TC1006

Office of Environmental Management – Grand Junction

Highway 160 Site Tuba City, Arizona Independent Verification Report

October 2011

U.S. Department of Energy

Office of Environmental Management

Prepared by S&K Aerospace, LLC, under contract number DE-EM0000437
for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.

TC1006

Highway 160 Site, Tuba City, Arizona
Independent Verification Report

October 2011

Prepared by S&K Aerospace, LLC, under contract number DE-EM0000437
for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.

Table of Contents

Acronyms and Abbreviations

cps	counts per second
DOE	U.S. Department of Energy
EM	Office of Environmental Management
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
GS	gamma scanning
HPGe	high-purity germanium
LM	Office of Legacy Management
µR/h	microroentgens per hour
NaI	sodium iodide
NN	Navajo Nation
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
Ra-226	radium-226
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RRM	residual radioactive material
S&K	S&K Aerospace, LLC
SVOC	semi-volatile organic compound
Th-230	thorium-230
UMTRA	Uranium Mill Tailings Remedial Action
VOC	volatile organic compound

1.0 Introduction

This Independent Verification Report includes approximately 15 acres of Navajo Nation (NN) land known as the U.S. Highway 160 Site, located six miles east of Tuba City, Arizona (see Figure 1). The site is across U.S. Highway 160 from the former Rare Metals uranium processing mill that was remediated under the Uranium Mill Tailings Remedial Action (UMTRA) Program. That site is known as the Tuba City Disposal Site and is maintained by the U.S. Department of Energy (DOE) Office of Legacy Management (LM). All independent verification activities were conducted by S&K Aerospace, LLC, (S&K) under contract to the DOE Office of Environmental Management (EM). Field activities were conducted from June through September 2011, and were observed by DOE EM staff and representatives of the NN Environmental Protection Agency (EPA).

1.1 Purpose and Scope

The purpose of this independent verification was to show an outside assessment of the completed removal of primarily residual radioactive material (RRM) present on the site, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and selected Resource Conservation and Recovery Act (RCRA) metals that were evaluated during the characterization of the site. The scope of the project included a 6.7-acre fenced area and an additional 10 outlying acres surrounding the fenced area. Remediation activities were performed according to the "Remedial Action Plan for the U.S. Highway 160 Site, Tuba City, Arizona," prepared by the NNEPA. This plan was accepted by DOE EM.

1.2 Methods

Following procedures described in the *Moab UMTRA Project Field Services Procedures Manual* (DOE-EM/GJ1631), radiological data was collected and evaluated to verify that contamination from RRM in excess of the U.S. Environmental Protection Agency (EPA) "Standards for Remedial Action at Inactive Uranium Processing Sites" (Title 40 Code of Federal Regulations Part 192 [40 CFR 192]) and are presented in this report. Thorium (Th)-230 cleanup standards mimic radium-226 (Ra-226) cleanup standards as per DOE Order 458.1, "Radiation Protection of the Public and the Environment."

The measurement techniques, instrumentation, and procedures used in this assessment are based primarily on protocols developed by the DOE Office of Remedial Action and Waste Technology's Technical Measurements Center and on field implementation experience gained from the verification of millsites and vicinity properties. Detailed procedures for collecting soil samples and measurements are presented in the *Field Services Procedures Manual* and in the *UMTRA Program Site Characterization Radiologic Field Measurements Procedures Manual.* Samples submitted to subcontract laboratories were analyzed using approved procedures as specified in the *DOE Integrated Contractor Procurement Team Statement of Work for Laboratory Analytical Services.*

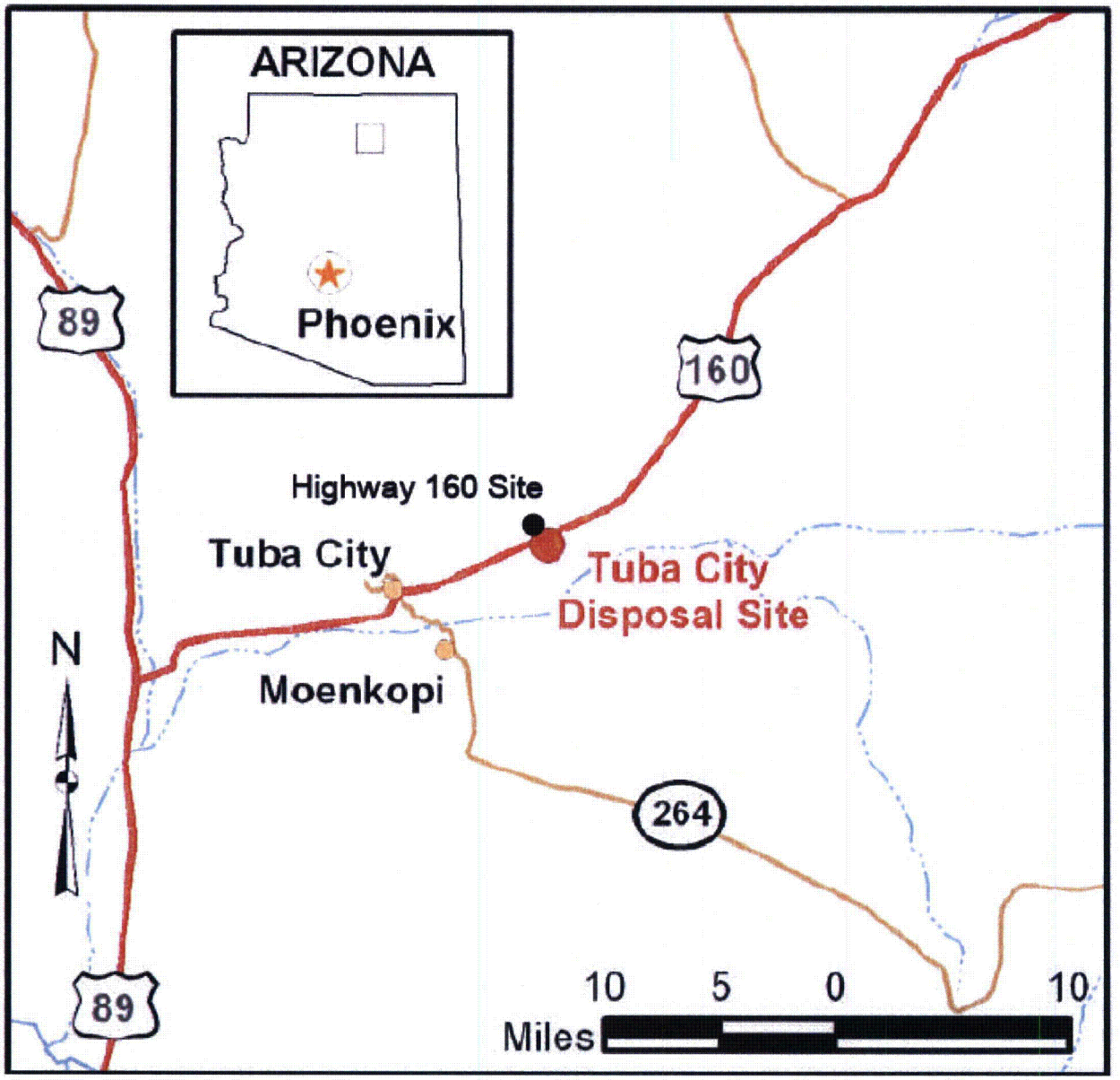


Figure 1. U.S. Highway 160 Site Location

2.0 Summary of Remedial Action

Areas of soils remediation are shown in Appendix A, background radium concentrations at exterior locations are shown in Appendix B, and laboratory analytical concentrations at exterior locations are shown in Appendix C. Pre-excavation gamma exposure rates, sample locations, and estimated extent (both aerial and vertical) of contamination maps as presented in the Highway 160 Site, Tuba City, Arizona Characterization Report are shown in Drawings 1, 2, and 3 in Appendix D.

Highway 160 Site, Tuba City, Arizona

• Location:	Six miles east of Tuba City, Arizona
• Inclusion Survey Contractor:	S&K
• Inclusion Notification Date:	January 2011
• Remedial Action Contractor:	New World Environmental Inc. (under contract to NNEPA)
• Remedial Action Plan Completed:	March 8, 2011
• Remedial Action Subcontractors:	Greenfield Logistics Extreme Measures Land Surveys, Inc. Rock Gap Engineering
• Volume of Material Removed:	3,913 cubic yards
• Total Area Cleaned Up:	37,559 square feet
• Disposal Site:	DOE Grand Junction Disposal Site

3.0 Operation Summary

3.1 Abstract of Remedial Action

Areas A through L, as described in the Highway 160 Site, Tuba City, Arizona, Characterization Report, were excavated and verified to specifications as stated in the NNEPA Highway 160 Project Site RAP (March 2011) by the Remedial Action Contractor. Various waste including laboratory sample bottles, some containing liquid, ceramic and steel balls, probably from a ball mill, and process pipes; uranium ore was also found in nearly all of the excavated areas. Much of the material appeared to have been burned in trenches and then covered with soil.

Also noted in the trenches were household-type trash (e.g., glass, dinnerware, scrap metal).

Several local backfill sources were used for fill material in sub-grade excavations. Radiologic surveys were performed and documented for all of these sources to ensure that the backfill material meets site specifications as described in the NNEPA RAP.

3.2 Previously Unidentified Contamination

Eleven additional areas (Areas M through W) were identified during the excavations of Areas D, H, I, J, K, and L. With the exception of Area P, all were less than 1 cubic yard in total volume of contaminated material excavated. Area S was the location where contaminated soils from the excavations were staged and stockpiled before being loaded into trucks. This area was previously assessed as uncontaminated during the site characterization activities.

4.0 Independent Verification Summary

4.1 Radiological Survey Data

Following excavation of the contaminated areas and prior to backfilling, a gamma exposure rate scan was completed by New World Environmental, Inc., and independently verified by S&K. The ground level exposure rate values, as measured by S&K, ranged from 10 μR/h to 14 μR/h and averaged 11 μR/h.

Independent verification soil samples were collected from all of the assessed and a majority of unassessed excavation areas following completion of the remedial action for each area. The samples were collected using standard UMTRA sampling methods, such that the samples represented an average concentration for the excavation areas. All of the verification soil samples were analyzed at the Moab UMTRA Project site, located near Moab, Utah, utilizing the Opposed Crystal System counting system to determine the Ra-226 concentrations.

Ra-226 concentrations in all of the samples collected in excavations following remediation meet the US EPA cleanup criteria under Title 42 United States Code 7901 (USC), "The Uranium Mill Tailings Remediation Control Act," and meet the NNEPA RAP cleanup criteria and are shown in Table 1. The post-excavation verification gamma exposure rate survey and verification sample locations, prior to backfilling activities, are shown in Drawings 4a through 4d in Appendix D.

The results of the analyses for non-radiological constituents are found in Appendix C. All of these samples were collected from excavated areas and were analyzed for VOCs, SVOCs, polychlorinated biphenyls (PCBs), and selected RCRA metals. All of the described samples were analyzed by ALS Environmental Laboratory using approved procedures as specified in the *DOE Integrated Contractor Procurement Team Statement of Work for Laboratory Analytical Services.* All of the analytical values are below detectable levels for VOCs, SVOCs, and PCBs. For metals, which are almost always detectable, values were within the range of samples collected from locations representing background conditions, with the exception of Area L. Although showing arsenic, barium, and selenium somewhat above background, they would not pose a risk to the environment. No soil staining, odors, or associated debris were observed after all of the contaminated material was removed. No further remedial action is required.

4.2 Recommendation for Certification

The Highway 160 Site is recommended for certification. The remedial action was successful in the removal of the RRM to specified project cleanup objectives as presented in the NNEPA RAP.

In addition, the VOCs, SVOCs, PCBs, and selected RCRA metals that were identified during the site characterization have also been cleaned up to acceptable levels.

All of the Independent Verification data has been reviewed, evaluated, and verified to meet the 40 CFR 192 and clean-up standards as per DOE Order 458.1 and meets site- and project-specific cleanup requirements as presented in the NNEPA RAP.

Table 1. Independent Verification Sample Results

Highway 160 Site – Tuba City, Arizona				
Area Designation	**Sample Number**	**Ticket Number**	**Gamma Exposure Rate in µR/h**	**Ra-226***
A	V-A-001	PAB 102	10 – 11	0.9
B	V-B-001	PAB 115	11	0.1
C	V-C-001	PAB 091	11 – 12	0.4
C	V-C-002	PAB 092	10 – 12	0.2
C	V-C-003	PAB 093	10 – 12	0.1
D	V-D-001	PAB 094	10 – 12	0.9
D	V-D-002	PAB 095	10 – 12	0.8
E	V-E-001	PAB 097	10 – 12	0.6
F	V-F-001	PAB 089	11	1.8
G	V-G-001	PAB 090	11 – 12	0.6
H	V-H-001	PAB 087	11 – 12	0.9
H	V-H-002	PAB 088	11 – 12	0.1
I	V-I-001	PAB 085	11 – 12	0.3
I	V-I-002	PAB 086	11 – 12	1.3
J	V-J-001	PAB 082	11 – 12	1.5
K	V-K-001	PAB 083	11 – 12	1.2
L	V-L-001	PAB 084	11 – 14	0.7
M	V-M-001	PAB 098	11	0.1
N	V-N-001	PAB 096	11 – 12	0.9
O	V-O-001	PAB 099	11	1.1
P	V-P-001	PAB 100	11	0.8
Q	V-Q-001	PAB 101	11 – 12	1.4
R	V-R-001	PAB 103	11	0.2
S	V-S-001	PAB 127	10 – 13	0.6
S	V-S-002	PAB 128	10 – 11	1.6
S	V-S-003	PAB129	10 – 11	1.6
S	V-S-004	PAB 130	10 – 11	0.1
T	Did not Sample	N/A	11	N/A
U	Did not Sample	N/A	11– 12	N/A
V	Did not Sample	N/A	11– 12	N/A
W	Did not Sample	N/A	11	N/A

5.0 References

40 CFR 192 (Code of Federal Regulations), "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," Subparts A, B, and C, "Standards for Remedial Action at Inactive Uranium Processing Sites."

42 USC 7901 (United States Code), "Uranium Mill Tailings Remediation Control Act."

DOE (U.S. Department of Energy), "Highway 160 Site Tuba City, Arizona, Characterization Report" (TC1004), March, 2011.

DOE (U.S. Department of Energy), "DOE Integrated Contractor Procurement Team Statement of Work for Laboratory Analytical Services."

DOE (U.S. Department of Energy), *Moab UMTRA Project Field Services Procedures Manual* (DOE-EM/GJ1631), October 2010.

DOE (U.S. Department of Energy) Order 458.1, "Radiation Protection of the Public and the Environment."

DOE (U.S. Department of Energy), "UMTRA Program Site Characterization Radiologic Field Measurements Procedures Manual."

NNEPA (Navajo Nation Environmental Protection Agency), Highway 160 Site Tuba City, Arizona, Characterization Work Plan" (NN2010-01), May 2010.

Appendix A.
Areas of Soils Contamination

Appendix A. Areas of Soils Contamination

Area Designation	Area (square feet)	Area (square meters)
A	375	35
B	523	49
C	6,006	558
D	5,348	497
E	193	18
G	333	1
H	4,521	420
I	2,898	269
J,K,L	9,489	882
M	164	15
N	52	5
O	9	1
P	127	12
Q	139	13
R	54	5
S	7,295	678
T	9	1
U	9	1
V	9	1
W	6	1
TOTAL	**37,559**	**3,489**

Notes: Table and areas based on 2 pCi/g cleanup criteria.
Surveyed by Extreme Measures, Inc, Flagstaff, AZ
September 19, 2011/Job #11-30

Appendix B.
Background Radium Concentrations at Exterior Locations

Appendix B. Background Radium Concentrations at Exterior Locations

Table B-1. Radium Concentrations at Exterior Locations				
Highway 160 Site, Tuba City, Arizona				
Sample Number	**Measurement Type**	**Depth - inches**	**Ra-226 pCi/g**	**Comments**
A1-8	OC	0 - 6	0.4	
A1-9	OC	0 - 6	0.8	
A1-10	OC	0 - 6	0.2	
A1-13	OC	0 - 6	0.4	
A1-14	OC	0 - 6	1.4	
A1-15	OC	0 - 6	0.7	
A1-18	OC	0 - 6	0.5	
A1-19	OC	0 - 6	1.0	
A1-20	OC	0 - 6	0.2	
A1-23	OC	0 - 6	1.2	
A1-24	OC	0 - 6	0.1	
A1-25	OC	0 - 6	0.2	
A2-6	OC	0 - 6	1.5	
A2-7	OC	0 - 6	0.1	
A2-8	OC	0 - 6	1.3	
A2-10	OC	0 - 6	0.9	
A2-11	OC	0 - 6	0.3	
A2-12	OC	0 - 6	0.2	
A2-13	OC	0 - 6	0.9	
A2-14	OC	0 - 6	0.1	
A2-15	OC	0 - 6	1.0	
A2-16	OC	0 - 6	0.9	
A2-17	OC	0 - 6	0.1	
A2-18	OC	0 - 6	0.1	
A2-19	OC	0 - 6	1.2	
A2-20	OC	0 - 6	0.6	
A3-1	OC	0 - 6	0.2	
A3-6	OC	0 - 6	0.6	
A3-7	OC	0 - 6	0.9	
A3-11	OC	0 - 6	1.1	
A3-16	OC	0 - 6	0.2	
A3-17	OC	0 - 6	0.7	

Appendix C.
Laboratory Analytical Concentrations at Exterior Locations

Appendix C. Laboratory Analytical Concentrations at Exterior Locations

Table C-1. Laboratory Analytical Concentrations at Exterior Concentrations (continued)									
Highway 160 Site, Tuba City, Arizona									
Sample Number	Depth in inches	Resource Conservation and Recovery Act — METALS							
		Silver	Arsenic	Barium	Cadmium	Mercury	Lead	Selenium	Chromium
V-C-001	>6	0.13	2.4	45	0.038	0.00057	2.7	0.31	1.4
V-D-001	>6	0.13	1.1	12	0.039	0.004	2.2	0.32	0.4
V-G-001	>6	0.12	0.8	12	0.037	0.00055	1.7	0.3	0.46
V-H-001	>6	0.12	0.65	6.2	0.036	0.00054	2.2	0.29	0.22
V-I-001	>6	0.12	4.9	45	0.037	0.0038	4.4	0.3	1.3
V-J-001	>6	0.13	4.0	110	0.048	0.00058	2.4	0.32	1.1
V-K-001	>6	0.12	1.9	52	0.038	0.0038	2.4	0.31	0.98
V-L-001	>6	0.12	14.0	200	0.081	0.0075	6.3	1.5	1.1
R078 (background)	0 - 6	0.12	1.6	53	0.037	0.0019	3.5	0.3	1.8
A2-18 (background)	0 - 6	0.13	1.5	61	0.038	0.0038	3.8	0.31	2.1

All results are reported in milligrams/kilogram

Appendix C. Laboratory Analytical Concentrations at Exterior Locations (continued)

Table C-1. Laboratory Analytical Concentrations at Exterior Concentrations							
Highway 160 Site, Tuba City, Arizona							
Sample Number	**Depth in inches**	**Ra-226 pCi/g**	**Th-230 pCi/g**	**Total Uranium mg/kg**	**Volatile Organic Compounds µg/kg**	**Semi-Volatile Organic Compounds µg/kg**	**Polychlorinated Biphenyl µg/kg**
V-C-001	> 6				<5	<660	<6.6
V-D-001	> 6				<5	<660	<6.6
V-G-001	> 6				<5	<660	<6.6
V-H-001	> 6				<5	<660	<6.6
V-I-001	> 6				<5	<660	<6.6
V-J-001	> 6				<5	<660	<6.6
V-K-001	> 6				<5	<660	<6.6
V-L-001	> 6				<5	<660	<6.6
R078	0 - 6				<5	<660	<6.6
A2-18	0 - 6				<5	<660	<6.6

Appendix D. Drawings

Drawing 1. Pre-excavation Exterior Gamma Exposure Rate Survey

Drawing 2. Pre-excavation Exterior Sample Locations

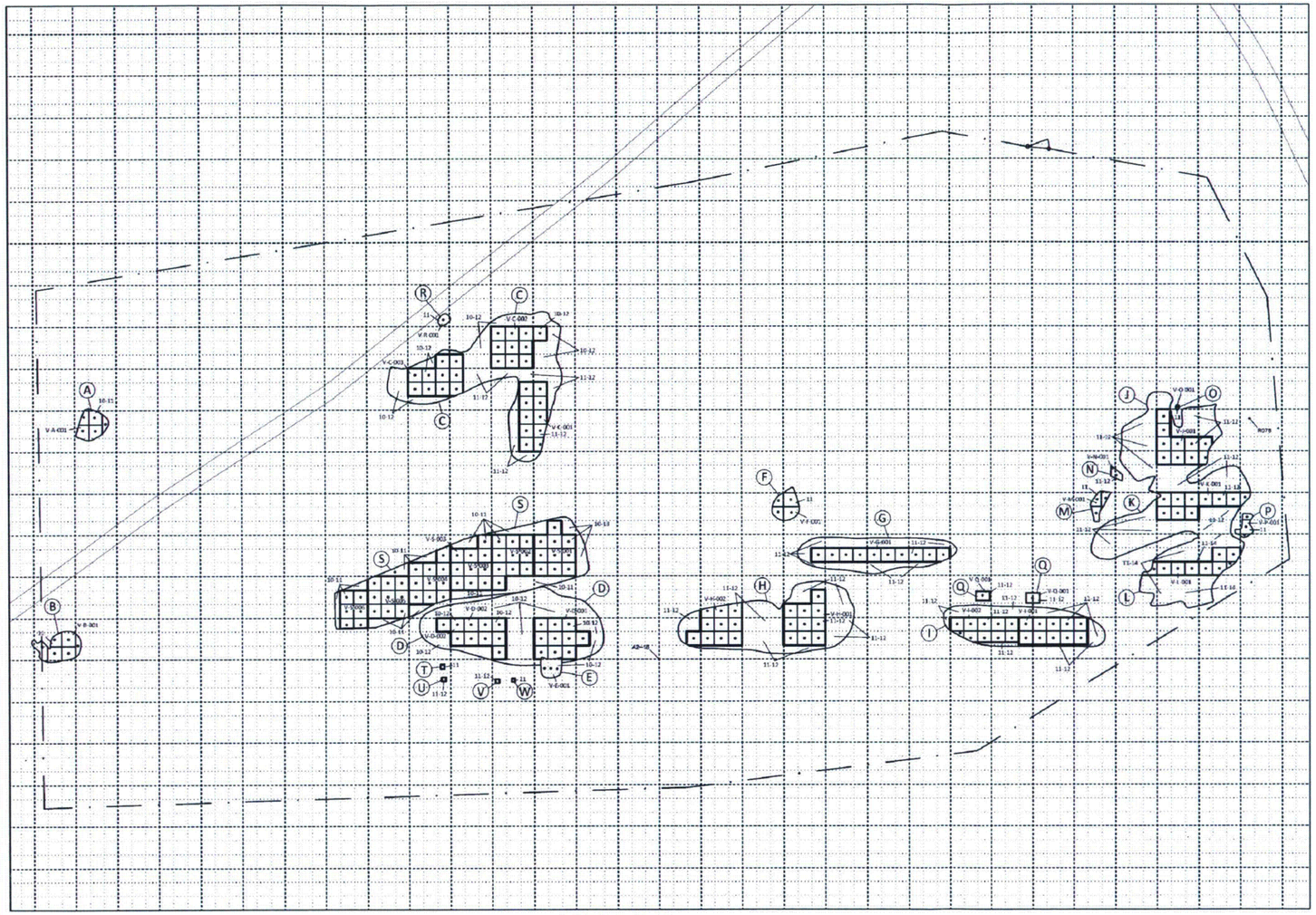
Drawing 3. Pre-excavation Exterior Estimated Extent of Contamination Above 2 pCi/g

Drawing 4a. Post-excavation Verification Gamma Exposure Rate Survey and Sample Locations Prior to Backfill

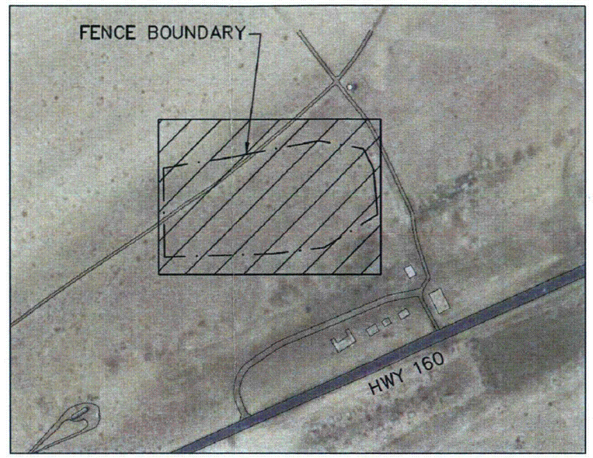
Drawing 4b. Post-excavation Exterior Sample Locations

Drawing 4c. Post-excavation Exterior Estimated Extent of Contamination Above 2 pCi/g

Drawing 4d. Post-excavation Verification Gamma Exposure Rate Survey and Sample Locations Drawing Prior to Backfill



OVERALL PLAN



KEY MAP
SCALE: NONE

Legend

V-B-001	Verification Area Designation
□	Verification Area
•	Location of Composite Soil Sample Aliquot
10-11	Gamma Scan Range at Ground Level in μR/h
▭	Boundary of Verification Area

N

SCALE IN FEET
40 0 40 80 120

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT MGR	APPROVAL
0	10/06/11	FINAL	ALP	RBH		JDR

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
TECHNICAL ASSISTANCE CONTRACTOR
Under DOE Contract
No. DE-EM0000437

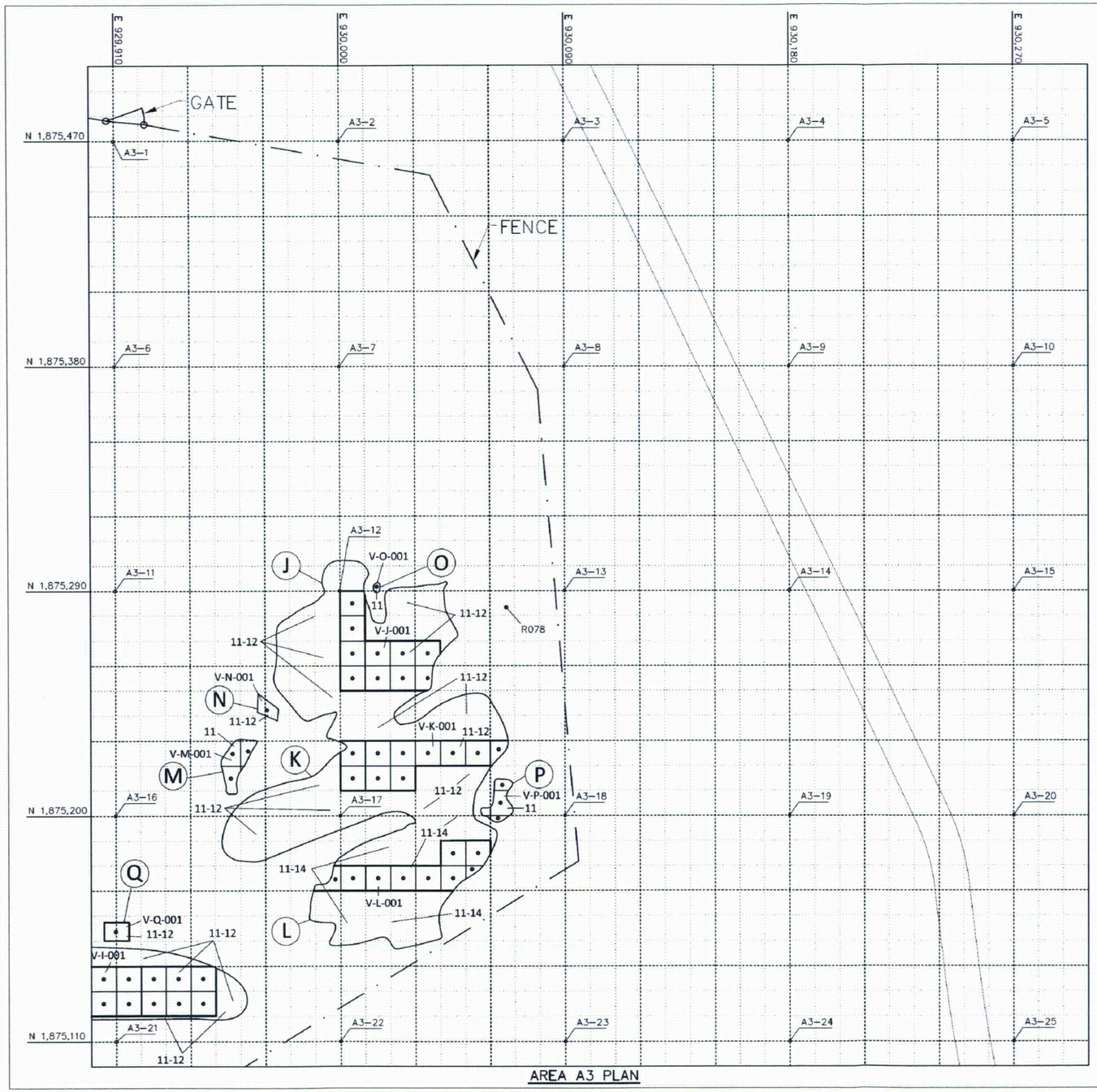
PROJECT LOCATION: HIGHWAY 160 SITE, TUBA CITY, AZ

APPROVALS

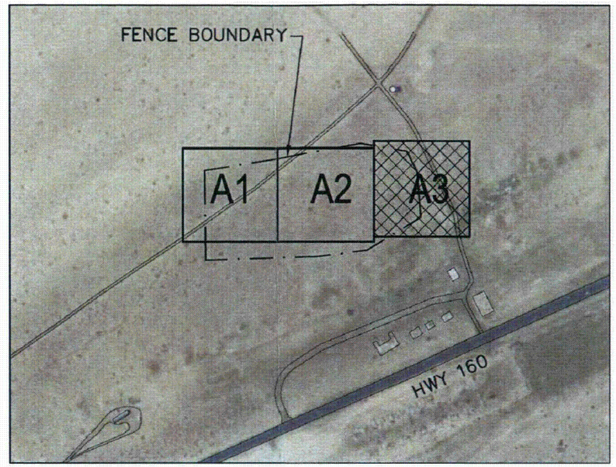
		DATE
DRAWN BY	A. PENNOYER	09/19/10
REVIEWED		
PROJECT ENGINEER		
APPROVED BY	R. HOPPING	10/06/11
PROJECT MANAGER	J. RITCHEY	10/06/11
DOE CONCURRENCE		

DRAWING 4d
SITE VERIFICATION OVERALL VIEW

PROJECT NO. 2000-102-40
DRAWING NO. SITE-ENF-4E-VERF-AREAS-ALL.DWG
SHT 1 OF 1



AREA A3 PLAN



KEY MAP
SCALE: NONE

Legend

V-B-001	Verification Area Designation
	Verification Area
•	Location of Composite Soil Sample Aliquot
10-11	Gamma Scan Range at Ground Level in μR/h
	Boundary of Verification Area

N

SCALE IN FEET
20 10 0 20 40 60

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	REVIEWED BY	PROJECT MGR.	APPROVAL
0	10/06/11	FINAL	ALP	RBH		JDR

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
TECHNICAL ASSISTANCE CONTRACTOR
Under DOE Contract No. DE-EM0000437

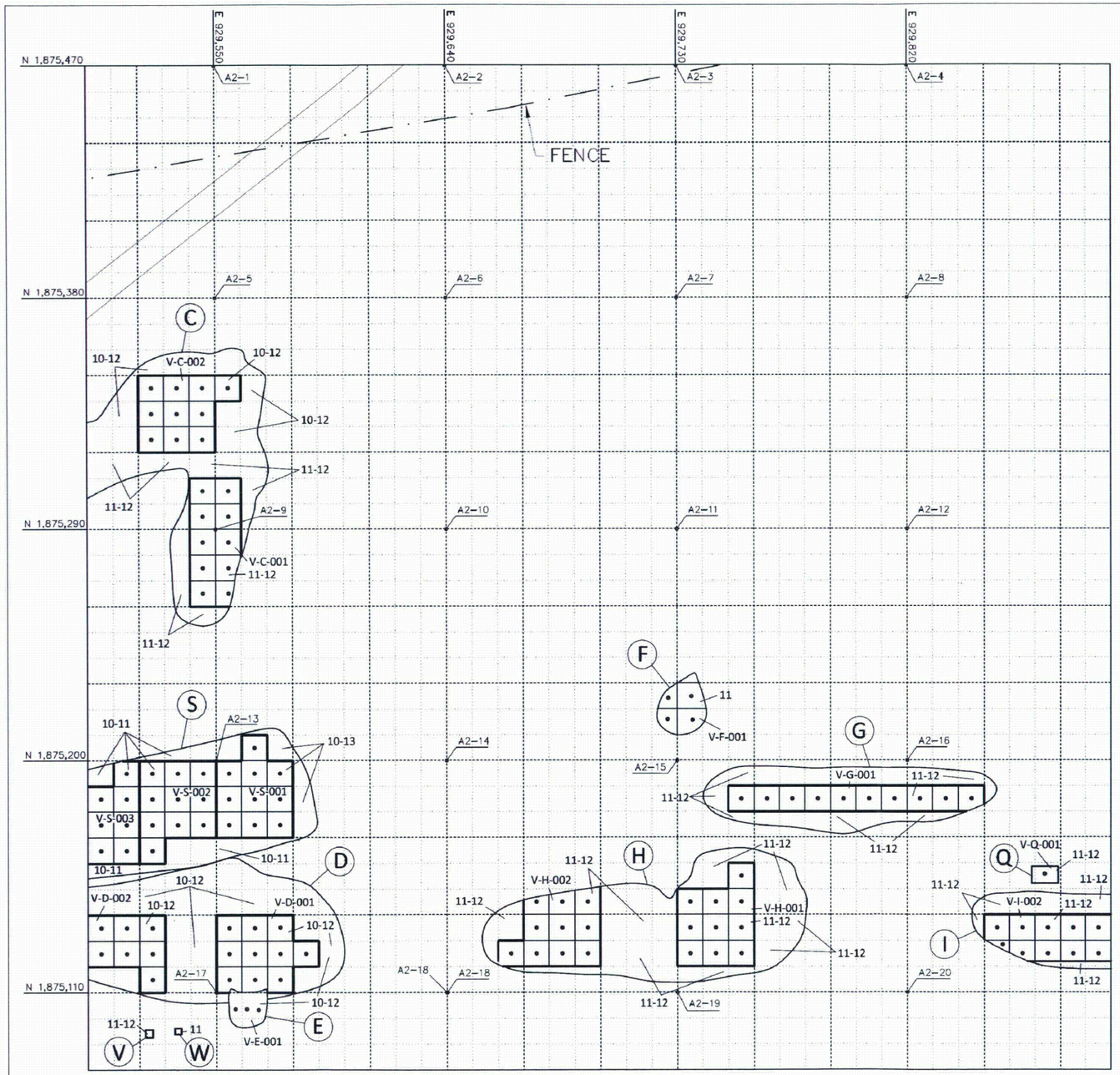
PROJECT LOCATION: HIGHWAY 160 SITE, TUBA CITY, AZ

APPROVALS

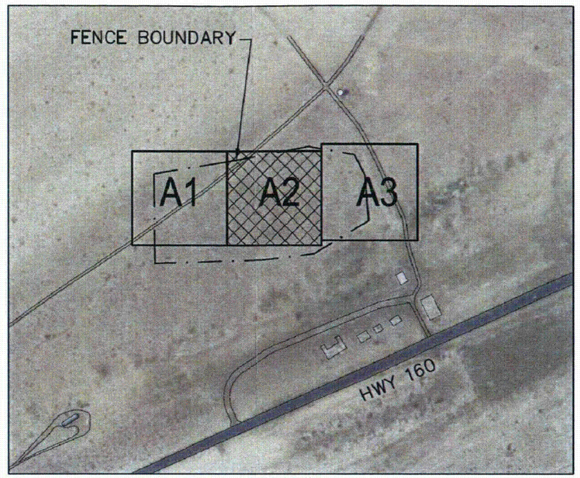
DESIGNED BY	A. FENNOYER	09/27/11
DRAWN BY		
PROJECT ENGINEER		
APPROVED BY	R. HOPPING	10/06/11
PROJECT MANAGER	J. RITCHEY	10/06/11
QA CONCURRENCE		

DRAWING 4c
SITE VERIFICATION WITHIN AREA A3

PROJECT NO. 2200-102-40
DRAWING NO. SCTO-DWG-RC-VERIF-AREA-A3.DWG
SHT 1 OF 1



AREA A2 PLAN



KEY MAP
SCALE: NONE

Legend

V-B-001	Verification Area Designation
☐	Verification Area
•	Location of Composite Soil Sample Aliquot
10-11	Gamma Scan Range at Ground Level in μR/h
⬭	Boundary of Verification Area

N

SCALE IN FEET
20 10 0 20 40 60

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	PROJECT MGR.	APPROVAL
0	10/06/11	FINAL	ALP	RBH		JDR

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
TECHNICAL ASSISTANCE CONTRACTOR
Under DOE Contract
No. DE-EM0004857

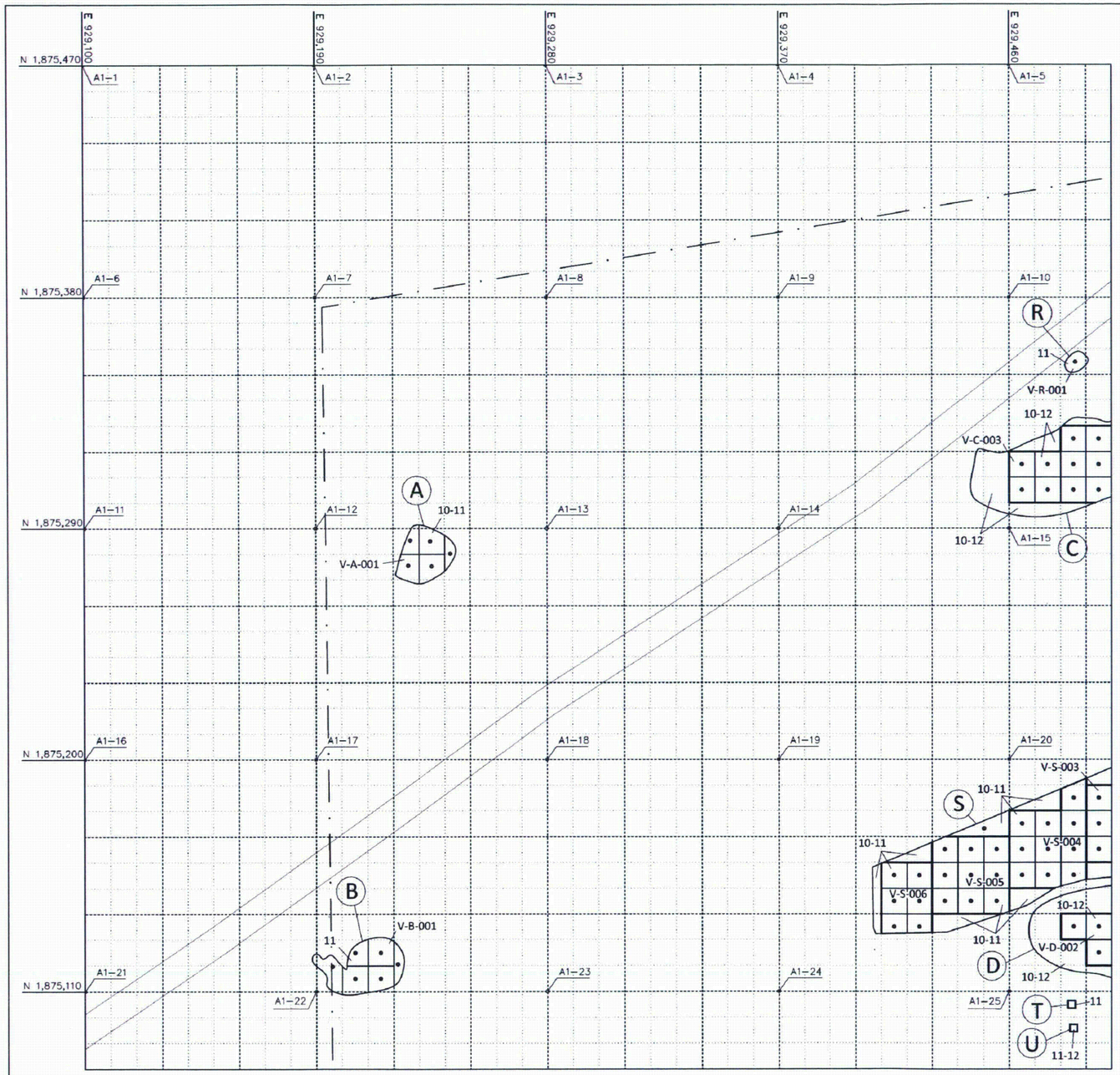
PROJECT LOCATION: HIGHWAY 160 SITE, TUBA CITY, AZ

APPROVALS

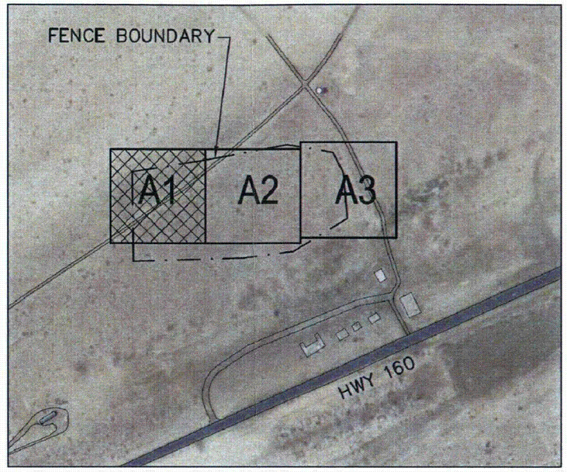
DRAWN BY	A. PENNYCOFF	09/16/11
ENGINEER		
PROJECT ENGINEER		
APPROVED BY	R. HOPPING	10/06/11
PROJECT MANAGER	J. HITCHEY	10/06/11
QUALITY ASSURANCE		

DRAWING 4b
SITE VERIFICATION WITHIN AREA A2

PROJECT NO. 2200-102-40
DRAWING NO. SCTC-DWG-40-VERIF-AREA-A2.DWG
SHT 1 OF 1



AREA A1 PLAN



KEY MAP
SCALE: NONE

Legend

V-B-001	Verification Area Designation
☐	Verification Area
•	Location of Composite Soil Sample Aliquot
10-11	Gamma Scan Range at Ground Level in μR/h
▭	Boundary of Verification Area

N

SCALE IN FEET
20 10 0 20 40 60

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL
0	10/06/11	FINAL	ALP	RBH		JDR

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
TECHNICAL ASSISTANCE CONTRACTOR
Under DOE Contract
No. DE-EM0000437

PROJECT LOCATION
HIGHWAY 160
TUBA CITY, AZ

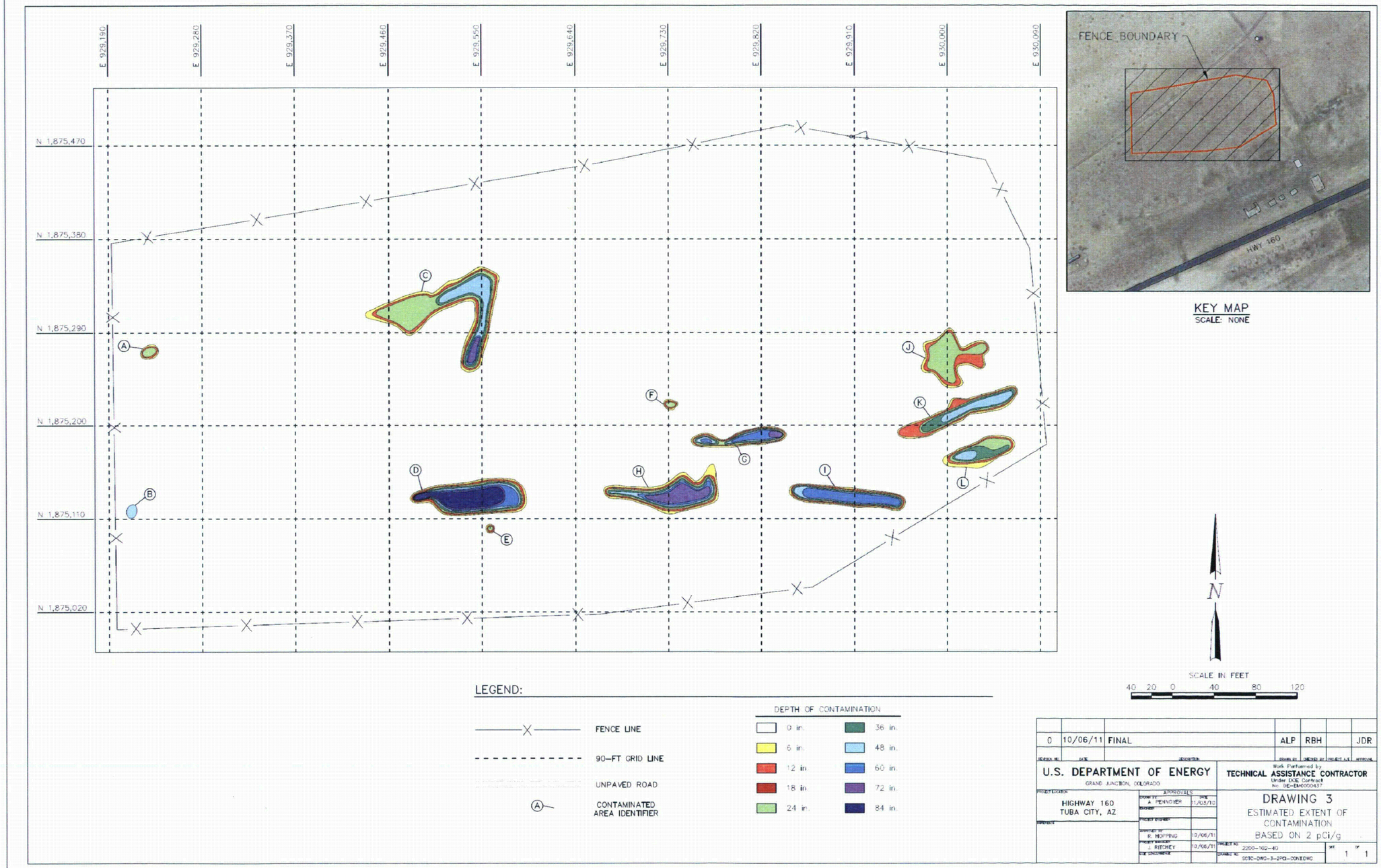
REFERENCE

APPROVALS

DRAWN BY	A. PENNOYER	09/27/11
CHECKED BY		
PROJECT ENGINEER		
DERIVATIVE BY	K. HOPPING	10/06/11
PROJECT MANAGER	J. RITCHEY	10/06/11
DOE CONCURRENCE		

DRAWING 4a
SITE VERIFICATION WITHIN AREA A1

PROJECT NO. 2200-102-40
DRAWING NO. SCTO-DWG-4A-VERIF-AREA-A1.DWG
SHT 1 OF 1



KEY MAP
SCALE: NONE

N

SCALE IN FEET
40 20 0 40 80 120

LEGEND:

FENCE LINE

90-FT GRID LINE

UNPAVED ROAD

(A) CONTAMINATED AREA IDENTIFIER

DEPTH OF CONTAMINATION

0 in.	36 in.
6 in.	48 in.
12 in.	60 in.
18 in.	72 in.
24 in.	84 in.

NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT M.E.	APPROVAL
0	10/06/11	FINAL	ALP	RBH		JDR

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by:
TECHNICAL ASSISTANCE CONTRACTOR
Under DOE Contract
No. DE-EM0000437

PROJECT LOCATION: HIGHWAY 160 TUBA CITY, AZ

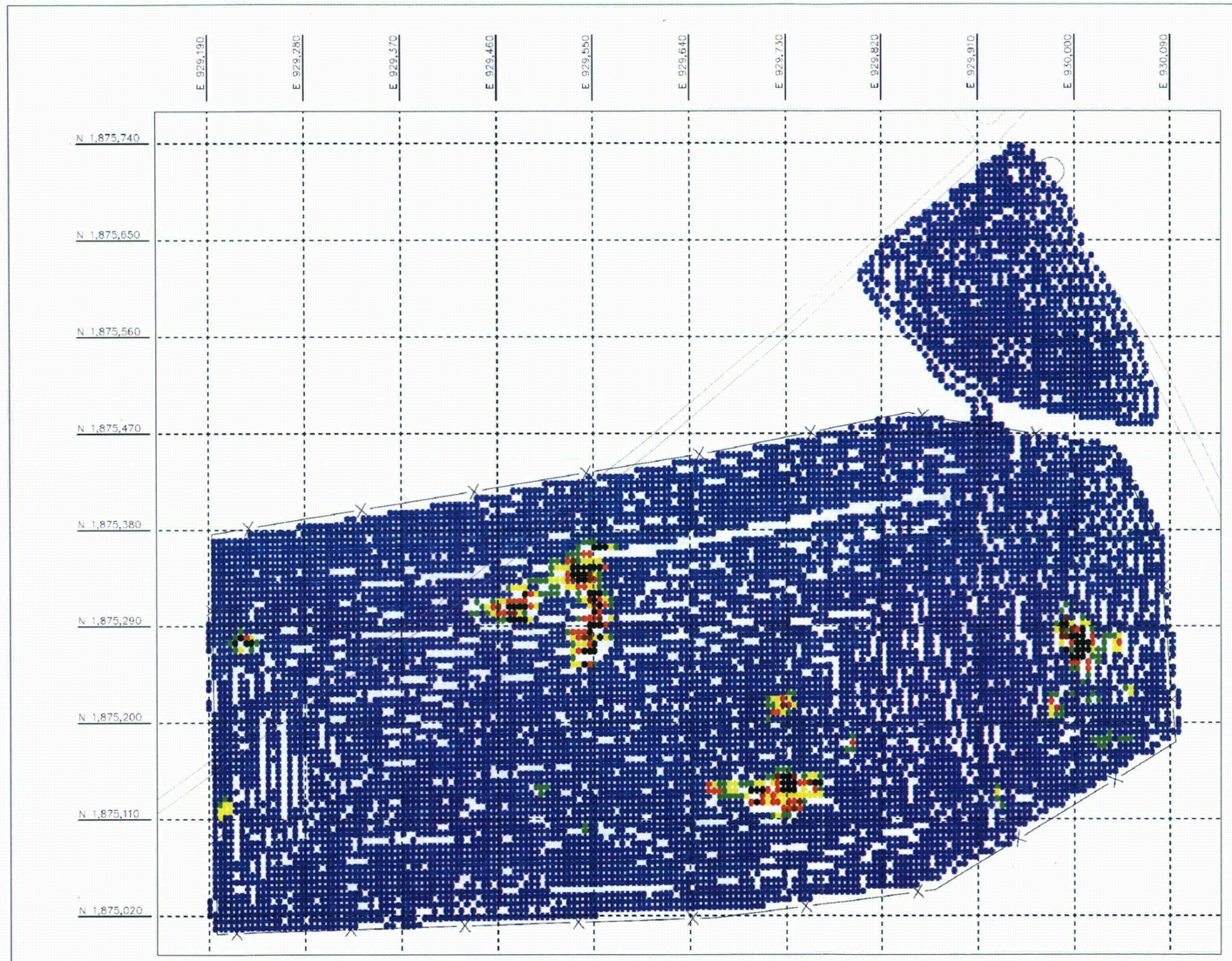
APPROVALS

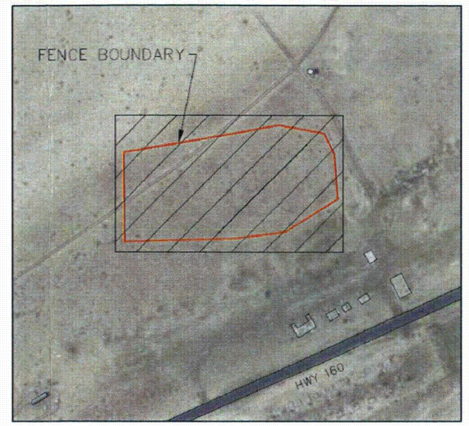
		DATE
DRAWN BY	A. PENNOYER	10/05/10
ENGINEER		
PROJECT ENGINEER		
APPROVED BY	R. HOPPING	10/06/11
PROJECT MANAGER	J. RITCHEY	10/06/11
DOE CONCURRENCE		

DRAWING 3
ESTIMATED EXTENT OF CONTAMINATION
BASED ON 2 pCi/g

PROJECT NO. 2200-102-40
DRAWING NO. SOIC-DWG-3-2PCI-CONTDWG
SHT 1 OF 1

Appendix D. Drawings





KEY MAP
SCALE: NONE

GAMMA SCAN (μR/h)

- 1 – < 12
- 12 – < 25
- 25 – < 40
- 40 – < 60
- 60 – < 75
- > = 75

N

SCALE IN FEET
50 25 0 50 100 150

LEGEND:

- FENCE LINE
- 90-FT GRID LINE
- UNPAVED ROAD

DESIGN NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT M.E.	APPROVAL
0	10/06/11	FINAL	ALP	RBH		JDR

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
TECHNICAL ASSISTANCE CONTRACTOR
Under DOE Contract
No. DE-EM0000437

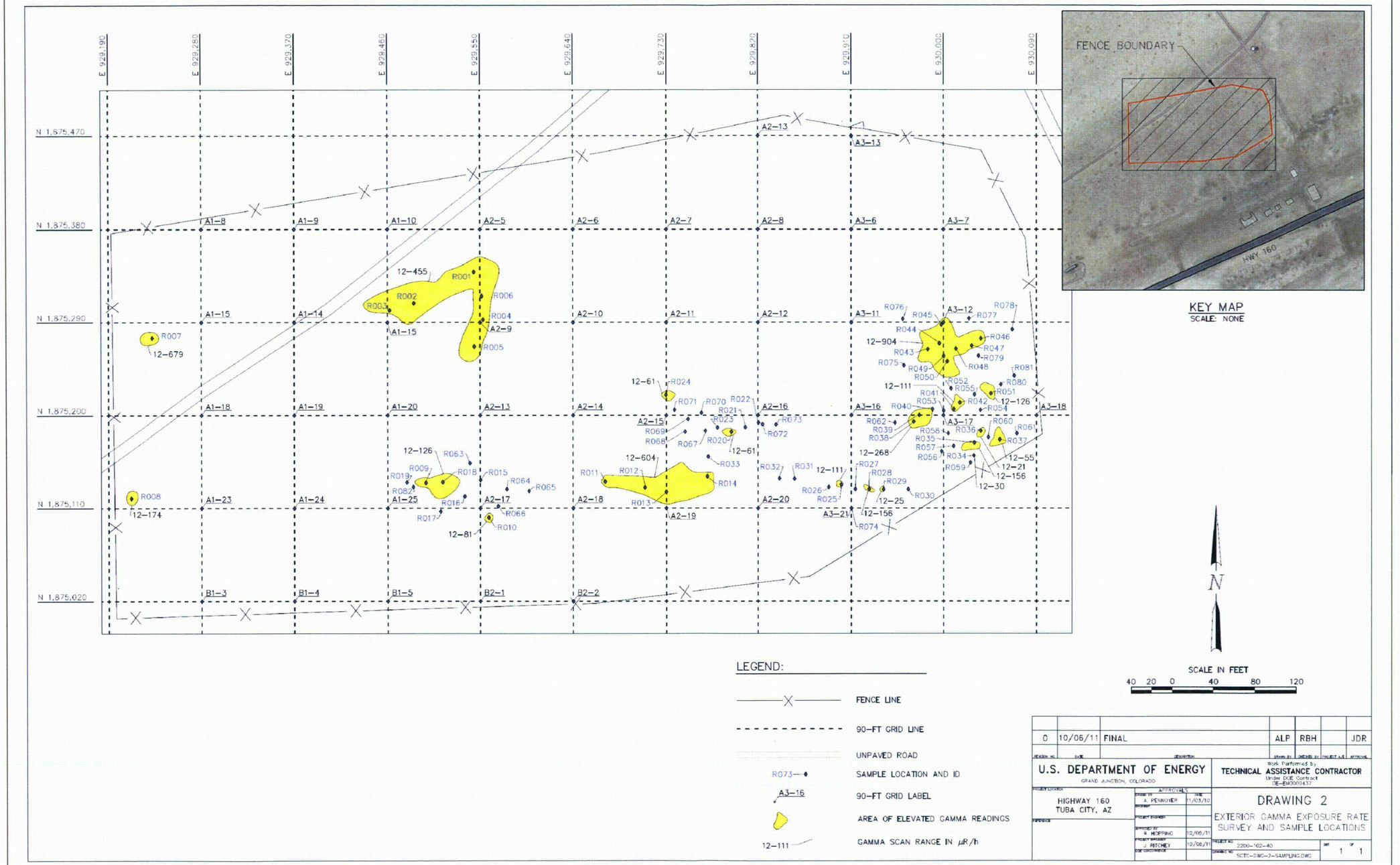
PROJECT LOCATION: HIGHWAY 160 TUBA CITY, AZ

APPROVALS

	SIGNATURE	DATE
DRAWN BY	A. PENNOYER	11/03/10
PROJECT ENGINEER		
APPROVED BY	R. HOFFING	10/06/11
PROJECT MANAGER	J. PITCHEY	10/06/11
DOE CONCURRENCE		

DRAWING 1
EXTERIOR GAMMA
EXPOSURE RATE SURVEY

PROJECT NO. 2200-102-40
DRAWING NO. SCTC-DWG-1-GAMMA-SCAN.DWG
SHT 1 OF 1


E 929,190
E 929,280
E 929,370
E 929,460
E 929,550
E 929,640
E 929,730
E 929,820
E 929,910
E 930,000
E 930,090
N 1,875,470
N 1,875,380
N 1,875,290
N 1,875,200
N 1,875,110
N 1,875,020
A1–8
A1–9
A1–10
A1–15
A1–14
A1–18
A1–19
A1–20
A1–23
A1–24
A1–25
B1–3
B1–4
B1–5
A2–5
A2–6
A2–7
A2–8
A2–13
A2–10
A2–11
A2–12
A2–14
A2–15
A2–16
A2–17
A2–18
A2–19
A2–20
B2–1
B2–2
A3–13
A3–6
A3–7
A3–11
A3–12
A3–16
A3–17
A3–18
A3–21
R001
R002
R003
R004
R005
R006
12–455
R007
12–679
R008
12–174
R009
R019
R082
R063
R018
R015
R064
R065
R016
R017
R066
R010
12–81
12–126
R024
R071
R070
R022
R021
R023
R020
12–61
R073
R072
R069
R068
R067
R033
R011
R012
12–604
R013
R014
R032
R031
12–111
R026
R025
R027
R028
R029
R030
12–25
12–156
R074
R076
R045
R078
R077
R044
12–904
R046
R043
R047
R075
R049
R079
R048
R081
R050
R080
R052
R055
R051
R041
R053
R042
12–126
R054
R040
R062
R039
R038
R058
R035
R057
R056
12–268
R060
R037
R034
R059
12–55
12–21
12–156
12–30
FENCE BOUNDARY
HWY 160
KEY MAP
SCALE: NONE
N
SCALE IN FEET
40 20 0 40 80 120
LEGEND:
FENCE LINE
90–FT GRID LINE
UNPAVED ROAD
R073
SAMPLE LOCATION AND ID
A3–16
90–FT GRID LABEL
AREA OF ELEVATED GAMMA READINGS
12–111
GAMMA SCAN RANGE IN μR/h
0 10/06/11 FINAL ALP RBH JDR
U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO
Work Performed by TECHNICAL ASSISTANCE CONTRACTOR
Under DOE Contract DE–EM0000437
HIGHWAY 160
TUBA CITY, AZ
APPROVALS
A. PENNOYER 11/03/10
R. HOPPING 10/06/11
J. RETCHEY 10/06/11
DRAWING 2
EXTERIOR GAMMA EXPOSURE RATE SURVEY AND SAMPLE LOCATIONS
PROJECT NO. 2200–102–40
SHT 1 OF 1
DRAWING NO. SCTC–DWG–2–SAMPLING.DWG