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RADIOLOGICAL SCANNER VAN SURVEY
Hunters Point Naval Shipyard
California
September 9-12 2002

United States Environmental Protection Agency
Radiation And Indoor Environments National Laboratory (R&IE)
4220 S. Maryland Parkway
Las Vegas, NV 89119

ED_004747_00001770-00001

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

April 10, 2003

Mr. Keith Forman
Naval Facilities Engineering Command
Southwest Division
1230 Columbia Street, Suite 1100
San Diego, CA 92101-8571

Mr. Chein Kao
Department of Toxics Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94710

Ms. Julie Menack
California Regional Water Quality Control Board
1515 Clay Street, #1400
Oakland, CA 94612

RE: USEPA Radiological Scanner Van Report, Hunters Point Shipyard, March 2003

Dear Mr. Forman, Mr. Kao and Ms. Menack:

The United States Environmental Protection Agency (USEPA) has completed its report summarizing the results of the radiological scanner van survey of Hunters Point Shipyard (HPS) which took place September 9 through 12, 2002. The report is included as an attachment to this letter. USEPA Region 9 Superfund staff requested USEPA Radiation And Indoor Environments National Laboratory (R&IE) conduct the scanner van survey of September 9 through 12, 2002 as a final radiation confirmation survey for Parcel A. The scan covered all navigable roads on and immediately adjacent to Parcel A. In addition to Parcel A, areas of Parcel B, Parcel C, and minor portions of Parcels D and E were scanned. (A map of the scanned areas is included in the subject report.) The scan covered only minor portions of Parcels D and E due to the inaccessibility of navigable roads and ongoing radiation investigation and/or remediation. All of the anomalies detected during the scan were attributable to natural occurring sources at levels consistent with what would normally be found in the environment. Based on the scan results, none of the areas which were scanned warrant further radiological investigation.

Background and Summary of Scanner Van Results

USEPA R&IE's radiological scanner van is the most recent tool that USEPA has used at HPS to confirm Navy cleanup of radiological contamination and to ensure protection of human health and the environment. The scanner van moves at slow speed and provides a unique means

of surveying an extensive area for gamma[1] emitting radionuclides. Any time that an unexplained anomaly is detected, the van stops and the scanner operator performs a gamma ray energy spectrum at that location. The operator then compares the spectrum to a computer gamma energies data base and identifies the radionuclide(s) responsible for the anomaly.

This scanner van system, while extremely efficient, does have limitations. The scanner van's ability to detect radiation anomalies is not easily quantified and is influenced by many factors. These factors may include: 1) the driving speed of the van which determines the amount of time the detectors have to detect a potential radiation source, 2) distance of a source away from the scanner van's detectors, 3) strength of a radiological source, 4) species of radionuclide(s), and 5) extent of shielding of a source (e.g., thickness/density of a building wall or ground surface cover such as asphalt or concrete, depth of a buried source, etc.).

As with any radiation detection system, increasing the distance of a radiation source from the detector causes a marked decrease in its detection efficiency. Closer is always better, but the size of the scanner van's detector, especially when compared to handheld radiation detection instruments, makes this system ideal for scanning over large areas to identify unusual or elevated background gamma radiation quickly and efficiently. It offers an otherwise unobtainable sense of security that nothing has been overlooked.

The purpose of the scanner van survey of HPS was to identify potential gamma radiation anomalies as a result of shipyard operations. No gamma anomalies were identified during the scan other than those attributable to what would normally be found in an unimpacted environment.

USEPA Oversight of Navy Investigation and Cleanup of Radiological Contamination at HPS

USEPA has provided oversight of Navy investigation and cleanup of HPS since USEPA placed the site on the National Priorities List in 1989. USEPA's oversight role includes ensuring that the Navy completes the investigation and cleanup of the site in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as well as ensuring protection of human health and the environment in both the short and long term. USEPA ensures that releases of radiological contamination to the environment at HPS are fully addressed under CERCLA and has requested that the Navy cleanup radiological contamination to a level that meets our risk based preliminary remediation goals (PRGs) for radionuclides or to indistinguishable from background. USEPA Region 9 Superfund staff work very closely with the Navy to ensure the appropriate investigation and cleanup of radiological

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[1]Gamma rays are the most energetic and most penetrating electromagnetic waves of radiant energy. Like visible light and x-rays, gamma rays are weightless packets of energy called photons. They have neither a charge nor a mass and are very penetrating. One source of gamma rays in the environment is naturally occurring potassium-40. Manmade sources include plutonium-239 and cesium-137. Gamma rays can easily pass completely through the human body or be absorbed by tissue, thus constituting a radiation hazard for the entire body. Gamma rays are best blocked by dense materials such as lead or thick materials such as several feet of concrete.

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contamination at HPS. Further, USEPA conducts independent radiation confirmation surveys to verify adequate investigation and cleanup.

Since the earliest stages of environmental investigation at HPS, the Navy and USEPA have focused on historical radiological operations particularly those of the former Naval Radiological Defense Laboratory (NRDL). Investigation and cleanup of radiological contamination has moved steadily forward on a separate track from the remedial investigations conducted to determine the nature and extent of chemical contamination. To date, the Navy has conducted four phases of radiological investigation and the fifth phase is ongoing. USEPA has been involved in the oversight of Navy activities throughout each of these phases. USEPA oversight has included conducting confirmation surveys to ensure that radiological contaminants are investigated, delineated, speciated and remediated in accordance with CERCLA.

USEPA's Superfund radiation technical support staff has conducted numerous radiation surveys at HPS over the last 12 years using handheld radiation detecting instruments. USEPA conducted independent soil analyses and determined that low-level radiation in soils located on the former subbase portion of Parcel B was attributable to naturally occurring radionuclides, not contamination. USEPA also conducted an analysis of the soil surrounding buried radioluminescent dials, gauges and deck markers on Parcel E and confirmed that the radium painted devices could be effectively separated and removed from soils. USEPA also recommended treatment technologies to the Navy to remove buried radium painted devices from Parcel E soils.

Next Steps

USEPA will continue to be actively involved in the oversight of the Navy's investigation and cleanup of radiological contamination at HPS. We are looking forward to receiving the Draft Final Historical Radiological Assessment (HRA) for review and comment in Fall 2003 and to performing additional radiation confirmation surveys as remediation is completed. Should you have any questions regarding the attached radiological scanner van survey, please contact me at 415-972-3013 or Steve Dean, USEPA Region 9 Superfund Technical Support Office, at 415-972-3071.

Sincerely,

Claire Trombadore
Remedial Project Manager

cc: Amy Brownell, City of SF
Lynne Brown, Restoration Advisory Board Co-chair
Lea Loizos, ARC Ecology
Deirdre Dement, CA Department of Health Services

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Radiological Scanner Van Survey Hunters Point Final Report

Steve Dean _____ 3/28/03
Project Manager or Representative, USEPA Region 9 — Date
Reviewed: Richard Hoppe 3/26/03

Jed Harrison _____ 26 MARCH 2003
Laboratory Director, R&IE — Date
Reviewed: Richard Hoppe 3/26/03

Jack Barnette _____ 3/25/03
acting – Director, CERMER (Center for Environmental Restoration, Monitoring and Emergency Response) — Date

Roger Goodman _____ 3/24/03
Project Lead — Date

Helly Diaz Marcano _____ 3/25/03
Field Scientist — Date

Mark Sells _____ 3/24/03
Project Quality Assurance Coordinator — Date

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Abstract

In a response to a request from EPA Region 9 and coordinated through the Office of Radiation and Indoor Air's Radiation Protection Division, The Radiation and Indoor Environments National Laboratory (R&IE) conducted a survey of the Hunters Point Naval Shipyard in San Francisco California, with R&IE's radiological Scanner Van from September 9 through 12, 2002. The purpose of the scan was to identify potential gamma radiation anomalies on the shipyard as a result of operations at the shipyard. There were no anomalies identified in the scan other than those attributable to what would normally be found in the environment. All gamma radiation levels were consistent with normal fluctuations in background that can be found in an unimpacted environment.

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Site History

The area in the vicinity of the Hunters Point Naval Shipyard, San Francisco is the focus of this scan. During the shipyard operations from 1870 through 1994, Hunters Point Naval Shipyard activities included shipbuilding and ship repair. From 1952 through 1969 Hunters Point was also the site of the Navy Radiological Defense Laboratory (NRDL). During shipyard and NRDL operations, radioactive materials were released onsite, including Radium 226 and Cesium-137. Remediation activities are ongoing at the site for PCBs, VOCs, PAHs, pesticides, heavy metals, and radioactive contaminants. Further historical information concerning this site is available through the Region 9 office. Region 9 has requested that the R&IE assist in evaluating a two (2) mile radius surrounding this area (within the shipyard boundaries) for potential contamination, using R&IE's Scanner Van to identify areas of elevated activity. For the purposes of this project, the vicinity of the facility is described as the area bordered by Building 144 on the North (Submarine Docks) and the former Main Gate at Crisp Avenue on the West, with Building 521 on the South (Corner of Mahan Street and J Street) and Building 219 on the East (Waterfront) which surrounds the Hunters Point Naval Shipyard, CA.

Methodology

R&IE's radiological Scanner Van was originally built under contract to the Bendix Corporation in 1980 and has recently been moved to a new Freightliner commercial delivery van chassis. It incorporates a four inch by four inch by sixteen inch sodium iodide detector shielded in such a way that it detects radiation predominantly out of the right side of the vehicle. The main scanning detector is shielded from background gamma radiation by being completely surrounded with copper and lead creating a four inch by sixteen inch "window" with a 55 degree viewing arc. This provides for a low level of background radiation, lowering the minimum detectable activity and providing for a directional "view" for the detector out to the right side of the van. This radiation detection system was developed specifically for uranium mine waste surveys (Allen 1981) but has been used by R&IE to find anomalous radiation sources from a variety of sources. The sodium iodide radiation detector and shield is detailed in the original engineering drawing (figure 1). The detector is coupled to a photomultiplier tube and mounted inside the shield.

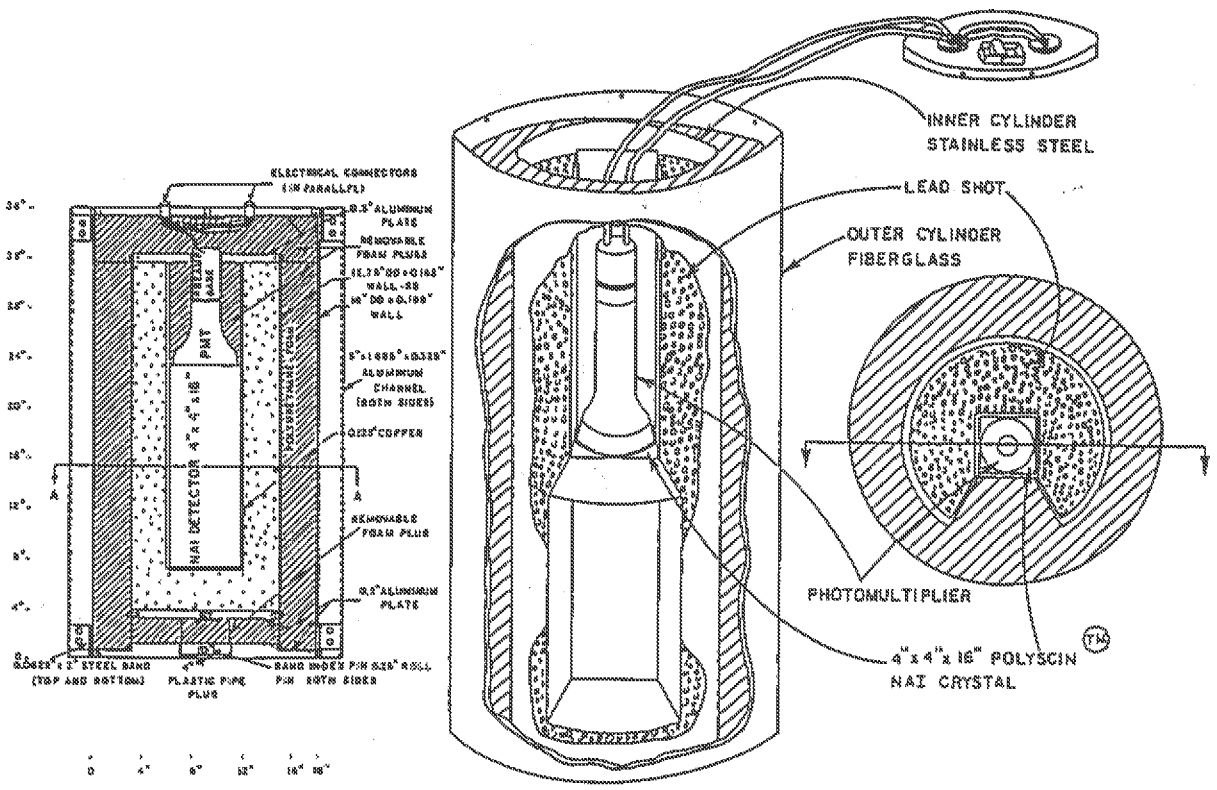


Figure 1. Cut-away of detector assembly.

A second system includes another four inch by four inch by sixteen inch unshielded sodium iodide detector, which is mounted in the forward upper corner of the van body. The scanner van employs this second system to determine whether or not there are other radiation sources on the road surface and sides away from the shield opening of the main detector, which may influence the main detector. The output of both detectors is integrated, displayed and recorded each second during the scan. Both detectors have their output signals sent to a multi-channel scalar and multi-channel pulse height analyzer. Signals are routed to a computer where a graphic display is generated using a Canberra database acquisition system. The scanner van is driven at five to seven miles per hour during the scan, and the operator visually monitors the graphic display on the CPS rate display, and notes anomalies from the information gathered. The data is recorded by the computer to a data file for future evaluation. When anomalies were identified, the system was switched to a multi-channel analysis (Pulse Height Analysis - PHA) mode and a long count was performed. This long count in the PHA mode allows the operator to determine the isotope and a relative intensity. Anomalies which cannot be resolved using this PHA mode are further investigated using hand-held instrumentation at the source of the anomaly. This information being displayed by the Scanner Van system is not quantitative. The absolute readings cannot be compared with other radiation detection devices because the relative background and vehicle speed are not fixed (this would relate to the counting geometry and count time). If one wanted to perform dose or risk modeling, a variety of factors would have to be determined for each location, among them efficiency of the detector, geometry of the detector, radionuclide mix, distance to source, exposure time, etc., and these factors change continuously as the vehicle moves. The Scanner Van simply identifies the anomalies in a rapid way, and at sensitivity lower than conventional hand-held radiation survey equipment. Each morning the system is checked in the same location, by placing a check source at increasing fixed distances from the detectors and recording the data. The results for each day are compared with the previous day to ensure consistency. Also, the system can be checked continuously in the PHA mode by observing the location of the natural occurring Potassium peak (approximately 1460 KeV).

A surveyor quality Ashtek Global Positioning System (GPS) is also mounted to the vehicle and connected to the computer. As the system records the radiation detector data, the system also logs the position of the van using this GPS system, along with the date and time. This allows for the data to be overlaid onto a map and photograph after the data is processed.

Scope

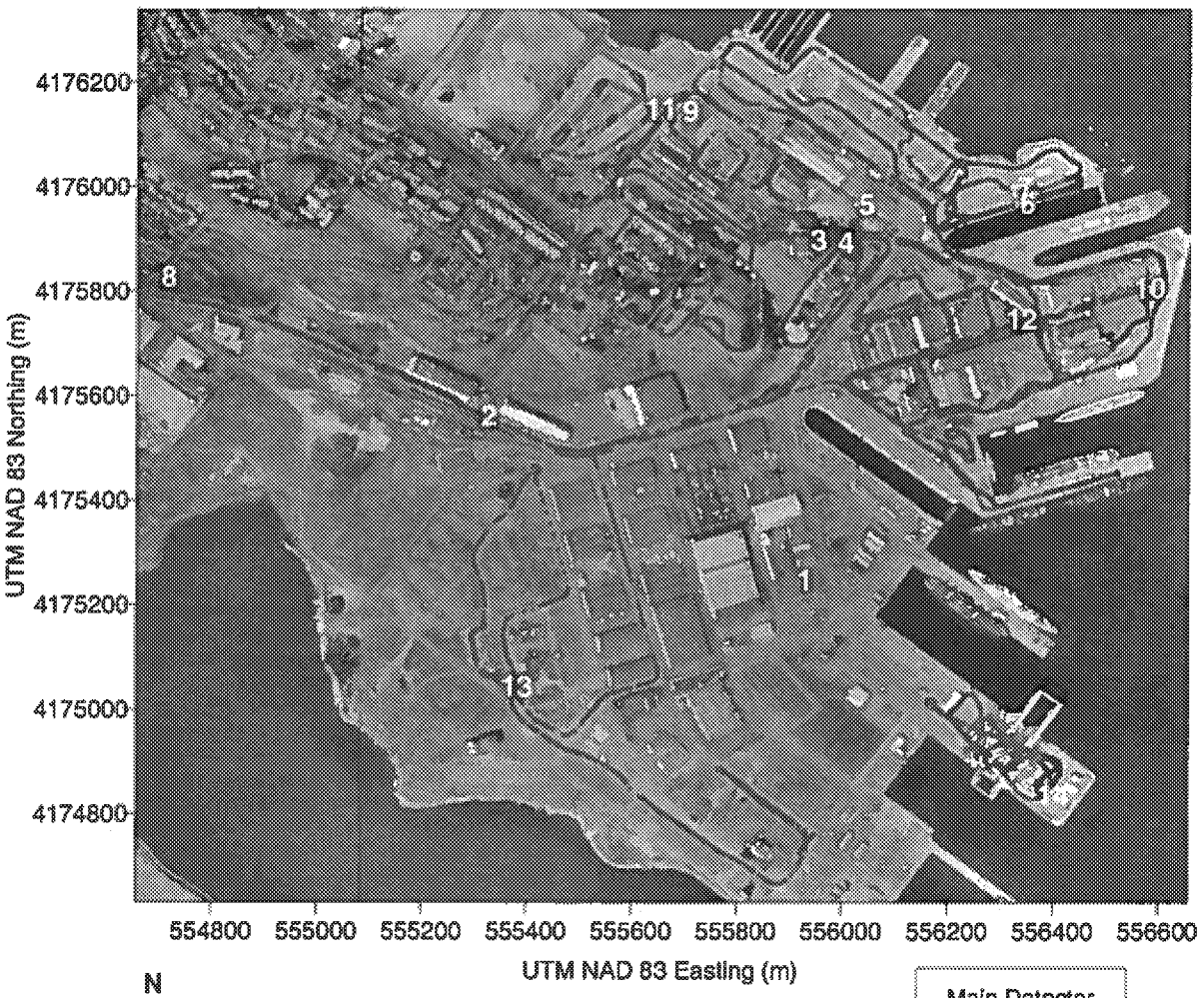
In coordination with the US EPA Region 9, several parcels of the Hunters Point Naval Shipyard were identified as the areas of highest priority. The areas identified as parcels A, B, and C were covered as completely as practicable. Sections of parcel D were surveyed that currently were not under remediation. Very little of Parcel E was scanned because most of its impacted areas are inaccessible to the Scanner Van and are still under investigation/ remediation. Areas were selected during the pre-survey planning phase for special emphasis based historical uses of radioactive materials in those areas. Roger Goodman and Helly Diaz Marcano of R&IE conducted the scan. Both scientists are experienced with performing radiation surveys, and Roger Goodman has performed three previous surveys with this Scanner Van system.

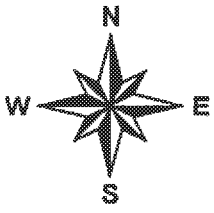
Hand-Held Instrument Verification of Anomalies

All of the anomalies were resolved using the PHA mode of the Scanner Van system, however several of the anomalies were additionally investigated by Certified Health Physicists Gerald Gels and David Roady of Veridian Corporation. Both are contractors to the US EPA Environmental response Team based in Cincinnati, Ohio. They conducted their surveys using hand-held instrumentation. Hand-held instrumentation included a calibrated Ludlum Model 19 Micro R (gamma scintillation) survey meter. Additionally, a calibrated BNC SAM model 935 portable Sodium Iodide based multi-channel analyzer was used. The portable instrument detector was placed at contact on the radiation sources to obtain the highest gamma dose rate of that anomaly. Gamma readings decline rapidly as the survey instrument is moved away. All of the anomalies investigated were attributable to natural occurring sources at levels consistent with what would normally be found in the environment.

Gamma Scan of Hunters Point Ship Yard
San Francisco, CA

Main Detector





Main Detector Countrate (CPS)
- 28 to 125
- 125 to 175
- 175 to 225
- 225 to 292

Survey Performed By:

14 Gamma Spectroscopy Measurements
UTM Universal Transverse Mercator
NAD North American Datum
CPS Counts Per Second
m meters
(Count Rate Range is Typical for Background for this Detector)

Mapping Provided By:

Listing of Points of Interest Map 1

Locations where Pulse Height Analysis was performed using the Main Detector.

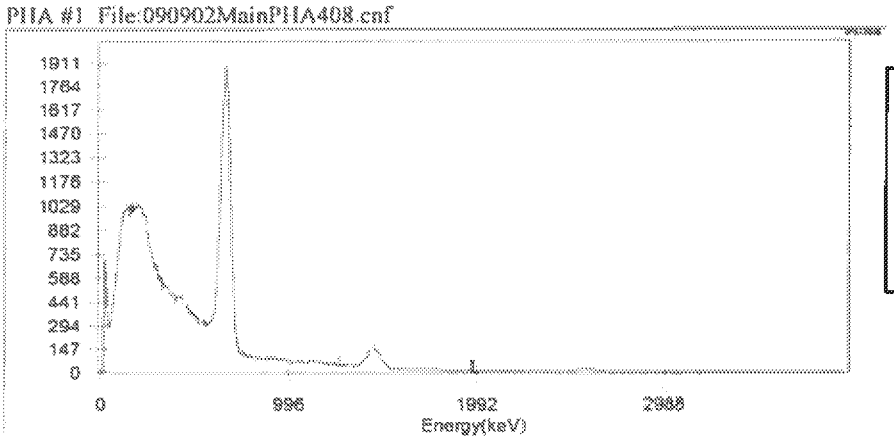
1) Calibration and Setup Location (Not an Anomaly)
2) Crisp Avenue
3) Robinson Street
4) Robinson Street at Horne Avenue
5) Lockwood Street near Fisher Avenue (Bldg 134)
6) North Side of Drydock #1 (North of Bldg 140)
7) North Side of Drydock #1 (South of Bldg 140)
8) Griffith Street at Crisp Avenue Gate (Old Main Gate)
9) Lot Near Building 117
10) Spear Avenue (Bldg 231 and 211)
11) Open Field North East of Donahue Street
12) Spear Avenue (Bldg 253)
13) J Street (Bldg 708)
14) End of Pier Under Large Overhead Crane

Graphical Data

Pulse Height Analysis graphs for Main Detector.

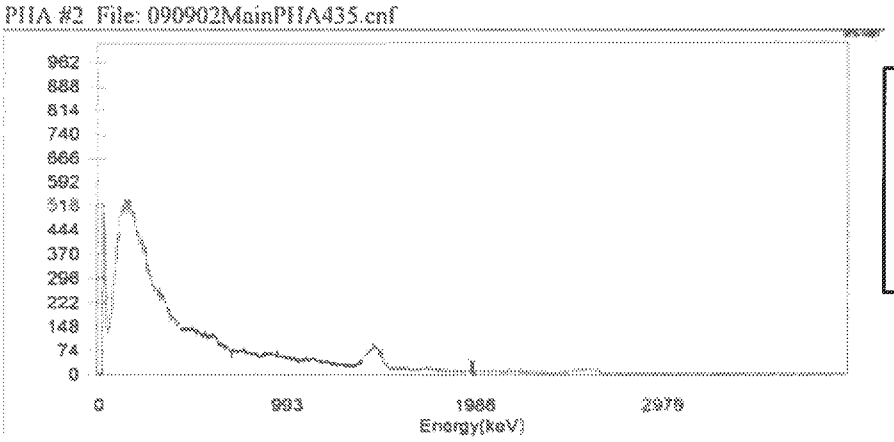
Hunters Point Gamma Spectroscopy

PHA #1 File:090902MainPHA408.cnf



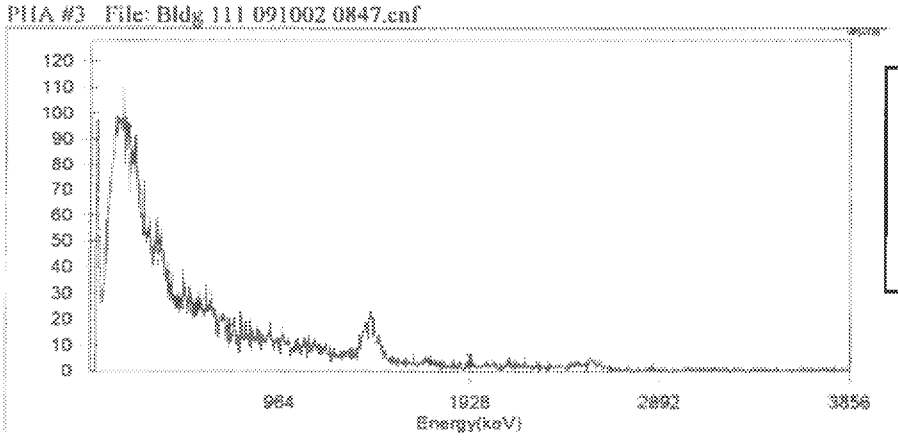
Shows Cs-137 Calibration Std and Natural K-40, Ra-228, and Th-232 Peaks.

PHA #2 File: 090902MainPHA435.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

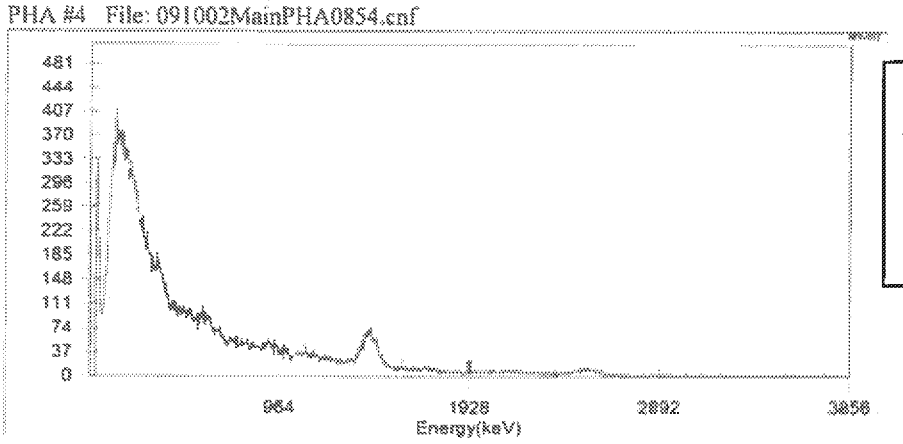
PHA #3 File: Bldg 111 091002 0847.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

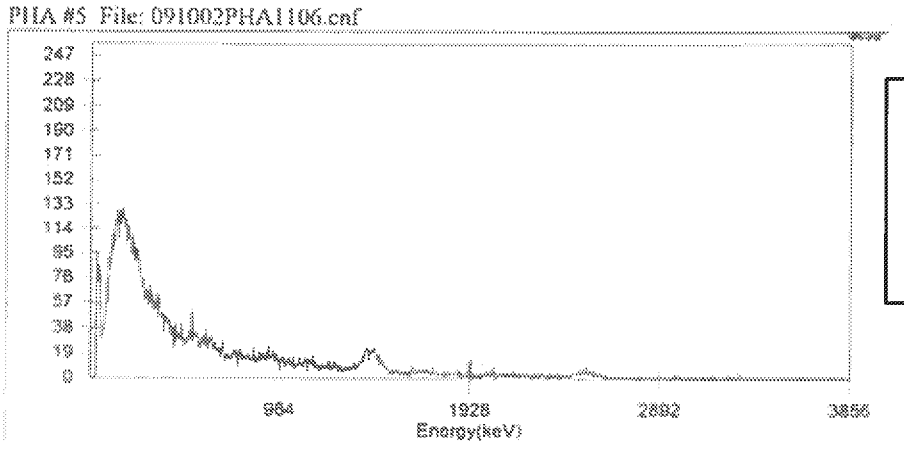
Hunters Point Gamma Spectroscopy

PHA #4 File: 091002MainPHA0854.cnf



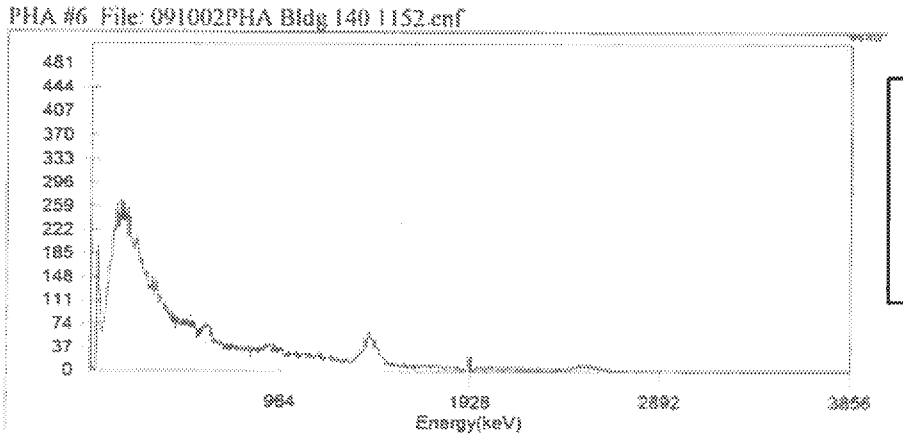
Shows
Natural K-40, Ra-228, and Th-232 Peaks.

PHA #5 File: 091002PHA1106.cnf



Shows
Natural K-40, Ra-228, and Th-232 Peaks.

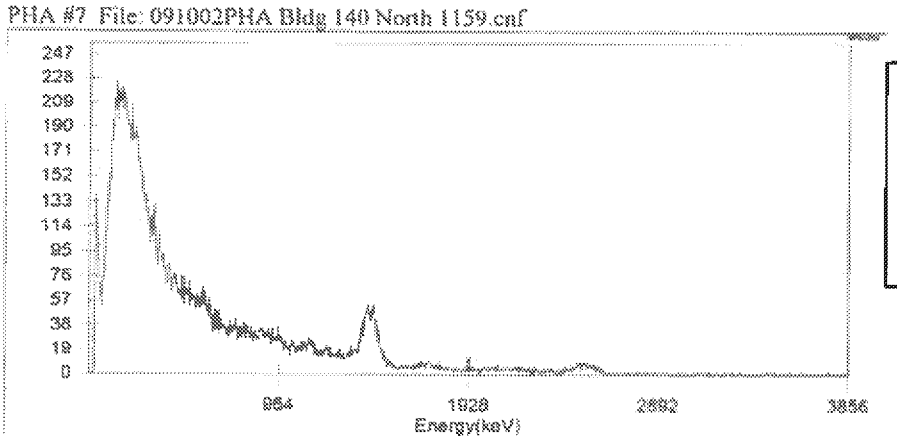
PHA #6 File: 091002PHA Bldg 140 1152.cnf



Shows
Natural K-40, Ra-228, and Th-232 Peaks.

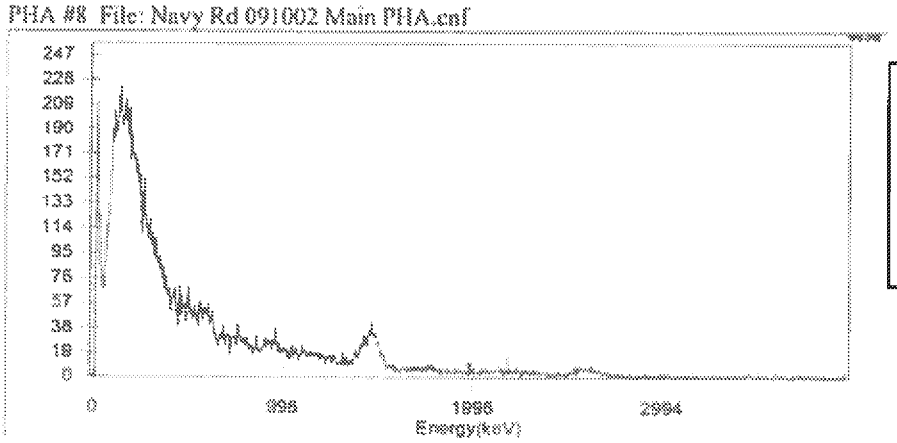
Hunters Point Gamma Spectroscopy

PHA #7 File: 091002PHA Bldg 140 North 1159.cnf



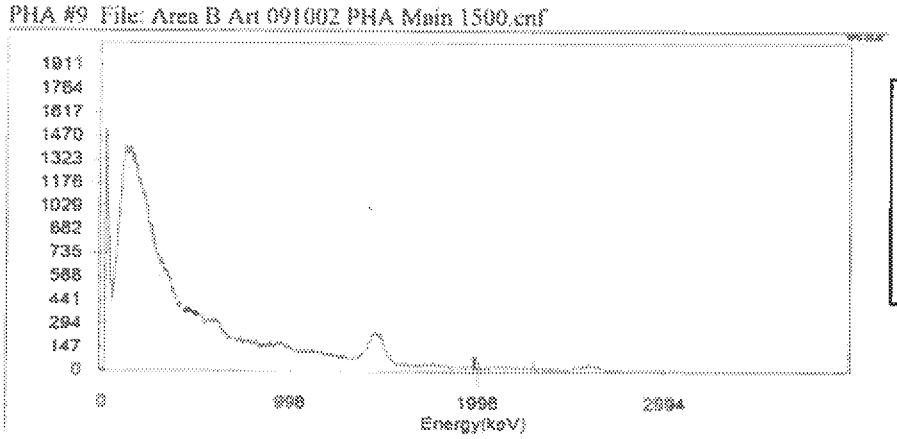
Shows Natural K-40, Ra-228, and Th-232 Peaks.

PHA #8 File: Navy Rd 091002 Main PHA.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

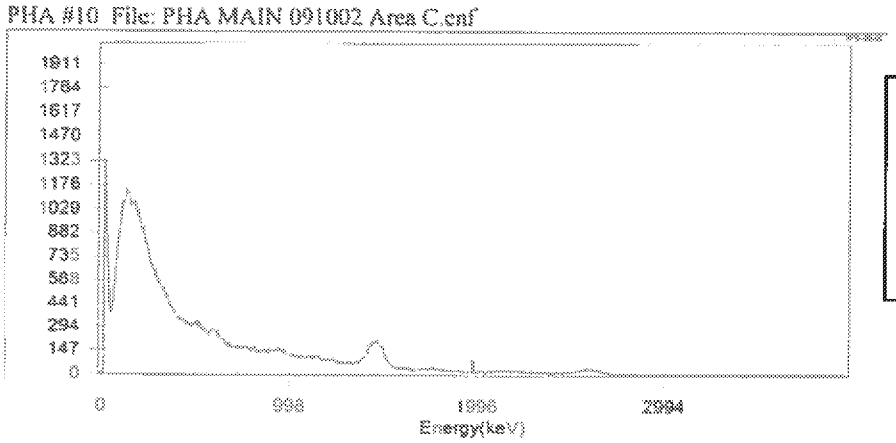
PHA #9 File: Area B Art 091002 PHA Main 1500.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

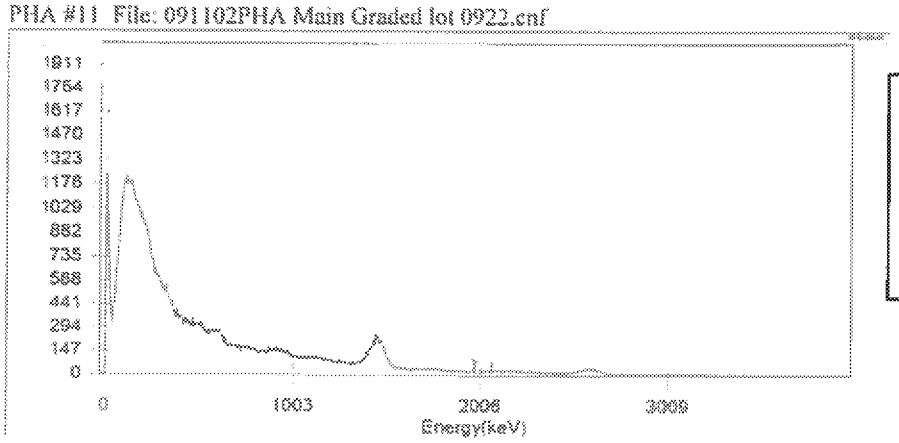
Hunters Point Gamma Spectroscopy

PHA #10 File: PHA MAIN 091002 Area C.cnf



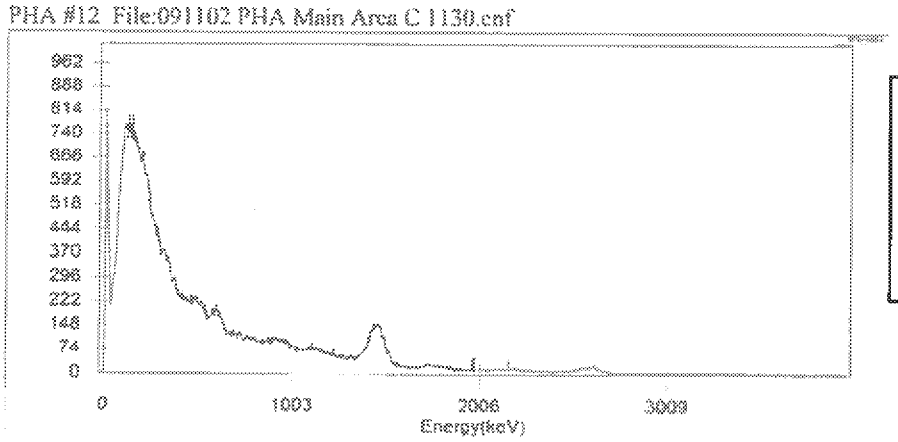
Shows Natural K-40, Ra-228, and Th-232 Peaks.

PHA #11 File: 091102PHA Main Graded lot 0922.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

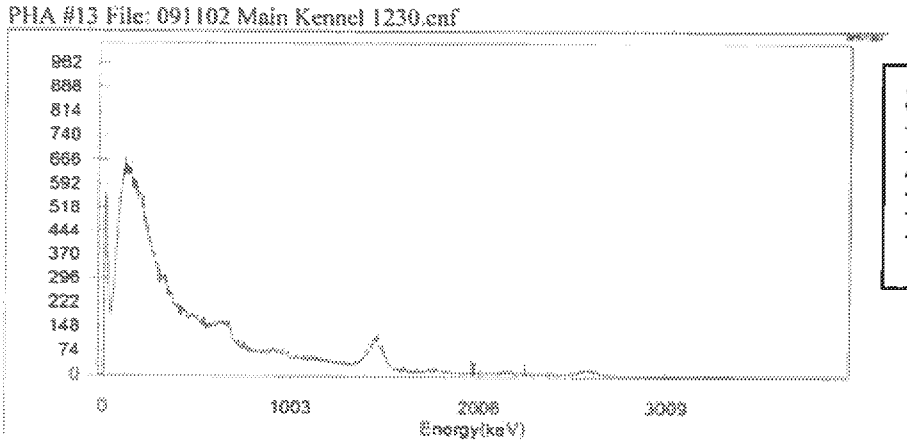
PHA #12 File:091102 PHA Main Area C 1130.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

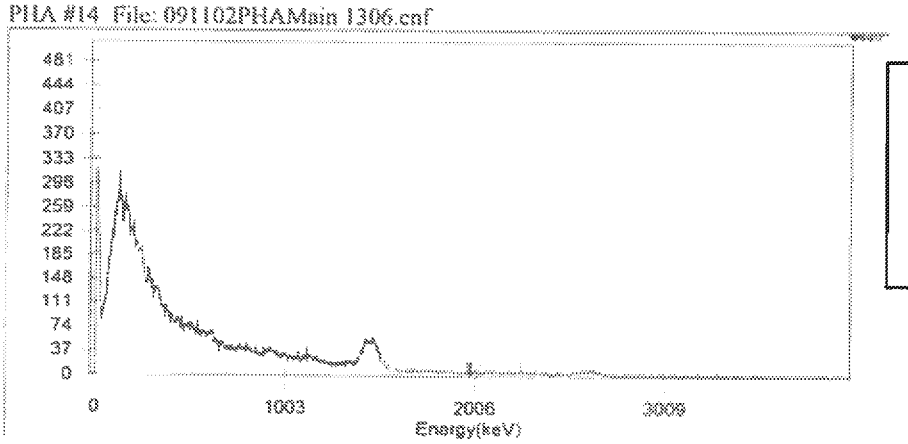
Hunters Point Gamma Spectroscopy

PHA #13 File: 091102 Main Kennel 1230.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

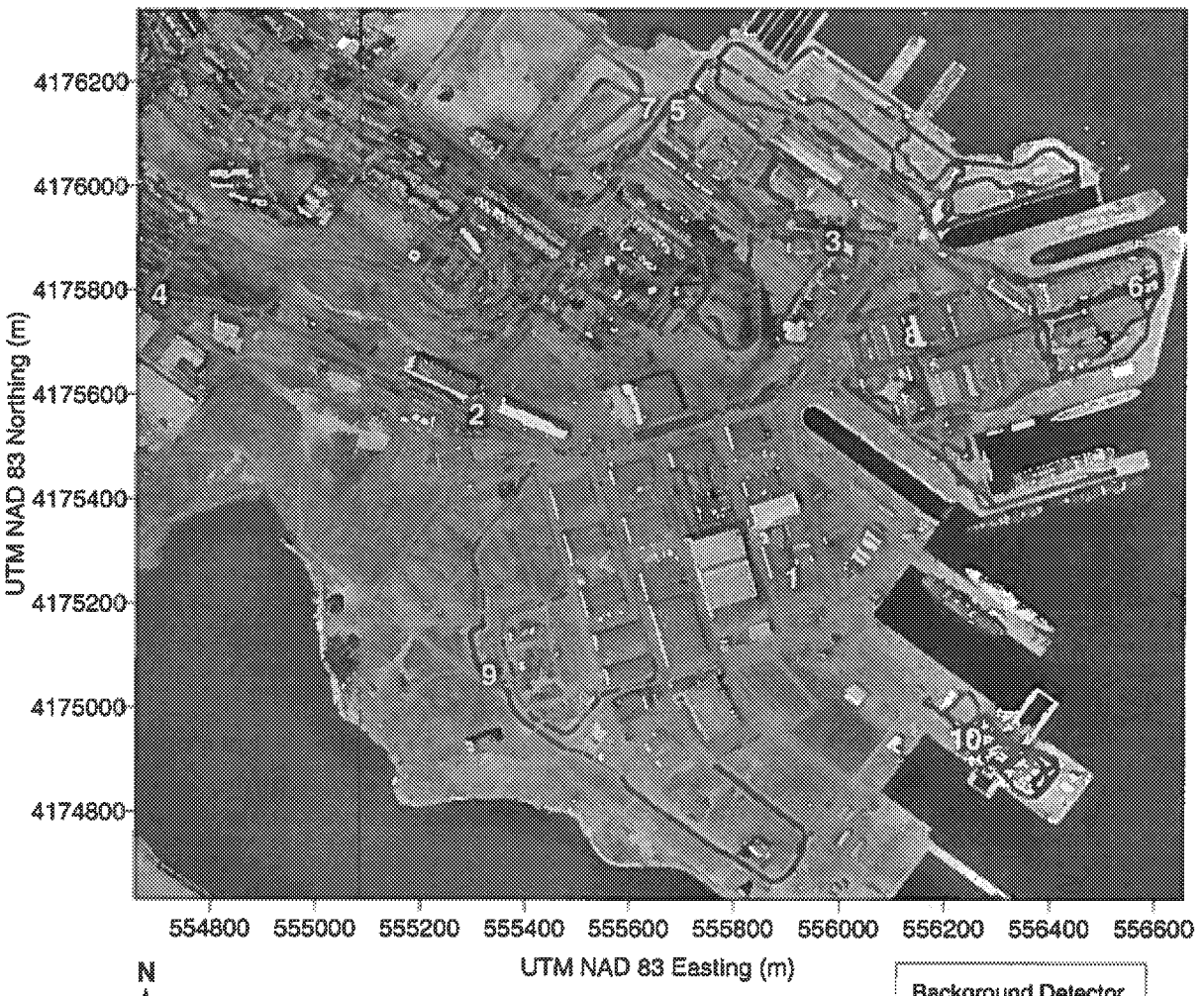
PHA #14 File: 091102PHAMain 1306.cnf

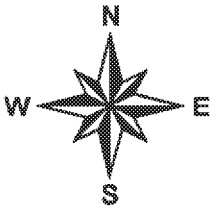


Shows Natural K-40, Ra-228, and Th-232 Peaks.

Gamma Scan of Hunters Point Ship Yard
San Francisco, CA

Unshielded Detector





Background Detector Countrate (CPS)

- 75 to 350
- 350 to 450
- 450 to 550
- 550 to 591

Survey Performed By:

10 Gamma Spectroscopy Measurements
UTM Universal Transverse Mercator
NAD North American Datum
CPS Counts Per Second
m meters
(Count Rate Range is Typical for Background for this Detector)

Mapping Provided By:

Listing of Points of Interest Map 2

Locations where Pulse Height Analysis was performed using the Unshielded Detector.

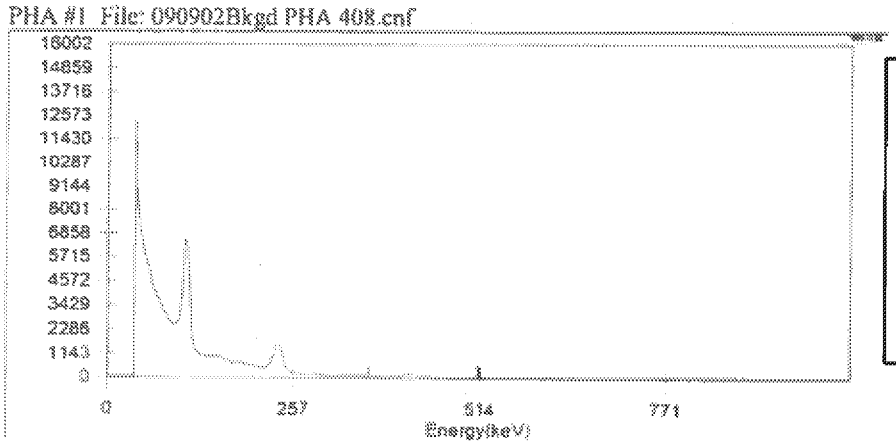
1) Calibration and Setup Location (Not an Anomaly)
2) Crisp Avenue
3) Robinson Street
4) Griffith Street at Crisp Avenue Gate (Old Main Gate)
5) Lot Near Building 117
6) Spear Avenue (Bldg 231 and 211)
7) Open Field North East of Donahue Street
8) Spear Avenue at C Street (Bldg 258)
9) J street between 3rd and 6th Avenue (Bldg 708)
10) Under Large Overhead Crane (Near Police Sub-Station)

Graphical Data

Pulse Height Analysis graphs for Unshielded Detector.

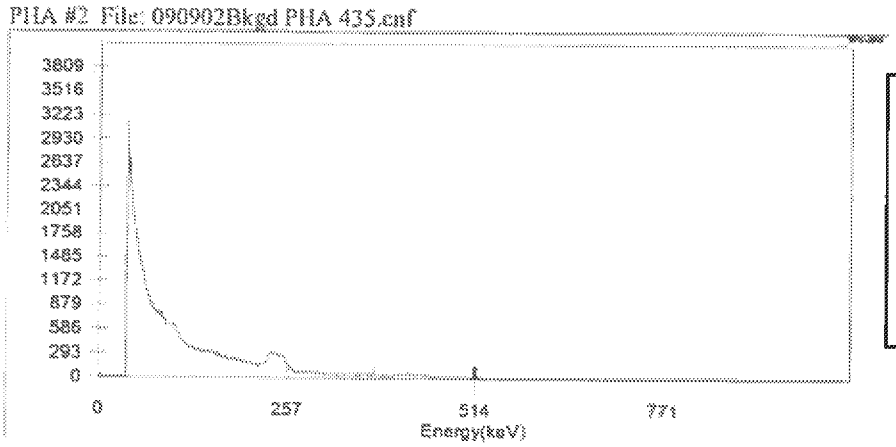
Hunters Point Gamma Spectroscopy

PHA #1 File: 090902Bkgd PHA 408.cnf



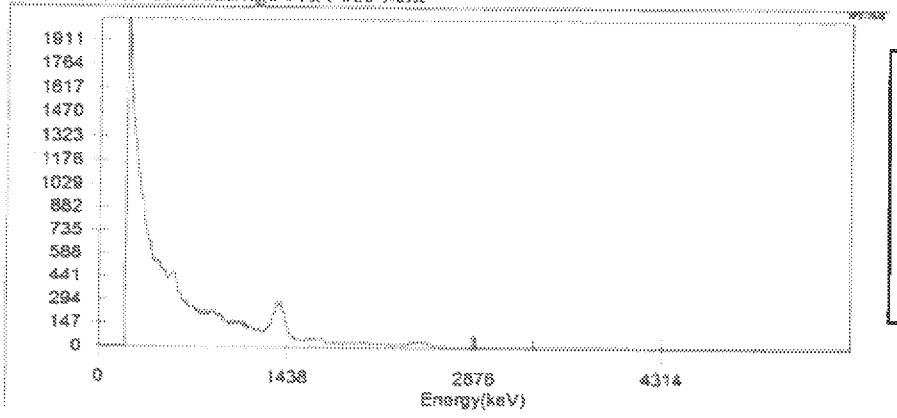
Shows Cs-137 Check Source and Natural K-40, Ra-228, and Th-232 Peaks.(Energy Scale not Calibrated)

PHA #2 File: 090902Bkgd PHA 435.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks. (Energy Scale not Calibrated)

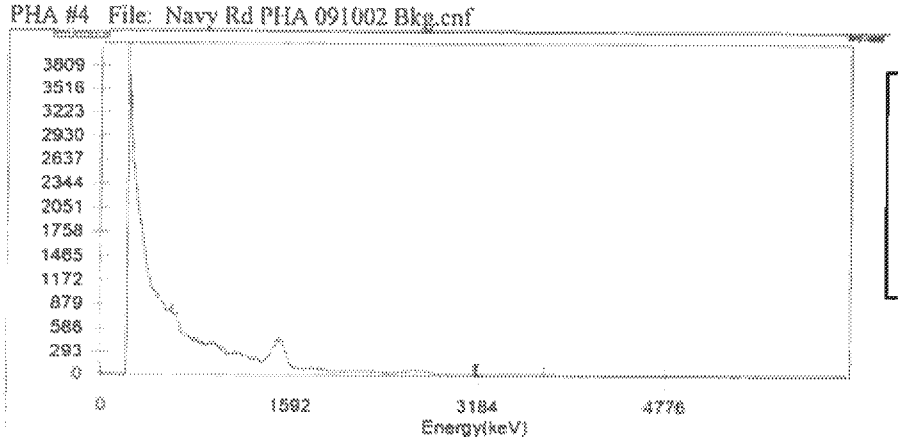
PHA #3 File: 091002Bkgd PHA 0854.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks. (Energy Scale not Calibrated)

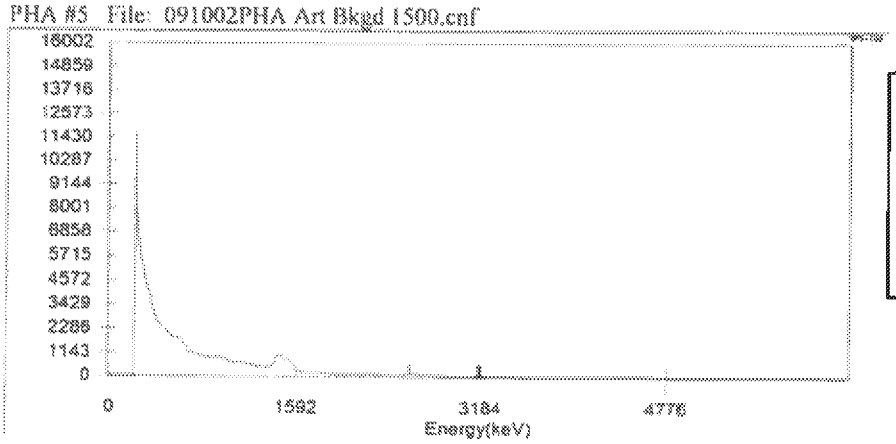
Hunters Point Gamma Spectroscopy

PHA #4 File: Navy Rd PHA 091002 Bkg.cnf



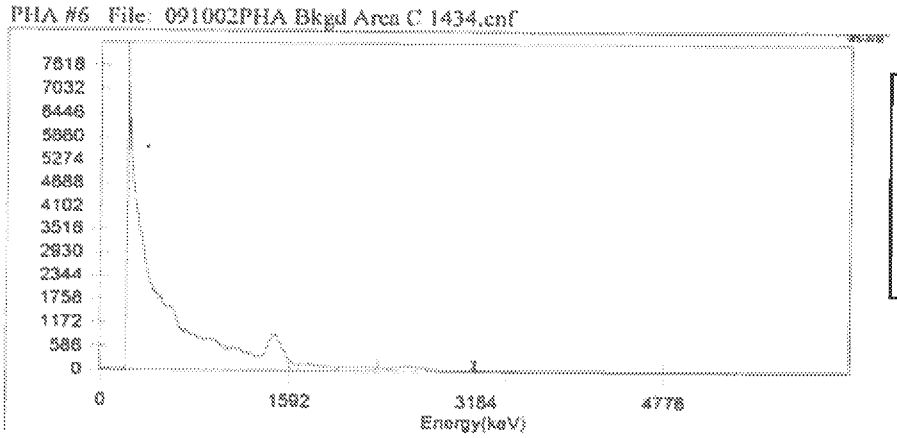
Shows Natural K-40, Ra-228, and Th-232 Peaks.

PHA #5 File: 091002PHA Art Bkgd 1500.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

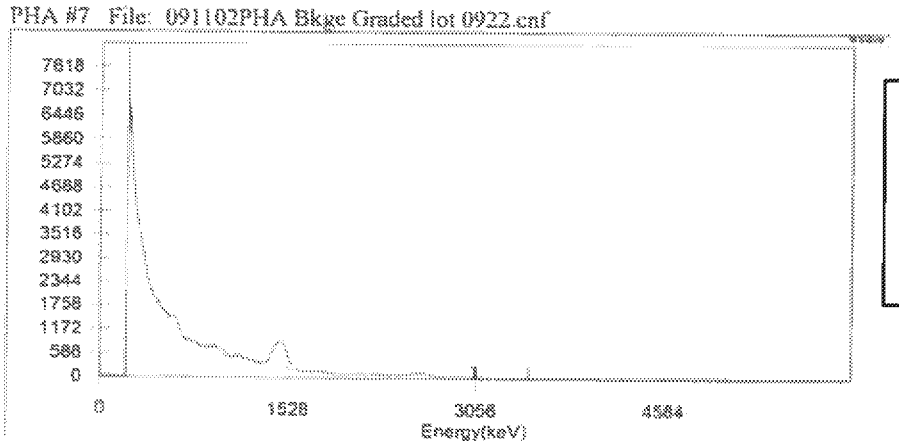
PHA #6 File: 091002PHA Bkgd Area C 1434.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

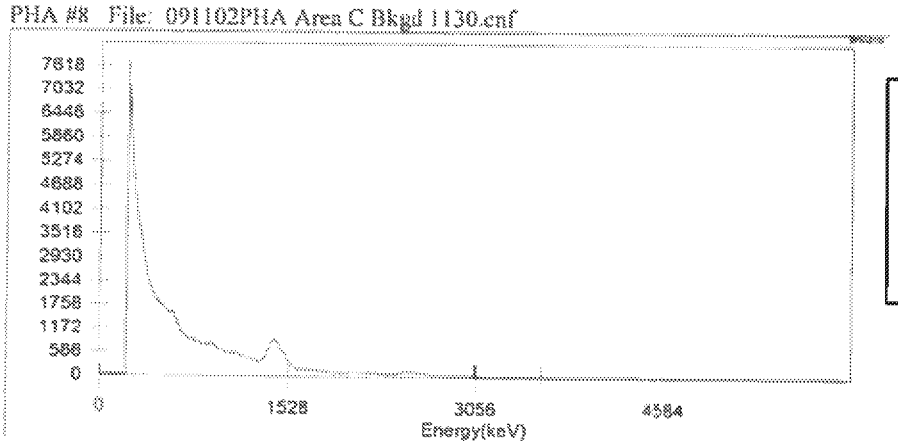
Hunters Point Gamma Spectroscopy

PHA #7 File: 091102PHA Bkge Graded lot 0922.cnf



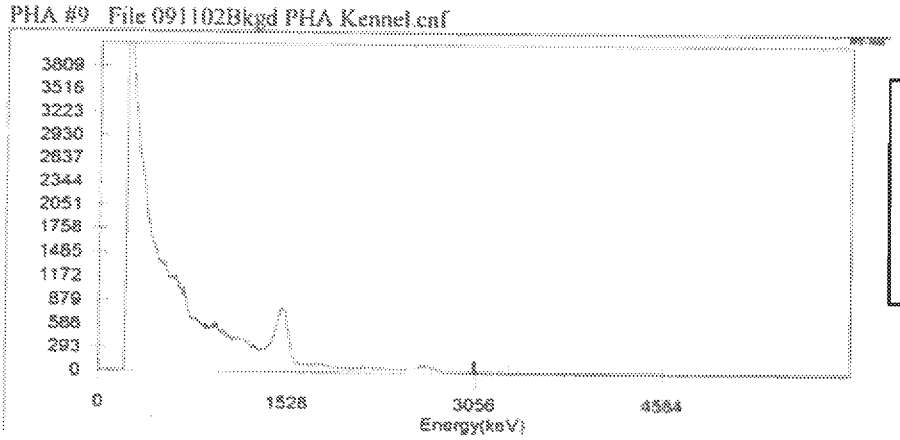
Shows Natural K-40, Ra-228, and Th-232 Peaks.

PHA #8 File: 091102PHA Area C Bkgd 1130.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

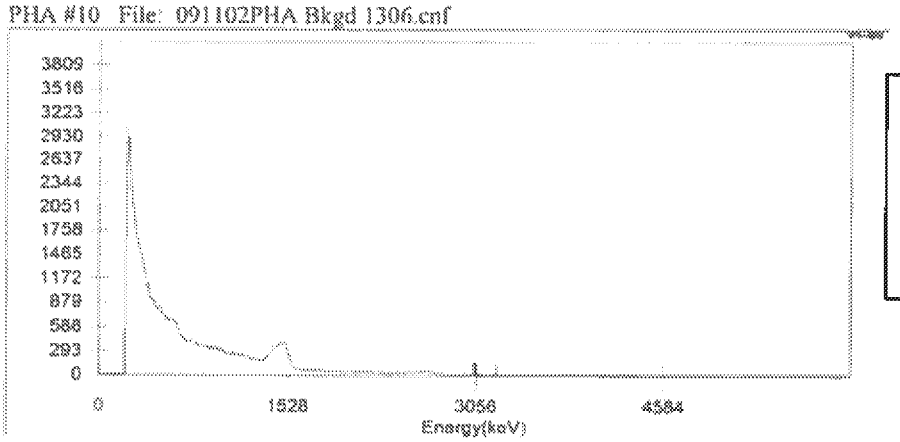
PHA #9 File 091102Bkgd PHA Kennel.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

Hunters Point Gamma Spectroscopy

PHA #10 File: 091102PHA Bkgd 1306.cnf



Shows Natural K-40, Ra-228, and Th-232 Peaks.

Discussion

It is not the purpose of this scan to suggest what cleanup levels should be and when or if a cleanup is warranted. However, in this scan, all anomalies detected in Parcels A, B, and C were attributable to Potassium-40, Radium-226, Thorium-232, and Uranium-238. All of these isotopes are naturally occurring in the environment. In all cases, the relative levels of these anomalies were consistent with what would normally be found in nature. The Potassium, Radium, Thorium, and Uranium are found naturally in the soil, rocks and seawater (concentrated by sea-spray along the waterfront). The Scanner Van is able to identify these environmental levels of naturally occurring material.

All anomalies detected in Parcel D were also due to the same naturally occurring radionuclides. However, the Scanner Van was unable to survey much of this parcel due to other remedial work being conducted at that time. Most of Parcel E was not surveyed because too many of the roads are unsuitable for travel. Also much of this parcel is still under investigation and remediation.

Conclusion

Based on the scan results, none of the areas in Parcels A, B, or C which were scanned warrant further investigation.

References

Allen James W., EPA-02 Surface Gamma Scanner System, Bendix Field Engineering Corporation, under EPA IAG 80-D-X-1013, June 1981.

Appendix: Raw Data, Tabular Format

On the enclosed CD, is the raw data collected during the scan.

Appendix: Raw Data, Tabular Format

Complete Raw Data file is attached with CD. There are 27000 lines, making this too large to print here.

Main Detector

PHA #	File	PHA time	GPS Time	Latitude (DMS)	Longitude (DMS)	Latitude (DD)	Longitude (DD)	Northing	Easting
1	408	1539	230810	3743.367	12221.93	37.72279	122.3656	4175248	555910.9
2	435	1621	231953	3743.539	12222.34	37.72565	122.3724	4175562	555306.4
3	847	84530	154346	3743.719	12221.92	37.72866	122.3653	4175899	555934.2
4	854	84826	154633	3743.716	12221.88	37.72861	122.3647	4175894	555985.3
5	1106	110415	180236	3743.756	12221.85	37.72926	122.3642	4175967	556024.8
6	1152	114809	184616	3743.755	12221.65	37.72925	122.3608	4175968	556328.8
7	1159	115629	185436	3743.772	12221.65	37.72953	122.3608	4175999	556325
8	Navy	143306	213113	3743.685	12222.76	37.72809	122.3793	4175828	554695.7
9	1500	144637	214449	3743.853	12222.08	37.73089	122.368	4176145	555687.8
10	Area C	155919	225724	3743.667	12221.49	37.72779	122.3581	4175807	556561.5
11	922	84529	154336	3743.855	12222.12	37.73092	122.3687	4176149	555631
12	1130	105544	175355	3743.636	12221.65	37.72727	122.3609	4175748	556318.9
13	1230	121642	191428	3743.259	12222.31	37.72098	122.3718	4175043	555361.4
14	1306	125708	195515	3743.142	12221.62	37.71904	122.3603	4174835	556380.1

Unshielded Detector

PHA #	File	PHA time	GPS Time	Latitude (DMS)	Longitude (DMS)	Latitude (DD)	Longitude (DD)	Northing	Easting
1	408	153930	230810	3743.36737	12221.93396	37.7227895	122.365566	4175248.06	555910.92
2	435	162142	231953	3743.53921	12222.34407	37.7256535	122.3724012	4175561.76	555306.42
3	854	84534	154633	3743.71643	12221.88024	37.7286072	122.3646707	4175894.06	555985.34
4	Navy	141759	211607	3743.66578	12222.75645	37.727763	122.3792742	4175791.77	554699.19
5	1500	144639	214447	3743.85311	12222.08176	37.73088517	122.3680293	4176144.80	555687.77
6	1434	155919	225728	3743.66743	12221.48852	37.7277905	122.358142	4175807.38	556561.38
7	922	84533	154338	3743.85549	12222.12036	37.73092483	122.3686727	4176148.82	555631.05
8	1130	111236	181043	3743.61731	12221.77855	37.72695517	122.3629758	4175711.79	556136.05
9	230	121051	190859	3743.26899	12222.32895	37.72114983	122.3721492	4175062.24	555331.98
10	1306	124900	194801	3743.19971	12221.71062	37.71999517	122.3618437	4174940.27	556241.07

Hunter's Point, 09-09-02

1330 Arrive on site, conduct safety briefing, begin calibration & QA/QC
1600 090902 G PS, 230529 clock 407 PM 090902BkgdPHA408 GPS 408
1610 Completed Calibration & QA/QC check
1615 Begin scanning Crisp Street at gate and block building 9 (RDL building)
1424 Vander Graff generator building 424 GPS 232237
1626 Turn around 232456
1430 Passed Start point 233100
1633 Turn around at Spear Avenue 233150
1635 Stopped 233316 Stopped GPS 090902 GPS 233316 clck 4 Save Canberra
1700 Stopped scanning

Took tour of area A and B to plan next day scan

09-10-02

0700 Arrive on site, conduct safety briefing calibrate & QA/QC
0827 Begin scan Fisher Street 152550 GPS file 091002 0827
0829 Passing intersection (no name) 152737
0831 Passing intersection
0835 Turn left Robinson 153201
0836 Turn Right at Galvez 153455
0838 Turning left Donahue 153644
0842 Turning around at Hudson (Dego Marys)
0842 Berm next to gate elevated two times 842 PHA indicates K-40 Ra-226 154100
0843 Moved forward, turned right, Galvez 154115
0844 Turn left Robinson 154252
0848 Stopped, save main as 110 091002 0848
0848 Restart 154657
0849 Right fisher 154718
0850 Turn right Crisp
0851 Crossing intersection 154935 854 155208
0854 Stop scan 155233, Stop GPS, Stop Canberra and save
0926 Start scanning building 110 GPS 162455 Pulled up along each side of building
0930 Bldg 101 and Art colony 162847 one-way clockwise
0934 Completed building. 101 GPS 163316 Going uphill to officer country
0935 Turn through parking lot and uphill 163435
0940 Channel 650 Berm 163903
0942 Passing 0fficers Club 164033 Channel 1004
0945 Officer Housing 164400
0948 Right turn down hill and around loop
0948 Passing Officers Club Close 164636, U-Turn at 0fficers Club and reverse the loop
0953 Left at Natoma 165159
0955 Stop at BOQ Channel 1710 165329
0956 Completed loop at 0fficers Club 165433
0958 Stop GPS, Stop save Canberra, 091002 GPS 165433 clck 0956 0958
0958 Start GPS 091002 GPS tempclck 958 Start Canberra
1002 Passing intersection of Natoma, Driving on Hudson 170043 channel 102
1004 Crossing Fridell, driving to dead end 170302

1007 Turn around dead-end 170522
1008 Turn right Innes to dead end 170645 Channel 471 Turn around
1011 Right Fridell, 170927 Ch 627
1012 Right Jerrold 171024 Ch 670
1012 Turn around dead end 171056 ch 708
1015 Right Fridell 1713 30
1016 Turn Right at "T" Kirkwood 171422 Ch 922
1016 U Turn at dead end 171455 ch 956
1016 Proceed to other end of Kilkwood
1019 U- Turn 171800 Ch 1134
1022 Right turn Fridell 172033 Ch 1289
1023 Right Jerell 172117 Ch 1333
1025 Left turn Coleman 172316 Ch 1453
1026 U-Turn at Hudson 172441 Ch 1535
1028 Right Turn Jerell 17263 5 Ch 1640
1029 Right turn Fridell 172727 Ch 1706
Elevated area Ra-226 and K-40 Ch 1715-1955
1033 Turn right Innes 173143 Ch 1955
1035 Stop save GPS 174000, Canberra 091002174000clck1035
1038 Start GPS 091002GPSTMPclck1038
1039 Re-run Ines 173712
1042 U-Turn Ines 174034 ch 271
1043 Right turn Fridell 174155 Ch 357
1044 Right turn Hudson 174240 Ch 395
1046 End of Hudson at loop entrance 174437
1056 Stop parking lot through Ch 1075 175415 Stop GPS 175546
1058 Begin Parcel B Driving down the hill on Donahue
1058 Start GPS 175546 Save Canberra 091002GPS 175546clck1058
1100 Starting Donahue 175800 CH 25
1101 Turn right on Lockwood 175917 Ch 94
1103 Passing building 114 180127 Ch 220
1104 Elevated Radium area 180255 Saved PHA
1107 U-Turn at T 180535 Ch 480
1108 Passing shop 38 Building 134 Machine Shop 180627
1109 Passing building 123 180726 Ch 577
1111 Right turn Donivan at building 146 180939 Ch 719
1112 Right turn other end Building 146 Submarine pen area 181042 Ch 777 1115
1115 Following contour of buildings Passing building 123 181317 Ch 933 Slight elevation in Ra-226 and K-40
1119 Passing Building 134 Elevated Ra-226 and k-40 181741 Ch 1185
1122 End at tip of Dry Dock 3 and U-turn 182006 Ch 1346
1122 Proceed along buildings at water front Passing Building 157 182057 Ch 1396
1123 Passing Building 156 182138 Ch 1420
1124 Passing Building 130 182236 Ch 1496
1125 Concrete Cinderblock Shield No elevated readings 182400 ch 1592
1126 Passing Building 128 182458 Ch 1637

1127 Passing Building 125 182552 Ch 1689
1129 Stop GPS 182725 File name 091002GPS 182725clckI 129
1131 Start GPS file name 091002GPStempcickI 13 I.txt Start Canberra
1133 Driving toward water front Looping building 159 clockwise 183117 Ch 87
1134 U-Turn and drive behind Building 125 Waterfront side 183248 Ch 181
1135 Passing water front side (North side) of Building 128 183344 GPS late start
1137 Passing building 130 north side 183522 Turn up east side Building 130
1138 Turn left across north side Building 156 183612 Ch 380
1138 Passing Building shed 183648
1138 Passing West side Building 157 183704 Ch 439
1139 Right turn North end Building 157 183733 Ch 466
1140 Right turn East side Building 157 183809 Ch 494
1140 Drive to end of North side dry dock 3
1142 Driving down crane tracks along north side of Dry dock 3 184044 ch 665
1145 U-Turn at mouth of Dry dock 184403 Ch 868
1146 Passing building 140 Pump House 93 Ch 967
Very large K-40, Thorium and daughters (gravel) some Ra-226 Save PHA
1154 U-Turn end of dry dock 3 going by north side Building 140 185247 Ch 1372
1155 Passing Building 140 185359 Ch 1442 - 1699
1200 Proceed to water front Turn left at water 185915 Ch 1771 Follow water front
1203 Passing Building 133 190131 Ch 1906
1204 Passing Berth 58 190225
1205 Stop GPS Stop save Canberra 190340 File name 091002GPS190340clckI205
1207 Start GPS 091002GPStempclckI207
1207 Restart scan at sub-berths
1208 Passing hearth 5 190650 Ch 42
1209 Passing Berth 6 190734 Ch100
Large K-40 peak very small Thorium and daughter
1213 Passing last berth left turn up Donivan 191210
1215 Passing gravel area off of Donivan 191310 Ch 434
1217 End at Galvez Stop scan 191506
1217 Stop for lunch Stop GPS Stop save Canberra 091002GPS191506cickI217
1417 Start scan at Crisp Gate Travel uphill
1417 Start GPS 091002GPS212026 Ch 268
1422 Begin scanning Navy Road, Turn around and back to beginning of Navy road
1431 End Navy road 212912
1435 Neighborhood 213300 Ch 911 through 1060
1438 Returning to area B 213640 Stop GPS Stop save Canberra
1445 Start GPS
1446 Start Canberra 214500
1447 Turn left Building 117 North (water front) side 214703
1451 Right turn around north side Building 104 English Street
1451 U-Turn at Robinson 215000 Ch 336
1454 Right turn Building 116 215200 ch 433
1455 Right north face Building 116 215316 ch 502
1455 crossing Building 115 and Right turn at building 115 on McCann Street Ch 555

1456 U-Turn at English Street 215458 Ch 615
1457 Passing Enlisted Club Reef Building 120 West side 215559 Ch 664
1458 Right at comer Building 120 North side on Lockwood 215654 Ch 733
1459 Right turn Building 120 215710 ch 750
1459 Right turn Building 120 South side 215753 Ch 790
1501 Passing Building 113/114 215928 Ch 890
1501 Backing down Lockwood
1505 Turning on alley between Building 120 and 113 220326 Ch 1124
1508 Turning left back up along back side of Building 113/114 220626 Ch 1290 1510
Possible Thoriurn welding rods or Thorium and K-40 in concrete Stopped 220829
1512 Stopped GPS Stop save Canberra 221110
1523 Start GPS Driving down waterfront straight down main area 222142
1527 Pass by large concrete buildings 222506 Ch 202
1527 End area B
1529 Begin area C Driving Lockwood 222756 Ch 393
1530 Passing Building 214 222837 Ch 456
1530 Left turn between buildings 231 and Dry Dock 2 1534
1534 Right turn along waterfront 223213 Ch 663
1534 Passing 219 Right turn 223250 Ch 706
1535 Left turn Nimitz Ave. Building 211 223317 Ch 731
1535 Right turn Building 211 223317 Ch 760
1537 Passing Building 253 shop 51 223511 Ch 853
1541 Through gate passing building Shoe Store 223 949 Ch 1100
1543 passing Building 270 224034 Ch 1212
1543 Stopped and started GPS 224250
1544 Passing C Street 224428 Ch 1281
1546 Turn right Building 203 Power Plant 224453 Ch 1430
1548 Passing Building 282 224600 Ch 1476
1548 Right Turn Spear 224704 Ch 1550 Bldg 215 Fire Dept. Station
1550 Passing Building 281 224839 Ch 1660
1552 Passing CIA (Controlled Industrial Area) Gate 225014 Ch 1746
1552 Passing Building 253 225049 Ch 1780
1554 U Turn at Building 219 (loop around clockwise) 225213 Ch 1867
1555 Stop driving west 225331 Stop GPS
1555 Stop/Save Canberra 091002 GPS225331Clck1555
1558 Start GPS 091002GPSTempClck1558.txt
1600 Driving West on Spear Ave. 225804
1601 Crossing Street 225924 Ch 122
1601 Crossing CIA Gate and Cafe 225940 Ch 146
1603 Passing Building 17 230133 Ch 259
1604 Left Turn Dry Dock 4 230222 Ch 304
1605 Left Turn Building 203 onto Nimitz 230338 Ch 373
1610 Gate locked, going around (at Building 229) 230813 Ch 651
1610 U Turn Nimitz, Turning Right C street from Nimitz 230950 Ch 735
1612 Right Turn Spear 231029 Ch 789
1613 Right Turn at Building 281 231118 Ch 851

1614 Left Turn Nimitz 231230 Ch 899
1615 Left Turn Building 253 231334 Ch 965
1617 Left Turn Building 231 231526 Ch 1092
1622 Stop scanning 232044 Ch 1400
1624 Returning to pickup street between Building 253 and 228 232204 Ch 1481
Large concrete Building Thorium and K-40 detected
1626 Left turn onto Spear 232400 Ch 1575
1627 Left turn onto C street 23517 Ch 1676
1648 Stop Scan 232648 Ch 1776
1648 Stop GPS Stop Save Canberra 091002GPS232648Clck1648 Stop for the Day
9/11/02
0655 Arrive on site
0715 Completed Morning Briefing
0730 Pickup Van
0740 Begin QA/QC and Calibration
0844 Begin Scanning
0844 Start GPS
0845 Start Canberra 154322GPS0845
0845 Counter clockwise, graded lot behind restaurant Dego Mary's from fence 154322
0900 U turn reverse to clockwise 155842 Ch 917
0906 Making inside passes, appears to have small amount of Thorium in the gravel (natural), and large K-40 concentration (also natural)
0922 Stopped Survey, Stop GPS Save 162000 091102GPS162000Clck0922
0922 Saved PHA 091102 Main/Bkgd Graded lot
1055 Start Area C 175343 Driving down Spear, Loop restaurant
1100 U turn at Robinson and Fisher 17815 Ch 265
1106 Turn into Van Keuren Ave. 180412
1108 U turn 180558, turn into lot between buildings
1112 turning into second lot between buildings
1115 Turning next lot between buildings
1130 Stop Save Canberra 182810
1137 Start GPS 183557 Start N-26 Triangle next to Drydock 4 and Pier 238
1204 Stop GPS 190706
1210 Start GPS
1214 Scanning Dog Kennel Building 707 (former known Cs-137 area and area of Radium cleanup) 191205
1229 Driving to former theater Bldg 509 192739 Ch 1120
1234 H and Mann 193235
1238 Passing theater location 193606 Ch 1640
1244 Stop GPS Save 194249
1248 Start GPS
1250 Start scan of police storage building (Building 383) and pier 194800
1305 Stop GPS, Stop scan Save file 200309

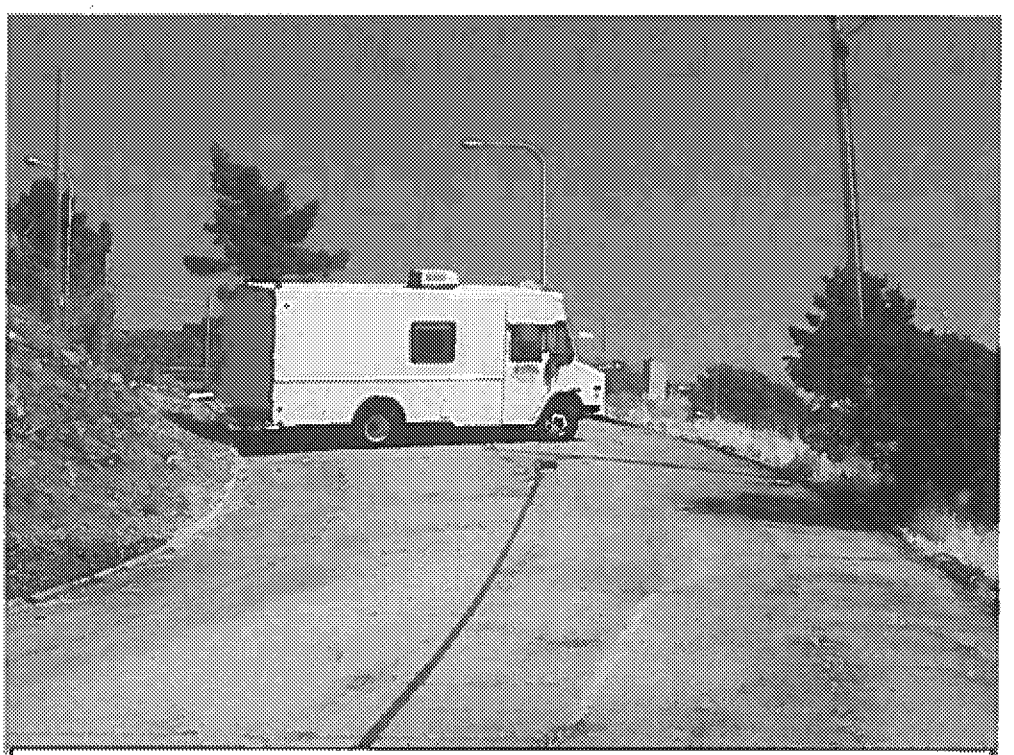
Attachment A

Photographs
Of
The US EPA
Scanner Van Survey
Conducted at
Hunters Point Naval Shipyard
From
September 9 to 12, 2002

US EPA Radiation and Indoor Air National Laboratory (RIANL)
Scanner Van surveying Crisp Avenue of
Hunters Point Naval Shipyard

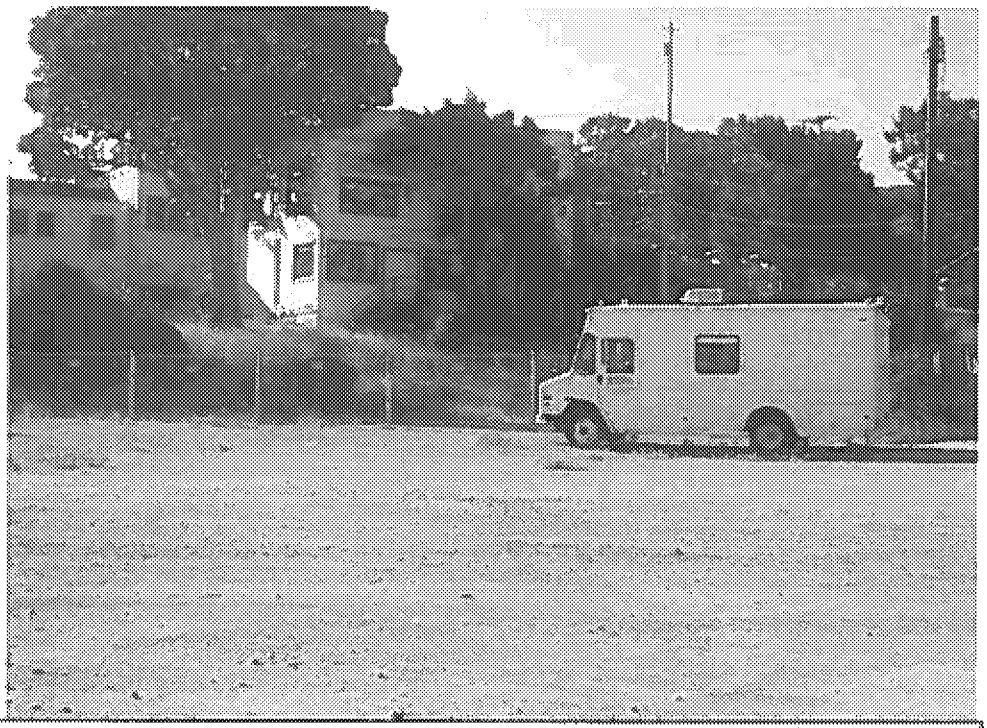
Scanner Van surveying the former residential areas in Parcel A

ED_004747_00001770-00034



Scanner Van on Old Navy Road in Parcel A

Scanning along the site's fence line at IR 7/18 in Parcel B

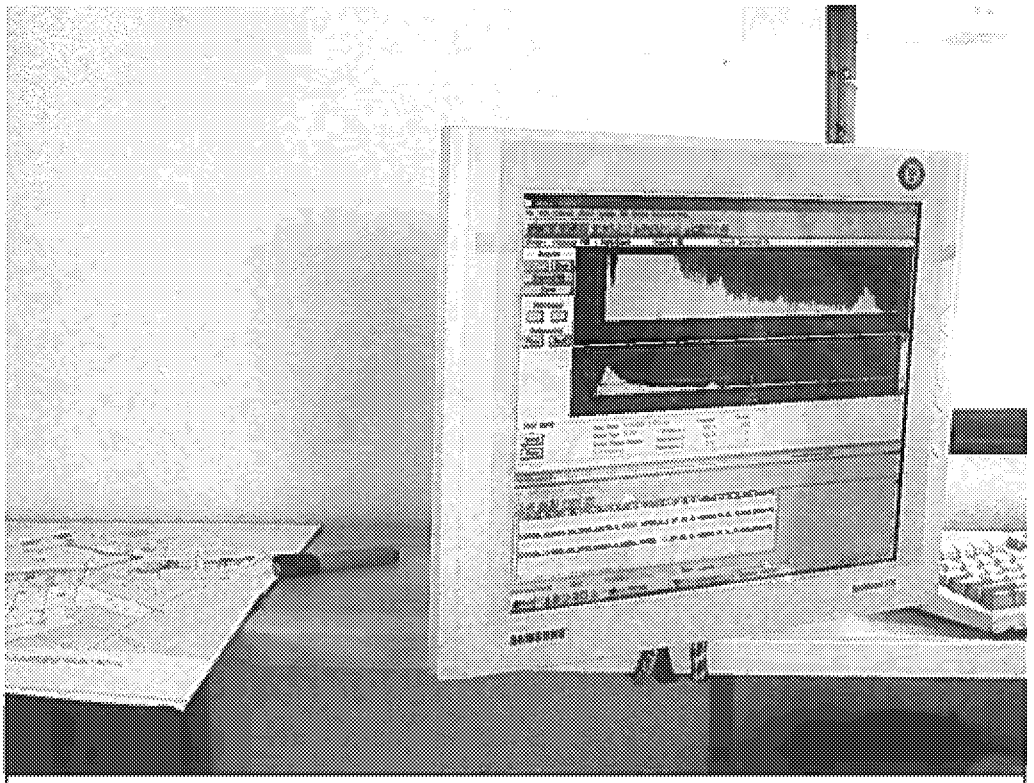


Surveying IR 7/18 behind Dago Mary's Resturant in Parcel B

Downtown San Francisco skyline from IR 7/18 in Parcel B

A view of Drydock #3 pumphouse through the Van's windshield

Roger Goodman scanning the north wall of Drydock #3 pumphouse



Spectrum image on the SV's pluse height analyer

Scanner Van main (shielded) detector and spectrum analyzer operator

Surveying the pier in Parcel C near Drydock #4

Scan Van surveying along the nort h side of Drydock #4

Scanning Parcel C near Drydock #4

Overgrown street in Parcel E