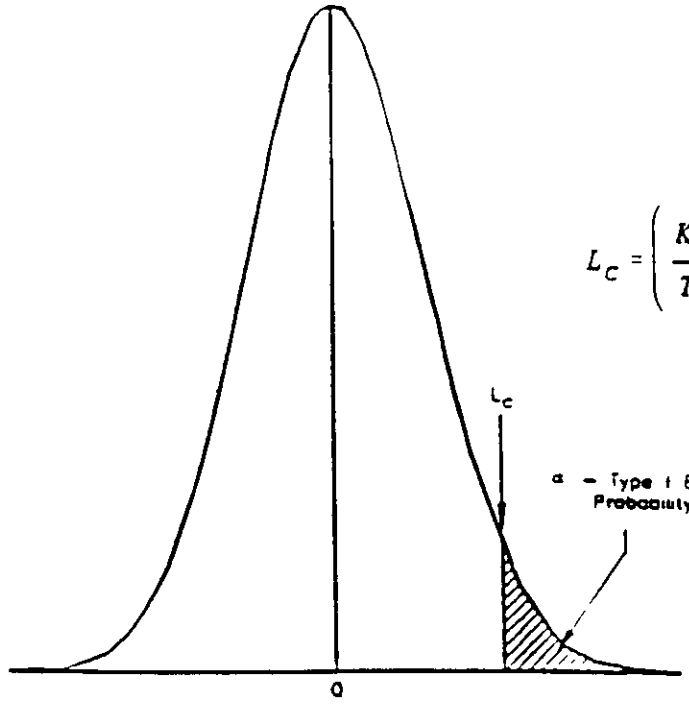
$$\textit{Less than value (for } r_s - r_b \leq L_c) = (r_s - r_b) + 1.645 \sqrt{\frac{r_s}{T_s} + \frac{r_b}{T_b}}$$

TABLE 2

SCANNING DETECTOR LIMITS[a]
(dpm/100cm^2)

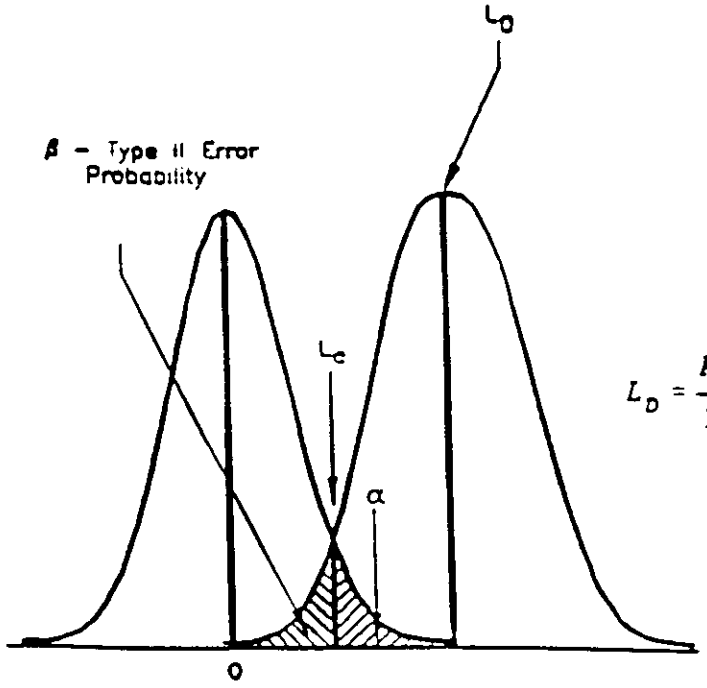
Detector	Background Equivalent Activity[b] (BEA)	Scanning Detection Limit[c] (cpm)	Net Limit[d] (dpm)	Net Alt MDA[e] (dpm)	Net Alt MDA[f] (dpm)
A	5	4	15	75	50
B	1,450	82	2,150	3,700	2,600
C	880	82	1,270	2,200	1,500
D	18	20	50	115	80
E	920	600	460	670	480
F	22	60	44	70	50
G	1,280	2,400	640	470	330

[a] Values are approximate.
[b] Product of detector background and activity conversion factor presented in Table 3.
[c] Product of background count rate and factor for perceptible increase of rate meter provided in text.
[d] Net detectable activity for stationary detector.
[e] Scanning MDC for moving detector using an instrument response time constant of 3 seconds.
[f] Scanning MDC for moving detector using an instrument response time constant of 10 seconds.



$$L_C = \left(\frac{K_\alpha}{T_s}\right) \times \sqrt{T_s r_b \left(1 + \frac{T_s}{T_b}\right)}$$

Critical Level, L_C



$$L_D = \frac{K_\alpha}{T_s} + \left[\frac{K_\alpha^2}{T_s} \times \sqrt{T_s r_b \left(1 + \frac{T_s}{T_b}\right)}\right]$$

Detection Limit, L_D

ATTACHMENT XX

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE[a]	AVERAGE[b c]	MAXIMUM[b d]	REMOVABLE[b e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm β-γ/100 cm^2	15,000 dpm β-γ/100 cm^2	1000 dpm β-γ/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

ATTACHMENT XXX
DETECTOR SELECTION AND COUNTING CONFIGURATION

Alpha counting will be performed with 1-inch diameter alpha scintillation detector; beta counting with a shielded pancake GM detector. Detectors are held in fixed geometry holders.

Detector Calibration

- Detectors are calibrated so that total contained activity is reported.
- Sources are normal 1-inch-diameter, typically electroplated, and certified by the manufacturer as traceable to NIST.
- Calibrations for counting of swipes are performed with standards prepared on filter paper backing.
- Calibrations for direct surveys are performed with standards prepared on plastic or metal backing.

Detector Set-up and Quality Control. Detector high-voltage, threshold, and window settings are established at the start of the project. Efficiency factors are determined and counting control charts established.

At least daily, background and efficiency are checked for each configuration, against control limits.

Data Reporting and Sample Size Correction. Swipes of areas less than 100 cm^2 are reported "per item." Swipes of areas greater than 100 cm^2 are reported per 100 cm^2. Where swipes of greater than 100 cm^2 exceed RG 1.86 values, the suspect area is resurveyed.

Detection Limits. Survey parameters will be adjusted so that the activity detection level does not exceed the RG 1.86 limiting value for fixed measurements. Specific maximum values for detection limits shall be specified in the workplan.

Additional fixed point surveys will be performed where scanning surveys cannot meet a detection sensitivity of 25 percent of the applicable RG 1.86 value. This is the case for the unshielded pancake detector, for all alpha emitting radioisotopes, and for strontium-90 (depending upon the method for calculating MDA) for all beta detectors described. The scanning methods have adequate sensitivity for other beta-gamma emitters using the gas proportional counters and for alpha emitters using the scintillation detector or the large gas proportional detector. The pancake detector will not be used for scanning surveys unless use of other detectors is constrained by geometry factors.

The procedure described below can be used to establish background at a specified variance and confidence interval (NRC 1993).

Background should be determined so that variance is minimized and the measurement is made to a specified confidence interval. Background measurements are influenced by two major factors: counting error variations and locational/environmental variations of radioisotope concentrations for a single measurement. Counting error variations are controlled by accumulating counts or by using a rate measurement system that has a sufficiently long averaging time (slow response), such that the only appreciable source of intermeasurement variability is from sample location variability.

Environmental variability is controlled by collecting sufficient point estimates of the natural background at multiple locations similar to the area of interest. In order to perform a background measurement to a variance of ν at the φ percent confidence interval, perform the following measurement process:

Take 10 background measurements at various locations, accumulating enough counts to maintain counting error below 5 percent. Calculate the mean and standard deviation of the background and calculate the coefficient of variation:

$$2 \times (S_b)/ X_b = \textbf{coefficient of variation } (\nu)$$

If this value is greater than ν, take additional measures, calculated as follows:

$$((t_{\varphi, df} \times S_b) / (\nu \times X_b))^2$$

or for 10 initial measurements and a maximum variance of 20 percent:

$$84 \times (S_b/X_b)^2$$

where:

$t_{\varphi, df}$ = the t statistic for n—1 degrees of freedom

S_b = the standard deviation of the background measurements

ACTIVITY LIMITS

The activity limits for release of each area shall be in accordance with USNRC Reg Guide 1.86 (see Attachment XX). The lowest limits will apply for each area unless the presence of specific commodities containing a specific isotope can be ruled-out from historical information.

Radium can be assessed by the presence of alpha radioactivity. In the event elevated locations are identified -- which are above the average and less than the maximum limits -- careful measurements will be made to average the surface activity as described in NUREG/CR-5849.

It is anticipated that most, if not all grid measurements will be below the activity limits specified for release, so that the upper confidence limit calculated from the data is less than the activity limit. Data will be reviewed during the measurement process, so that if additional measurements are necessary, to improve the measurement statistics, they can be made without additional mobilization. In the event residual activity is detected, swipe samples will be collected and submitted to an off site laboratory for isotope identification.

REPORTING UNITS

All measurements will be reported in units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2).

QUALITY ASSURANCE

All work for this radiation investigation will be performed in accordance with PRC's CLEAN II Quality Control Management Plan, Revision 0 (QCMP) June 23, 1995. Specific provisions related to radiological measurements are discussed in the following sections.

DATA QUALITY OBJECTIVES

Data quality for this survey will be achieved by meeting the data quality objectives described in the following sections.

Precision

Precision is a measure of mutual agreement among individual measurement of the same property, usually under prescribed similar conditions. Precision is evaluated by performing duplicate radiation measurements of the same sample or location, either using a second observer, or at a different time.

The measurement precision objective is to maintain counting error and instrument drift errors to within 10 percent of the mean value. Overall measurement repeatability at any field location shall be demonstrable within 50% at the detection limit, when positioning error, other field error factors, and instrument precision are considered. Precision will be evaluated by comparison of mean values of two independent measurements over a subset of the data set for which replicate measurements are performed.

Accuracy

Accuracy is a measure of agreement between any observed or measured value and the true value as determined by a primary physical standard, standard reference material, or a secondary traceable standard. The accuracy of field radiological measurements will be determined by measurement of a secondary standard prepared by a commercial vendor, as a calibration standard. Secondary standards shall be traceable to the National Institute of Standards and Technology (NIST) and certification of source emission records shall be maintained.

Each instrument will be calibrated at the start of the project, following any instrument repair or maintenance, and monthly thereafter by measurement of a known secondary standard in a fixed reproducible geometry. After calibration, each detector will be checked daily to confirm the measurement system is maintained within acceptable control parameters.

Accuracy for surface contamination measurements includes consideration of the source terms for error including the calibration source (certification error), the counting error, and other field systematic (bias) errors and random errors. Counting error is minimized by a long-duration count during standardization. Bias is introduced by estimating the error introduced by positioning, backscatter, filter self-absorption, and other factors. Bias introduced will be in a conservative (i.e. protective) direction.

Representativeness

Representativeness is a measure of how well the sampled surfaces or locations represent the total population. The difference between the true mean and population standard deviation and the sample mean and sample standard deviation for any data set are an indicator of the representativeness of any sample. In most situations, the true mean cannot be practicably measured, therefore, representativeness can only be assessed by comparing several independent estimates of the sample mean.

In the case of building surveys, where potential hot spots are randomly located, representativeness is assured by a combination of random measurements, biased random measurement, and systematic sampling. Systematic sampling consists of measurement at defined locations on an established grid. Biased random measurements consist of samples collected at likely source accumulation locations such as pits, cracks, drains, low points, and vents.

Representativeness will be evaluated by comparing duplicate scans (100% coverage) of the same grid locations which were initially screened by partial scans. Where the duplicate scan determines that an area which passed upon the initial scan, then fails upon a complete scan, a failure is noted. The criteria for representativeness is that no more than 2 of 10 areas fail. A minimum of 1% or 10 grids will receive a 100% beta-gamma scan survey.

Comparability

Comparability is a measure of agreement between different sources of measurements performed by independent teams, perhaps using different techniques, personnel, and equipment. Comparability is provided by using (1) standard techniques, (2) commercial instrumentation, (3) comparisons to NIST traceable secondary standards or calibrations, and (4) instrument quality control.

Sensitivity

Sensitivity for a radiological measurement is the ability to distinguish between background radioactivity and radioactivity not associated with background. In the case of surface radiological screening, all

activity greater than one standard deviation above the count background are presumed to be associated with sources not associated with background. The term for this statistical parameter is the critical level, which defines one aspect of the measurement process. Count background is normally determined in the location of interest with the probe's sensitive surface shielded. Since different foundation, slab, and building construction materials affect ambient gamma radiation background, and because the surface contamination beta-gamma probe is sensitive to this background, the background count rate may be periodically redetermined.

Sensitivity is controlled by (1) selection of instrumentation - probe surface area, shielding, inherent efficiency, (2) ambient background, and (3) counting time or scan rate. Sensitivity is evaluated by confirming that required sensitivities or detection limits are in fact achieved.

CONTROL CHARTS

At the start of the survey, a control table will be established for each detector and rate meter/scalar pair. The control measurement of background and source activity will be taken to a 1% precision count. A fixed jig or template, providing the same geometry as the source measurement will be used for establishing control measurement. The background measurement will be made in a manner such that it is free of surface activity influence. At the same time that the detector control measurement is made (establishing detector efficiency) a second measurement may be made with a non-certified (transfer) standard.

If the primary standard is licensed for a specific location, is of high value, or is retained in a control location to support multiple projects, the transfer calibration technique will be used. From the initial measurement, a two sigma control limit and three sigma control limit will be established. Each instrument/detector pair will be checked daily (or as necessary by detector changes, battery replacement, severe shock, or damage) for response within the control limits using the field counting times and either the certified standard or a transfer standard.

The mean value and standard deviation will be determined from a series of 20 to 30 measurements for the same time as the field measurement. For a digital rate meter, the digital value is simply recorded for 20 to 30 sequential changes. For an analog rate meter, the radiation field team will record the value from

20 to 30 sequential randomly times observations. The mean and standard deviation will then be calculated.

Drifting outside the two sigma boundary is a cause for concern. Any measurement made before an instrument has drifted outside the three sigma control value shall be considered for rejection and repeat of the measurement process.

DATA RECORDING

All field survey measurement will be recorded on standard field collection forms and managed in accordance with PRC's Navy CLEAN contract standard operating procedures and QCMP. Any electronically accumulated data shall be printed and authenticated daily, thereafter managed in accordance with PRC's Navy CLEAN contract standard operating procedures.

All daily source checks, control charts, calibration records, and related records will be maintained as project records.

DATA VALIDATION

An independent survey of at least five percent of all fixed survey point locations will be conducted. The independent surveyor may use the same instrumentation and calibration sources; however, all calculation, measurements, and calibrations will be independent.

In addition, the independent surveyor will perform a 100% beta-gamma scan of one percent of the total surface area, using judgmental selection of areas considered most likely to retain residual contamination. Anomalies identified will be compared with results from partial coverage scans to assess the representativeness of the scanning survey technique.

The data validator will review all calibration records and control charts for accuracy, missing information, and consistency. The validator will examine all field data and compare the base survey with independent surveyor data.

After eliminating any data which is deemed invalid, the validator will determine if the precision, accuracy, representativeness, completeness, comparability, and sensitivity criteria have been met. Any data which do not meet full criteria will be resurveyed or identified in the report with qualification.