REMOVAL ASSESSMENT REPORT
FOR
WEBSTER-GULF NUCLEAR
202 MEDICAL CENTER BOULEVARD
WEBSTER, HARRIS COUNTY, TEXAS

Prepared for

U.S. Environmental Protection Agency Region 6
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Contract No. 68-W-01-005
Technical Direction Document No. 06-03-05-0001
WESTON Work Order No. 12632.001.121.1784
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FPN NO N/A
EPA OSC Greg Fife
START-2 PTL Chad Hall

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EXECUTIVE SUMMARY

Weston Solutions, Inc., (WESTON®) Superfund Technical Assistance and Response Team (START-2) was tasked by the U.S. Environmental Protection Agency (EPA) Region 6 under Contract Number 68-W-01-005, Technical Direction Document (TDD) 06-03-05-0001 (Attachment A), to perform a removal assessment at the Webster-Gulf Nuclear site located in Webster, Harris County, Texas. The objectives of the removal assessment were to use Ground Penetrating Radar (GPR), scanning and other instrumentation to identify areas of elevated radioactive soil contamination and identify possible buried ferrous objects beneath the surface. Additional objectives were to coordinate with the EPA's Radiation and Indoor Environment National Laboratory Las Vegas, (EPA Las Vegas) and State Agencies to investigate the nature and extent of surface and subsurface contaminants in the soil to estimate the volume of contaminated soil to be removed. EPA Las Vegas contributed to this Removal Assessment report through coordination activities and testing as prescribed in Section 5.

Removal assessment objectives were achieved by collection of surface and subsurface soil samples and scanning instrumentation and evaluation of the data collected. Sampling activities for the removal assessment were initiated on 2 June 2003 and completed on 13 June 2003. A total of 332 quantitative and qualitative soil samples were collected. Survey and Analytical Results show definite surface contamination across the entire site. Most of the high contamination levels were found within the first 30 centimeter (cm) of soil. However, there are areas at a depth of 30-45 cm below ground surface that require remediation.

It is recommended that soil be removed from across the entire surface of the site at a depth of six (6) inches and then individual areas of elevated contamination be remediated to deeper depths in order to minimize the removal amount. The total estimate of soil to be removed from the site is 395 bank (in-place) cubic yards.

TABLE OF CONTENTS

Section **Page**

LIST OF ATTACHMENTS

LIST OF FIGURES

Figure **Page**

LIST OF TABLES

1. INTRODUCTION

Weston Solutions, Inc., (WESTON®) Superfund Technical Assistance and Response Team (START-2) was tasked by the U.S. Environmental Protection Agency (EPA) Region 6 under Contract Number 68-W-01-005, Technical Direction Document (TDD) 06-03-05-0001 (see Attachment A) to perform a removal assessment at the Webster-Gulf Nuclear site located in Webster, Harris County, Texas (Figure 1-1 and Figure 1-2). START-2 prepared this Removal Assessment Report to describe the technical scope of work performed and to report an estimated quantity of contaminated soil and other on-site wastes.

1.1 PROJECT OBJECTIVES

The removal assessment objectives were: 1) use scanning and other instrumentation to identify areas of elevated radioactivity, 2) coordinate with EPA Las Vegas and State Agencies, 3) collect surface and subsurface soil samples on-site, 4) investigate the nature and extent of contaminants in the soil, and 5) calculate an estimated contaminated soil volume to be removed.

The soil samples were collected and analyzed in accordance with the Quality Assurance Sampling Plan (QASP) (see Attachment B). The sample locations identified in the QASP were surveyed. The analytical results were evaluated and estimated volumes were calculated.

Soil samples were collected based on a Multi-Agency Radiation Survey and Sampling Investigation Manual type (MARSSIM) 15x15 foot grid system established at the northeastern most corner fence post and labeled A1. Each column A-H starts on the Northern property fence and was established from North to South, with location numbers starting at 1 on the Northern fence line and ending at 16 on the Southern fence line.

Figure 1-1

Site Location Map

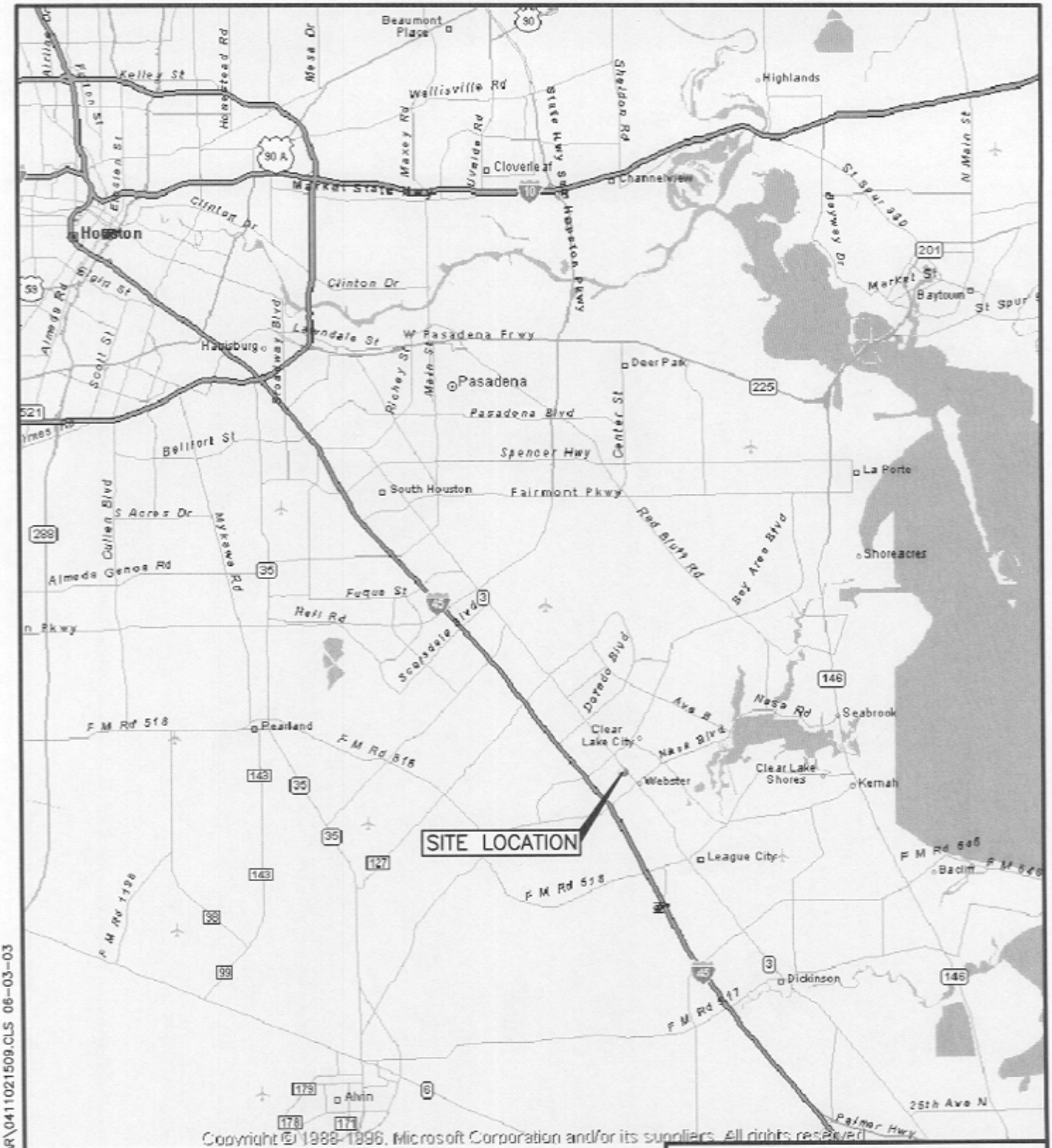

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FIGURE 1-1
SITE LOCATION MAP
WEBSTER GULF NUCLEAR SOILS

WEBSTER, HARRIS COUNTY, TEXAS

DATE:	W.O. #	SCALE:
06-03-03	12632.001.121.1784	NOT TO SCALE

TDD No.: 06-03-05-0001

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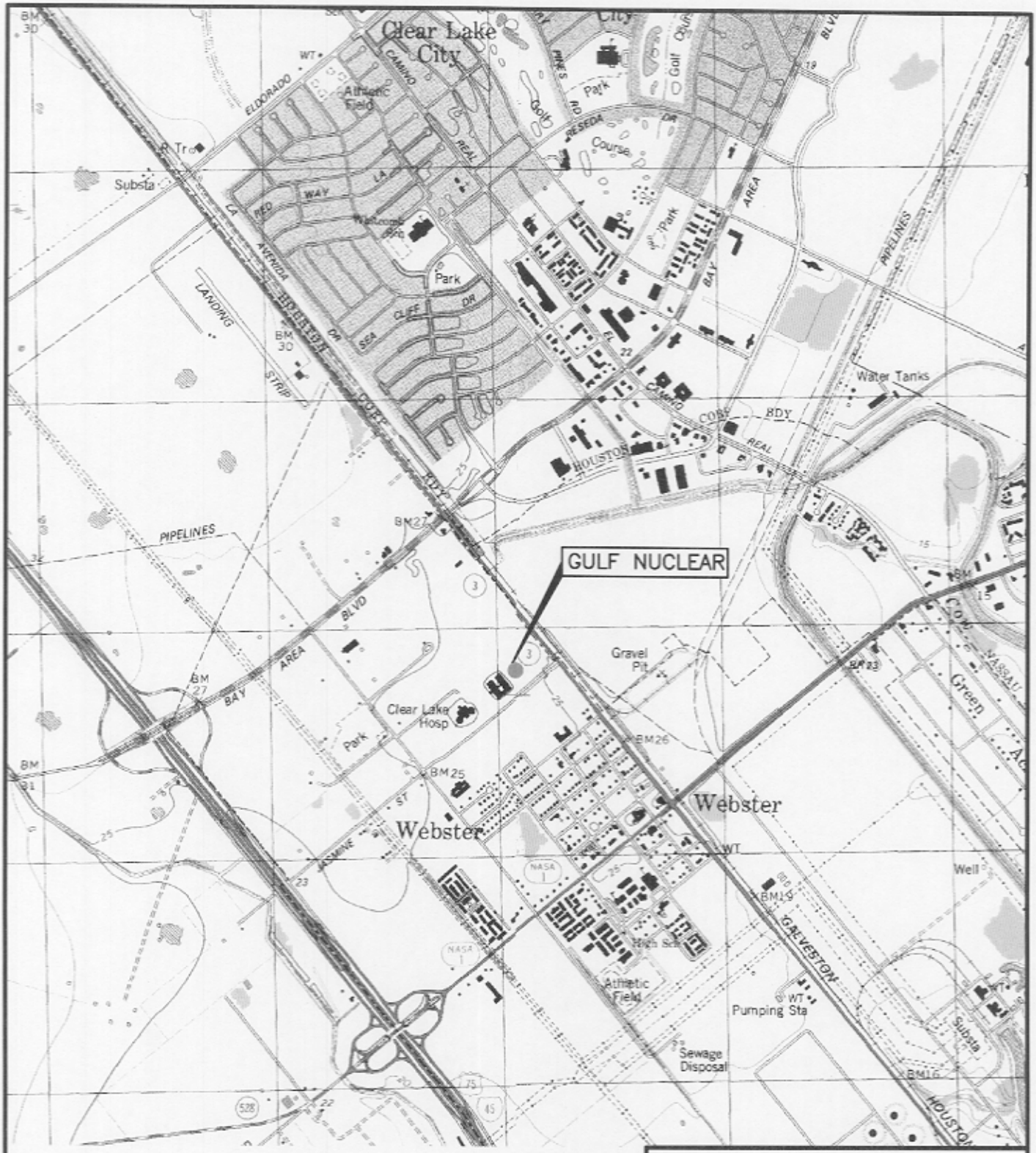
Figure 1-2

Site Area Map



SOURCE: USGS 7.5 MINUTE SERIES TOPOGRAPHIC, FRIENDSWOOD AND LEAGUE CITY, TEXAS (1982).
TDD No.: 06-03-05-0001

US EPA REGION 6
START-2

FIGURE 1-2
SITE AREA MAP
WEBSTER GULF NUCLEAR
WEBSTER, HARRIS COUNTY, TEXAS

DATE:	W.O. #	SCALE:
06-03-03	12632.001.121.1784	1" = 2000'

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2. PURPOSE AND SCOPE

2.1 SITE LOCATION

Webster-Gulf Nuclear site, currently unoccupied, is a 0.224 acre tract of land located at 202 Medical Center Boulevard in Webster, Harris County, Texas (see Figure 1-2). The geographic center of the site is approximately Latitude 29.54250 North and Longitude 95.12458 West. The global positioning system (GPS) coordinates were obtained with a hand-held GPS instrument.

2.2 SITE HISTORY AND DESCRIPTION

The Webster facility was owned and operated by Gulf Nuclear Industries (GNI). GNI prepared radiation sources for the medical and oil field industries. In 1983, an inadvertent 3-curie americium-beryllium source breach prompted an extensive facility investigation and survey. Webster ceased operations in 1991 and is still in bankruptcy proceedings. The EPA and United States Army Corps of Engineers (USACE) completed a site radiation survey and building demolition. It was determined that site contamination was above normal background levels with alpha, beta and gamma sources of radiation.

2.3 PREVIOUS INVESTIGATIONS

Texas Department of Health Bureau of Radiation Control started monitoring both Webster Gulf Nuclear and Tavenor (Webster's sister site) in 1983 and presently continues to monitor each site. The monitoring was initiated as a direct result of the inadvertent 3-curie americium-beryllium source breach. This incident initiated extensive facility investigations and surveys that have continued throughout the years.

3. SAMPLING APPROACH AND PROCEDURES

3.1 OVERVIEW OF SAMPLING ACTIVITIES

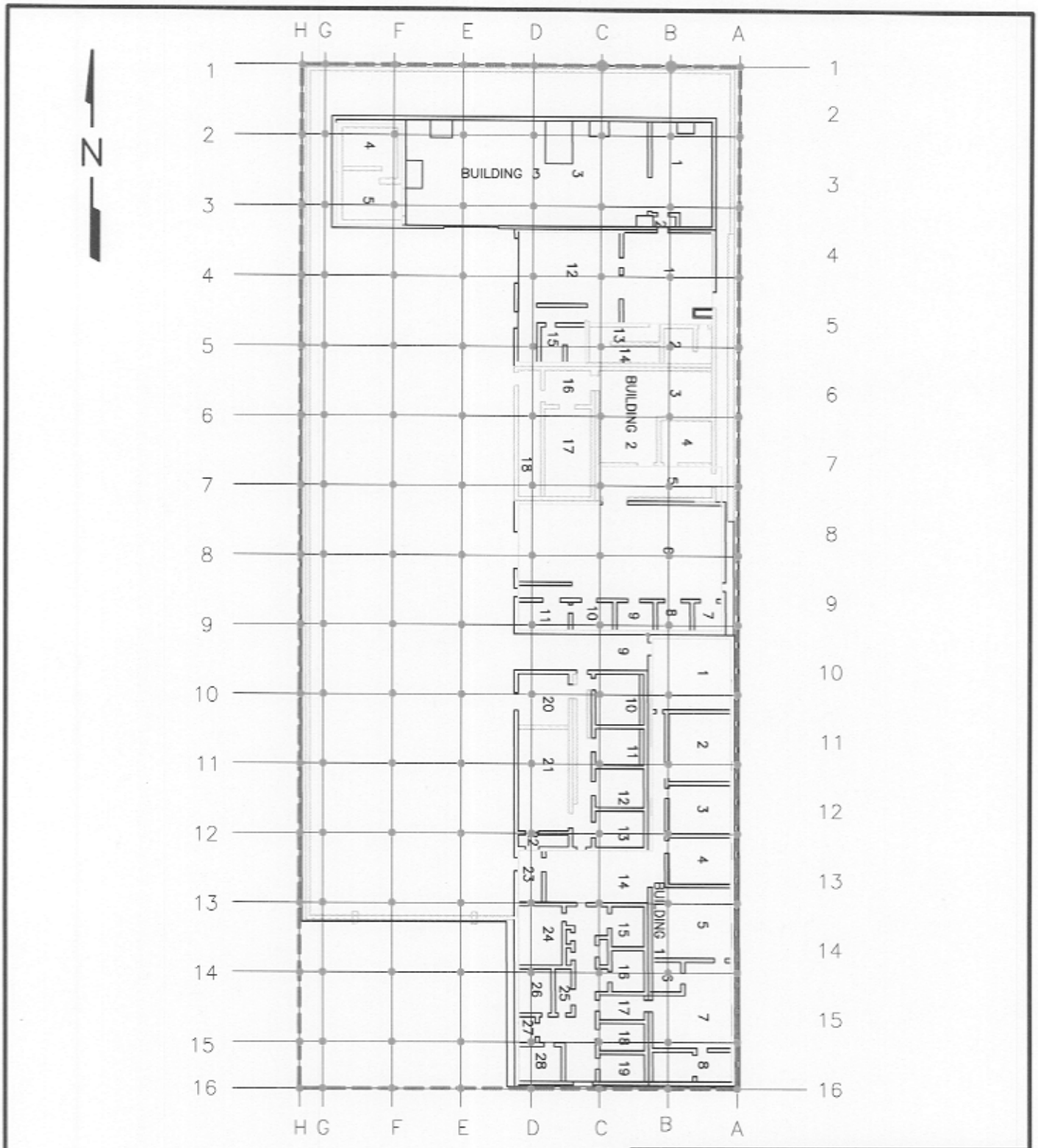
After consultation with EPA On-scene Coordinator (OSC) Greg Fife, sampling locations were based on a MARSSIM type strategy prepared by START-2 (see Attachment B). This strategy utilized a 15x15 foot grid system for the entire site. The primary isotopes of concern for the site are Cesium-137 and Americium 241.

3.2 SOIL SAMPLING

Soil sampling activities for the removal assessment were conducted on 02 June 2003. Geoprobe® and Slambar were used to sample 128 on-site locations, as shown in Figure 3-1. The sampling strategy and locations were approved by the EPA. When possible each of the 128 sample cores was divided into two sections based on a depth of 15-30 cm (6 -12 in), and 45-60 cm (18 - 24 in). Specific information regarding the number of samples collected is detailed in Removal Assessment Analytical Results Section 5 of this report. A complete description of sampling techniques performed on-site is included in the QASP (see Attachment B).

Figure 3-1

On-Site Sample Location Map



LEGEND:

- SOIL SAMPLE
- SITE FENCE

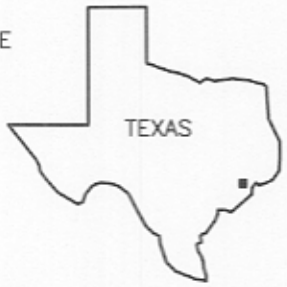


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FIGURE 3-1
ON-SITE SAMPLE LOCATION MAP
WEBSTER GULF NUCLEAR

WEBSTER, HARRIS COUNTY, TEXAS

DATE:	W.O. #	SCALE:
06-03-03	12632.001.121.1784	NOT TO SCALE

TDD No.: 06-03-05-0001

H:\DWG\START EPA\WEBSTER-GULF NUCLEAR\060303021 7.CLS\ss Fig 3-1 07-01-03

4. REMOVAL ASSESSMENT FIELD ACTIVITIES

The removal assessment sampling and surveying activities were conducted between 02 June and 13 June 2003. The first two days of field activities, START-2 mobilized and staged field sampling equipment, coordinated with EPA Las Vegas, and initiated surface and subsurface soil sample collection using surface scoops, Geoprobe and Slambars. Sample locations were identified using a MARSSIMs type sampling strategy prepared by START. The MARSSIMs sampling strategy is included in Attachment B along with the QASP. Surface soil samples were collected from 72 of the 128 on-site areas, while the remaining 56 on-site sample areas were located on concrete or asphalt, and therefore were not sampled. The subsurface soil samples were collected from 96 of the 128 on site sample locations. Due to the non-homogenous make up of the soil, 32 subsurface samples could not be obtained. Two background samples were collected off-site for Quality Control/Quality Assurance purposes. Where conditions allowed, Geoprobe and Slambar cores were taken to a depth of 60 cm (2 ft). Each core was divided into two samples: 15 to 30cm (6 - 12 in), and 45 to 60 cm (18 - 24 in). Photo documentation of site activities is provided in Attachment C.

During field activities, START-2 and EPA Las Vegas used two separate Ludlum 2221's with an attached unshielded 3x3 probe to survey the entire site at the sample locations. Data from START-2 is shown in Table 4-1, Figure 4-1 and data from EPA Las Vegas is shown in Table 4-2 and Figure 4-4.

Target areas were generated by WESTON using a Spatial Analyst for Arc-View 3.2 with an Inverse Distance Weighting (IDW) methodology from the sample data collected. Figures 4-3 and 4-4 show areas of higher activity across the site of both Cesium 137 and Americium 241.

4.1 GEOPHYSICAL STUDY

On 29 May 2003 and 30 May 2003 START-2 had a geophysical study conducted on site by Environmental Geophysics Associates; 9211 Colony Pond Drive, Spring, Texas 77379 in

accordance with the Technical Direction Document (TDD 06-03-05-0001). The results of the entire study are provided in Attachment D of this report.

The study concludes that there are anomalies across the site that are consistent with the neighboring buildings and the existing on-site concrete slabs containing rebar. However, the report states that there are six (6) areas on the site (Labeled A, B, C, D, E, F in Figure 3 of the geophysical report) that are consistent with ferrous sources at the near site surface. The report states that there is indication that buried ferrous sources could exist on the site.

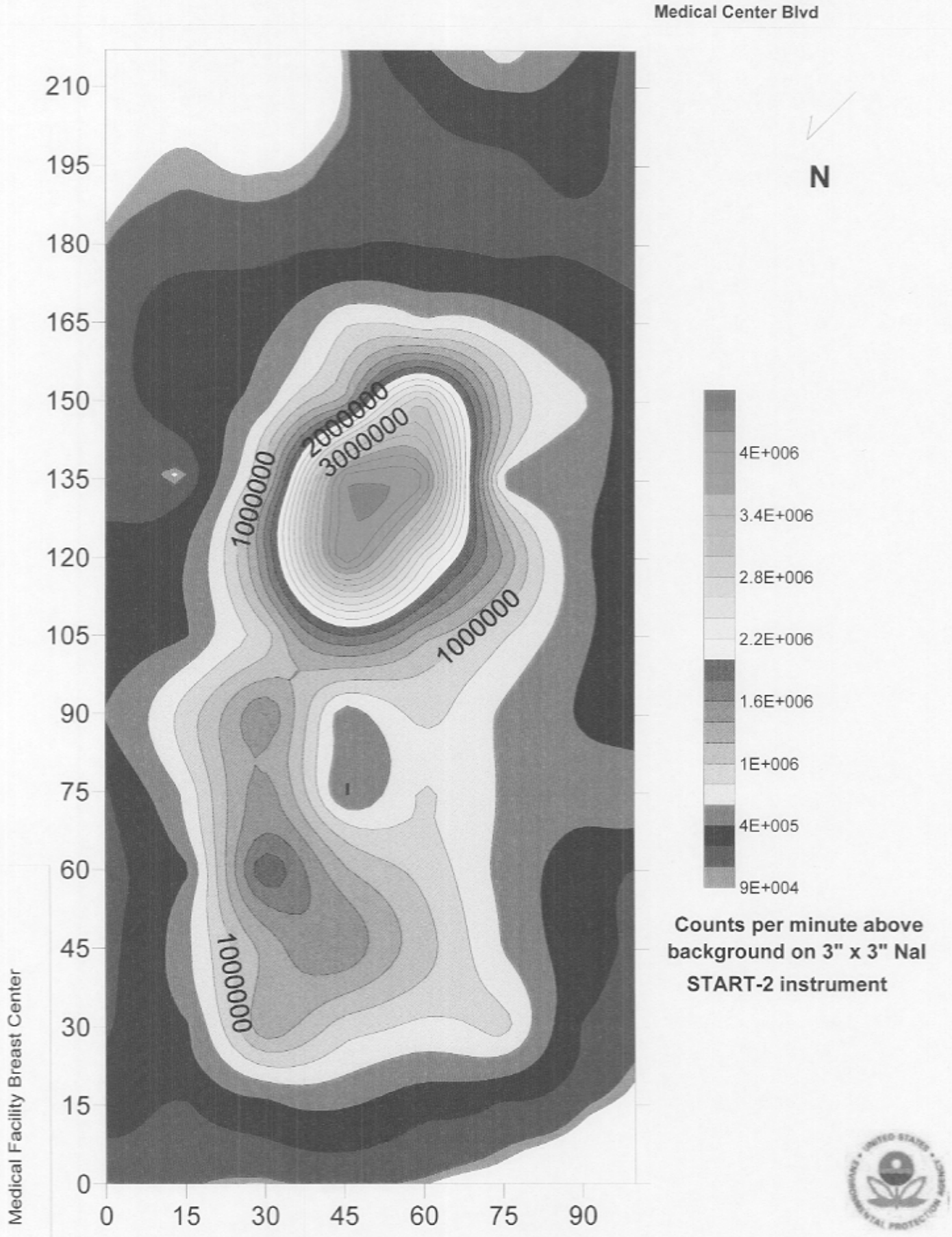

Medical Center Blvd
N
210
195
180
165
150
135
120
105
90
75
60
45
30
15
0
0
15
30
45
60
75
90
Medical Facility Breast Center
1000000
2000000
3000000
1000000
1000000
4E+006
3.4E+006
2.8E+006
2.2E+006
1.6E+006
1E+006
4E+005
9E+004
Counts per minute above background on 3" x 3" NaI START-2 instrument

FIGURE 4 - 1

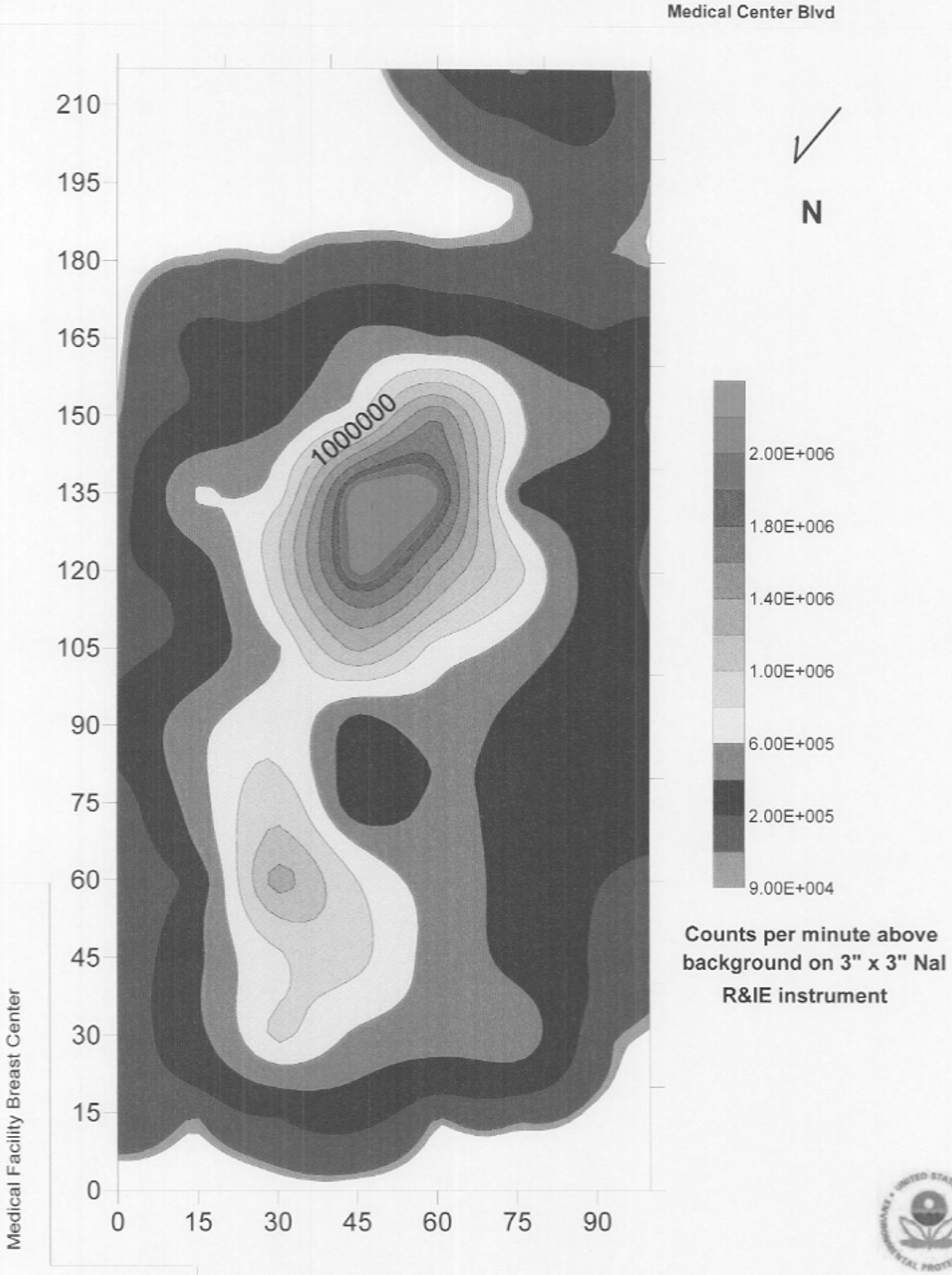
3 inch by 3 inch (3" x 3") Sodium Iodine (NaI) detector with a Ludlum Model 2221 meter	Settings are:	HV =	994
Weston's EPA-START-2 Contractor instrument		Thr =	101
1 Minute count at 30 cm off of ground		Win =	n/a
		Win =	"OUT"
	S/N		117614
	Bkg =		22721 cpm

Sample Location	Surfer x-axis	Surfer y-axis	3"x3" NaI cpm	3" x 3" NaI cpm minus background
A1	0	0	119035	96314
A2	0	15	317726	295005
A3	0	30	213616	190895
A4	0	45	179962	157241
A5	0	60	209117	186396
A6	0	75	205438	182717
A7	0	90	433214	410493
A8	0	105	266475	243754
A9	0	120	286895	264174
A10	0	135	207305	184584
A11	0	150	167015	144294
A12	0	165	131687	108966
A13	0	180	122036	99315
A14	0	195	99550	76829
A15	0	210	88597	65876
A16	0	217	100171	77450
B1	15	0	130700	107979
B2	15	15	203910	181189
B3	15	30	375632	352911
B4	15	45	562083	539362
B5	15	60	338504	315783
B6	15	75	655225	632504
B7	15	90	920334	897613
B8	15	105	393520	370799
B9	15	120	415842	393121
B10	15	135	99922	77201
B11	15	150	356021	333300
B12	15	165	392766	370045
B13	15	180	152678	129957
B14	15	195	121593	98872
B15	15	210	98732	76011
B16	15	217	93525	70804
C1	30	0	109583	86862
C2	30	15	345083	322362
C3	30	30	1408823	1386102
C4	30	45	1256648	1233927
C5	30	60	2047238	2024517
C6	30	75	1535460	1512739
C7	30	90	1660561	1637840
C8	30	105	868816	846095
C9	30	120	1562417	1539696
C10	30	135	1039639	1016918
C11	30	150	518650	495929
C12	30	165	371750	349029
C13	30	180	160403	137682
C14	30	195	111219	88498
C15	30	210	82659	59938
C16	30	217	89236	66515
D1	45	0	131082	108361
D2	45	15	439775	417054
D3	45	30	902102	879381
D4	45	45	1597090	1574369
D5	45	60	1250207	1227486
D6	45	75	369148	346427
D7	45	90	482366	459645
D8	45	105	1816473	1793752
D9	45	120	4255647	4232926
D10	45	135	4186099	4163378
D11	45	150	1211290	1188569
D12	45	165	801018	778297
D13	45	180	202434	179713

Table 4 - 1

Sample Location	Surfer x-axis	Surfer y-axis	3"x3" NaI cpm	3" x 3" NaI cpm minus background
D14	45	195	139230	116509
D15	45	210	113273	90552
D16	45	217	110145	87424
E1	60	0	114465	91744
E2	60	15	267837	245116
E3	60	30	752931	730210
E4	60	45	1115360	1092639
E5	60	60	958821	936100
E6	60	75	857616	834895
E7	60	90	895977	873256
E8	60	105	1270653	1247932
E9	60	120	2474258	2451537
E10	60	135	4139790	4117069
E11	60	150	3049695	3026974
E12	60	165	652066	629345
E13	60	180	218156	195435
E14	60	195	160210	137489
E15	60	210	259039	236318
E16	60	217	400870	378149
F1	75	0	100176	77455
F2	75	15	190163	167442
F3	75	30	914911	892190
F4	75	45	610763	588042
F5	75	60	555910	533189
F6	75	75	601884	579163
F7	75	90	587144	564423
F8	75	105	846514	823793
F9	75	120	1447859	1425138
F10	75	135	510163	487442
F11	75	150	1110935	1088214
F12	75	165	565753	543032
F13	75	180	180256	157535
F14	75	195	176877	154156
F15	75	210	429913	407192
F16	75	217	734490	711769
G1	90	0	74574	51853
G2	90	15	125430	102709
G3	90	30	199119	176398
G4	90	45	278091	255370
G5	90	60	301808	279087
G6	90	75	468620	445899
G7	90	90	402697	379976
G8	90	105	459895	437174
G9	90	120	473083	450362
G10	90	135	507775	485054
G11	90	150	684526	661805
G12	90	165	359883	337162
G13	90	180	202207	179486
G14	90	195	287559	264838
G15	90	210	304571	281850
G16	90	217	421160	398439
H1	100	0	74818	52097
H2	100	15	103884	81163
H3	100	30	149919	127198
H4	100	45	212058	189337
H5	100	60	208340	185619
H6	100	75	617985	595264
H7	100	90	278145	255424
H8	100	105	315312	292591
H9	100	120	237719	214998
H10	100	135	319882	297161
H11	100	150	254866	232145
H12	100	165	295954	273233
H13	100	180	150670	127949
H14	100	195	155910	133189
H15	100	210	169109	146388
H16	100	217	143622	120901

Table 4 - 1


Medical Center Blvd
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2.00E+006
1.80E+006
1.40E+006
1.00E+006
6.00E+005
2.00E+005
9.00E+004
Counts per minute above background on 3" x 3" NaI R&IE instrument
Medical Facility Breast Center
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210

FIGURE 4 - 2

3 inch by 3 inch (3" x 3") Sodium Iodine (NaI) detector with a Ludlum Model 2221 meter
EPA-Las Vegas R&IE's instrument
1 Minute count at 30 cm off of ground

Settings are:

HV =	877
Thr =	100
Win =	562
Win =	"IN"
S/N	147500
Bkg =	15974 cpm

Sample Location	Surfer x-axis	Surfer y-axis	3"x3" NaI cpm	3" x 3" NaI cpm minus background
A1	0	0	64241	48267
A2	0	15	196627	180653
A3	0	30	125494	109520
A4	0	45	123097	107123
A5	0	60	134796	118822
A6	0	75	127454	111480
A7	0	90	285057	269083
A8	0	105	161424	145450
A9	0	120	191873	175899
A10	0	135	136139	120165
A11	0	150	108273	92299
A12	0	165	94437	78463
A13	0	180	80975	65001
A14	0	195	67252	51278
A15	0	210	59233	43259
A16	0	217	65160	49186
B1	15	0	77395	61421
B2	15	15	114488	98514
B3	15	30	366766	350792
B4	15	45	369868	353894
B5	15	60	249978	234004
B6	15	75	517073	501099
B7	15	90	563990	548016
B8	15	105	251319	235345
B9	15	120	283946	267972
B10	15	135	666816	650842
B11	15	150	236643	220669
B12	15	165	264994	249020
B13	15	180	109601	93627
B14	15	195	80752	64778
B15	15	210	60719	44745
B16	15	217	59554	43580
C1	30	0	86760	70786
C2	30	15	227496	211522
C3	30	30	889165	873191
C4	30	45	766476	750502
C5	30	60	1347796	1331822
C6	30	75	1007954	991980
C7	30	90	820132	804158
C8	30	105	574615	558641
C9	30	120	948482	932508
C10	30	135	673866	657892
C11	30	150	356832	340858
C12	30	165	254994	239020
C13	30	180	109656	93682
C14	30	195	85608	69634
C15	30	210	67742	51768
C16	30	217	62844	46870
D1	45	0	85862	69888
D2	45	15	287246	271272
D3	45	30	569050	553076
D4	45	45	879760	863786
D5	45	60	818922	802948
D6	45	75	215142	199168
D7	45	90	275764	259790
D8	45	105	1274634	1258660
D9	45	120	2099630	2083656
D10	45	135	2200650	2184676
D11	45	150	697028	681054
D12	45	165	482368	466394

Table 4 - 2

Sample Location	Surfer x-axis	Surfer y-axis	3"x3" NaI cpm	3" x 3" NaI cpm minus background
D13	45	180	140580	124606
D14	45	195	92748	76774
D15	45	210	69410	53436
D16	45	217	69596	53622
E1	60	0	80515	64541
E2	60	15	114334	98360
E3	60	30	505070	489096
E4	60	45	525194	509220
E5	60	60	529120	513146
E6	60	75	465718	449744
E7	60	90	524476	508502
E8	60	105	708918	692944
E9	60	120	1396710	1380736
E10	60	135	2103710	2087736
E11	60	150	1639332	1623358
E12	60	165	417354	401380
E13	60	180	132844	116870
E14	60	195	86022	70048
E15	60	210	140588	124614
E16	60	217	222254	206280
F1	75	0	74703	58729
F2	75	15	131706	115732
F3	75	30	583908	567934
F4	75	45	342570	326596
F5	75	60	356656	340682
F6	75	75	358618	342644
F7	75	90	354240	338266
F8	75	105	527212	511238
F9	75	120	908654	892680
F10	75	135	343582	327608
F11	75	150	658452	642478
F12	75	165	329662	313688
F13	75	180	134336	118362
F14	75	195	110426	94452
F15	75	210	245106	229132
F16	75	217	454400	438426
G1	90	0	53208	37234
G2	90	15	89254	73280
G3	90	30	133534	117560
G4	90	45	197118	181144
G5	90	60	224950	208976
G6	90	75	318994	303020
G7	90	90	261172	245198
G8	90	105	287800	271826
G9	90	120	321036	305062
G10	90	135	341488	325514
G11	90	150	509963	493989
G12	90	165	228662	212688
G13	90	180	116968	100994
G14	90	195	185752	169778
G15	90	210	269792	253818
G16	90	217	249560	233586
H1	100	0	54706	38732
H2	100	15	71996	56022
H3	100	30	102237	86263
H4	100	45	155548	139574
H5	100	60	148134	132160
H6	100	75	348044	332070
H7	100	90	225332	209358
H8	100	105	224880	208906
H9	100	120	194124	178150
H10	100	135	224212	208238
H11	100	150	181220	165246
H12	100	165	284368	268394
H13	100	180	107866	91892
H14	100	195	112205	96231
H15	100	210	128250	112276
H16	100	217	102522	86548

Table 4 - 2

5. REMOVAL ASSESSMENT ANALYTICAL RESULTS

The analysis for the Webster-Gulf Nuclear site was completed on site by EPA Las Vegas. Tables 5-1 through 5-3 with accompanying figures presents results for each sample collected.

5.1 SOIL AND SEDIMENT SUMMARY

Analytical results were compared with two (2) biased reference background samples to establish radiation levels for the area. The reference samples were taken in accordance with the QASP sampling strategy for this site. The results of the reference samples show that all were below the Minimal Detectable Amounts (MDA) for the constituents of concern

5.2 DETECTOR AND SOFTWARE CHARACTERISTICS

All samples collected by EPA START-2 were analyzed by EPA Las Vegas personnel on a High Purity Germanium (HPGe) P-Type detector rated at 66% relative efficiency. The usable range of this detector is 50 keV to 2000 keV. The calibration range is from 60 keV to 2000 keV. This corresponds to ^{241}Am at 60 keV to ^{88}Y at 1836 keV. Information pertaining to the detector and calibration is presented in Attachment E.

The Gamma Spectral Analysis data reduction software is a commercial package, Genie-2000 Version 1.3, supplied by Canberra, Inc. Reference on the software validation can be obtained directly from Canberra. In addition, Canberra's Quality Assurance Software was utilized. The Quality Assurance Software tracks various nuclides and keeps a historical record of all efficiency calibration checks.

5.3 CALIBRATION AND QUALITY ASSURANCE

The 66% HPGe detector was calibrated using a 16 oz. glass jar NIST traceable soil geometry prepared by Analytics Inc (# 64282-613). All information pertaining to the efficiency calibration and calibration standard is presented in Attachment E.

Before and during each counting day a multiple line gamma standard with gamma-rays in the specific region of interest was used to perform an energy calibration on the HPGe detector. The software stores the energy calibration (gamma-ray energy as a function of multichannel analyzer channel number) for the specific detector. The Energy Calibration Reports are presented in Attachment E.

The Quality Assurance Software captures and stores a historical database for the detector activity, full-width-at-half-maximum (FWHM), and peak centroid. Cadmium-109 (^{109}Cd), cesium-137 (^{137}Cs), and cobalt-60 (^{60}Co) are tracked through the life of this type of analysis and represents the low, middle, and high portion of the efficiency calibration curve. The Quality Assurance Reports are presented in Attachment E.

5.4 ON SITE SOIL SAMPLE ANALYSIS - QUANTITATIVE

302 soils samples were collected from the site by EPA START-2 and were analyzed by EPA Las Vegas personnel using gamma-ray spectrometry and procedures outlined in the Mobile Environmental Radiation Laboratory (MERL) SOP FSB-427. Energy and efficiency calibrations for gamma-ray spectrometry are outlined EPA Las Vegas SOP RQA-400 and RQA-402. Each sample was counted for 20 to 30 minutes. This counting time achieved Minimum Detectable Activity's (MDA's) for the following radio-nuclides within a glass jar geometry containing 500 grams of dried soil utilizing a 66% HPGE detector relative to a 3" by 3" NaI:

	Nuclide	Analysis	MDA (pCi/gram)
1.	Co-60	Gamma	1.75E-1
2.	Cs-137	Gamma	2.40E-1
3.	Ra-226	Gamma	4.81E+0
4.	Am-241	Gamma	1.76E+0

The MDA's listed above were changed slightly from the original quality objectives to accommodate more samples in the on-site laboratory without jeopardizing detection criteria. Quantitative analysis were performed on each soil sample over the range from 59 Kev to 2 Mev. A list of radio-nuclides standard library for gamma spectrometry is provided in Attachment E. The analyst performed visual inspection of each spectrum obtained for each sample to verify no peaks above the continuum (background) were identified that was not identified by the gamma

software package. Analytical data results are provided in Tables 5-1, 5-2, 5-3, and 5-4 for each soil sample. Only radioisotopes of concern, cesium-137 (^{137}Cs) and americium-241 (^{241}Am), are shown within these tables. Also identified during analysis were natural occurring uranium and thorium progeny radioisotopes but no activities were reported above natural concentrations (Eisenbud and Gesell. 1997).

Figures 5-1A and 5-1B show the surface data sampling derived ^{241}Am and ^{137}Cs activity isopleth maps, respectively, generated by the Surfer contouring and 3D surface mapping software (Keckler 2002) using statistical method of kreging. Additionally, Figures 5-2A and 5-2B show subsurface (6 to 12 inches in depth) while figures 5-3A and 5-3B show subsurface (12 to 24 inches in depth) data sampling derived activity isopleth maps. The sampling locations are shown in Figure 3-1. The Surfer software assumes that the activity between all measured points is continuous. In the case for Figures 5-1A and 5-1B surface samples, this is true because the majority of sampling points showed varying degrees of ^{241}Am and ^{137}Cs activity. However, Figures 5-2A, 5-2B, 5-3A and 5-3B have few points over all sampling locations that showed any activity so the Surfer software extrapolates one or two data points over larger areas than would be anticipated.

Additionally, 8 background soil samples were collected off-site away from the Gulf Nuclear fenced limits representing surface (0 - 6 inches depth), shallow subsurface (6 -12 inches depth), and deeper subsurface (12 - 24 inches depth). These samples were taken to verify the background outside the location of the Gulf Nuclear boundary did not show elevated activity that would have otherwise negated the results within the Webster-Gulf Nuclear property. No radio-nuclides were detected in the background sample.

The Webster-Gulf Nuclear soil samples indicated elevated ^{241}Am and ^{137}Cs contamination over the entire site with localized areas having up to 50 times greater than the cleanup level of 6 pCi/g for ^{241}Am and a 100 times greater than the cleanup level of 40 pCi/g for ^{137}Cs, Figures 5-1A and 5-1B respectively. The soil samples had a minimum activity concentration below MDA for ^{241}Am and ^{137}Cs. The soil samples had a maximum activity concentration of approximately 355 pCi/g for ^{241}Am and approximately 10,000 pCi/g for ^{137}Cs. One sample represented by sample location D9, Figure 3-1, showed an extremely high ^{137}Cs concentration. A hot particle

from previous cleanup process may have been introduced into the sample during sample collection and does not represent the activity over entire site. The ^{241}Am maximum activity was under Building 3 where the large roll-up door was located and the ^{137}Cs maximum activity was under Building 2 approximately where the machine shop pluming was located. These structures were removed during a previous removal project and are not discussed in this report.

5.5 ADDITIONAL SAMPLE ANALYSIS - QUALITATIVE

Eleven soil samples and eleven concrete samples were analyzed by a qualitative method. These samples could not be quantified due to visual inspections of the samples prior to analysis. Each of the samples contained rocks and other debris that did not fit the calibration geometry composition. Even though the samples could not be quantitatively analyzed, each sample under went a qualitative identification. This comprised of placing the sample on detector and counting for approximately the same amount of time as the other samples were analyzed. Table 5-5 shows the results of these samples. All 22 samples were graded on the presence of ^{137}Cs and if the sample showed a greater than 5 gamma's per second (gps) ^{137}Cs peak identification. If the sample showed both these traits, then a hit for ^{137}Cs was identified as being at or above 40 pCi/g. While the data is qualitative only and not able to be validated, the samples identified as having ^{137}Cs present should not be ignored during the cleanup process.

5.6 CORRECTION OF INSTRUMENTATION TO SOIL RELEASE CONCENTRATION OR CLEANUP LEVEL

To minimize the amount of contaminated soil material to be removed, an action level for survey instrumentation comparable to the 40 pico-Curie per gram (pCi/g) cesium-137 (^{137}Cs) level should be established. The 40 pCi/g for ^{137}Cs is the cleanup criteria agreed upon by EPA Region-6 and Texas Department of Health-Bureau of Radiation Control (TDH-BRC) in accordance with the Texas Administrative Code, 24 TAC 289.202 (ggg) (8). To establish this level, all parties involved with the cleanup should be interested in removing only contaminated material. Removal of any additional material would increase cleanup cost. Constant vigilance will be necessary to remove only contaminated material.

Because of this concern, a comparison of a Ludlum model 2221 in conjunction with a 3" x 3" NaI) detector probe used as a survey instrumentation can be used to approximate a final release concentration cleanup level of 40 pCi/g ^{137}Cs. As shown on Figures 4-1 and 4-2, ^{137}Cs is distributed over the complete site and while not 100% homogeneous can be detected to the 40 pCi/g using this technique. Even though americium-241 is present, only ^{137}Cs will be used for this technique because it is easily detected at these levels due to the higher gamma-ray energy produced during decay.

Two Ludlum model 2221 with 3" x 3" NaI probes were used side by side at each location, Figure 3-1. Both instruments, one belonging to EPA START-2 and the other to EPA Las Vegas, were setup to count one minute intervals at 30 cm above the ground surface and electronically set allowing maximum sensitivity for the gamma-ray produced by ^{137}Cs. Data from the Ludlum 2221 and NaI probes were then compared with areas of known contamination to see the variance of the readings from the Ludlum and NaI probe versus the known surface soil concentrations, Table 5-1. While the data is qualitative only and not able to be validated, it was discovered that a count rate of 80,000 cpm above background for the EPA START-2 instrument and 50,000 cpm above background for EPA R&IE-LV instrument approximated 40 pCi/g ^{137}Cs. It should be noted that both these instruments were calibrated at separate facilities. Sensitivity of the instruments are dependent on width of the spectrum windows and high voltages settings.

The 80,000 cpm above background on the EPA START-2 instrument can be related back to Attachment B or C, which gives an approximate, count rate for START-2 instrument used during this process. It states that a count rate between 85,000 and 115,000 with a 3"x3" NaI would approximate 40 Ci/g theoretically until site-specific data is available.

Future discussions using the Ludlum 2221 and NaI probe should be to use this type of instrument for approximating 40 pCi/g during soil removal activities but should not be used as the final release criteria.

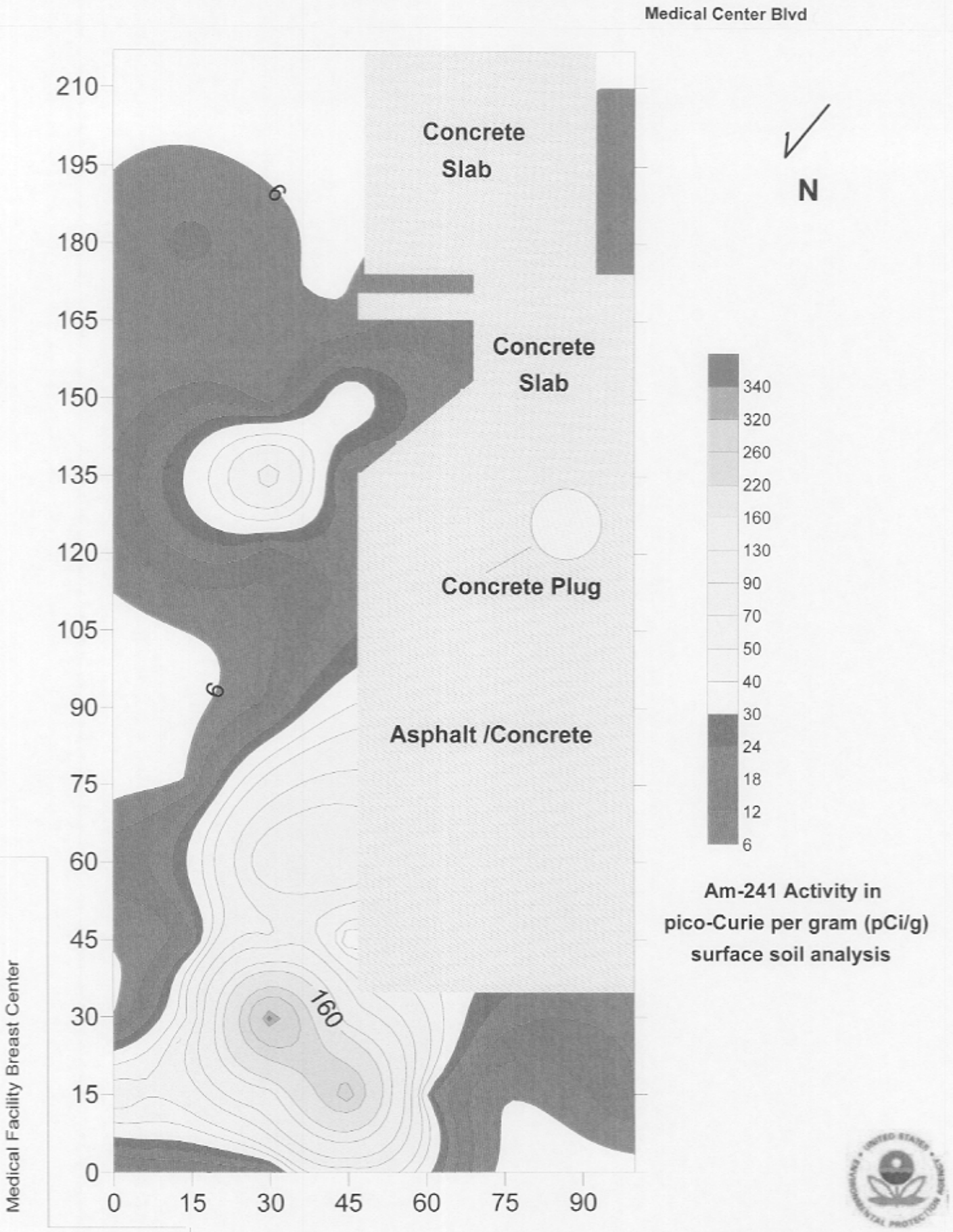

Medical Center Blvd
Concrete Slab
Concrete Slab
Concrete Plug
Asphalt /Concrete
N
340
320
260
220
160
130
90
70
50
40
30
24
18
12
6
6
6
160
Am-241 Activity in pico-Curie per gram (pCi/g) surface soil analysis
Medical Facility Breast Center
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210

FIGURE 5 - 1A

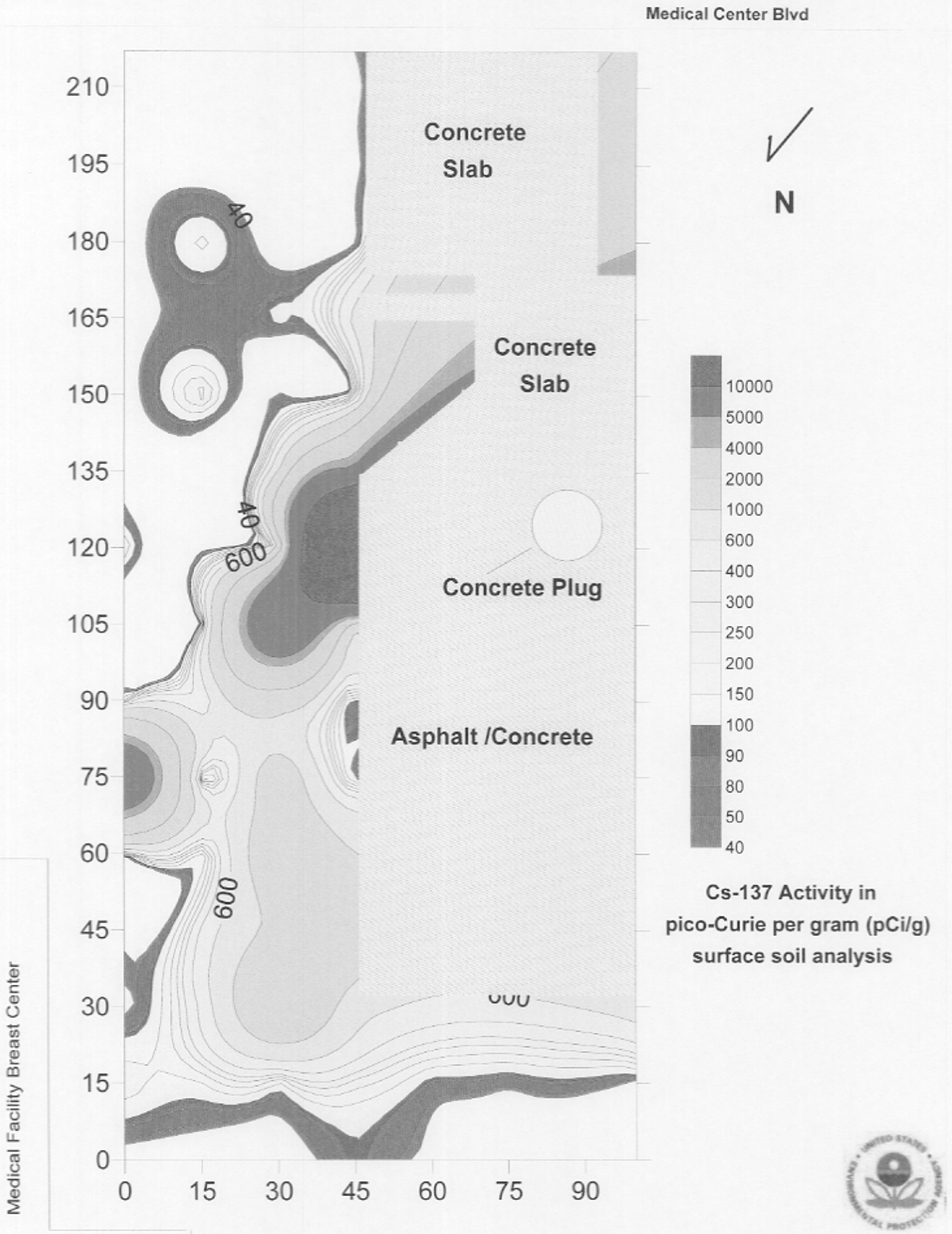
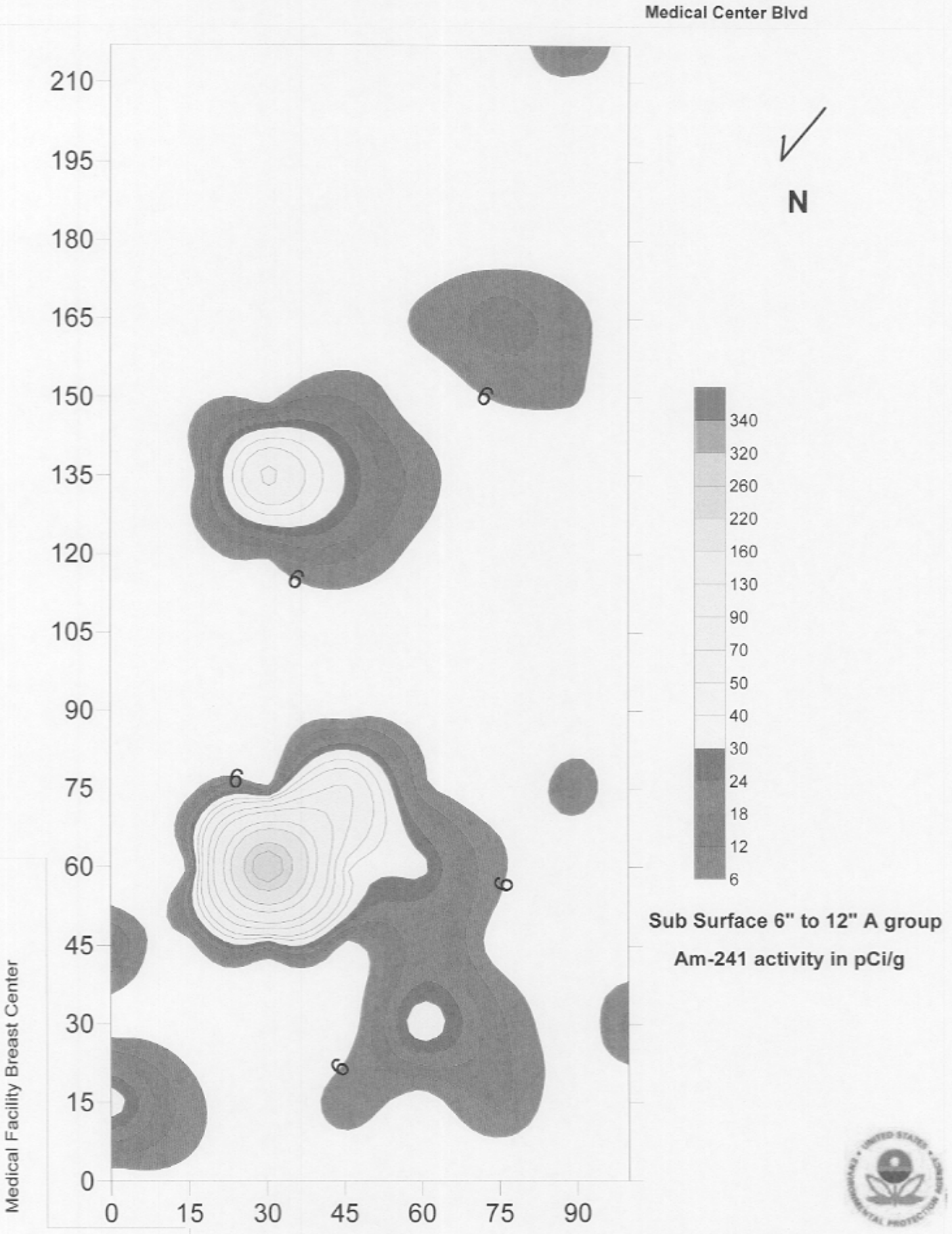

Medical Center Blvd
Concrete Slab
Concrete Slab
Concrete Plug
Asphalt /Concrete
40
40
600
600
600
N
10000
5000
4000
2000
1000
600
400
300
250
200
150
100
90
80
50
40
Cs-137 Activity in pico-Curie per gram (pCi/g) surface soil analysis
Medical Facility Breast Center
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210

FIGURE 5 - 1B

GULF NUCLEAR INDUSTRIES SOIL GAMMA SPECTROSCOPY ANALYSIS FOR SUPERFUND SITE ASSESSMENT
SURFACE SOIL SAMPLES 0" - 6" DEPTH

Sample ID	Sample type	Am-241 activity pCi/g	Am-241 error 2-sigma	Am-241 MDA	above 6 pCi/g Texas Reg	Cs-137 activity pCi/g	Cs-137 error 2-sigma	Cs-137 MDA	above 40 pCi/g Texas Reg		Surfer coordinate x-axis	Surfer coordinate y-axis
A1	Surface	6.72	0.58	2.70	x	6.26	0.24	0.28			0	0
A2	Surface	59.60	3.41	8.24	x	192.70	5.32	0.68	x		0	15
A2-Dup	Surface	90.53	5.08	4.82	x	266.60	7.33	0.85	x			
A3	Surface	5.65	0.55	2.78	x	16.47	0.51	0.23			0	30
A4	Surface	7.41	0.65	2.94	x	18.31	0.57	0.31			0	45
A5	Surface	17.12	1.09	3.10	x	24.12	0.72	0.24			0	60
A6	Surface	<MDA		39.40		9578.00	261.00	2.54	x		0	75
A7	Surface	<MDA		4.57		134.80	3.73	0.51	x		0	90
A8	Surface	<MDA		1.96		5.96	0.23	0.25			0	105
A9	Surface	<MDA		5.32		218.00	6.00	0.66	x		0	120
A10	Surface	<MDA		1.88		16.49	0.50	0.23			0	135
A11	Surface	6.85	0.57	2.21	x	5.19	0.21	0.20			0	150
A12	Surface	<MDA		1.45		2.11	0.12	0.24			0	165
A13	Surface	<MDA		1.48		2.01	0.12	0.25			0	180
A14	Surface	<MDA		1.44		1.79	0.10	0.23			0	195
A15	Surface	<MDA		1.49		2.31	0.13	0.19			0	210
A16	Surface	<MDA		2.01		14.74	0.47	0.26			0	217
B1	Surface	10.89	0.75	2.63	x	8.41	0.29	0.21			15	0
B1-Dup	Surface	12.12	0.91	3.04	x	30.15	0.89	0.51				
B2	Surface	60.45	3.39	3.38	x	144.30	3.99	0.44	x	trace Co-60	15	15
B2-Dup	Surface	143.80	7.76	2.90	x	130.10	3.60	0.54	x	trace Co-60		
B3	Surface	53.97	3.35	5.68	x	425.00	11.60	0.44	x		15	30
B4	Surface	15.73	1.46	9.78	x	425.60	11.60	0.45	x		15	45
B5	Surface	32.50	1.88	4.65	x	84.28	2.36	0.34	x		15	60
B6	Surface	7.23	0.76	4.46	x	56.09	1.60	0.47	x		15	75
B7	Surface	<MDA		6.94		412.90	11.30	0.41	x		15	90
B8	Surface	<MDA		1.64		11.43	0.37	0.22			15	105
B9	Surface	<MDA		2.00		26.15	0.77	0.29			15	120
B10	Surface	<MDA		2.19		27.54	0.82	0.28			15	135
B11	Surface	14.82	1.27	7.37	x	301.50	8.26	0.30	x		15	150
B12	Surface	7.16	0.67	4.77	x	49.46	1.41	0.32	x		15	165
B13	Surface	14.22	1.17	6.35	x	171.30	4.72	0.65	x		15	180
B14	Surface	<MDA		1.43		3.69	0.16	0.23			15	195
B15	Surface	<MDA		1.44		3.35	0.15	0.18			15	210
B16	Surface	<MDA		2.13		14.87	0.49	0.30			15	217
C1	Surface	12.67	0.91	2.85	x	6.50	0.25	0.29			30	0
C1-Dup	Surface	19.26	1.34	2.86	x	6.83	0.27	0.26				
C2	Surface	115.50	6.00	3.21	x	117.90	3.28	0.59	x		30	15
C2-Dup	Surface	107.90	5.92	3.68	x	130.10	3.61	0.55	x			
C3	Surface	355.10	18.80	14.20	x	2010.00	54.80	1.00	x		30	30
C4	Surface	68.68	4.21	21.20	x	1086.00	29.60	0.71	x		30	45
C5	Surface	113.70	6.59	22.00	x	1711.00	46.60	0.90	x		30	60
C6	Surface	<MDA		13.50		1506.00	41.10	0.80	x		30	75
C7	Surface	13.69	2.01	17.40	x	1317.00	35.90	0.76	x		30	90
C8	Surface	<MDA		43.20		9971.00	273.00	3.13	x		30	105
C9	Surface	14.06	1.41	9.25	x	442.90	12.10	0.43	x		30	120
C10	Surface	81.10	4.51	8.87	x	939.80	25.60	0.65	x		30	135
C11	Surface	6.71	0.67	3.96	x	73.77	2.06	0.39	x		30	150
C12	Surface	<MDA		4.26		130.00	3.60	0.58	x		30	165
C12-Dup	Surface	<MDA		7.71		329.30	9.08	0.45	x			
C13	Surface	<MDA		1.43		5.12	0.20	0.19			30	180
C14	Surface	<MDA		1.26		1.41	0.09	0.17			30	195
C15	Surface	0.69	0.22	1.28		0.60	0.07	0.26			30	210
C16	Surface	<MDA		1.10		0.57	0.06	0.16			30	217
D1	Surface	58.22	3.30	6.28	x	104.50	2.92	0.68	x		45	0
D1-Dup	Surface	31.70	2.07	5.43	x	64.55	1.86	0.54	x			
D2	Surface	286.10	15.20	4.91	x	222.10	6.11	0.50	x		45	15
D2-Dup	Surface	138.90	7.63	5.27	x	255.00	7.01	0.73	x			
D3	Surface	108.20	6.17	7.54	x	728.30	19.90	0.51	x		45	30
D4	Surface	28.99	2.46	15.10	x	1329.00	36.20	0.85	x		45	45
D5	Surface	121.20	6.83	17.60	x	1007.00	27.50	0.73	x		45	60
D5-Dup	Surface	44.39	2.99	13.30	x	740.30	20.20	0.55	x			
D6	Surface	<MDA		2.93		35.92	1.05	0.36			45	75
D7	Surface	<MDA		2.24		17.68	0.56	0.29			45	90
D8	Surface	<MDA		9.58		591.50	16.20	1.13	x		45	105
D9	Surface	<MDA		676.00		35330.00	976.00	54.40	x		45	120

Sample ID	Sample type	Am-241 activity pCi/g	Am-241 error 2-sigma	Am-241 MDA	above 6 pCi/g Texas Reg	Cs-137 activity pCi/g	Cs-137 error 2-sigma	Cs-137 MDA	above 40 pCi/g Texas Reg		Surfer coordinate x-axis	Surfer coordinate y-axis
D10	Surface	14.05	6.40	20.90	x	5592.00	152.00	1.73	x		45	135
D11	Surface	38.43	2.30	3.12	x	95.76	2.67	0.51	x		45	150
D12	Surface	6.88	1.27	8.79	x	701.30	19.20	0.54	x		45	165
D13	Surface	<MDA		1.77		9.03	0.31	0.22			45	180
D14	Surface	<MDA		1.35		1.55	0.10	0.23			45	195
D15	Surface	<MDA		1.93		4.91	0.22	0.28			45	210
D16	Surface	<MDA		2.83		36.77	1.09	0.34			45	217
E1	Surface	<MDA		3.17		31.07	0.95	0.36			60	0
E2	Surface	26.89	1.65	4.93	x	70.99	1.99	0.41	x		60	15
E2-Dup	Surface	12.63	0.92	3.35	x	31.27	0.92	0.30				
F1	Surface	<MDA		2.19		13.88	0.46	0.28			75	0
F1-Dup	Surface	<MDA		1.94		11.16	0.93	0.23				
F2	Surface	6.42	0.65	2.71	x	50.91	1.45	0.44	x		75	15
F2-Dup	Surface	7.74	0.75	4.21	x	92.22	2.57	0.40	x			
G1	Surface	<MDA		1.97		9.01	0.33	0.28			90	0
G1-Dup	Surface	<MDA		2.06		8.30	0.32	0.31				
G2	Surface	10.95	1.12	3.75	x	75.61	2.16	0.73	x		90	15
G2-Dup	Surface	11.92	1.09	5.54	x	68.59	1.98	0.57	x			
H1	Surface	2.81	0.49	3.62		28.54	0.88	0.41			100	0
H1-Dup	Surface	2.82	0.61	3.40		37.51	1.15	0.41				
H2	Surface	18.37	1.36	3.59	x	22.46	0.73	0.47			100	15
H2-Dup	Surface	17.52	1.22	3.97	x	36.99	1.09	0.34				


Medical Center Blvd
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Medical Facility Breast Center
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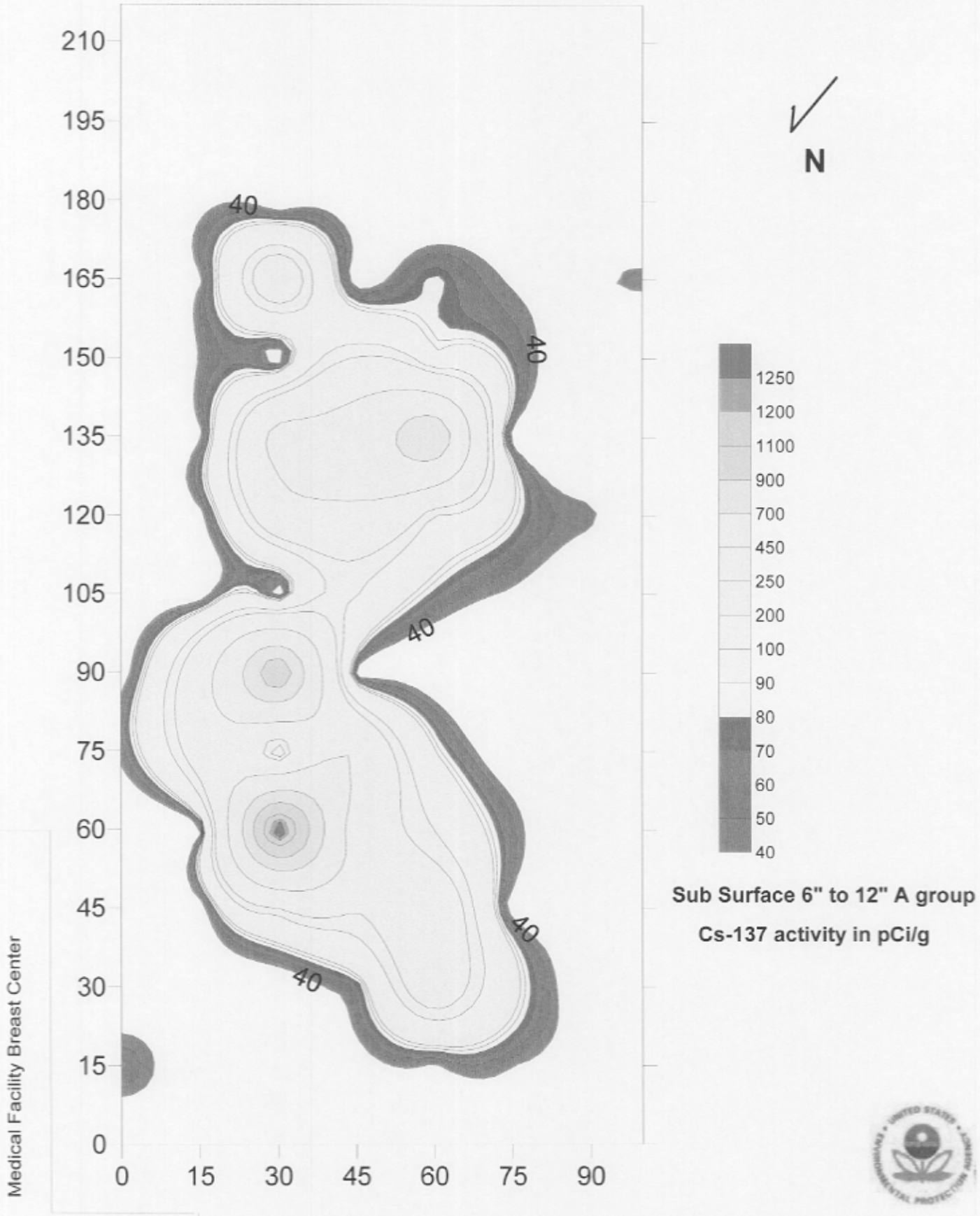
340
320
260
220
160
130
90
70
50
40
30
24
18
12
6
Sub Surface 6" to 12" A group
Am-241 activity in pCi/g

FIGURE 5 - 2A


Medical Center Blvd
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0
15
30
45
60
75
90
40
40
40
40
1250
1200
1100
900
700
450
250
200
100
90
80
70
60
50
40
Sub Surface 6" to 12" A group
Cs-137 activity in pCi/g
Medical Facility Breast Center

FIGURE 5 - 2B

GULF NUCLEAR INDUSTRIES SOIL GAMMA SPECTROSCOPY ANALYSIS FOR SUPERFUND SITE ASSESSMENT
SUB-SURFACE SOIL SAMPLES 6" - 12"

Sample ID	Sample type	Am-241 activity pCi/g	Am-241 error 2-sigma	Am-241 MDA	above 6 pCi/g Texas Reg	Cs-137 activity pCi/g	Cs-137 error 2-sigma	Cs-137 MDA	above 40 pCi/g Texas Reg		Surfer coordinate x-axis	Surfer coordinate y-axis
A1-SB-A-DUP	6" - 12"	<MDA		3.62		5.36	0.34	0.59			0	0
A2-SB-A	6" - 12"	37.47	2.65	8.19	x	66.16	2.00	0.65	x		0	15
A3-SB-A-DUP	6" - 12"			6.15		8.45	0.42	0.74			0	30
A4-SB-A-DUP	6" - 12"	21.35	1.67	5.10	x	34.71	1.10	0.60			0	45
A7-SB-A-DUP	6" - 12"	<MDA		3.87		9.78	0.43	0.50			0	90
A9-SB-A-DUP	6" - 12"	<MDA		3.89		29.09	0.95	0.54			0	120
A10-SB-A-DUP	6" - 12"	<MDA		3.22		5.79	0.31	0.58			0	135
A11-SB-A-DUP	6" - 12"	<MDA		2.75		6.58	0.32	0.47			0	150
A12-SB-A-DUP	6" - 12"	<MDA		3.54		0.92	0.17	0.59			0	165
A13-SB-A-DUP	6" - 12"	<MDA		3.50		0.95	0.17	0.55			0	180
B3-SB-A	6" - 12"	<MDA		3.18		14.68	0.54	0.49			15	30
B4-SB-A	6" - 12"	<MDA		2.28		13.91	0.47	0.29			15	45
B4-SB-A-DUP	6" - 12"	<MDA		5.76		93.26	2.69	0.75	x			
B5-SB-A	6" - 12"	2.24	0.41	1.88		7.33	0.29	0.30			15	60
B6-SB-A	6" - 12"	<MDA		7.82		327.10	9.01	1.21	x		15	75
B8-SB-A	6" - 12"	<MDA		1.61		0.84	0.09	0.24			15	105
B8-SB-A-DUP	6" - 12"	<MDA		2.65		7.06	0.33	0.42				
B9-SB-A	6" - 12"	<MDA		2.85		23.37	0.74	0.31			15	120
B9-SB-A-DUP	6" - 12"	<MDA		2.45		12.90	0.46	0.31				
B10-SB-A	6" - 12"	<MDA		4.13		26.32	0.89	0.55			15	135
B12-SB-A	6" - 12"	<MDA		3.20		31.45	1.00	0.50			15	165
B14-SB-A	6" - 12"	<MDA		3.60		5.59	0.33	0.53			15	195
B15-SB-A	6" - 12"	<MDA		2.47		2.60	0.20	0.40			15	210
B16-SB-A	6" - 12"	<MDA		2.80		2.08	0.19	0.45			15	217
C2-SB-A	6" - 12"	<MDA		2.80		0.51	0.13	0.44			30	15
C3-SB-A	6" - 12"	<MDA		2.63		0.44	0.13	0.46			30	30
C4-SB-A	6" - 12"	13.33	1.37	9.50	x	233.80	6.48	0.89	x		30	45
C5-SB-A	6" - 12"	339.20	18.40	13.30	x	1407.00	38.40	1.04	x		30	60
C6-SB-A	6" - 12"	<MDA		4.78		106.20	3.00	0.72			30	75
C6-SB-A-DUP	6" - 12"	150.30	9.27	30.60	x	2615.00	71.30	1.51	x			
C7-SB-A	6" - 12"	<MDA		15.40		1140.00	31.10	0.95	x		30	90
C8-SB-A	6" - 12"	<MDA		1.53		2.72	0.17	0.28			30	105
C9-SB-A	6" - 12"	5.88	1.22	8.53	x	379.50	0.10	1.24	x		30	120
C10-SB-A	6" - 12"	81.00	4.95	20.20	x	537.00	14.70	1.60	x		30	135
C11-SB-A	6" - 12"	<MDA		1.90		0.41	0.09	0.30			30	150
C11-SB-A-DUP	6" - 12"	<MDA		4.36		21.86	0.79	0.62				
C12-SB-A	6" - 12"	<MDA		11.50		398.70	11.00	1.34			30	165
C13-SB-A	6" - 12"	<MDA		2.19		0.49	0.10	0.32			30	180
C14-SB-A	6" - 12"	<MDA		2.54		0.71	0.13	0.37			30	195
C15-SB-A	6" - 12"	<MDA		2.52		<MDA		0.48			30	210
D2-SB-A	6" - 12"	10.43	0.96	3.90	x	20.75	0.68	0.41			45	15
D3-SB-A	6" - 12"	<MDA		3.63		58.27	1.68	0.47	x		45	30
D4-SB-A	6" - 12"	<MDA		6.87		256.50	7.07	0.81	x		45	45
D5-SB-A	6" - 12"	41.58	3.05	13.30	x	324.40	9.00	1.19	x		45	60
D6-SB-A	6" - 12"	77.81	4.68	16.10	x	449.10	12.30	0.63	x		45	75
D7-SB-A	6" - 12"	<MDA		2.77		12.12	0.49	0.52			45	90
D8-SB-A	6" - 12"	<MDA		7.41		207.10	5.79	0.93			45	105
D8-SB-A-DUP	6" - 12"	<MDA		4.37		52.40	1.58	0.65	x			
D12-SB-A	6" - 12"	<MDA		2.87		10.55	0.43	0.36			45	165
D12-SB-A-DUP	6" - 12"	5.30	1.37	6.75	x	199.80	5.63	0.87	x			
D13-SB-A	6" - 12"	<MDA		2.39		<MDA		0.39			45	180
D14-SB-A	6" - 12"	<MDA		2.72		<MDA		0.46			45	195
D15-SB-A	6" - 12"	<MDA		2.35		<MDA		0.39			45	210
D16-SB-A	6" - 12"	<MDA		2.43		8.44	0.34	0.31			45	217
E2-SB-A	6" - 12"	<MDA		4.23		32.25	1.02	0.50			60	15
E3-SB-A	6" - 12"	39.53	2.72	14.60	x	360.40	9.93	1.31	x		60	30
E4-SB-A	6" - 12"	20.87	1.92	11.20	x	378.10	10.40	1.43	x		60	45
E5-SB-A	6" - 12"	33.73	2.58	11.60	x	199.70	5.62	1.14	x		60	60
E6-SB-A	6" - 12"	7.28	0.95	7.15	x	102.40	2.90	0.50	x	trace Co-60	60	75
E7-SB-A	6" - 12"	<MDA		3.03		14.58	0.54	0.41			60	90
E8-SB-A	6" - 12"	<MDA		1.49		<MDA		0.26			60	105
E9-SB-A	6" - 12"	2.99	0.86	4.76		185.50	5.17	1.03	x		60	120
E10-SB-A	6" - 12"	9.39	2.25	16.20	x	939.30	25.70	0.77	x		60	135
E11-SB-A	6" - 12"	<MDA		4.86		109.60	3.09	0.62	x		60	150
E12-SB-A	6" - 12"	7.90	1.01	4.80	x	91.12	2.60	0.61	x		60	165
E12-SB-A-DUP	6" - 12"	8.98	1.00	4.81	x	140.20	3.91	0.72	x			

Sample ID	Sample type	Am-241 activity pCi/g	Am-241 error 2-sigma	Am-241 MDA	above 6 pCi/g Texas Reg	Cs-137 activity pCi/g	Cs-137 error 2-sigma	Cs-137 MDA	above 40 pCi/g Texas Reg		Surfer coordinate x-axis	Surfer coordinate y-axis
E13-SB-A	6" - 12"	<MDA		1.80		0.16	0.07	0.28			60	180
E14-SB-A	6" - 12"	<MDA		1.43		0.82	0.08	0.23			60	195
E15-SB-A	6" - 12"	<MDA		3.47		24.42	0.82	0.46			60	210
E16-SB-A	6" - 12"	<MDA		3.17		17.89	0.60	0.38			60	217
F1-SB-A	6" - 12"	<MDA		3.22		19.24		0.45			75	0
F2-SB-A	6" - 12"	13.91	1.19	3.73	x	39.45	1.19	0.47	x		75	15
F4-SB-A	6" - 12"	<MDA		2.21		12.70	0.44	0.30			75	45
F6-SB-A	6" - 12"	<MDA		2.11		3.92	0.20	0.28			75	75
F8-SB-A	6" - 12"	2.95	0.50	3.45		36.71	1.09	0.35			75	105
F10-SB-A	6" - 12"	<MDA		2.71		6.06	0.31	0.39			75	135
F12-SB-A	6" - 12"	17.06	1.35	6.20	x	36.79	1.12	0.43			75	165
F13-SB-A	6" - 12"	<MDA		2.02		<MDA		0.30			75	180
F14-SB-A	6" - 12"	<MDA		1.48		0.92	0.09	0.23			75	195
F15-SB-A	6" - 12"	<MDA		4.91		24.96	0.92	0.65			75	210
F16-SB-A	6" - 12"	<MDA		1.70		1.92	0.13	0.24			75	217
G1-SB-A	6" - 12"	<MDA		2.81		5.67	0.29	0.38			90	0
G2-SB-A	6" - 12"	<MDA		3.13		22.99	0.75	0.43			90	15
G3-SB-A	6" - 12"	<MDA		2.60		6.32	0.29	0.44			90	30
G4-SB-A	6" - 12"	2.93	0.61	4.26		18.72	0.67	0.46			90	45
G5-SB-A	6" - 12"	<MDA		1.80		5.07	0.21	0.22			90	60
G6-SB-A	6" - 12"	10.51	0.95	4.64	x	40.03	1.19	0.41	x		90	75
G7-SB-A	6" - 12"	2.61	0.59	3.42		22.10	0.74	0.44			90	90
G8-SB-A	6" - 12"	<MDA		2.58		12.07	0.45	0.35			90	105
G9-SB-A	6" - 12"	<MDA		4.08		46.44	1.39	0.46	x		90	120
G10-SB-A	6" - 12"	<MDA		2.68		25.58	0.79	0.32			90	135
G11-SB-A	6" - 12"	6.72	0.67	2.56	x	11.83	0.41	0.29			90	150
G12-SB-A	6" - 12"	8.58	0.90	4.34	x	40.29	1.22	0.43	x		90	165
G13-SB-A	6" - 12"	<MDA		2.00		6.05	0.27	0.33			90	180
G14-SB-A	6" - 12"	<MDA		1.50		0.74	0.08	0.22			90	195
G15-SB-A	6" - 12"	3.25	0.70	3.87		41.15	1.29	0.68	x		90	210
G16-SB-A	6" - 12"	18.01	1.42	6.19	x	27.99	0.89	0.46			90	217
H1-SB-A	6" - 12"	<MDA		1.49		0.89	0.09	0.22			100	0
H2-SB-A	6" - 12"	<MDA		3.12		17.52	0.61	0.42			100	15
H3-SB-A	6" - 12"	14.88	1.29	5.03	x	28.41	0.92	0.46			100	30
H4-SB-A	6" - 12"	<MDA		3.83		27.68	0.93	0.60			100	45
H5-SB-A	6" - 12"	1.86	0.42	2.87		10.55	0.40	0.33			100	60
H6-SB-A	6" - 12"	<MDA		1.97		1.32	0.12	0.32			100	75
H7-SB-A	6" - 12"	3.93	0.60	3.21		19.60	0.64	0.35		trace Co-60	100	90
H8-SB-A	6" - 12"	4.81	0.57	3.41		12.45	0.43	0.29			100	105
H9-SB-A	6" - 12"	<MDA		1.98		6.96	0.27	0.28			100	120
H10-SB-A	6" - 12"	3.47	0.71	4.77		13.88	0.55	0.65			100	135
H11-SB-A	6" - 12"	<MDA		2.63		10.14	0.40	0.37			100	150
H12-SB-A	6" - 12"	<MDA		4.08		45.15	1.35	0.48	x		100	165
H13-SB-A	6" - 12"	<MDA		1.61		10.63	0.36	0.26			100	180
H14-SB-A	6" - 12"	<MDA		1.90		4.03	0.20	0.26			100	195
H15-SB-A	6" - 12"	<MDA		2.39		4.41	0.23	0.37			100	210
H16-SB-A	6" - 12"	<MDA		2.21		2.95	0.17	0.29			100	217

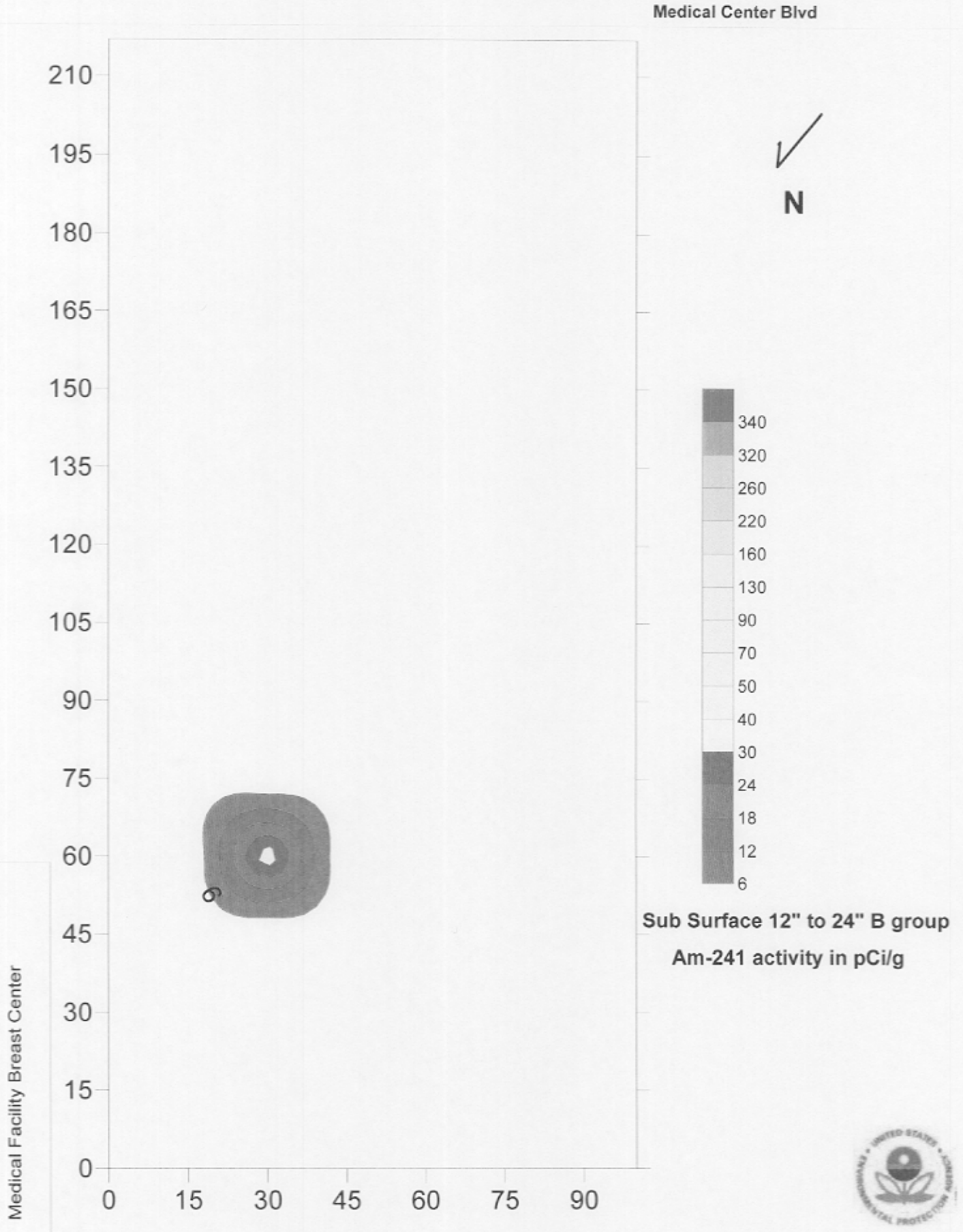
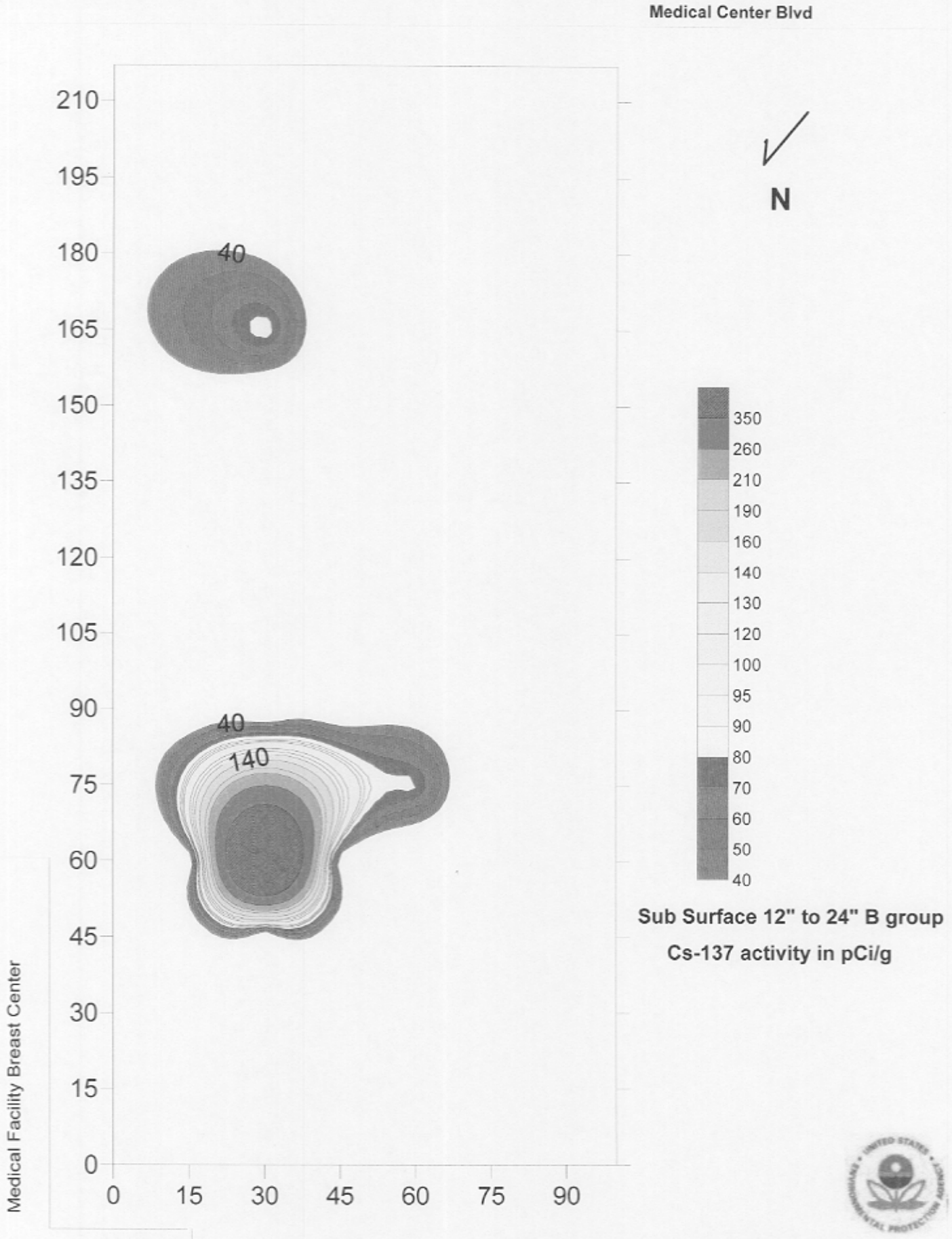

Medical Center Blvd
N
340
320
260
220
160
130
90
70
50
40
30
24
18
12
6
Sub Surface 12" to 24" B group
Am-241 activity in pCi/g
Medical Facility Breast Center
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210

FIGURE 5 - 3A



Sub Surface 12" to 24" B group

Cs-137 activity in pCi/g

FIGURE 5 - 3B

GULF NUCLEAR INDUSTRIES SOIL GAMMA SPECTROSCOPY ANALYSIS FOR SUPERFUND SITE ASSESSMENT
SUB-SURFACE SOIL SAMPLES 12" - 24"

Sample ID	Sample type	Am-241 activity pCi/g	Am-241 error 2-sigma	Am-241 MDA	above 6 pCi/g Texas Reg	Cs-137 activity pCi/g	Cs-137 error 2-sigma	Cs-137 MDA	above 40 pCi/g Texas Reg		Surfer coordinate x-axis	Surfer coordinate y-axis
A2-SB-B-DUP	12" - 24"	<MDA		3.70		4.64	0.28	0.48			0	15
A3-SB-B	12" - 24"	2.37	0.52	3.40		2.78	0.20	0.44			0	30
A4-SB-B-DUP	12" - 24"	<MDA		2.64		1.91	0.16	0.36			0	45
A6-SB-B	12" - 24"	<MDA		3.66		1.15	0.18	0.51			0	75
A7-SB-B-DUP	12" - 24"	<MDA		2.86		4.29	0.25	0.44			0	90
A8-SB-B	12" - 24"	<MDA		3.31		0.40	0.13	0.44			0	105
A9-SB-B	12" - 24"	<MDA		1.98		0.52	0.09	0.36			0	120
A10-SB-B	12" - 24"	<MDA		3.42		<MDA		0.49			0	135
A11-SB-B-DUP	12" - 24"	<MDA		2.67		<MDA		0.50			0	150
A12-SB-B-DUP	12" - 24"	<MDA		2.94		<MDA		0.53			0	165
A13-SB-B-DUP	12" - 24"	<MDA		3.89		<MDA		0.56			0	180
B2-SB-B-DUP	12" - 24"	3.13	0.62	3.20		15.98	0.61	0.45			15	15
B4-SB-B	12" - 24"	<MDA		1.81		0.16	0.07	0.25			15	45
B5-SB-B	12" - 24"	<MDA		2.93		0.34	0.11	0.40			15	60
B7-SB-B	12" - 24"	<MDA		1.70		5.80	0.24	0.25			15	90
B8-SB-B	12" - 24"	<MDA		1.67		<MDA		0.24			15	105
B9-SB-B	12" - 24"	<MDA		2.45		8.69	0.34	0.37			15	120
C2-SB-B	12" - 24"	<MDA		1.64		<MDA		0.29			30	15
C3-SB-B	12" - 24"	<MDA		1.93		0.15	0.07	0.30			30	30
C4-SB-B	12" - 24"	<MDA		1.71		0.21	0.08	0.29			30	45
C5-SB-B	12" - 24"	35.48	3.01	22.80	x	761.80	20.90	0.69	x		30	60
C6-SB-B	12" - 24"	<MDA		1.36		<MDA		0.24			30	75
C7-SB-B	12" - 24"	<MDA		2.44		2.44	0.17	0.38			30	90
C7-SB-B-DUP	12" - 24"	<MDA		1.98		7.23	0.29	0.30				
C8-SB-B	12" - 24"	<MDA		1.64		1.33	0.10	0.22			30	105
C9-SB-B	12" - 24"	<MDA		2.26		9.77	0.37	0.34			30	120
C10-SB-B	12" - 24"	<MDA		1.68		0.92	0.10	0.34			30	135
C11-SB-B	12" - 24"	<MDA		2.04		0.22	0.08	0.31			30	150
C12-SB-B	12" - 24"	<MDA		5.90		92.11	2.65	0.69	x		30	165
C14-SB-B	12" - 24"	<MDA		2.48		1.28	0.17	0.48			30	195
C15-SB-B	12" - 24"	<MDA		1.79		<MDA		0.31			30	210
D2-SB-B	12" - 24"	<MDA		1.29		<MDA		0.23			45	15
D3-SB-B	12" - 24"	2.91	0.51	2.37		19.40	0.64	0.33			45	30
D4-SB-B	12" - 24"	<MDA		1.52		0.62	0.08	0.27			45	45
D5-SB-B	12" - 24"	<MDA		4.73		9.53	0.50	0.80			45	60
D6-SB-B	12" - 24"	<MDA		1.91		<MDA		0.31			45	75
D7-SB-B	12" - 24"	<MDA		3.48		11.33	0.50	0.53			45	90
D12-SB-B	12" - 24"	<MDA		2.65		6.39	0.31	0.44			45	165
D13-SB-B	12" - 24"	<MDA		2.38		0.20	0.09	0.32			45	180
D14-SB-B	12" - 24"	<MDA		1.98		<MDA		0.32			45	195
D15-SB-B	12" - 24"	<MDA		2.35		0.18	0.09	0.34			45	210
D16-SB-B	12" - 24"	<MDA		1.93		0.19	0.08	0.34			45	217
E2-SB-B	12" - 24"	<MDA		1.83		0.40	0.08	0.31			60	15
E4-SB-B	12" - 24"	<MDA		1.40		0.28	0.06	0.24			60	45
E5-SB-B	12" - 24"	<MDA		2.61		1.42	0.14	0.40			60	60
E6-SB-B	12" - 24"	<MDA		7.06		86.48	2.58	0.68	x		60	75
E7-SB-B	12" - 24"	<MDA		3.20		<MDA		0.59			60	90
E8-SB-B	12" - 24"	<MDA		1.61		<MDA		0.28			60	105
E9-SB-B	12" - 24"	<MDA		1.72		1.12	0.11	0.29			60	120
E10-SB-B	12" - 24"	<MDA		1.76		2.45	0.15	0.26			60	135
E11-SB-B	12" - 24"	<MDA		2.26		8.79	0.33	0.29			60	150
E12-SB-B	12" - 24"	4.58	0.62	3.58		17.24	0.58	0.41			60	165
E13-SB-B	12" - 24"	<MDA		2.95		0.57	0.13	0.42			60	180
E14-SB-B	12" - 24"	<MDA		1.86		<MDA		0.33			60	195
E15-SB-B	12" - 24"	<MDA		1.92		<MDA		0.36			60	210
E16-SB-B	12" - 24"	<MDA		2.19		0.72	0.11	0.37			60	217
F1-SB-B	12" - 24"	<MDA		1.83		<MDA		0.35			75	0
F2-SB-B	12" - 24"	<MDA		2.63		10.01	0.38	0.37			75	15
F3-SB-B	12" - 24"	<MDA		1.85		0.26	0.07	0.24			75	30
F4-SB-B	12" - 24"	<MDA		1.64		0.78		0.27			75	45
F6-SB-B	12" - 24"	<MDA		1.57		0.23	0.07	0.23			75	75
F7-SB-B	12" - 24"	<MDA		2.13		5.30	0.24	0.28			75	90
F8-SB-B	12" - 24"	<MDA		2.06		4.58	0.21	0.28			75	105
F10-SB-B	12" - 24"	<MDA		1.86		0.49	0.08	0.26			75	135
F11-SB-B	12" - 24"	<MDA		1.72		0.82	0.09	0.22			75	150
F12-SB-B	12" - 24"	<MDA		2.02		0.80	0.10	0.35			75	165

Sample ID	Sample type	Am-241 activity pCi/g	Am-241 error 2-sigma	Am-241 MDA	above 6 pCi/g Texas Reg	Cs-137 activity pCi/g	Cs-137 error 2-sigma	Cs-137 MDA	above 40 pCi/g Texas Reg		Surfer coordinate x-axis	Surfer coordinate y-axis
F13-SB-B	12" - 24"	<MDA		1.64		<MDA		0.26			75	180
F14-SB-B	12" - 24"	<MDA		1.57		<MDA		0.23			75	195
F15-SB-B	12" - 24"	<MDA		2.14		0.68	0.10	0.35			75	210
F16-SB-B	12" - 24"	<MDA		1.58		0.49	0.07	0.20			75	217
G1-SB-B	12" - 24"	<MDA		1.89		1.82	0.13	0.31			90	0
G2-SB-B	12" - 24"	<MDA		2.56		3.96	0.24	0.61			90	15
G3-SB-B	12" - 24"	<MDA		1.68		<MDA		0.30			90	30
G4-SB-B	12" - 24"	<MDA		2.19		0.67	0.10	0.36			90	45
G5-SB-B	12" - 24"	<MDA		1.45		<MDA		0.24			90	60
G6-SB-B	12" - 24"	<MDA		2.39		1.05	0.11	0.30			90	75
G8-SB-B	12" - 24"	<MDA		2.02		1.18	0.11	0.30			90	105
G9-SB-B	12" - 24"	<MDA		2.05		4.08	0.20	0.29			90	120
G10-SB-B	12" - 24"	<MDA		1.43		0.80	0.08	0.18			90	135
G11-SB-B	12" - 24"	<MDA		1.58		2.20	0.13	0.23			90	150
G12-SB-B	12" - 24"	<MDA		2.06		2.48	0.16	0.29			90	165
G13-SB-B	12" - 24"	<MDA		2.19		<MDA		0.38			90	180
G14-SB-B	12" - 24"	<MDA		1.47		0.67	0.08	0.26			90	195
G15-SB-B	12" - 24"	<MDA		1.99		2.88	0.17	0.34			90	210
G16-SB-B	12" - 24"	<MDA		2.03		4.13	0.21	0.33			90	217
H1-SB-B	12" - 24"	<MDA		1.40		0.10	0.05	0.20			100	0
H2-SB-B	12" - 24"	<MDA		1.67		0.27	0.07	0.28			100	15
H3-SB-B	12" - 24"	<MDA		1.49		0.55	0.07	0.19			100	30
H4-SB-B	12" - 24"	<MDA		2.46		0.89	0.13	0.38			100	45
H5-SB-B	12" - 24"	<MDA		1.50		<MDA		0.26			100	60
H6-SB-B	12" - 24"	<MDA		1.89		0.19	0.07	0.28			100	75
H7-SB-B	12" - 24"	1.08	0.25	1.53		3.14	0.17	0.26			100	90
H8-SB-B	12" - 24"	<MDA		1.49		0.23	0.06	0.19			100	105
H9-SB-B	12" - 24"	<MDA		1.65		0.44	0.07	0.22			100	120
H10-SB-B	12" - 24"	3.32	0.64	4.95		34.32	1.07	0.57			100	135
H11-SB-B	12" - 24"	<MDA		2.01		3.24	0.18	0.43			100	150
H12-SB-B	12" - 24"	<MDA		2.67		0.95	0.15	0.53			100	165
H13-SB-B	12" - 24"	<MDA		1.43		0.19	0.06	0.24			100	180
H14-SB-B	12" - 24"	<MDA		1.82		1.20	0.11	0.31			100	195
H15-SB-B	12" - 24"	<MDA		1.60		0.20	0.06	0.21			100	210
H16-SB-B	12" - 24"	<MDA		1.69		0.40	0.08	0.30			100	217

GULF NUCLEAR INDUSTRIES SOIL GAMMA SPECTROSCOPY ANALYSIS FOR SUPERFUND SITE ASSESSMENT
Background Reference Samples taken off-site

Sample ID	Sample type	Am-241 activity pCi/g	Am-241 error 2-sigma	Am-241 MDA	above 6 pCi/g Texas Reg	Cs-137 activity pCi/g	Cs-137 error 2-sigma	Cs-137 MDA	above 40 pCi/g Texas Reg
Ref-1-S	bkg-surface	<MDA		1.76		<MDA		0.31	
Ref-1-SBA	bkg-subsurface 6-12in	<MDA		1.76		0.21	0.06	0.24	
Ref-1-bias-12"	bkg-subsurface 6-12in	<MDA		1.71		<MDA		0.27	
Ref-1-bias-24"	bkg-subsurface 12-24in	<MDA		2.20		<MDA		0.31	
Ref-2-S	bkg-surface	<MDA		1.76		<MDA		0.26	
Ref-2-SBA	bkg-subsurface 6-12in	<MDA		1.64		<MDA		0.24	
Ref-2-bias-12"	bkg-subsurface 6-12in	<MDA		1.68		<MDA		0.31	
Ref-2-bias-24"	bkg-subsurface 12-24in	<MDA		1.66		<MDA		0.25	

GULF NUCLEAR INDUSTRIES SOIL GAMMA SPECTROSCOPY ANALYSIS FOR SUPERFUND SITE ASSESSMENT
Miscellaneous Qualitative analysis as a hit/no hit for cesium-137

Sample ID	Sample type	> 5.0 Gammas Per Second on gamma spectroscopy system indicates above 40pCi/g	
B-11-SB-A	Sub-surface 6-12in	no	
B-13-SB-A	Sub-surface 6-12in	no	
B-14-SB-A-DUP	Sub-surface 6-12in	no	
C-7-SB-A-DUP	Sub-surface 6-12in	yes	5 x above
D-4-SB-A-DUP	Sub-surface 6-12in	yes	2 x above
D-9-SB-A	Sub-surface 6-12in	yes	8 x above
D-10-SB-B	Sub-surface 12-24in	no	
D-11-SB-A	Sub-surface 6-12in	no	
E-9-SB-A-DUP	Sub-surface 6-12in	yes	3 x above
E-10-SB-A-DUP	Sub-surface 6-12in	yes	extremely high
E-11-SB-A-DUP	Sub-surface 6-12in	yes	15 x above
E-13-Concrete	concrete sample	no	
E-14-Concrete	concrete sample	no	
E-15-Concrete	concrete sample	no	
E-16-Concrete	concrete sample	yes	at criteria
F-10-Concrete	concrete sample	yes	4 x above
F-11-Concrete	concrete sample	yes	3 x above
F-12-Concrete	concrete sample	yes	2 x above
F-13-Concrete	concrete sample	no	
F-14-Concrete	concrete sample	no	
G-13-Concrete	concrete sample	no	
H-13-Concrete	concrete sample	no	

6. RECOMMENDATIONS AND PROPOSED FUTURE ACTIONS

Based on analytical data obtained and survey results, the site contains areas of elevated radioactive contamination. After review of the analytical Surfer data, provided by EPA Las Vegas, and the excavation surface maps provided by START-2, it is the recommendation of both EPA Las Vegas and START-2 that six (6) inches of soil be removed from the entire site initially, followed by isolated lifts identified from the subsurface maps in conjunction with the use of live instrumentation. This will minimize the total volume of soil to be removed. The estimated volume of in place soil to be removed from the site is 395 yards. This estimate does not account for underground structures or other waste streams generated on site.

7. REFERENCES

Eisenbud, M.; Gesell, T. *Environmental Radioactivity From Natural, Industrial, and Military Sources*. Academic Press, San Diego, CA; 1997

Keckler, D. *User's Guide: Surfer for Windows*, Version 8. Golden Software Inc., Golden, CO; 20

Attachment A

Technical Direction Document (06-03-05-0001)

Attachment B

Quality Assurance Sampling Plan (QASP) and Amendments

REMOVAL ASSESSMENT
QUALITY ASSURANCE SAMPLING PLAN
FOR
WEBSTER-GULF NUCLEAR
HOUSTON, HARRIS COUNTY, TEXAS

Prepared for

U.S. Environmental Protection Agency Region 6
1445 Ross Avenue
Dallas, Texas 75202

Contract No. 68-W-01-005
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June 2003

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TABLE OF CONTENTS

Section **Page**

LIST OF APPENDICES

LIST OF FIGURES

1. INTRODUCTION

Weston Solutions, Inc. (WESTON®) Superfund Technical Assessment and Response Team (START-2) has been tasked by the U.S. Environmental Protection Agency (EPA) Region 6 under Contract Number 68-W-01-005, Technical Direction Document 06-03-05-0001 to perform a removal assessment of the Webster-Gulf Nuclear (Webster) site located in Houston, Harris County, Texas (Figure 1-1 and Figure 1-2). The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) identification number assigned to the site is TX0000605420. START-2 has prepared this Removal Assessment Quality Assurance Sampling Plan (QASP) to describe the technical scope of work to be completed as part of the removal assessment.

1.1 PROJECT OBJECTIVES

START-2 is providing technical assistance to EPA Region 6 for the performance of the removal assessment. The objectives of the removal assessment are to investigate the nature and extent of radiological contamination and possible migration from site. This phase of the investigation is being conducted to determine an estimated volume of material to be removed during the removal actions.

The objectives of the removal assessment will be achieved by evaluating data obtained from soil samples collected on-site. Soil samples will be collected from areas where historical site activities and potential migration of the contaminants of concern have occurred or have potentially occurred, and they will be analyzed for various radionuclides.

1.2 QASP FORMAT

This QASP has been organized in a format that is intended to facilitate and effectively meet the objective of the removal assessment. The QASP is organized as follows:

- Section 1 - Introduction
- Section 2 - Site Background
- Section 3 - Sampling Approach and Procedures
- Section 4 - Quality Assurance

All figures and tables are included at the end of each representative section. Appendix A is attached with Initial Site Investigation Results.

Figure 1-1

Site Location Map

Figure 1-2

Site Area Map

2. SITE BACKGROUND

Information regarding the site location, site history, and description, and previous investigation conducted at the site are presented in the following subsections.

2.1 SITE LOCATION

The Webster site is located on 0.224 acres of land at 202 Medical Center Blvd. Houston, Harris County, Texas (Figure 1-2). The geographic center of the site is Latitude 29.54250° North and Longitude 95.12458°West.

2.2 SITE HISTORY AND DESCRIPTION

The Webster facility was owned and operated by Gulf Nuclear Industries. Webster prepared radiation sources for the medical and oil field industries. In 1983, an inadvertent breach of a 3 curie americium-beryllium source prompted an extensive investigation and facility survey. Webster ceased production in 1991 and continues to be in bankruptcy proceedings. The EPA and United States Army Corps of Engineers (USACE) have completed a site survey of radiation and building demolition and determined that site contamination is above normal background levels with alpha, beta and gamma sources of radiation.

2.3 PREVIOUS INVESTIGATIONS

Texas Department of Health Bureau of Radiation Control monitored both Webster Gulf Nuclear and Tavenor (Webster's sister site) from 1983 to present day. The monitoring was initiated because of an incidence with an inadvertent breach of three curie americium-beryllium sources at the Webster Site. In 1983, this incident prompted an extensive investigation and facility survey.

Figure 2-1

Proposed On-Site Sample Locations

3. SAMPLING APPROACH AND PROCEDURES

3.1 OVERVIEW OF SAMPLING ACTIVITIES

The Federal On-Scene Coordinator (FOSC) proposed that soil samples should be collected utilizing a Multi-Agency Radiation Survey and Sampling Investigation Manual (MARSSIM) based type radiological survey of soil contamination. Background samples will be taken at Las Vegas. The results of this sampling scheme will provide information necessary for planning for potential subsequent removal activities. Additional sampling may be performed upon request by the FOSC.

3.1.1 Health and Safety Plan Implementation

The removal assessment field activities will be conducted in accordance with the site-specific Health and Safety Plan (HASP). In general, the HASP specifies that work will proceed in Level D. Individuals present on site will be required to wear both Therma-luminescence dosimeter (TLD) badges and dosimeters. The Site Health and Safety Coordinator (SHSC) will be responsible for implementation of the HASP during the field investigation activities. All START-2 subcontractors will be required to conduct work according to the guidelines and requirements of the HASP. In accordance with the START-2 general health and safety operating procedures, the field team will also drive the route to the hospital specified in the HASP prior to initiating sampling activities.

3.2 SAMPLING

3.2.1 Soil Sampling

Figure 2-1 provides the 114 proposed sampling points for the Webster site and the background sample points. Each sample point will be sampled to a depth of 45 centimeters (cm) (2 feet) using a slam bar sampling method. Each core will be divided into two samples, 15-30 cm (6 to 12 inches) and 30-45 cm (12 to 18 inches). The results of this sampling scheme will provide information necessary for planning for potential subsequent removal activities. Sleeve ends will be labeled after extraction to indicate top from bottom. Sample cores will be divided utilizing dedicated disposable plastic equipment.

3.2.2 Sampling and Sample Handling Procedures

Samples will be collected using equipment and procedures appropriate to the matrix, parameters, and sampling objectives. All samples will be wiped down with a clean cloth and swiped. The swipes will be analyzed on a swipe counter to insure no contamination is present on outside of sampling container. Samples will then be placed in a ziploc bag for storage. The nature of the sample does not require any preservation techniques other than sealed containers. Samples can be held for up to 30 years. The volume of the sample collected must be between 50 and 500 grams (g) in order to perform the analysis requested.

All clean, decontaminated sampling equipment and sample containers will be maintained in a clean, segregated area. All samples will be collected with clean, decontaminated equipment (SOP 1201.01). All samples collected for laboratory analysis will be placed directly into pre-cleaned, unused glass or plastic containers. Sampling personnel will change gloves between each sample collection/handling. All samples will be assembled and catalogued prior to shipping (SOPs 1101.01 and 1102.01) to the designated laboratory.

3.2.3 Quality Assurance Samples

START-2 will collect field duplicate samples of soil from two sample locations. A duplicate sample will be taken of both a background and above background sample location. Quality assurance/quality control (QA/QC) samples will be collected according to the following:

- Field duplicate soil samples will be collected during sampling activities at locations selected by the START-2. The data obtained from these samples will be used to assist in the quality assurance of the sampling procedures and laboratory analytical data by allowing an evaluation of reproducibility of results. Efforts will be made to collect a duplicate sample in a location where contamination is suspected and in a sample location where contamination is not suspected. Field duplicate samples will be collected at the rate of one duplicate for every 10 samples collected.

3.3 SAMPLE MANAGEMENT

3.3.1 Sample Identification

The specific nomenclature used by START-2 will provide a consistent means of facilitating the sampling and overall data management for the project (SOP 0110.04).

As stated in SOP 0110.04, sample nomenclature will follow a general format regardless of the type or location of the sample collected. The general nomenclature consists of the following components.

- Sample Location (As labeled and marked on initial site investigation).
- Sample Type [Surface Water (SW), Soil (S), Groundwater (GW), Air (A)].
- QA/QC (N = Normal, D = Duplicate).

3.4 DECONTAMINATION

The nondisposable sampling equipment (plastic scopes) will be disposed of after each sample.

3.5 SAMPLE PRESERVATION, CONTAINERS, AND HOLD TIMES

Once collected, samples will be stored in sealed containers in an uncontaminated area of the site until they are submitted for analysis. Samples will be analyzed by the EPA-ORIA Las Vegas laboratory.

3.6 SAMPLE ANALYSIS ON-SITE

Soil samples collected will be analyzed on location using a portable gamma spectroscopy system by EPA-ORIA Las Vegas. The gamma spectroscopy system utilizes a High Purity Germanium Detector with a portable shield to reduce background levels and Canberra gamma spectroscopy Genie 2000 software package version 1.3. Soil samples will be analyzed for radio-nuclides energies between 50 KeV - 2000 KeV (i.e., americium-241 @ 59 KeV and cesium-137 @ 662 KeV the two primary radioisotope of concern).

The system has been calibrated using a National Institute of Standards and Technology (NIST) source prepared by Analytics Incorporated out of Atlanta, Georgia, with a reference date of July 1, 2002. This source represents a soil mixture with a density between 1.5 - 1.8. A mixture of 10 radio-

nuclides, which includes americium-241 @ 59 KeV, is used to build a calibration curve to subsequently perform analysis of each sample. The gamma spectroscopy system will be energy calibrated every day using a three line gamma-ray energy sources which represents the lower, middle, and upper energy of the 50 KeV - 2000 KeV analysis spectrum.

Using the on site Gamma Analysis System (Germanium type detector) calibrated for the specific soil geometry, 8-12 samples could be analyzed per day.

Analytical data will be submitted to START-2 personnel for entry into a database for sample identification, location, and result values.

3.7 ANALYTICAL RESULT CORRELATION TO FIELD INSTRUMENT

Samples collected and analyzed on site could be used to build a correlation graph for future removal activities. Correlation graphing is not exact, but will speed up the process for identifying contaminated soil versus not contaminated. The process is performed by collecting a composite surface soil sample in a one square meter area (five discrete soil samples within this area and composited into one sample). At the same location using a Sodium Iodine (NaI) detector, preferably a 3 inch by 3 inch, a one to two minute count at approximately 30 cm above the ground. Ten to fifteen locations will be selected to document the count rate from the 3" by 3" NaI detector.

Analyze the soil samples on a gamma spectroscopy system and document the activity values in pico-Curie per gram (pCi/g).

The correlation graph is designed to find a correlation of the counts obtained from the 3" by 3" NaI to that of the analytical result values in pCi/g at the same sampling location. Plot the count rate of the 3" by 3" NaI on the y-axis and plot the activity in pCi/g from the gamma spectroscopy system on the x-axis using any type of graphing program available (i.e., Lotus 123 or Excel). A linear relationship should be shown on the graph. Once the graph is obtained the user should find the 3" by 3" NaI count rate on the meter and take that value and find the corresponding pCi/g value.

This technique will be used as a screening tool for determining if soil is contaminated at the removal levels. Guidelines for soil concentrations for Cesium 137 (Cs137) in the State of Texas are found 24 TAC 289.202 (ggg) (8) and is 40 pico - Curies per gram (pCi/g).

4. QUALITY ASSURANCE

Quality assurance will be conducted in accordance with WESTON's Draft Programmatic Quality Assurance Project Plan (QAPP), dated 5 December 2000. START-2 will be responsible for QA/QC of the field investigation activities. The designated laboratory utilized during the investigation will be responsible for QA/QC related to the analytical work. START-2 will also collect samples to help verify that laboratory QA/QC is consistent with the required standards as discussed in the QAPP.

4.1 SAMPLE CUSTODY PROCEDURES

Because of the evidentiary nature of sample collection, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. After sample collection and identification, samples will be maintained under the chain-of-custody procedures. If the sample collected is to be split (laboratory QC), the sample will be allocated into similar sample containers. Sample labels completed with the same information as that on the original sample container will be attached to each of the split samples. All personnel required to package and ship coolers containing potentially hazardous material will be trained accordingly.

The chain-of-custody (COC) procedures are documented in SOP 1101.01 and will be made available to all personnel involved with the sampling. A typical chain-of-custody record included in SOP 1101.01 will be completed each time a sample or group of samples is prepared for shipment to the laboratory. The record will repeat the information on each sample label and will serve as documentation of handling during shipment. A copy of this record will remain with the shipped samples at all times, and another copy will be retained by the member of the sampling team who originally relinquished the samples. START-2 personnel will complete a COC form for all samples sent to a START-2 designated off-site laboratory.

Samples relinquished to the participating laboratories will be subject to the following procedures for transfer of custody and shipment:

- Samples will be accompanied by the chain-of-custody record. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of the sample transfer on the record. This custody record

documents transfer of sample custody from the sampler to another person or to the laboratory.

- Samples will be properly packed for shipment and dispatched to the appropriate laboratory for analysis with separate, signed custody records enclosed in each sample box or cooler. Sample shipping containers will be custody-sealed for shipment to the laboratory. The preferred procedure includes use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal will then be folded over and stuck to itself to ensure that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape.

- If sent by common carrier, a bill of lading or air bill will be used. Bill of lading and air bill receipts will be retained in the project file as part of the permanent documentation of sample shipping and transfer.

SOPs 1101.01 and 1102.01 describe these procedures in more detail.

4.2 PROJECT DOCUMENTATION

4.2.1 Field Documentation

All documents will be completed legibly and in ink. Any corrections or revisions will be made by lining through the original entry and initialing the change. The following field documentation will be maintained:

Field Logbook (SOP 1501.01)

The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. All entries will be signed by the individuals making them. Entries should include, at a minimum, the following:

- Site name and project number.
- Names of personnel on-site.
- Dates and times of all entries.
- Description of all site activities, including site entry and exit times.
- Noteworthy events and discussions.
- Weather conditions.
- Site observations.
- Identification and description of samples and locations.
- Information and names of on-site personnel.
- Dates and times of sample collections and chain-of-custody information.

- Records of photographs.
- Site sketches.

Sample Labels

Sample labels will be securely affixed to the sample container. They will clearly identify the particular sample, and should include the following information:

- Site name and project number.
- Date and time the sample was collected.
- Sample preservation method.
- Analysis requested.
- Sampling location.

Chain-of-Custody Record (SOP 1101.01)

A Chain-of-Custody will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of the record will be kept by each individual who has signed it. The Chain-of-Custody is discussed in Section 4.1- Sample Custody Procedures.

Custody Seal

Custody Seals demonstrate that a sample container has not been opened or tampered with. The individual who has custody of the samples will sign and date the seal and affix it to the container in such a manner that it cannot be opened without breaking the seal.

Photo Documentation

START-2 will take photographs to document site conditions and activities as site work progresses. Initial conditions should be well documented by photographing features that define the site-related contamination or special working conditions. Representative photographs should be taken of each type of site activity. The photographs should show typical operations and operating conditions as well as special situations and conditions that may arise during site activities. Site final conditions should also be documented as a record of how the site appeared at completion of the work.

All photographs should be taken with either a film camera or digital camera capable of recording the date on the image. Each photograph should be recorded in the logbook with the location of the photographer, direction the photograph was taken, the subject of the photograph, and its significance (i.e., why the picture was taken). Where appropriate, the photograph location, direction, and subject should also be shown on a site sketch. SOPs 1502.01 and 1502.02 discuss photo documentation in more detail.

4.2.2 Oversight Documentation

START-2 will prepare for the FOSC pollution reports (POLREPs), if requested by EPA, to document on-site activities including any sampling that took place. Upon completion of the removal activities and at the direction of the FOSC, START-2 will prepare a final report to correlate available background information with data generated under this project. In addition, supportable conclusions and recommendations that satisfy the objectives of this work plan will be presented.

Appendix A

MARSSIM Sampling Strategy

Attachment C

Photo Documentation

Attachment D

Geophysical Study

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GEOPHYSICAL STUDY

GULF NUCLEAR SOIL SAMPLING SITE

WEBSTER, TEXAS

Submitted to: Weston Solutions, Inc.

June 4, 2003

1.0 Site Background

The site is located at 202 Medical Center Road in Webster, Texas. The site was used to be a medical facility. The building on it has been demolished and its perimeter is fenced (Figure 1). There are concrete pads (with rebar) scattered throughout the site. The site dimension is about 218 x 95 feet.

2.0 Purpose of Geophysical Surveys and Field Survey Design

Geophysical surveys (magnetic and conductivity) were conducted to determine locations of buried man-made materials, such as, drums, pipes, etc.

To accomplish this objective, a grid was laid at the site with a profile spacing of 10-foot. Conductivity and magnetic data were collected continuously in the north-south direction with 5-foot profile spacing. The data collection rate was 0.2 (magnetic) and 0.5 (conductivity) seconds, which corresponded to a data point at every 1-foot or less.

3.0 Instrumentation

Instrumentation used for the magnetic survey was a G-858 cesium magnetometer. It measures earth's magnetic field, and thus detects ferrous sources in the subsurface. It can locate a drum as deep as 14 feet. Its unit is nanoTesla (nT). Its sensitivity is about 0.1 nT.

Ground conductivity surveys were conducted using a Geonics model EM-31 instrument. The EM-31 unit is a one-man unit with an intercoil spacing of 12 feet, which has an effective depth exploration of 15 feet. Its unit is milliSiemen/meter (mS/m).

Two types of data sets were collected during the EM-31 conductivity survey. One is called "quadrature phase" of the conductivity, which measures conductivity changes of subsurface material, such as natural soil, leachate contamination, pipes, etc. The EM-31 conductivity unit is measured in milliSiemen/meter (mS/m). The second is "inphase" component, which is only sensitive to metallic sources. Its unit is per part million (ppt).

4.0 Data Preparation and Processing

Geophysical surveys were completed between May 29 and June 2, 2003. Upon completion of the survey, the data was transferred into a laptop computer and x and y coordinate of each data point was determined. The data was then ready to be processed.

The presentation of the magnetic and conductivity data is in color to provide rapid visual recognition of subsurface anomalies. Red, orange yellow colors represent high anomalies, the red being the highest. The green and light blue colors indicate the background values for the site. The dark blue represents the low anomalies

5.0 Interpretation of Magnetic Data

Anomalies in the earth's magnetic field are the results of disturbances caused by changes in the magnetization of the materials in the near subsurface. A magnetic profile over a magnetically homogeneous region does not contain any anomalies. However, presence of a ferrous buried material, such as an UST, will distort the magnetic field and cause a high magnetic anomaly. A single buried ferrous object will generally create a dipole magnetic anomaly (a high in the southern part of the source and a low in the northern part of the source). However, in the case of multiple ferrous sources close by to each other this anomaly pattern may not be observed.

A magnetic map (total earth's magnetic field) of the study area is given in Figure 2. There are several significant magnetic anomalies across the site, high and low; shown by red and dark blue colors, respectively.

In order to enhance the location and amplitude of the magnetic anomalies, a vertical derivative of the total earth's magnetic field (Figure 2) was taken and is shown in Figure 3. This map indicates dipole anomalies across the site, which is shown with letters A, B, C, D and E.

There are linear magnetic anomalies observed in the SW part of the site, which are shown with letters F and G. These anomalies correspond to where the old driveway of the building was located (Pers. Communication with Mr Chad Hall of Weston Solutions).

The red and blue anomalies shown in the NW part of the site appear to be due to the cultural affect of a building which partially surrounds the site in the east and north sides. The rest of the anomalies observed on the magnetic map are caused by ferrous sources in the near surface.

In order to make more quantitative interpretation with the magnetic data, an Euler Deconvolution was applied to the gridded magnetic data. This process takes into account the amplitude of magnetic field data, its gradients, and provides a solution as to where the magnetic sources are located across the site Locations of the magnetic sources are displayed with a circle in Figure 4, which is named as "Gridepth Solution." The more the circled data is the better the possibility of a magnetic source at that location. X and Y

coordinates of these magnetic sources and their respective depths (Z) are shown below:

X (Ft)	Y (Ft)	Z (Ft)
40	181	1.2
48	183	2.0
52	184	3.0
25	162	4.0
38	164	1.0
56	160	3.5
50	153	4.0
40	153	4.0
41	141	3.9
27	148	4.2
26	132	5.6
46	129	1.9
48	119	3.8
60	119	1.0
29	114	4.0
29	111	4.5
78	102	3.5
72	99	3.5
34	100	1.6
27	94	2.5
20	91	4.5
19	82	3.2
47	82	1.2
68	74	2.4
78	74	3.0
19	69	4.5
75	68	3.0
74	56	2.2
19	52	4.2
56	44	3.3
19	40	1.2
45	44	4.2
62	38	5.5
77	32	3.2
21	29	3.5
40	29	4.5
22	19	2.0
40	16	2.5
63	20	2.0
67	14	2.5

7	9	5.5
9	4	5.0

6.0 Interpretation of Conductivity Data

Conductivity anomalies are the results of disturbances caused by changes in the conductivity of the materials present in the subsurface. A conductivity profile over a homogeneous region does not contain any anomalies. However, presence of a buried material, such as pipes or lateral conductivity changes in the near surface will distort the conductivity field and cause conductivity anomalies.

A conductivity (quadrature) map of the site is given in Figure 5. There is a significant low conductivity anomaly shown by the blue color. This anomaly trends in the north-south direction and is continuous across the site. The source causing this anomaly appears to be metallic sources buried in the near surface, such as a concrete pad with rebar or a trench filled with metallic items.

There are high conductivity anomalies in the SW part of the site shown by the red color and letters of X and Y. Sources causing these anomalies are unknown. However, the fence and the adjacent building cause high conductivity values along the eastern boundary of the site.

Background conductivity values are shown with the green color in Figure 5.

7.0 Correlation of Conductivity and Magnetic Data

Majority of magnetic anomalies determined at the site falls into an area where the low conductivity anomaly is present. The magnetic data indicates several ferrous sources within the low conductivity anomaly whereas the conductivity data shows a single low anomaly crossing the entire site from north to the south. The magnetic anomalies determined in the eastern part of the site, outside the perimeter of the low conductivity anomaly, are not observed on the conductivity data.

8.0 Conclusions

The magnetic data obtained at the Gulf Nuclear Soil Sampling Site indicate significant magnetic anomalies across the site. Some of these anomalies could be related to concrete pads with rebar; however, some could be due to other buried ferrous sources.

The conductivity anomaly indicates a significant low anomaly across the site. Location of this anomaly in the southwest part of the study area

approximately corresponds to where a large concrete pad (drive way?) is present.

9.0 Appendix: Geophysical Maps

EXECUTIVE SUMMARY

Integrated geophysical surveys (magnetic and conductivity) were conducted at the Gulf Nuclear Soil Sampling Site, which is located in Webster, Texas. The scope of geophysical surveys was to locate buried metallic man-made sources.

The magnetic data obtained at the site indicates several magnetic anomalies across the site. Some of these anomalies could be due to concrete pads embedded with rebar, which are present at the site. Some, however, could be due to other buried magnetic sources.

The conductivity data (both quadrature and inphase) indicate a significant low anomaly crossing the entire site from the north to the south. Majority of the magnetic anomalies appear to fall into this conductivity anomaly. The cause for this anomaly could be partly related to presence of concrete pads embedded with rebars.

CONTENTS

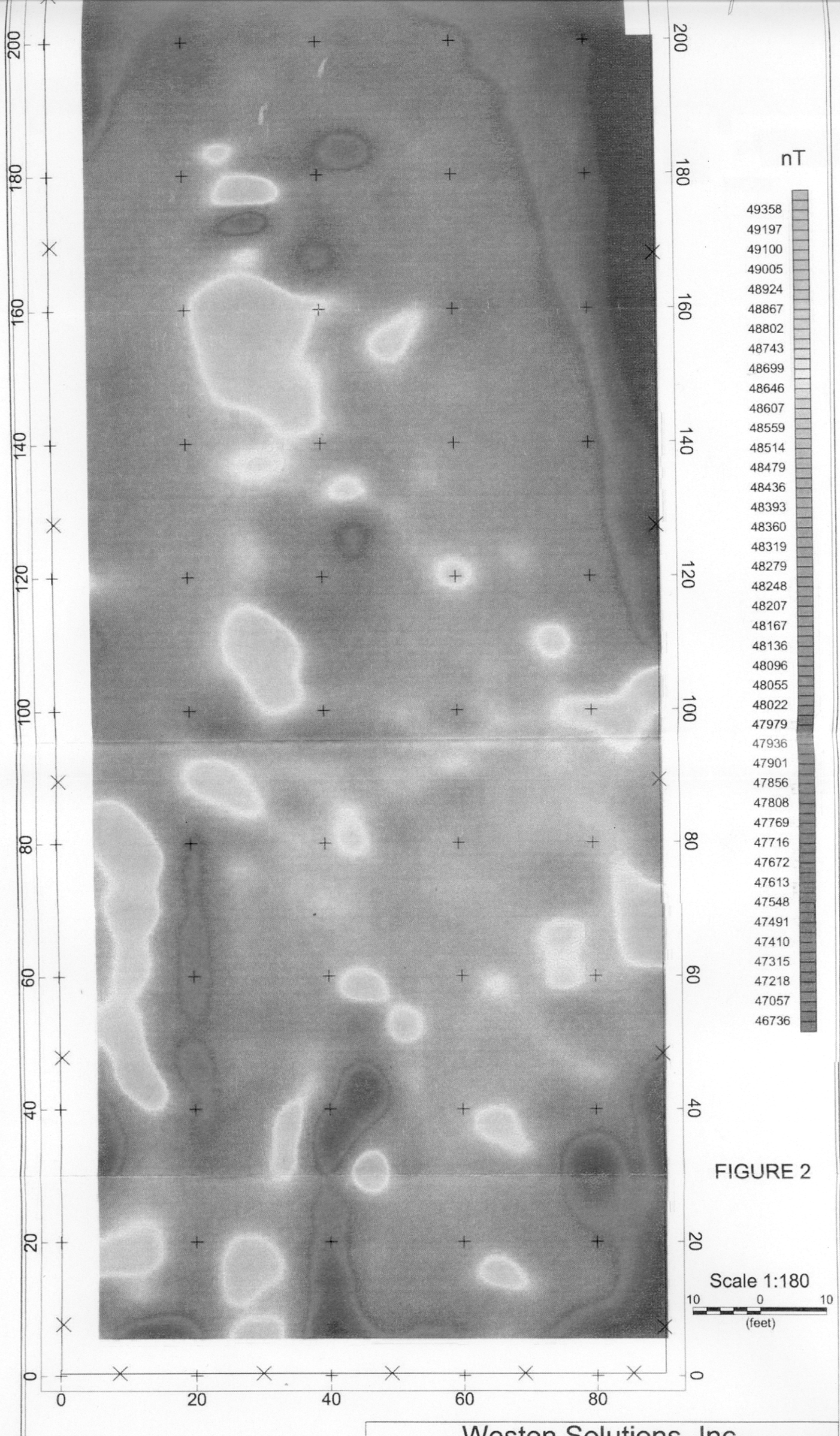
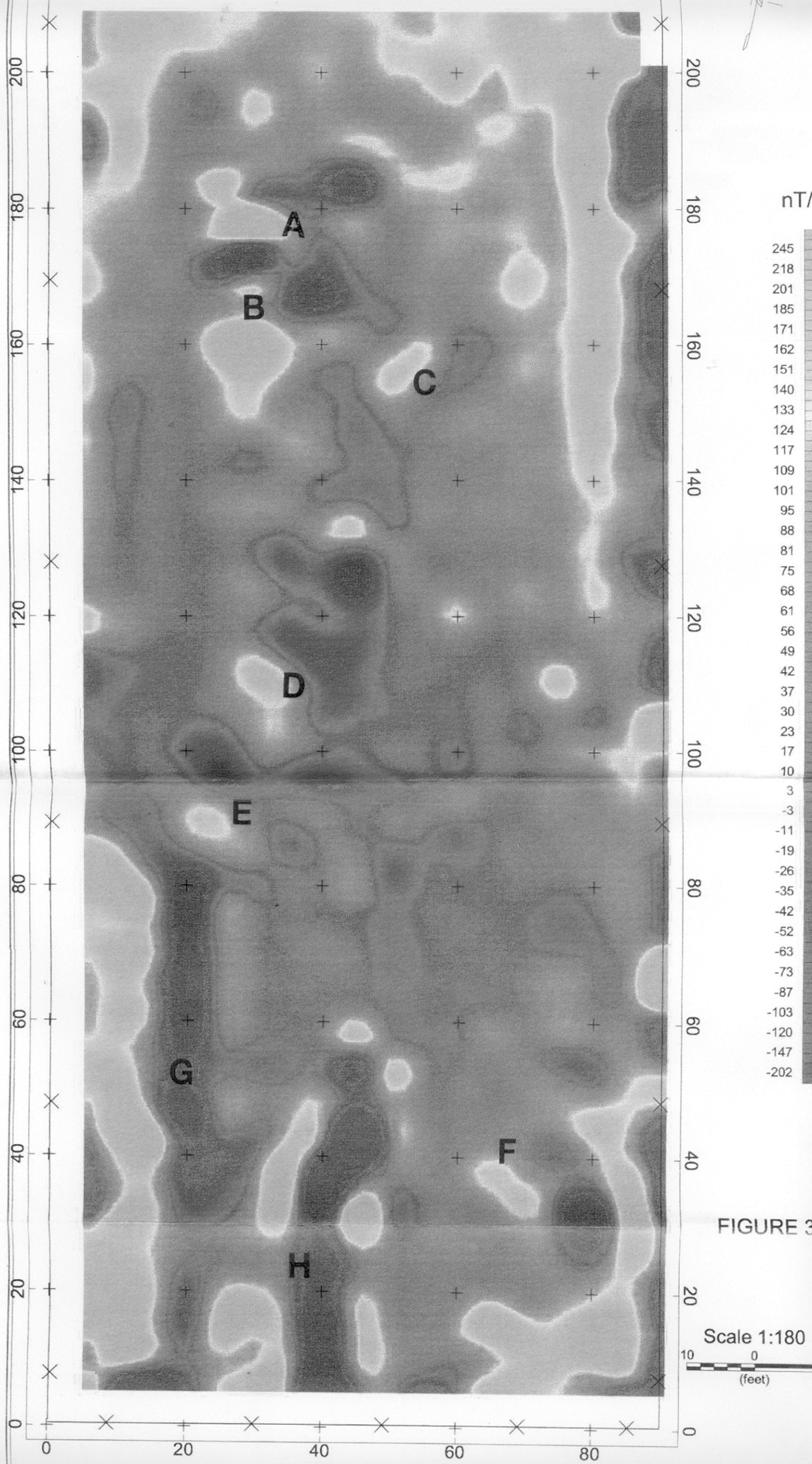


FIGURE 2

Weston Solutions, Inc.

Total Magnetic Field Map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F
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95
88
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3
-3
-11
-19
-26
-35
-42
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-63
-73
-87
-103
-120
-147
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20
40
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80
100
120
140
160
180
200
Scale 1:180
10
0
(feet)

FIGURE 3

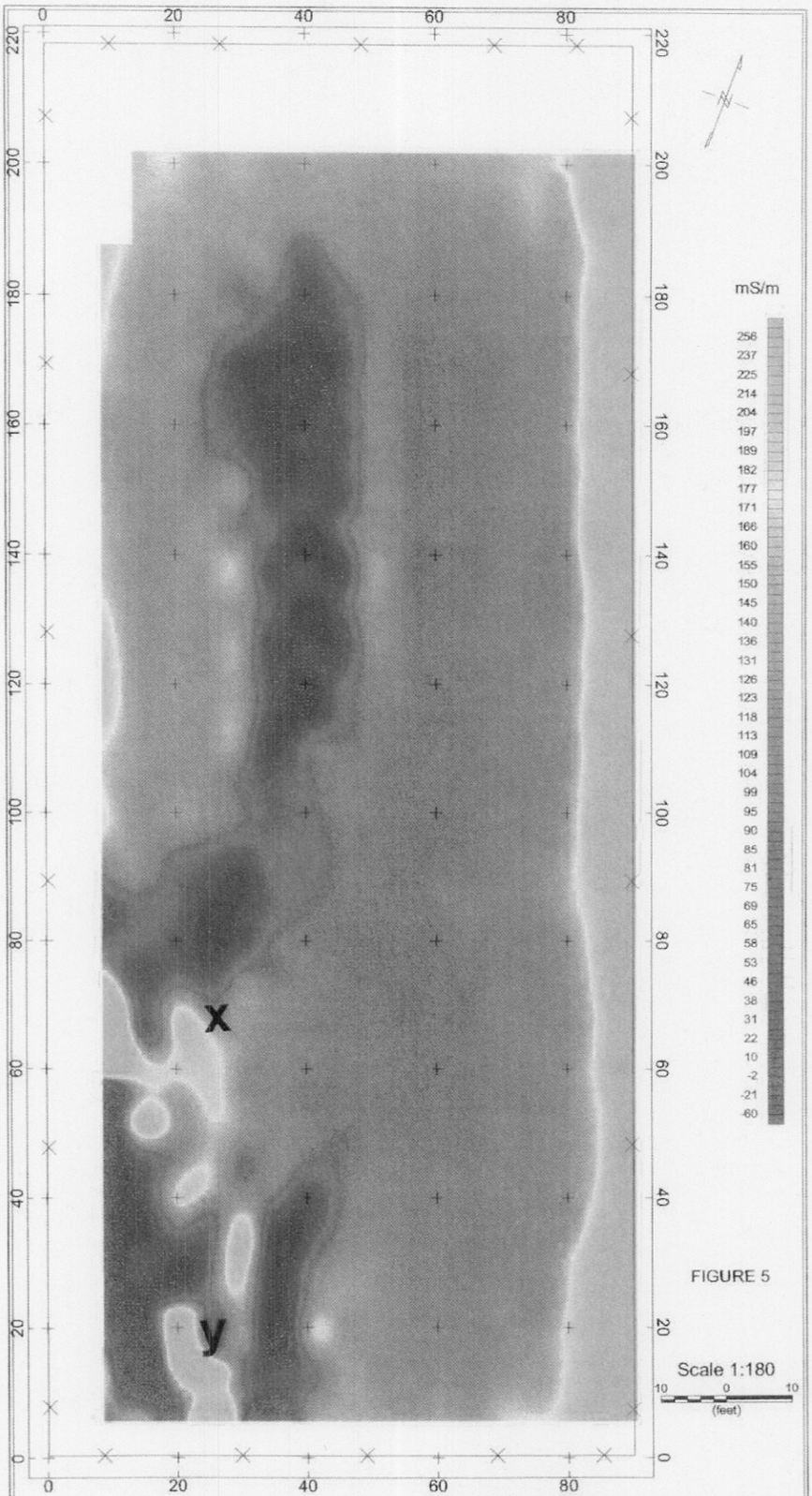


FIGURE 5

Weston Solutions, Inc.

Conductivity Map
Gulf Nuclear Soil Sampling Site
Webster, Texas

Environmental Geophysics Assoc.

Attachment E

High Purity Germanium Detector Information

Attachment F

Analytical Soil Sample Data and Supporting Documentation

Analytical Soil Sample Data and Supporting Documentation

All analytical data obtained for the Gulf Nuclear Superfund Site combined EPA Las Vegas and WESTON EPA START-2 Soil Assessment, May 27- June 13, 2003, are supplied for quick reference on a Compact Disk-Recordable (CD-R) read-only format to the official original versions of this report. Hard copies of the information supplied on the CD-R's are in the custody of Environmental Protection Agency, Radiation and Indoor Environments National Laboratory-Las Vegas, NV (EPA/R&IE-LV). Six copies of the CD-R were made for this report. Each one has a unique serial number imbedded in the center of the disk. If viewing the analytical data on one of these CD-R's and the serial number does not correspond to the numbers listed below, the data is in suspect and should not be used. Additional copies of the CD-R can be requested from EPA but an amendment must be added to this report to track the serial numbers.

The serial numbers of the CD-R's supplied with the final report were:

#1)	LH6114 GJ2011094D4	#2)	LH6114 GJ2011100D3
#3)	LH6114 GJ2011096D2	#4)	LH6114 GJ2011102D1
#5)	LH6114 GJ2011098D5	#6)	LH6114 GJ2011104D4

A Table of Contents for the CD-R is provided below with explanations and description of each directory/folder and each subsequent directory/folder below the primary directory/folder. Some of the files are only viewable through Canberra Industries Gamma Spectroscopy proprietary counting software. Most other files are ASCII text type format or Portable Document Format (PDF). The ASCII text type formatted files can be viewed through any wordprocessor program such as WordPerfect, Microsoft Word, or Windows Notepad. The PDF files are viewable with any program that will allow PDF viewing such as Acrobat Reader.

Directories or subdirectories containing Analysis Reports Text Format

These directories contain all the gamma spectroscopy analysis reports generated at the end of the each counting cycle. Five main directories exist for all analysis. Each file within the directory/folder is in a ASCII text type format by .rpt and can be viewed from any wordprocessor. The directories/subdirectories/folders are:

- Background analysis - Main directory

a) Bkg empty jar-empty shield - subdirectory and Analysis report text file as a subdirectory *(an empty jar was placed on detector and count several times throughout analysis process, file naming system for G00d01b.rpt where G00 is the geometry and associated geometry number (empty shield) - and d01 is detector number)*

b) Ref #1 soil bkg off-site 0in - 6in - subdirectory and Analysis report text file as subdirectory *(Background soil samples taken off-site at 0 inches to 6 inches)*

c) Ref #1 soil bkg off-site 6in - 12in - subdirectory and Analysis report text file as subdirectory *(Background soil samples taken off-site at 6 inches to 12 inches)*

d) Ref #1 soil bkg off-site 12in - 24in -subdirectory and Analysis report text file as subdirectory *(Background soil samples taken off-site at 12 inches to 24 inches)*

e) Ref #2 soil bkg off-site 0in - 6in - subdirectory and Analysis report text file as subdirectory *(Background soil samples taken off-site at 0 inches to 6 inches)*

f) Ref #2 soil bkg off-site 6in - 12in - subdirectory and Analysis report text file as subdirectory *(Background soil samples taken off-site at 6 inches to 12 inches)*

g) Ref #2 soil bkg off-site 12in - 24in -subdirectory and Analysis report text file as subdirectory *(Background soil samples taken off-site at 12 inches to 24 inches)*

- Misc Sample analysis - Main directory

  a) Analysis report text files - subdirectory (a hit no hit qualitative analysis was performed on these samples)

- Surface soil analysis 0in - 6in - Main directory

  a) Analysis report text files - subdirectory and Row A through H subdirectories (quantitative analysis reports for all samples taken above 6 inches in depth, the data is separated by the grid system sample location used to collect samples)

- Sub-Surface soil analysis 6in - 12in - Main directory

  a) Analysis report text files - subdirectory and Row A through H subdirectories *(quantitative analysis reports for all samples taken between 6 inches and 12 inches in depth, the data is separated by the grid system sample location used to collect samples)*

- Sub-Surface soil analysis 12in - 24in - Main directory

  a) Analysis report text files - subdirectory and Row A through H subdirectories *(quantitative analysis reports for all samples taken between 12 inches and 24 inches in depth, the data is separated by the grid system sample location used to collect samples)*

Directories and subdirectories containing Gamma Spectrum files viewable by Canberra Industries Software

Directories containing supporting documentation for efficiency calibration, sample spectrum, quality assurance quality control data, and background spectrum files viewable by Canberra Industries Gamma Spectroscopy software in use by R&IE during the project. The Canberra software that R&IE used for this project was Genie-2K v.1.3. Files within the directories/folders are in several different formats with extensions of .cal, .cnf, .nlb, and .qaf specific to Canberra proprietary gamma spectroscopy software. The .cal files are calibration efficiency curves used in the analysis of each sample, the .cnf files are raw sample counting data (channel verses counts) to rebuild spectrums and all counting information (i.e. counting time, sample number, collection time), the .nlb file is the nuclide library to identify nuclides and associated isotopes via gamma-ray energy lines, and the .qaf files are to rebuild quality control charts which tracks various gamma-ray energy lines for full width half maximum (FWHM), peak centroid, and isotope activity up to and including this project.

The manufacturer of the software states that the above file formats can be viewed by any Canberra Industries or Nuclear Data Industries Gamma Spectroscopy version software (i.e. Genie-PC, Genie-2K, and VAX/VMS). Some of these files such as efficiency calibration files were printed, scanned, and formatted in to a PDF file. The subdirectories/folders are:

- Background analysis - Main directory

    a) Bkg empty jar-empty shield - subdirectory and Spectrum file as a subdirectory *(an empty jar was placed on detector and count several times throughout analysis process, file naming system for G00d01b.cnf where G00 is the geometry and associated geometry number (empty shield) - and d01 is detector number)*

    b) Ref #1 soil bkg off-site 0in - 6in - subdirectory and Spectrum file as subdirectory *(Background soil samples taken off-site at 0 inches to 6 inches)*

    c) Ref #1 soil bkg off-site 6in - 12in - subdirectory and Spectrum file as subdirectory *(Background soil samples taken off-site at 6 inches to 12 inches)*

    d) Ref #1 soil bkg off-site 12in - 24in -subdirectory and Spectrum file as subdirectory *(Background soil samples taken off-site at 12 inches to 24 inches)*

    e) Ref #2 soil bkg off-site 0in - 6in - subdirectory and Spectrum file as subdirectory *(Background soil samples taken off-site at 0 inches to 6 inches)*

f) Ref #2 soil bkg off-site 6in - 12in - subdirectory and Spectrum file as subdirectory *(Background soil samples taken off-site at 6 inches to 12 inches)*

g) Ref #2 soil bkg off-site 12in - 24in -subdirectory and Spectrum file as subdirectory *(Background soil samples taken off-site at 12 inches to 24 inches)*

- Misc Sample analysis - Main directory

  a) Spectrum files - subdirectory (a hit no hit qualitative analysis was performed on these samples)

- Surface soil analysis 0in - 6in - Main directory

  a) Spectrum files - subdirectory and Row A through H subdirectories *(quantitative analysis spectrum for all samples taken above 6 inches in depth, the data is separated by the grid system sample location used to collect samples)*

- Sub-Surface soil analysis 6in - 12in - Main directory

  a) Spectrum files - subdirectory and Row A through H subdirectories *(quantitative analysis spectrum for all samples taken between 6 inches and 12 inches in depth, the data is separated by the grid system sample location used to collect samples)*

- Sub-Surface soil analysis 12in - 24in - Main directory

  a) Spectrum files - subdirectory and Row A through H subdirectories *(quantitative analysis spectrum for all samples taken between 12 inches and 24 inches in depth, the data is separated by the grid system sample location used to collect samples)*

- Gamma Spectrum files viewable by Canberra Software - Main Directory (files contained in this directory are: gni_lib.nib Nuclide library used for spectrum, G19D01.cal Soil efficiency calibration file, G00D01b.cal background file empty shield subtraction, G20D01.cal efficiency check calibration used for QA/QC detector check, G20D01c.qaf Calibration quality assurance data file)

Directories and subdirectories containing Portable Document Format (PDF) files viewable with Acrobat reader

These directories and subsequent subdirectories containing Portable Document Format (PDF) files which are viewable from any program that can read PDF's. The most common program is Acrobat Reader any version. All files within the directories/folders are in PDF format and were printed, scanned, and formatted to this type of file. Some PDF files were not originally computer generated and consist of laboratory notebooks or calibration certificates. Other files such as efficiency calibration files are originally stored in a proprietary software were printed, scanned, and formatted in to a PDF file for quick reference. The directories/folders are:

- Gamma Spec detector specifications - Main directory (printable copies of the high purity germanium detector system original specification sheet used for the sample analysis and liquid nitrogen fill logs)

- Gamma Spec QA-QC info - Main directory (printable copies of the efficiency calibration analysis including radioactive material manufacturer certification certificates and energy calibration files)

- Sartorious balance serial # 60907201- Main directory (printable copies of analytical balance calibration certificate, analytical weights calibration certificate, and logbook entry data for analytical balance)

- Soil efficiency calibration file- Main directory (printable copies of the soil calibration efficiency raw data and nuclide library used for sample analysis)

- Extra PDF files - Main directory (printable copies of the regression of data for obtaining cpm on 2221 from activity concentrations in soil. These files are to be used as a field tools only and not final release criteria)

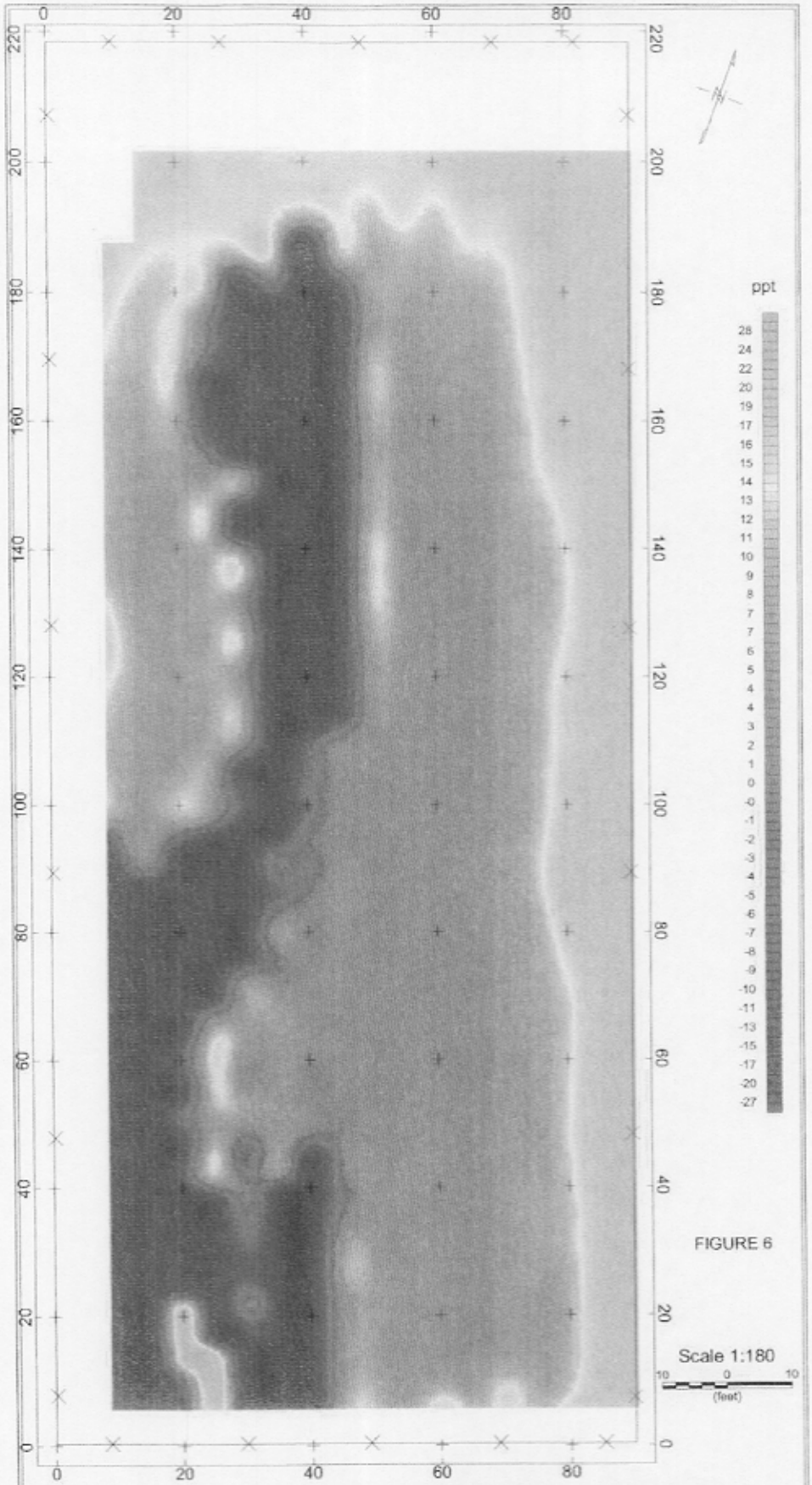
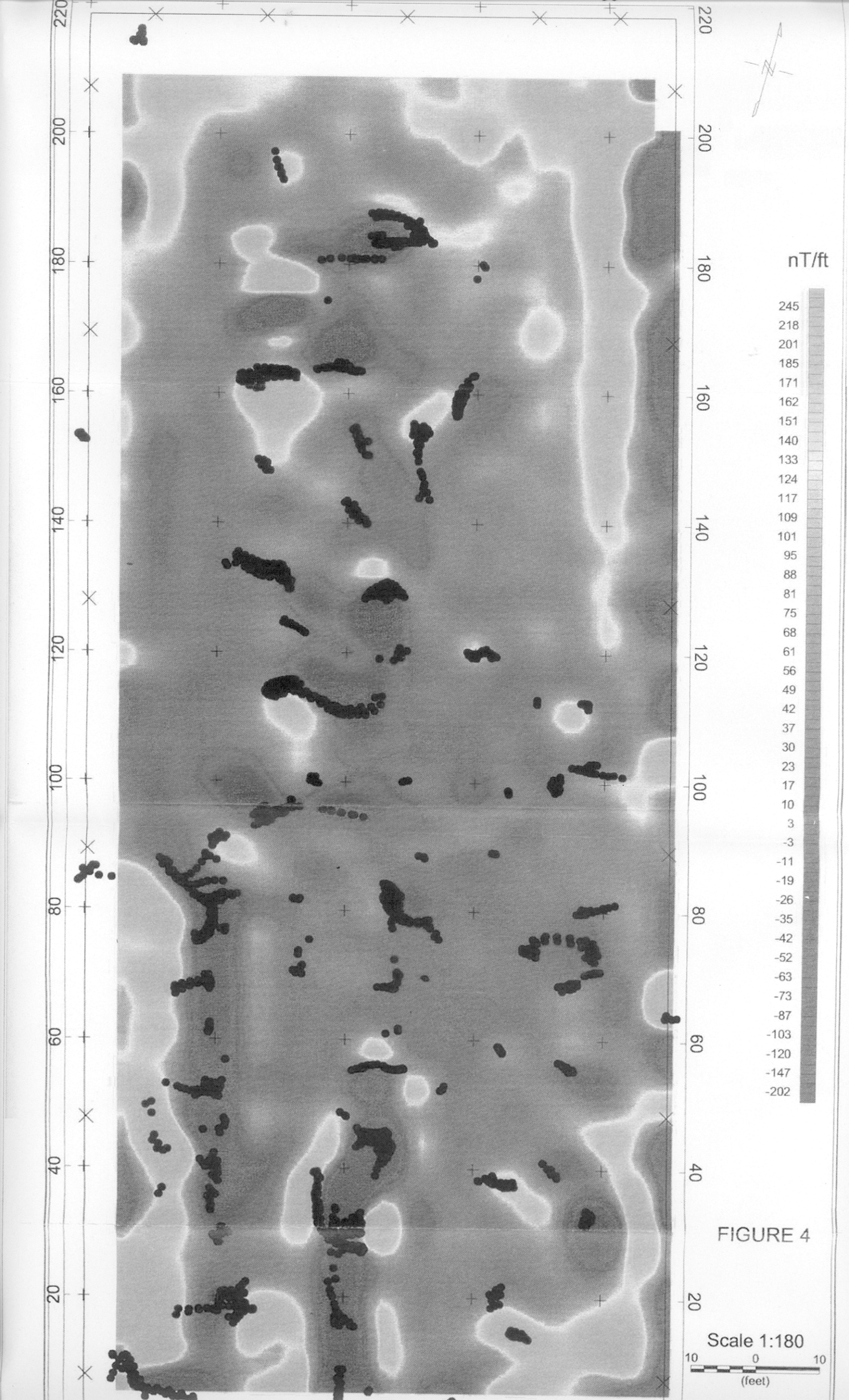


FIGURE 6

Weston Solutions, Inc.

Inphase Map
Gulf Nuclear Soil Sampling Site
Webster, Texas

Environmental Geophysics Assoc.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-63
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-87
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-120
-147
-202
Scale 1:180
10
0
10
(feet)

FIGURE 4