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**FACT SHEET / STATEMENT OF BASIS  
Sandia National Laboratories  
Proposal for Corrective Action Complete  
Status**

**for**

**24 Solid Waste Management Units / Areas of Concern**

**(RCRA Permit No. NM5890110518)**

**September 17, 2012**

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## ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AT&T	American Telephone and Telegraph
bgs	below ground surface
CAC	Corrective Action Complete
CEARP	Comprehensive Environmental Assessment and Response Program
COA	City of Albuquerque
COC	constituent of concern
COPECs	constituents of potential ecological concern
cy	cubic yard(s)
DCG	derived concentration guidelines
DOE	U.S. Department of Energy
DSS	drain and septic systems
EB	equipment blank
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FPTS	Flyer Plate Test Site
ft	foot (feet)
gpd	gallon(s) per day
GS	Gore-Sorber™
HE	high explosives
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
HWB	Hazardous Waste Bureau
J	estimated value
KAFB	Kirtland Air Force Base
kg	kilogram(s)
L	liter(s)
LECS	Liquid Effluent Control System
LWDS	Liquid Waste Disposal System
MDA	minimum detectable activity
MDL	method detection limit
mg/kg	milligram(s)/kilogram
mrem/yr	millirem(s)/year
µg/kg	microgram(s)/kilogram(s)
NFA	no further action
NMAC	New Mexico Administrative Code
NMSA	New Mexico Statutes Annotated
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NOD	Notice of Deficiency
P1VCA	Phase 1 Voluntary Corrective Action
P2VCA	Phase 2 Voluntary Corrective Action
PCB	polychlorinated biphenyl

pCi	picocurie(s)
pCi/g	picocurie(s)/gram
ppbv	parts per billion by volume
PSL	Physical Science Laboratory
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RMMA	Radiological Materials Management Area
RPSD	Radiation Protection Sample Diagnostics
RSI	Request for Supplemental Information
SAP	Sampling and Analysis Plan
SEM	scanning electron microscope
SERF	Sandia Engineering Reactor Facility
SNL	Sandia National Laboratories
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TAG	Tijeras Arroyo Groundwater
TB	trip blank
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TDD	telecommunications device for the deaf
TEDE	total effective dose equivalent
TPH	total petroleum hydrocarbons
TTY	telephone typewriter or teletypewriter
UCL	upper confidence limit
USFS	U.S. Forest Service
UXO	unexploded ordnance
VCM	voluntary corrective measure
VOC	volatile organic compound
XRF	x-ray fluorescence
yd	yard(s)

## FACT SHEET / STATEMENT OF BASIS

Proposal for Corrective Action Complete Status for  
24 Solid Waste Management Units / Areas of Concern  
Sandia National Laboratories, EPA ID No. NM5890110518

Under the authority of the New Mexico Hazardous Waste Act, NMSA 1978, § 74-4-1 *et seq.*, and the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC, the New Mexico Environment Department (Department) may approve or deny hazardous waste permits, closure plans, permit modifications, and amendments. Pursuant to this authority the Department intends, pending public input, to approve corrective action complete (CAC) status for 24 Solid Waste Management Units (SWMUs)/Areas of Concern (AOCs) at the Sandia National Laboratories Facility (SNL or the Facility). Each of the SWMUs/AOCs proposed for CAC status was addressed in one or more of the following permitting requests from the U.S. Department of Energy (DOE) and Sandia Corporation (Permittees): a March 14, 2006, permit modification request regarding 26 SWMU/AOCs; a January 7, 2008 request regarding 5 additional SWMUs/AOCs; and a March 16, 2012 request regarding one additional SWMU. (The number of SWMUs/AOCs involved in this present permitting action does not total 32 because three have been acted on separately as explained below, and five are undergoing additional characterization requested by the Department). These permit modification requests are subject to 20.4.1.900 NMAC, incorporating 40 CFR 270.42(c), and 20.4.1.901 NMAC. The SWMUs/AOCs are listed in the Hazardous and Solid Waste Amendments (HSWA) Corrective Action Module IV, which is part of the Permittees' current Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit (NM5890110518) issued in 1992.

The Department is also issuing for public comment on this same date a revised draft Hazardous Waste Facility Permit (draft Permit) which, when finalized, would authorize the Permittees to manage, treat and store hazardous and mixed waste at the Facility. A fact sheet concerning the draft Permit is available separately from the Department through the contact procedures indicated in Sections D and H of this Fact Sheet/Statement of Basis. The draft Permit, when finalized, will replace in full the Hazardous Waste Facility Permit for SNL issued in 1992. Approval or disapproval of CAC status for the 24 SWMUs/AOCs will be tracked in the new Hazardous Waste Facility Permit (specifically, in Attachment K of that permit).

On December 10, 2007, the Department issued a public notice proposing to grant CAC status for 26 SWMUs/AOCs through a Class 3 modification of the 1992 permit. The public comment period for this action ended February 8, 2008, and the Department received public comments and a request for a public hearing. The Department granted CAC status for three SWMUs/AOCs on July 27, 2012, which were not opposed by the public, but has not made a final decision for the other SWMUs/AOCs which may be subject to a public hearing. As required by 20.4.1.901.A (4) NMAC, the Department, in conjunction with the Permittees, has attempted since February 2008 to resolve the issues giving rise to opposition to granting CAC status for the other 23 SWMUs/AOCs.

Twenty of the 26 SWMUs/AOCS addressed by the public notice of December 10, 2007, are again included in the current proposal to grant CAC status. NMED has determined that three

SWMUs/AOCs will require additional characterization; therefore those three SWMUs/AOCs are not included in the current proposal.

Persons who provided public comment by the February 8, 2008 deadline do not need to resubmit their comments, and may submit additional comments concerning any of the 24 SWMUs/AOCs currently being proposed for CAC status. However, those who requested a public hearing by the February 8, 2008, deadline must request a hearing again in accordance with the procedures described below in Section F under the heading *Public Participation* if they still desire that a public hearing be held concerning one or more of the SWMUs/AOCs currently proposed for CAC status.

Anyone who has not previously submitted comments during the comment period ending February 8, 2008, may submit comments or request a hearing regarding the 24 SWMUs/AOCs currently being proposed for CAC status by following the procedures under the heading *Public Participation*.

Since December 2007, the Permittees have requested that an additional six SWMUs/AOCs be considered for CAC status. The Department has not previously issued a notice for public comment concerning these six SWMUs/AOCs. Of the six SWMUs/AOCs, four are included in the current proposal to grant CAC status; these are SWMUs 28-2, 105, LTES-1 and AOC 1101 (two of the six are among the five SWMUs/AOCs for which the Department has requested additional site characterization). Anyone wishing to comment on these four SWMUs/AOCs or request a hearing in relation to these sites must follow the procedures under the heading *Public Participation*.

The Department is proposing that for some of the SWMUs/AOCs that the Permittees be required to maintain administrative and physical controls (Corrective Action Complete with Controls). Those SWMUs/AOCs will be addressed in Attachment M of the draft Permit mentioned above, once that Permit becomes effective. Examples of such controls include posting signage, conducting inspections, restricting future land use, and annual reporting. One SWMU (SWMU 52) was originally categorized in error as requiring an industrial land use control in the December 2007 public notice but is now listed in the draft Permit as not requiring any controls. Additionally, the Department proposes that the Permittees will no longer have to conduct annual groundwater monitoring at SWMUs 49 and 116 (required by the NMED as a control in a letter of April 8, 2010) because definitive evidence of groundwater contamination was not detected in eight quarters of monitoring. Thus, a groundwater control requirement will not be found for SWMUs 49 and 116 in Attachment M of the draft Permit.

All of the AOCs subject to this permit modification request are also properly classified as SWMUs. The AOC designation in some of the names of the SWMUs is retained in this document as a matter of maintaining consistency with the names listed in the Facility's current Permit tables.

## **A. Facility Description**

Sandia National Laboratories is located within the boundaries of Kirtland Air Force Base south of and adjacent to the city of Albuquerque in Bernalillo County, New Mexico. SNL is a multi-purpose engineering and science laboratory owned by the U. S. Department of Energy (DOE) and operated by Sandia Corporation, a subsidiary of Lockheed Martin. The DOE and Sandia Corporation are collectively referred to as the "Permittees".

SNL designs components for the nation's nuclear weapons, designs and tests conventional military weapons, performs a wide variety of energy research and development projects, and works on assignments that respond to national security threats. As a result of its testing and research activities, SNL generates solid wastes and hazardous, radioactive, and mixed wastes (those wastes containing both hazardous and radioactive components). From 1945 to 1988, hazardous, mixed, and solid wastes were disposed or released of at SNL at numerous locations which have been classified by the Department as SWMUs or AOCs. The SWMUs and AOCs include landfills, drainfields and seepage pits, outfalls, waste piles, and test areas.

The mailing address for Sandia Corporation is 1515 Eubank SE, Albuquerque, New Mexico 87123. The Sandia Site Office of the U. S. Department of Energy (DOE)/ National Nuclear Security Administration (NNSA) is located at KAFB-East, Pennsylvania and H Street, P.O. Box 5400, Albuquerque, NM 87185. The Facility's primary contact for this action is: Mr. David Rast, DOE/NNSA, P.O. Box 5400, Albuquerque, NM 87185.

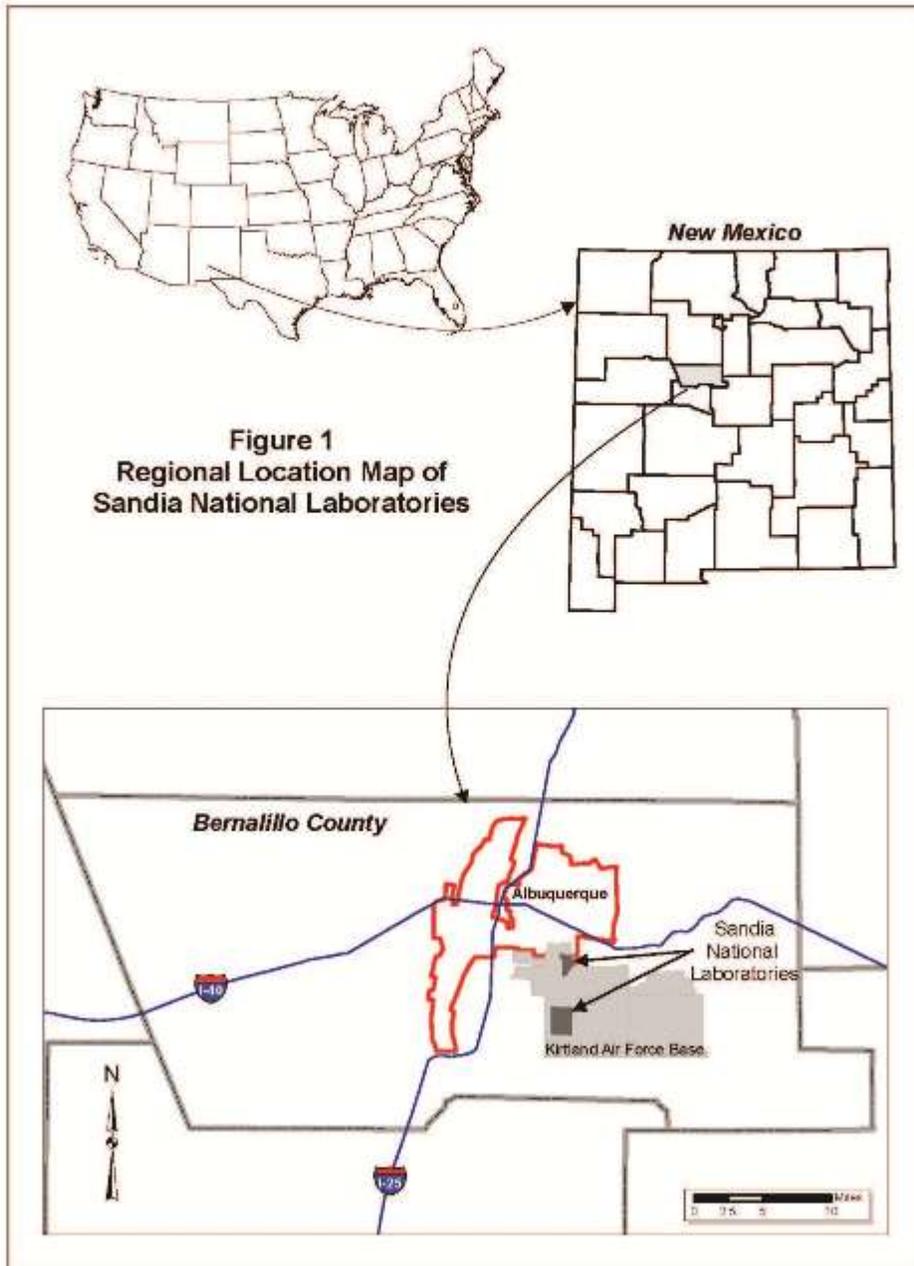
## **B. Background**

Under the 1984 Hazardous and Solid waste Amendments (HSWA), the U.S. Environmental Protection Agency (EPA) issued Module IV to Permittee's RCRA Hazardous Waste Facility Permit, effective August 26, 1993. Module IV required investigation and corrective action at approximately 200 Environmental Restoration (ER) sites (referred to as SWMUs/AOCs in the Permit and draft Permit). On January 2, 1996, the Department received authorization from the EPA for corrective action and became the administrative authority for this action.

This Statement of Basis describes 24 SWMU/AOCs for which the Permittees are seeking CAC status. Table 1 lists the SWMU/AOCs included in the current proposal to grant CAC status. Some SWMUs/AOCs are referred to as ER Sites in older documentation.

Currently, Table A.1 of Module IV of the Permittees' Hazardous Waste Facility Permit lists SWMU/AOCs where corrective action is necessary to characterize and/or remediate past releases of hazardous wastes or hazardous waste constituents. Additionally, in the current Hazardous Waste Facility Permit Module IV, Table A.2 lists SWMU/AOCs for which corrective action is not required. Table A.1 corresponds to Table K-1 of Attachment K of the draft Permit. Table A.2 has been replaced by Tables K-3 and K-4 in the draft Permit. Table K-3 lists SWMUs/AOCs where corrective action is complete with controls; Table K-4 lists SWMUs/AOCs where corrective action is complete without controls. (Table K-2 is reserved for SWMUs/AOC requiring corrective action under the permit, of which there are currently none). As indicated above, controls for each SWMU/AOC for which controls are required are found in Attachment M of the draft permit.

If approved in full, the proposed modification would grant CAC Status for the 24 SWMU/AOCs. Based on public comment, it is possible that CAC status will not be approved for some of the SWMU/AOCs. If any SWMU/AOCs are not approved for CAC status, their names will remain listed on Table K-1. If some or all of the 24 SWMU/AOCs are approved for CAC status, the listings of the approved SWMU/AOCs would be transferred to Tables K-3 and K-4.



**Table 1**  
**List of SWMUs/AOCs**

<b>Index No.</b>	<b>SWMU/ AOC Number</b>	<b>OU</b>
1	4	1307
2	5	1307
3	28-2	1332
4	46	1309
5	49	1295
6	52	1307
7	91	1335
8	101	1295
9	105	1306
10	116	1295
11	138	1295
12	140	1295
13	147	1295
14	150	1295
15	161	1295
16	196	1306
17	1090	1295
18	1094	1295
19	1095	1295
20	1101	1295
21	1114	1295
22	1116	1295
23	1117	1295
24	LTES 1	1306

Section I, below, briefly describes the location, history, evaluation of relevant information and the basis for determination for each of the 24 SWMU/AOCs proposed for CAC. More detailed descriptions of the particulars for each SWMU/AOC can be found in the original RCRA Facility Investigation Report or other reports for each SWMU/AOC.

### **C. Investigation and Remediation**

The Department has developed CAC criteria that are used during the investigation and remediation (if necessary) of SWMU/AOCs and that are used to determine the appropriateness of proposing CAC for any particular SWMU/AOC. In this case, it was determined that each of the SWMU/AOCs were characterized and remediated (if necessary) in accordance with current applicable state and/or federal regulations, and confirmatory data indicate that any remaining contaminant concentrations pose acceptable levels of risk to human health and the environment under current and projected future land uses (Criterion 5, see Section E below).

### **D. Administrative Record**

The Administrative Record for this proposed action consists of the three SNL Permit modification requests, this Fact Sheet/Statement of Basis, the Public Notice, RCRA Facility Investigation Report and other reports for each SWMU/AOC, Tables A.1 and A.2 of the current Permit, and Attachments K and M of the draft Permit. The complete Administrative Record may be reviewed at the following location during the public comment period with prior appointment:

NMED – Hazardous Waste Bureau  
2905 Rodeo Park Drive East, Building 1  
Santa Fe, New Mexico 87505-6303  
(505) 476-6000  
*Monday - Friday from 8:00 a.m. to 5:00 p.m.*  
*Contact: Pam Allen*

A copy of this Fact Sheet/Statement of Basis, the Public Notice, and Attachments K and M of the draft Permit are available electronically on the NMED website at: [www.nmenv.state.nm.us/HWB/snlperm.html](http://www.nmenv.state.nm.us/HWB/snlperm.html) under No Further Action or may be reviewed at the following location during the public comment period with prior appointment:

NMED-District 1 Albuquerque Office  
5500 San Antonio NE  
Albuquerque, New Mexico 87109  
(505) 222-9551  
*Monday - Friday from 8:00 a.m. to 5:00 p.m.*  
*Contact: William Moats*

Any person seeking additional information may also contact:

Mr. John E. Kieling, Chief  
Hazardous Waste Bureau - New Mexico Environment Department  
2905 Rodeo Park Drive East, Bldg 1  
Santa Fe, New Mexico 87505-6303  
E-mail: john.kieling@state.nm.us  
Telephone: (505) 476-6000  
Fax: (505) 476-6030

To obtain a copy of the Administrative Record or a portion thereof, please contact Ms. Pamela Allen at (505) 476-6000, or at the Santa Fe address given above. NMED will provide copies, or portions thereof, of the Administrative Record at a charge to the requestor.

### **E. Corrective Action Complete Criteria**

CAC status may be proposed based upon one or more of the following: field surveys, historical records, aerial photographs, employee interviews and/or confirmatory sampling results that indicate that there has not been a release of hazardous wastes or constituents to the environment or that the release does not pose a significant risk to human health or the environment. The criteria to propose a SWMU/AOC for CAC are:

1. The SWMU/AOC cannot be located, does not exist, is a duplicate SWMU/AOC, or is located within—and, therefore, investigated as part of—another SWMU/AOC.
2. The SWMU/AOC has never been used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents or other Comprehensive Environmental Response, Compensation and Liability Act hazardous substances.
3. No release to the environment has occurred nor is likely to occur in the future. The term “release” includes any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping or disposing of hazardous wastes (including hazardous constituents) into the environment.
4. There was a release but the site was characterized and/or remediated under another authority that adequately addressed corrective action, and documentation such as a closure letter is available.
5. The SWMU/AOC has been characterized or remediated in accordance with current applicable state and/or federal regulations and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

### **F. Public Participation**

NMED issues this public notice on **September 17, 2012** to announce the beginning of a 60-day comment period that will end at **5:00 p.m. MST, November 16, 2012**. Any person who wishes to comment on this action or request a public hearing should submit written or electronic mail (e-mail) comment(s) with the commenter’s name and address to the respective address below. Only comments and/or requests received on or before **5:00 p.m. MST, November 16, 2012** will be considered.

John E. Kieling, Chief  
Hazardous Waste Bureau - New Mexico Environment Department  
2905 Rodeo Park Drive East, Bldg 1  
Santa Fe, NM 87505-6303  
Ref: SNL – CAC Status 2012  
E-mail: [john.kieling@state.nm.us](mailto:john.kieling@state.nm.us)  
Ref: Draft SNL Permit

Written comments should include, to the extent practicable, all referenced factual materials. Documents in the Administrative Record need not be re-submitted if expressly referenced by the commenter. Requests for a public hearing shall provide: (1) a clear and concise factual statement of the nature and scope of the interest of the person requesting the hearing; (2) the name and address of all persons whom the requestor represents; (3) a statement of any objections to the draft Permit, including specific references to any conditions being addressed; and (4) a statement of the issues which the commenter proposes to raise for consideration at the hearing. Written comment and requests for public hearing must be filed with Mr. John Kieling on or before **5:00 p.m. MST, November 16, 2012**. NMED will provide a thirty (30) day notice of a public hearing, if scheduled.

Persons having a disability and requiring assistance or auxiliary aid to participate in this process should contact Connie Joseph at the New Mexico Environment Department, Human Resources Bureau, P.O. Box 5469, 1190 St. Francis Drive, Santa Fe, New Mexico, 87502, telephone number: (505) 827-9769. TDY users please access her number via the New Mexico Relay Network at 1-800-659-8331.

### **G. Next Steps**

All written comments submitted will be considered in formulating a final decision and may be cause for revisions. The Department will respond in writing to all public comments. This response will specify which provisions, if any, have been changed in the final decision and the reasons for the changes. All persons presenting written comments or who requested notification in writing will be notified of the decision by mail. The response will also be posted on the Department's website.

After consideration of all written public comments received and all data, views, and arguments presented at the public hearing, if one is held, NMED will issue, or modify and issue, the Permit indicating which SWMUs/AOCs have been approved for CAC status. The Permittees shall be provided by mail a copy of any relevant modified documents and a detailed written statement of reasons for the modifications.

The Secretary of the New Mexico Environment Department will make the final decision publicly available and shall notify the Permittees by certified mail. The Secretary's decision shall constitute a final agency decision and may be appealed as provided by the HWA. *See* NMSA 1978, § 74-1-14.

The final decision will become effective thirty (30) days after service of the decision to the Permittees, unless a later date is specified or review is requested under the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC, Section 901.F, *Hearings*.

## **H. Contact Person for Additional Information**

For additional information, contact:

John E. Kieling, Chief  
New Mexico Environment Department  
Hazardous Waste Bureau  
2905 Rodeo Park Drive East, Building 1  
Santa Fe, New Mexico 87505-6303  
Ref: SNL – CAC Status 2012  
Email: [john.kieling@state.nm.us](mailto:john.kieling@state.nm.us)  
Telephone: (505) 476-6000  
Fax: (505) 476-6030

## **I. Description of SWMUs and AOCs Proposed for CAC**

### **SWMU 4, LWDS Surface Impoundments/Liquid Disposal System**

#### **Site Location**

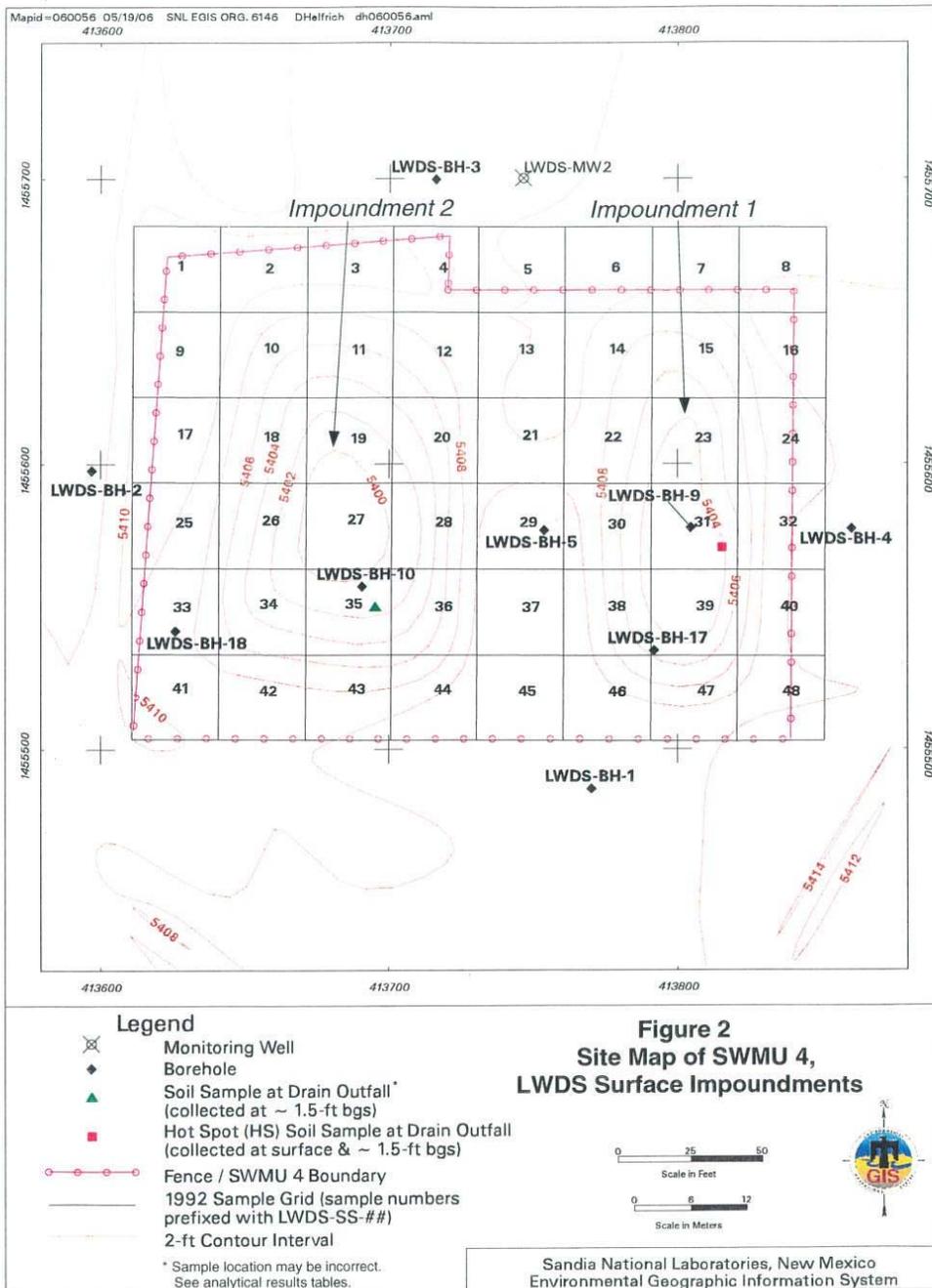
SWMU 4, the Liquid Waste Disposal System (LWDS) Surface Impoundments, is located northwest of TA-V (Figure 2). The LWDS consisted of three individual SWMUs including SWMU 52, the Holding Tanks; SWMU 5, the Drainfield; and SWMU 4, the Surface Impoundments (Figure 3).

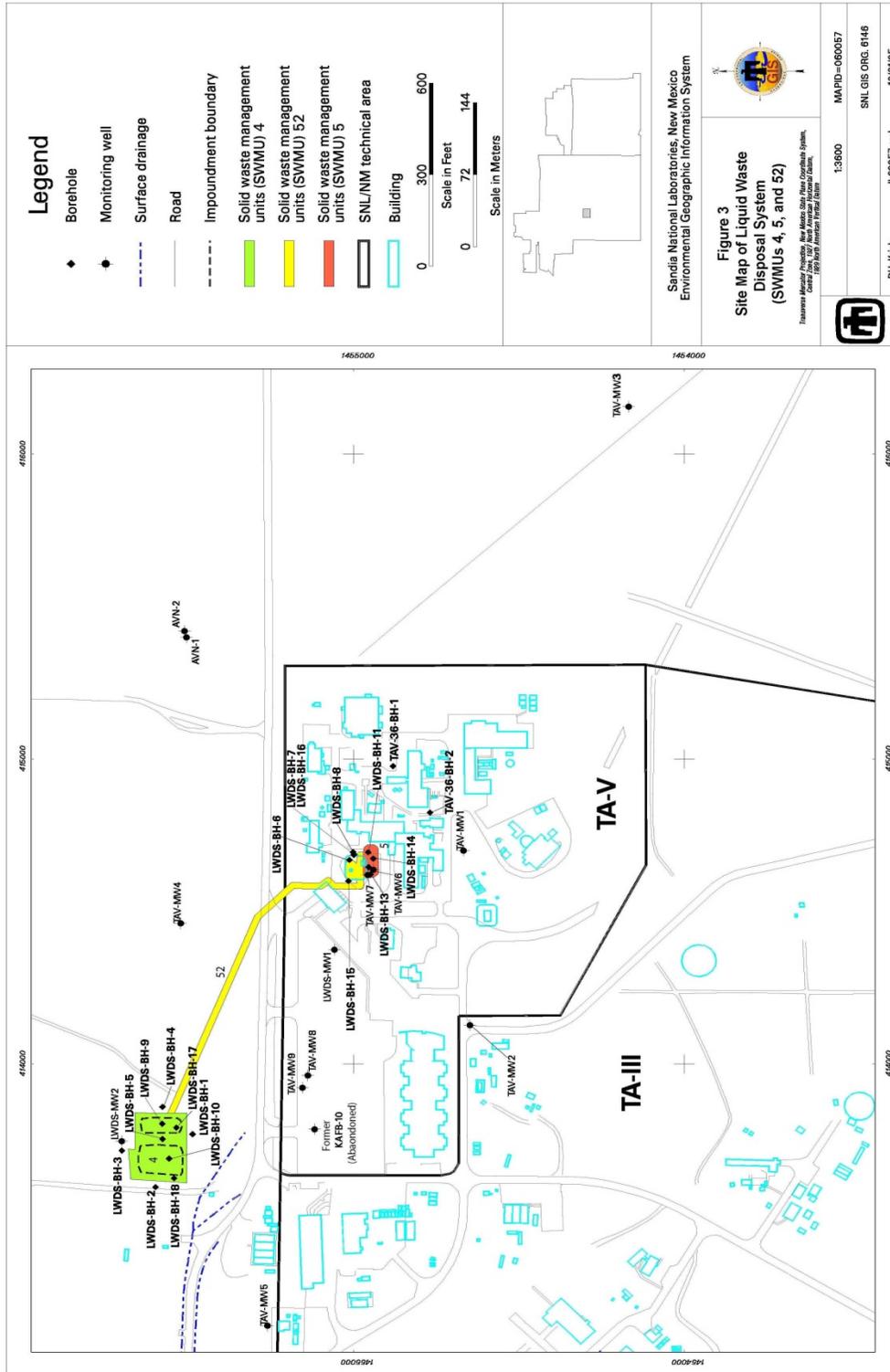
#### **Evaluation of Relevant Information**

SWMU 4 site investigation began in 1992 and included a surface radiation survey, organic vapor surveys and extensive surface soil sampling. A 10- by 10-yard (yd) grid was established and surface soil samples were collected from the center of each 10- by 10-yd square. Additional samples were collected from the surface and at a depth of 1 foot (ft) at the drainage outfalls. Soil samples were analyzed at an off-site laboratory for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PCBs, metals and radionuclides.

In 1992 five soil boreholes (LWDS-04-BH01 through LWDS-04-BH05) were advanced from 85 to 100 ft below ground surface (bgs) around the surface impoundments. In 1994 four more soil boreholes (LWDS-04-BH09, LWDS-04-BH10, LWDS-04-BH17 and LWDS-04-BH18) were advanced within the surface impoundments. Continuous core was collected from all the boreholes. Soil samples were collected at approximately 5-ft intervals and analyzed for metals, VOCs, SVOCs, PCBs, tritium and radionuclides by gamma spectroscopy.

In 1992, groundwater monitor well LWDS-MW2 was installed north of the impoundments to a total depth of 531 ft bgs and screened between 506 to 526 ft bgs. This monitor well is part of the TA-III/V monitor well network and is sampled on a regular basis. Continuous core was collected from the borehole for the monitor well. Soil samples were collected at approximately 5-ft intervals and submitted for laboratory analysis for VOCs, SVOCs, metals and radionuclides.





Results of the soil samples revealed 17 metals (antimony, arsenic, barium, beryllium, cadmium, total chromium, chromium VI, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium and zinc) that were detected above background values. One PCB (aroclor-1260) was detected in a surface sample at 0.071 mg/kilogram (kg). Nine VOCs (acetone, benzene, 2-butanone, 2 hexanone, methylene chloride, 4-methyl-2-pentanone, styrene, tetrachloroethene and toluene) and seven SVOCs (benzo(a)anthracene, benzo(b)fluoranthene, bis(2-Ethylhexyl) phthalate, chrysene, fluoranthene, phenanthrene and pyrene) were detected. Five (5) radionuclides (cesium-137, radium-226, thorium-232, uranium-235 and tritium) were detected above background activities. Cobalt-60 and lead-210 were detected, but there are not background activities for comparison. There was a detection of uranium-238 that equaled the background activity.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects in the industrial and residential land-use scenarios. For the industrial land-use scenario, the total hazard index (HI) and the estimated excess cancer risk are acceptable (Table 2). For the residential land-use scenario, the total HI and excess cancer risk are unacceptable (Table 2).

In this case, average concentrations are thought to be more representative of actual site conditions. Using the upper confidence limit (UCL) of the mean concentrations for the main contributors to risk (arsenic, cadmium and phenanthrene), the total HI and estimated excess cancer risk were reduced to 2.10 and 2E-6, respectively. None of the individual hazard quotients (HQs) for noncarcinogens exceed 1.0 under these conditions. Although the excess cancer risk under the residential scenario is acceptable, the HI is unacceptable.

For the radiological COCs (cesium-137, cobalt-60, lead-210, radium-226, thorium-232, tritium, uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 1.7E+1 millirem (mrem)/year (yr). The estimated excess cancer risk is 2.3E-4. Most of the dose is due to short-lived radionuclides that will quickly decay away. In August 2003, the DOE approved unrestricted radiological release for the site, using 25 mrem/yr as the threshold guidance.

Ecological risks associated with SWMU 4 were estimated through a risk assessment that incorporated site-specific information when available. Overall, risks to ecological receptors are expected to be low because predicted risks associated with exposure to constituents of potential ecological concern (COPECs) are based upon calculations using maximum detected values and (for the burrowing owl) the assumed area use factor of 1.0. Application of the area use factor of 0.023 reduces all HQs for the burrowing owl to values less than 1. The UCL concentrations of arsenic and barium are within the background range. HQs based upon the UCLs of cobalt, copper, lead, and acetone result in no HQs greater than unity. All other HQs (based upon UCL concentrations) are less than 10 with the exception of total chromium (HQ of 28 for plants) based upon a chromium VI plant benchmark, and all HQs greater than 2.6 are limited to plants. Based upon this final analysis, ecological risks associated with SWMU 4 are expected to be low.

In conclusion, human health and ecological risks are acceptable under an industrial land-use scenario.

**Table 2**  
**Risk Assessment Values for SWMU 4 Nonradiological COCs**

COC	Maximum Concentration /UCL Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Antimony	9.3	0.02		0.31	
Arsenic	7.6/2.7	0.03/ <b>Below Background<sup>b</sup></b>	5E-6 / <b>Below Background<sup>b</sup></b>	0.35/ <b>Below Background<sup>b</sup></b>	2E-5/ <b>Below Background<sup>b</sup></b>
Barium	849	0.01		0.16	
Beryllium	4.9	0.00	2E-9	0.03	5E-9
Cadmium	154/ <b>11.1</b>	0.30/ <b>0.02</b>	5E-8/ <b>4E-9</b>	3.95/ <b>0.28</b>	1E-7/ <b>8E-9</b>
Chromium, total	97.7	0.00		0.00	
Chromium VI	11.2	0.00	2E-8	0.05	5E-8
Cobalt	42.2	0.00	2E-8	0.03	5E-8
Copper	239	0.01		0.08	
Mercury	0.61	0.00		0.03	
Nickel	173	0.01		0.11	
Selenium	10	0.00		0.03	
Silver	90.5	0.02		0.24	
Thallium	1.2	0.02		0.24	
Vanadium	52.7	0.01		0.10	
Zinc	198	0.00		0.01	
<b>Organic</b>					
Acetone	4.3	0.00		0.00	
Benzene	0.01	0.00	7E-9	0.00	2E-8
Benzo(a)anthracene	0.35	0.00	2E-7	0.00	6E-7
Benzo(b)fluoranthene	0.46	0.00	2E-7	0.00	7E-7
bis(2-Ethylhexyl) phthalate	5.9	0.00	3E-8	0.00	1E-7
2-Butanone	0.17	0.00		0.00	
Chrysene	0.36	0.00	2E-9	0.00	6E-9
Fluoranthene	0.85	0.00		0.00	
2-Hexanone	0.024	0.00		0.00	
Methylene chloride	0.046	0.00	3E-7	0.00	6E-7
4-Methyl-2-pentanone	0.02	0.00		0.00	
Phenanthrene	0.71/ <b>0.34</b>	0.26/ <b>0.12</b>		0.84/ <b>0.39</b>	
Pyrene	0.75	0.00		0.00	
Styrene	0.0025	0.00		0.00	
Tetrachloroethene	0.0085	0.00	2E-9	0.00	6E-9
Toluene	0.012	0.00		0.00	
Total		0.71/ <b>0.24</b>	6E-6/ <b>6E-7</b>	6.58/ <b>2.10</b>	2E-5/ <b>2E-6</b>

Note: UCLs are calculated only for risk drivers. UCL concentrations and associated risk are in **bold**.

<sup>a</sup>EPA 1989.

<sup>b</sup>UCL concentration was below background screening level. Therefore risk was not calculated.

## **Basis for Determination**

SWMU 4 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use (industrial).

## **SWMU 5, LWDS Drainfield/Liquid Disposal System**

### **Site Location**

SWMU 5, the LWDS drainfield, covers 0.11 acres and is located in TA-V. TA-V is a fenced, secured research and testing area located in the northeast corner of TA-III. The surface of the site is paved and situated in a flat area west of Building 6580 (Figure 4).

### **Operational History**

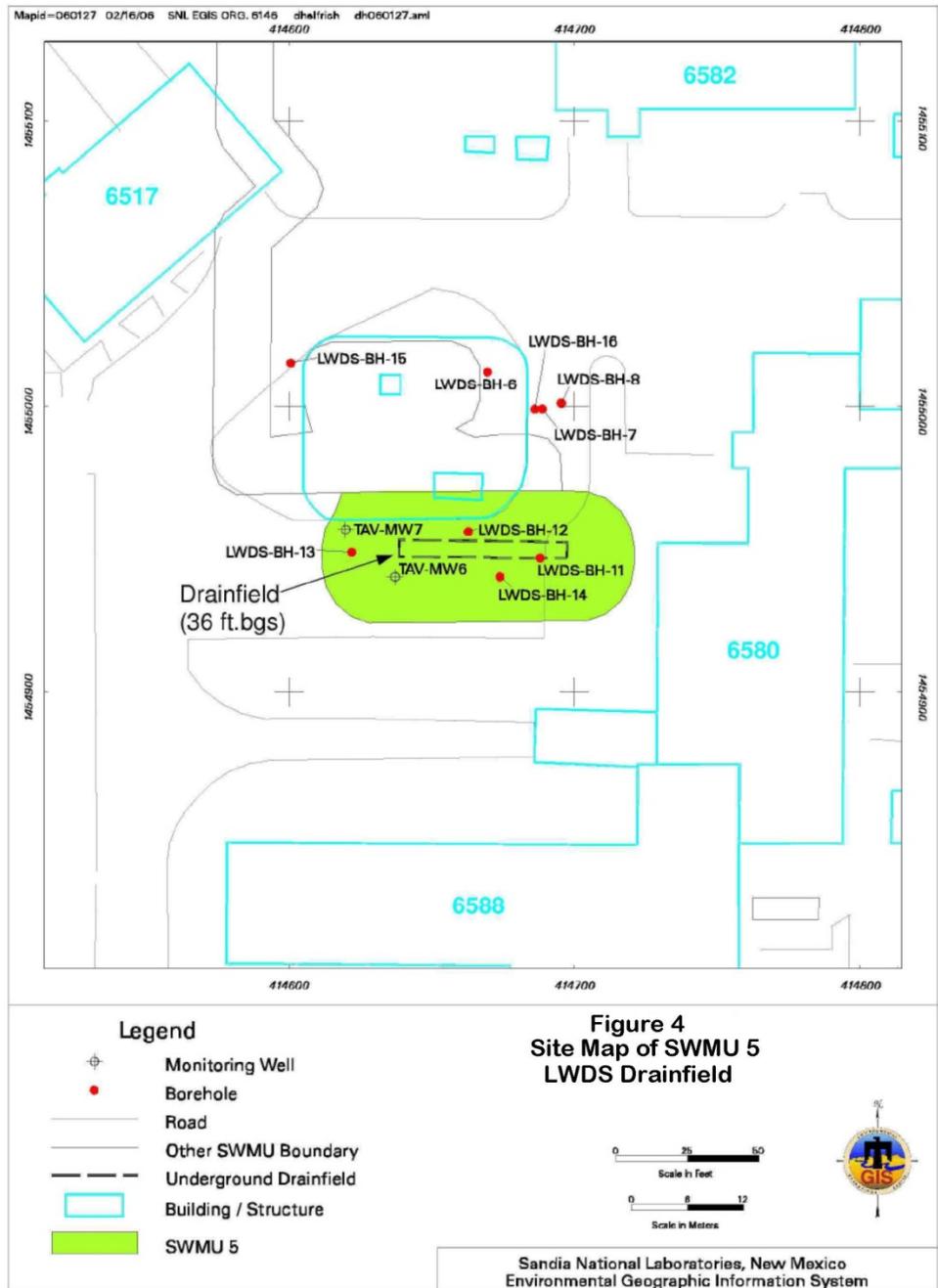
The LWDS was designed to receive, monitor and discharge radioactive effluent from the Sandia Experimental Reactor Facility in TA-V. The LWDS consists of three holding tanks (SWMU 52), a drainfield (SWMU 5), and two surface impoundments (SWMU 4). The drainfield, also known as Tank 3 of the system, is constructed of a horizontal concrete conduit filled with gravel and is buried approximately 30 ft below grade.

The SERF operated from 1962 to 1967. Effluent from the SERF was released to the holding tanks to allow short-lived radionuclides to decay before discharge to the Drainfield. The drainfield collapsed in 1967 and the unlined Surface Impoundments (SWMU 4) were built to receive effluent from the SERF. The COCs include metals, VOCs, SVOCs and radionuclides

### **Evaluation of Relevant Information**

In March 1994 four soil boreholes (LWDS-05-BH11 through LWDS-05-BH14) were advanced and samples collected at approximately 5-ft intervals starting at about 25 ft bgs to depths of 50 to 70 ft bgs. Soil samples were analyzed by an off-site laboratory for VOCs, SVOCs, metals and radionuclides by gamma spectroscopy. Five VOCs (acetone, 2-butanone, methylene chloride, toluene and trichlorethene) and two SVOCs [bis (2-Ethyhexyl) phthalate and di-n-butyl phthalate] were detected. Eleven metals (antimony, barium, cadmium, chromium, cobalt, lead, mercury, nickel, silver, thallium, vanadium and zinc) were detected above background values. In addition, four metals in one sample (arsenic, beryllium, selenium and thallium) had method detection limits (MDLs) that exceeded the background value. Cesium-137, thorium-232 and tritium had activities above background values. Cobalt-60 was detected in one sample.

In 2001, the monitor well TAV-MW6 was installed within the boundaries of SWMU 5. Soil samples were collected at 20 ft bgs and at 20-ft intervals from 80 to 500 ft bgs. Soil samples were analyzed for VOCs and metals by an off-site laboratory and for radionuclides by gamma spectroscopy by an on-site laboratory. The soil samples collected at 20 ft bgs and from 120 to 500 ft bgs were also analyzed for tritium by an off-site laboratory. Nine metals (arsenic, beryllium, cadmium, chromium, cobalt, nickel, selenium, thallium and vanadium) had concentrations that exceeded background values. Five VOCs (acetone, 2-butanone, 4-methyl-2-pentanone, methylene chloride and toluene) were detected. One sample had a tritium activity that exceeded the background value. Three radionuclides (radium-226, thorium-232 and uranium-235) had activities that exceeded background values. Also, several of the soil samples had MDAs for uranium-235 that exceeded the background value.



**Table 3**  
**Risk Assessment Values for SWMU 5 Nonradiological COCs**

COC	Maximum Concentration /UCL Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Antimony	15 <sup>c</sup> / <b>5.34</b>	0.04	–	0.49/ <b>0.17</b>	–/–
Arsenic	5.39/ <b>3.89</b>	0.02/ <b>Below Background<sup>c</sup></b>	3E-6/ <b>Below Background<sup>c</sup></b>	0.25/ <b>Below Background<sup>c</sup></b>	1E-5/ <b>Below Background<sup>c</sup></b>
Barium	258	0.00		0.05	
Beryllium	0.735	0.00	3E-10	0.00	7E-10
Cadmium	51.1/ <b>9.85</b>	0.10/ <b>0.02</b>	2E-8/ <b>3E-9</b>	1.31/ <b>0.25</b>	4E-8/ <b>7E-9</b>
Chromium, total <sup>b</sup>	42.4/ <b>18.18</b>	0.02/ <b>0.01</b>	9E-8/ <b>3E-8</b>	0.19/ <b>0.08</b>	2E-7/ <b>8E-8</b>
Cobalt	9.87 J	0.00	5E-9	0.01	1E-8
Copper	24.2	0.00		0.01	
Mercury	0.85	0.00		0.04	
Nickel	16	0.00		0.01	
Selenium	1.27	0.00		0.00	
Silver	3.7 J	0.00		0.01	
Thallium	3.89/ <b>1.09</b>	0.06/ <b>Below Background<sup>c</sup></b>	–/ <b>Below Background<sup>c</sup></b>	0.77/ <b>Below Background<sup>c</sup></b>	–/ <b>Below Background<sup>c</sup></b>
Vanadium	35.7	0.01		0.07	
Zinc	67.3	0.00		0.00	
<b>Organic</b>					
Acetone	0.0130	0.00		0.00	
2-Butanone	0.0107	0.00		0.00	
Di-n-butyl phthalate	46 J	0.00		0.01	
bis(2-Ethylhexyl) phthalate	1.6	0.00	8E-9	0.00	4E-8
Methylene chloride	0.0096	0.00	6E-10	0.00	1E-7
4-Methyl-2-pentanone	0.00218	0.00		0.00	
Toluene	0.051	0.00		0.00	
Trichloroethene	0.0038 J	0.00	4E-10	0.00	9E-8
Total		0.26/ <b>0.08</b>	3E-6/ <b>5E-8</b>	3.23/ <b>0.73</b>	1E-5/ <b>4E-7</b>

Note: UCLs are calculated only for risk drivers. UCL concentrations and associated risk are in **bold**.

<sup>a</sup>EPA 1989.

<sup>b</sup> Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

<sup>c</sup>UCL concentration was below background screening level. Therefore risk was not calculated.

COC = Constituent of concern.

EPA = U.S. Environmental Protection Agency.

J = Concentration was qualified as an estimated value.

mg/kg = Milligram(s) per kilogram.

SWMU = Solid Waste Management Unit.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For the industrial land-use scenario, the total HI and the estimated excess cancer risks were acceptable (Table 3). For the residential land-use scenario, the total HI is unacceptable (Table 3).

Average concentrations are thought to be more representative of actual site conditions. Using the UCL of the mean concentrations for the main contributors to excess cancer risk and hazards, the total HI and estimated excess cancer risk are reduced to 0.73 and 4E-7, respectively (Table 3). Thus, using these concentrations in the risk calculations, both the total human health HI and estimated excess cancer risk are acceptable for the residential land-use scenario.

For the radiological COCs (cesium-137, cobalt-60, thorium-232, tritium and uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 5.5E-6 millirem (mrem)/year (yr). The estimated excess cancer risk is 1.2E-10.

The exposure pathway analysis established that no complete ecological pathway exists for exposure of ecological species to contaminants at SWMU 5. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

### **Basis for Determination**

SWMU 5 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

### **SWMU 28-2, Mine Shaft**

#### **Site Location**

SWMU 28-2, Mine Shaft, is one of 10 mines identified as SWMU 28 Mine Shafts in the Foothills Test Area. SWMU 28-2 is situated in the USFS Withdrawn Area near the southeast corner of KAFB (Figure 5).

#### **Operational History**

SWMU 28-2 is an abandoned mine where activities took place in the early to mid-1900s. Based on interviews of SNL personnel, it was used for experimental testing and possible disposal activities.

Depleted uranium was found immediately beneath the ground surface outside the mine when a barrier was being installed in 2001 to secure the opening of the mine shaft from entry.

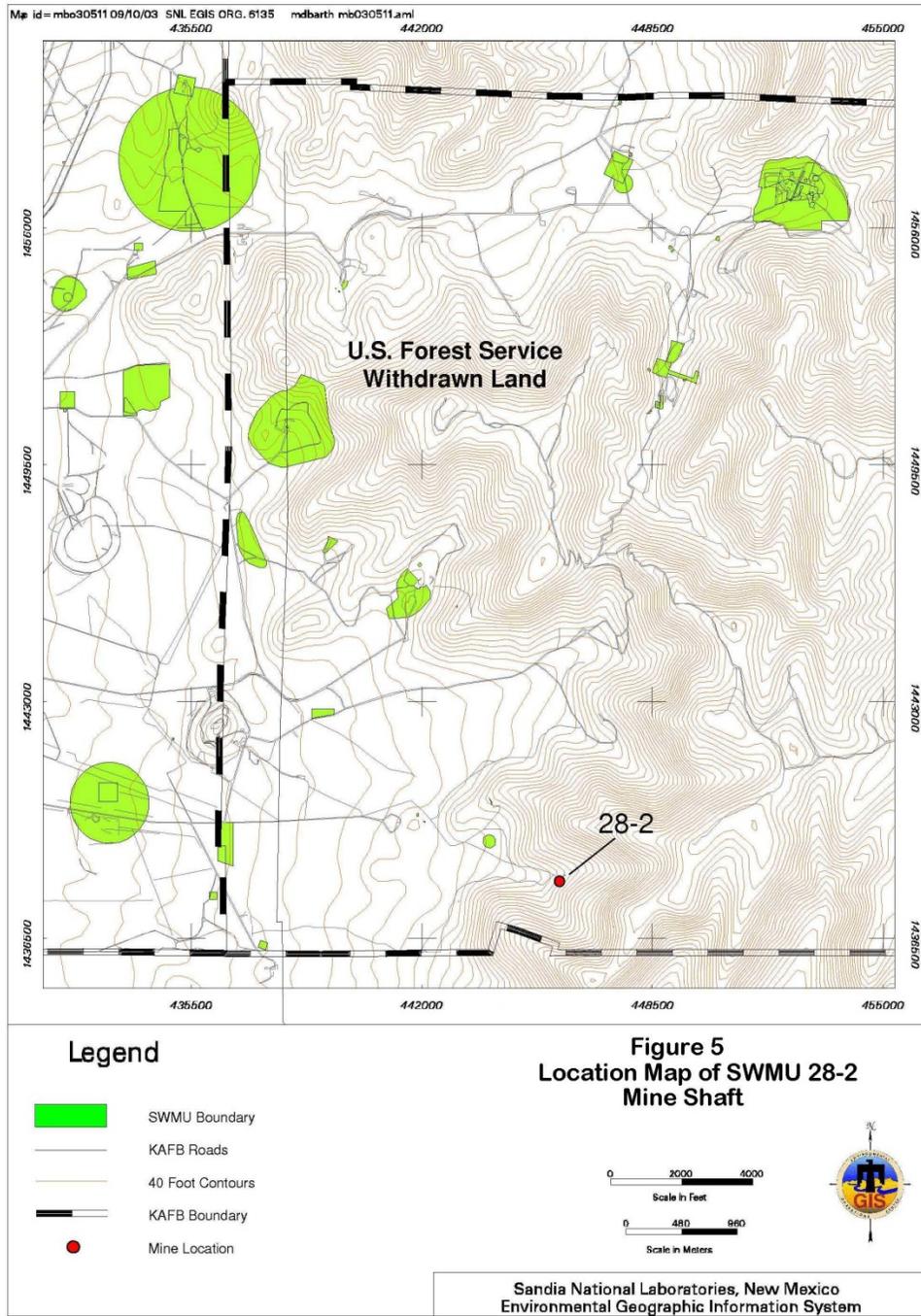
The COCs include metals, HE, and radionuclides.

#### **Depth to Groundwater**

The depth to groundwater at the site is not known, as there are no wells in the immediate vicinity, but it is likely to be greater than 100 ft bgs (based on drilling at this site).

#### **Evaluation of Relevant Information**

In April 1998, 12 soil samples were collected from inside the mine as part of the RCRA Facility Investigation (RFI). The soil samples were analyzed for the COCs.



In December 2001, while installing a barrier to the entrance, depleted uranium was found outside of the mine entrance. In July 2002, a Voluntary Corrective Action (VCA) was conducted to remove the depleted uranium. An initial radiation walkover survey was conducted to identify anomalies. The anomalies and surrounding contaminated soil were removed. A confirmatory radiation walkover survey was conducted to verify that the site was successfully remediated.

Following the confirmatory radiation survey, five in situ soil gamma spectroscopy measurements were taken, and eight confirmatory soil samples plus one duplicate were collected and analyzed for the COCs. The in situ gamma spectroscopy measurements revealed activities for uranium-238, the indicator radionuclide, in the remaining soil are slightly above or consistent with the background level of 2.31 picocuries/gram (pCi/g).

Twenty soil samples plus one duplicate collected in 1998 and 2002 were used in the risk assessment for SWMU 28-2.

HE was detected in all of the samples collected in 1998. Ten samples contained 1,3,5 trinitrobenzene at concentrations ranging from 140 J to 200 micrograms/kilogram ( $\mu\text{g}/\text{kg}$ ). Six samples contained hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) at concentrations ranging from 150 J to 220 J  $\mu\text{g}/\text{kg}$ . No detectable levels of HE were found in the VCA confirmatory samples collected in 2002.

Arsenic was detected above the background concentration in two samples collected in 1998 and in two samples collected in 2002 at concentrations ranging from 10.1 to 20.5 mg/kg. Beryllium was detected above the background concentration in all of the samples collected in 2002 at concentrations ranging from 0.863 to 1.23 mg/kg. Beryllium was not detected above the background concentration in any of the samples collected in 1998. Barium was detected above the background concentration in two samples collected in 1998 and in eight samples collected in 2002 at concentrations ranging from 274 to 1,880 mg/kg. Chromium was detected above the background concentration in two samples collected in 2002 at a maximum concentration of 22.2 mg/kg. Chromium was not detected above the background concentration in any of the samples collected in 1998. Lead was detected above the background concentration in all samples collected in 1998 and 2002 at concentrations ranging from 74.8 J to 484 mg/kg. Eleven samples collected in 1998 contained detectable mercury above the background concentration, and all the samples collected in 2002 contained elevated mercury at concentrations ranging from 0.0601 to 1.02 mg/kg. Silver was detected above the background concentration in two samples collected in 2002 with a maximum value of 1.78 mg/kg, but was not detected in any of the samples collected in 1998.

Uranium-238 had an MDA above background activity levels in two samples collected in 1998; six samples collected in 2002 had activities ranging from 2.4 to 452 pCi/g which are above the background activity. Thorium-232 was detected above background activity levels in three samples collected in 1998 and in all of the samples collected in 2002 with activities ranging from 1.08 to 1.77 pCi/g. All cesium-137 activities for samples collected in 1998 and 2002 were below the NMED-approved background activity level. All of the samples collected in 2002 contained uranium-235 activities or MDAs above the approved background activity level, with MDAs ranging from 0.228 to 7.12 pCi/g; all of the samples collected in 1998 had associated MDAs above the approved background activity levels with MDAs ranging from 0.232 to 0.349 pCi/g.

A risk screening assessment was performed for this site, initially using maximum COC concentrations, to evaluate the potential for adverse health effects in recreational and residential land-use scenarios.

The maximum concentration value for lead was 484 mg/kg. The EPA does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. The NMED guidance for lead screening concentrations for construction and industrial land-use scenarios are 750 and 1,500 mg/kg, respectively. The EPA screening guidance value for a residential land-use scenario is 400 mg/kg. The maximum concentration for lead at this site is greater than the residential screening value. However, using the 95% UCL of the mean lead concentration (259.6 mg/kg) is lower than all the screening values; therefore, lead was eliminated from further consideration in the human health risk assessment. For the recreational land-use scenario, the total human health HIs and the estimated excess cancer risks were less than NMED guidelines for risk (Table 4). For the residential land-use scenario, the total human health HIs and excess cancer risks exceeded NMED guidelines for risk

**Table 4**  
**Risk Assessment Values for SWMU 28-2 Nonradiological COCs**

COC Name	Maximum Concentration/UCL Concentration (mg/kg)	Recreational Land-Use Scenario (Maximum Concentration)		Residential Land-Use Scenario (Maximum Concentration)		Residential Land-Use Scenario (UCL Concentration)	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>							
Arsenic	20.5/ <b>10.3</b>	0.02	1.E-06	0.95	5.E-05	<b>0.48</b>	<b>3.E-05</b>
Barium	1880	0.01	--	0.36	--	0.36	--
Beryllium	1.23	0	4.E-11	0.01	1.E-09	0.01	1.E-09
Chromium, total <sup>a</sup>	22.2	0	4.E-09	0.1	1.E-07	0.1	1.E-07
Mercury	1.02	0	--	0.04	--	0.04	--
Silver	1.78	0	--	0	--	0	--
<b>Organic</b>							
1,3,5-Trinitrobenzene	0.2 J	0	--	0	--	0	--
RDX	0.22 J	0	1.E-09	0	5.E-08	0	5.E-08
<b>Total</b>		<b>0.03</b>	<b>1.E-06</b>	<b>1.46</b>	<b>5.E-05</b>	<b>1</b>	<b>3.E-05</b>

Note: UCLs are calculated only for risk drivers. UCL concentrations and associated risk are in **bold**.

<sup>a</sup>Chromium, total considered to be chromium VI in risk calculations (most conservative)

COC = Constituent of concern.

mg/kg = Milligram(s) per kilogram.

RDX = hexahydro-1, 3, 5-trinitro-1, 3, 5-triazine

The total human health HI calculated for nonradiological COCs is 1.46 for a residential land-use scenario, which is greater than the NMED guideline of 1. The total estimated excess cancer risk is 5E-5 for a residential land-use scenario, which exceeds the NMED guideline of 1E-5.

Although both the HI and estimated excess cancer risk exceed NMED guidelines for a residential land-use scenario, maximum concentrations were used in the risk calculations. Using the 95% UCL of the mean concentration of the main contributor to risk (arsenic), the HI and excess cancer risk are reduced to 1 and 3.E-5, respectively. The estimated excess cancer risk still exceeds the NMED guidelines for a residential land-use scenario; however, the main risk driver is arsenic. SWMU 28-2 is an abandoned mine that exploited an ore deposit containing metals in addition to fluorspar. Higher background levels of arsenic at this site are likely to be present due to natural conditions, and not testing activities. Other mines in the area that do not show evidence of testing activities are likely also to exhibit higher background concentrations of metals given that the deposits contain galena (lead sulfide), barite (barium sulfate) and chalcopyrite (copper iron sulfide). Because the arsenic at SWMU 28-2 is likely present due to natural conditions, controls will not be imposed for the site.

Based on maximum concentrations, both the HI and estimated excess cancer risk are less than the NMED guidelines for risk under a recreational land-use scenario, indicating acceptable risk under this scenario no matter the source of arsenic.

The human health incremental TEDE under a recreational land-use scenario is 1.8 mrem/yr, which is less than the EPA numerical guidance of 15 mrem/yr. The human health incremental TEDE under a residential land-use scenario is 3.2E-1 mrem/yr, which is significantly less than the numerical guidance of 75 mrem/yr.

Using the SNL ecological risk assessment methodology, the ecological risk for SWMU 28-2 is predicted to be low.

In conclusion, human health risk and ecological risks are acceptable per NMED guidance.

### **Basis for Determination**

SWMU 28-2 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk.

### **SWMU 46, Old Acid Waste Line Outfall**

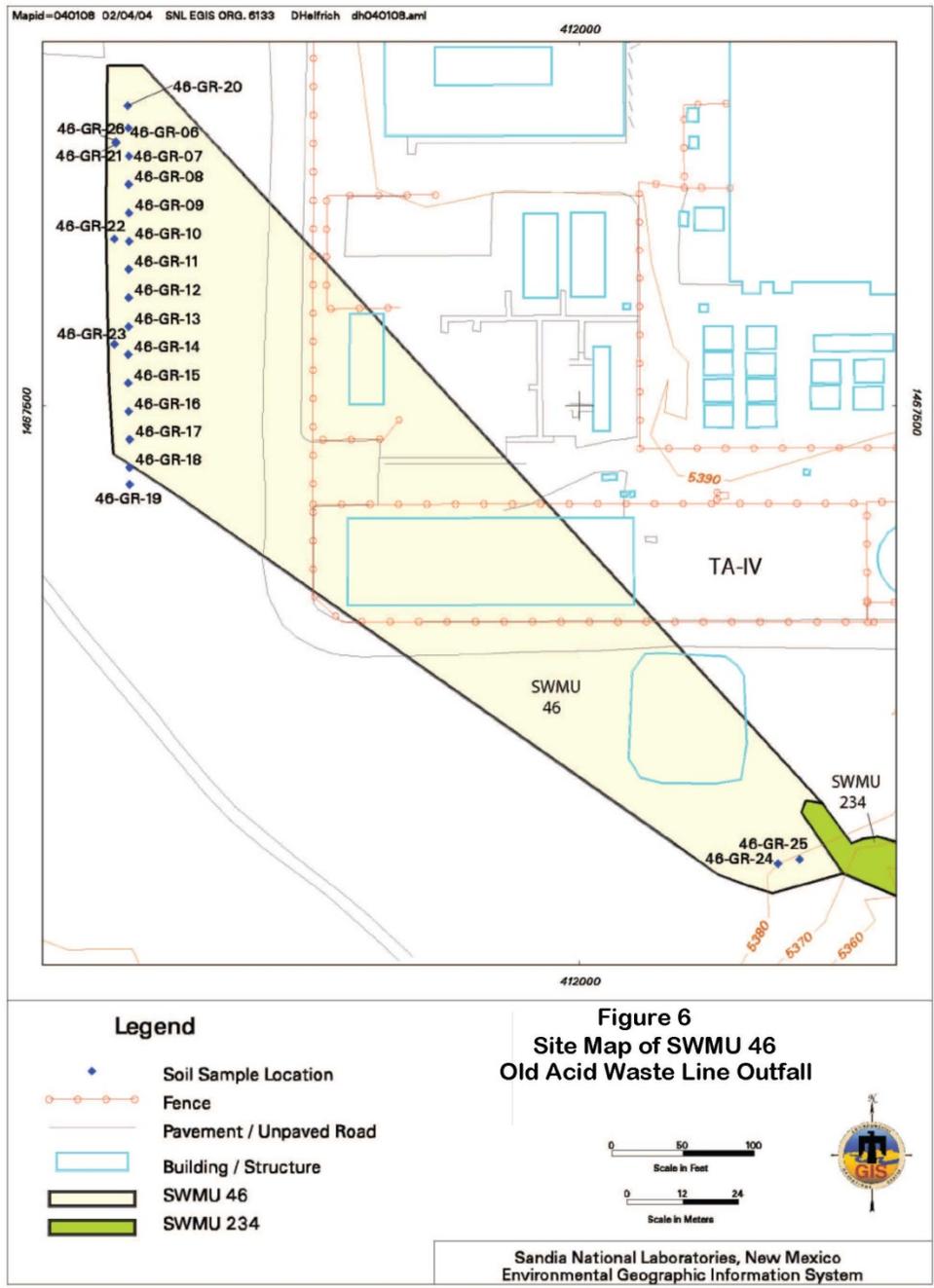
#### **Site Location**

SWMU 46 is at the southwest corner of TA-IV (Figure 6). The site covers approximately 2.25 acres on the northern rim of the Tijeras Arroyo. The site consists of the inactive outfall (discharge point) for the Old Acid Waste Line (SWMU 226). The wastewater from SWMU 226 discharged into three shallow, nearly parallel, earthen outfall ditches. Each outfall ditch measured approximately 700 ft long. The confluence of these three outfall ditches is still present on the northern rim of the Tijeras Arroyo.

#### **Operational History**

From about 1948 through late 1974, SWMU 46 was the discharge point for the Old Acid Waste Line (SWMU 226) that was connected to several TA-I buildings containing research laboratories, machine shops, a paint shop, an electroplating shop, a foundry and a photographic processing laboratory. In the late 1960s, an estimated 130,000 gpd of TA-I wastewater was discharged at the SWMU 46 outfall ditches.

The COCs include metals, HE compounds, VOCs, SVOCs, PCBs and radionuclides.



## Evaluation of Relevant Information

In September 1994, soil samples were collected from a nearby storm-water ditch. A review of historical aerial photographs conducted in 2000 determined that this ditch had been constructed in 1977 for storm water runoff from TA-IV. Therefore, the soil samples were not associated with the acid waste line discharge and the results of this sampling were not used in the risk assessment.

In 1994 and 2001, SWMU 46 was surveyed for unexploded ordnance (UXO), HE and radiological material; none were found.

In August 1998, soil-vapor samples were collected from four Geoprobe boreholes. Samples were collected at depths of 10, 20, and 30 ft bgs. Low concentrations of 16 VOCs were detected in soil-vapor samples collected near the confluence of the outfall ditches. Trichlorethene (TCE) had a maximum concentration of 55 parts per billion by volume (ppbv). VOCs were not detected in boreholes BH-1 and BH-2, which were located approximately 700 and 300 ft south of the confluence, respectively.

In October 1999, passive soil-vapor samples were collected. The sampling area covered approximately 7 acres and focused on the surface-water ditch, which at the time was the suspected waste-water discharge location. After being buried for 30 days at shallow depths ranging from approximately 0.5 to 1 ft bgs, the collectors were retrieved and analyzed for VOCs and total petroleum hydrocarbon (TPH). Low concentration levels of 17 VOCs were detected.

In 2000, a historical review of aerial photographs from 1951 to 1993 and personnel interviews identified three outfall ditches that had been located at SWMU 46. None of these ditches was determined to be the storm-water ditch that had been sampled in 1994. The first outfall ditch was constructed about 1948. The ditch was approximately 700 ft long and extended from the waste-line outfall to the arroyo rim. A parallel ditch was constructed about 1950, and a third ditch was constructed in the mid-1960s. Each of the three outfall ditches were unlined (earthen) ditches approximately 3 ft deep and 5 ft wide. Nearly the entire length of each outfall ditch was filled with soil during TA-IV construction in the mid-1980s.

In July 2000, a field investigation found that 60-ft-long segments for two of the outfall ditches were still present on the steep northern rim of the arroyo. In addition, a 110-ft-long segment of the old acid waste line (SWMU 226) was found at the northern end of the site. The waste line was composed of 8-inch diameter vitrified clay pipe.

From April 2001 through March 2002, soil-vapor samples were collected from monitor wells 46-VW-01 and 46-VW-02 for five quarters. The sampling ports for monitor well 46-VW-01 were set at 15, 65, 115, 165, 215 and 265 ft bgs, and the sampling ports for monitor well 46-VW-02 were set at 46, 96, 146, 196, 246 and 296 ft bgs. For the five quarters, the maximum TCE concentration from monitor well 46-VW-01 was 46,000 ppbv, which was collected from a depth of 115 ft bgs; the maximum TCE concentration at the lowest sampling port, a depth of 265 ft bgs, was 350 ppbv. Monitor well 46-VW-02 had a maximum TCE concentration of 650 ppbv at 96 ft bgs, and the maximum TCE soil-vapor concentration near the bottom of hole, at 246 ft bgs, was 480 ppbv.

In January 2001, a deep borehole, TJA-6, near the south end of the site was completed as a groundwater monitoring well. Soil samples were collected at 45, 95, 145 and 245 ft bgs. In March 2001, a second deep borehole, 46-VW-01, was developed as a monitoring well and samples were collected at 45, 95, 145, 195, 245 and 295 ft bgs. The samples were analyzed for

metals, VOCs, SVOCs, PCBs, HE compounds and radionuclides. Five metals (beryllium, cadmium, chromium, selenium and thallium) were detected with concentrations above background values. Four VOCs (acetone, 2-butanone, methylene chloride and toluene) and two SVOCs [bis(2-Ethylhexyl) phthalate and phenol] were detected. The radionuclide, thorium-232 was detected above background value and U-235 had two samples with MDAs greater than the background value. No PCBs or HE compounds were detected. The monitoring well, TJA-6, is part of the TAG monitoring well system and is routinely sampled.

In April 2001, soil samples were collected from three locations at the northern end of the site and one at the southeast end of the site. The samples were analyzed for VOCs, SVOCs, PCBs, HE compounds, metals and radionuclides. Two of the samples had PCB concentrations above 1 mg/kg, and several metals had concentrations above background values. This area was included in the August 2003 VCA. None of the April 2001 samples were used in the risk assessment.

In June 2001, soil samples were collected from two locations at the southeastern end of SWMU 46 as part of the characterization of SWMU 234, but were applicable to SWMU 46. Samples were collected at the surface and 5 ft bgs (with a backhoe) and analyzed for metals, VOCs, SVOCs and radionuclides. Two metals (chromium and silver) were detected slightly above background values. No VOCs were detected above MDLs. Seventeen SVOCs were detected. No radionuclides were detected above background activities.

In August 2001, a Geoprobe was used to collect soil samples from 11 boreholes (a 12th borehole was started but abandoned with no sampling) to a depth of 18 ft near the visible portion of the acid waste line at the northern end of the site. The soil samples were analyzed for VOCs, SVOCs, PCBs, metals, cyanide, HE compounds and radionuclides. Nine metals had concentrations that exceeded background values. Total PCBs greater than 1 mg/kg were not detected. Cyanide was detected. Four VOCs (acetone, 2-butanone, methylene chloride and toluene) and 26 SVOCs were detected. One HE compound (2-nitrotoluene) was detected in one soil sample. Two radionuclides (uranium-235 and uranium-238) were detected at activities above background values.

In August 2003, a VCA was conducted to remove soil that contained total PCBs in excess of 1 mg/kg (EPA screening level). A 275-ft long trench was excavated at the northern end of the site. The trench was 2.5 ft wide with a depth of 0.8 to 2 ft becoming shallower at the southern end. Approximately 50 cubic yards (cy) of contaminated soil and pieces of the waste line were shipped to an off-site disposal facility. Confirmatory soil samples were collected from the floor of the trench, from four undisturbed areas outside the trench and at the confluence of Outfalls 1 and 2. The samples were analyzed for PCBs, metals, chromium VI, VOCs and SVOCs. The maximum sample depth was 10 ft bgs. None of the soil samples contained total PCB concentrations greater than 1 mg/kg. Eleven metals were detected at concentrations above background values. Three VOCs and 14 SVOCs also were detected; most were J-qualified.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For the industrial land-use scenario, the total HI and the estimated excess cancer risks were acceptable (Table 5). For the residential land-use scenario, the total HI and excess cancer risks were unacceptable (Table 5).

**Table 5**  
**Risk Assessment Values for SWMU 46 Nonradiological COCs**

COC	Maximum Concentration /UCL Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Arsenic	5.23/2.8	0.02/ <b>Below Background<sup>b</sup></b>	3E-6/ <b>Below Background<sup>b</sup></b>	0.24/ <b>Below Background<sup>b</sup></b>	1E-5/ <b>Below Background<sup>b</sup></b>
Barium	572	0.01		0.11	
Beryllium	0.891	0.00	4E-10	0.01	8E-10
Cadmium	213/ <b>40.6</b>	0.42/ <b>0.08</b>	7E-8/ <b>1E-8</b>	5.46/ <b>1.03</b>	1E-7/ <b>1E-7</b>
Chromium VI	2.08	0.00	4E-9	0.01	1E-8
Chromium-total	120	0.00		0.00	
Copper	133 J	0.00		0.05	
Mercury	0.0766	0.00		0.00	
Nickel	379/ <b>87.5</b>	0.02/ <b>0.00</b>		0.25/ <b>0.03</b>	
Selenium	1.28	0.00		0.00	
Silver	16.2	0.00		0.04	
Thallium	2.19/ <b>1.1</b>	0.03/ <b>0.02</b>		0.44/ <b>0.22</b>	
Vanadium	46.5	0.01		0.09	
Zinc	149 J	0.00		0.01	
Cyanide-total	12.7	0.00		0.01	
<b>VOCs</b>					
Acetone	0.0132	0.00		0.00	
2-Butanone	0.107	0.00		0.00	
Methylene chloride	0.00385 J	0.00	3E-8	0.00	5E-8
Toluene	0.017	0.00		0.00	
<b>SVOCs</b>					
Acenaphthene	0.00626 J	0.00		0.00	
Acenaphthylene	0.00406 J	0.00		0.00	
Anthracene	0.0212 J	0.00		0.00	
Benzo(a)anthracene	0.258	0.00	1E-7	0.00	4E-7
Benzo(a)pyrene	0.435/ <b>0.06</b>	0.00/ <b>0.00</b>	2E-6/ <b>3E-7</b>	0.00/ <b>0.00</b>	7E-6/ <b>1E-6</b>
Benzo(b)fluoranthene	0.506	0.00	2E-7	0.00	8E-7
Benzo(ghi)perylene	0.309/ <b>0.05</b>	0.00/ <b>0.00</b>	1E-6/ <b>2E-7</b>	0.00/ <b>0.00</b>	5E-6/ <b>8E-7</b>
Benzo(k)fluoranthene	0.471	0.00	2E-8	0.00	8E-8
Butylbenzylphthalate	0.0565 J	0.00		0.00	
Carbazole	0.0182 J	0.00	1E-10	0.00	6E-10
2-Chlorophenol	0.00835 J	0.00		0.00	
Chrysene	0.435	0.00	2E-9	0.00	7E-9
Di-n-butylphthalate	0.0495 J	0.00		0.00	
Di-n-octylphthalate	0.0102 J	0.00		0.00	
Diethylphthalate	0.0877 J	0.00		0.00	
Dibenzofuran	0.0094 J	0.00		0.00	

1,2-Dichlorobenzene	0.00451 J	0.00		0.00	
1,3-Dichlorobenzene	0.00486 J	0.00		0.00	
Diphenylamine	0.0073 J	0.00		0.00	
bis(2-Ethylhexyl) phthalate	2.04	0.00	1E-8	0.00	5E-8
Fluoranthene	0.450	0.00		0.00	
Fluorene	0.014 J	0.00		0.00	
Hexachlorobenzene	0.0057 J	0.00	5E-9	0.00	2E-8
Indeno(1,2,3-c,d)pyrene	0.345 J	0.00	2E-7	0.00	6E-7
Naphthalene	0.00345 J	0.00		0.00	
Phenanthrene	0.139	0.00		0.00	
Phenol	1.59	0.00		0.00	
Pyrene	0.603	0.00		0.00	
<b>HE Compound</b>					
2-Nitrotoluene	0.0152	0.00		0.00	
Total		<b>0.52/0.13</b>	<b>7E-6/1E-6</b>	<b>6.72/1.61</b>	<b>3E-5/4E-6</b>

Note: UCLs are calculated only for risk drivers. UCL concentrations and associated risk are in **bold**.

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

Using the UCL of the mean concentrations for the main contributors to risk [arsenic, cadmium, nickel, thallium, benzo(a)pyrene and benzo(ghi)perylene], the total HI and estimated excess cancer risk are reduced to 1.61 and 3.86E-6, respectively. In addition, only cadmium had an individual HQ for noncarcinogens that exceed 1.0 under these conditions. The cadmium HQ (1.03) was only slightly greater than 1.0. Thus, using these concentrations in the risk calculations, the total human health HI is still unacceptable for residential land-use scenario while the estimated excess cancer risk is acceptable.

For the radiological COCs (thorium-232, uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 2.1 millirem (mrem)/year (yr). The estimated excess cancer risk is 2.7E-5 which is acceptable for an industrial land-use scenario. Ecological risks associated with SWMU 46 were estimated through a screening assessment that incorporated site-specific information when available. Initial calculations of HQs indicated a potential for risk for 12 inorganic and 9 organic COPECs. However, based upon the analysis of uncertainties associated with these HQs, the actual potential for risk to ecological receptors are expected to be low. This is primarily due to the use of maximum detected values as the exposure point concentrations for these HQs. Predicted risks from exposures based upon the UCL concentrations are significantly lower. All HQs based upon the UCLs were less than 5 and/or were attributable to conservative toxicity benchmarks or conservative assumptions of bioavailability. Based upon this final analysis, ecological risks associated with SWMU 46 are expected to be low.

In conclusion, human health and ecological risks are acceptable under an industrial land-use scenario.

### **Basis for Determination**

SWMU 46 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use (industrial).

## **SWMU 49, Building 9820 Drains, Lurance Canyon**

### **Site Location**

SWMU 49, the Building 9820 Drains, is located in Lurance Canyon within the boundaries of the USFS Withdrawn Area controlled by KAFB and permitted to the DOE. SWMU 49 consists of a surface discharge area associated with a former trailer used as a darkroom and the area around a drainpipe outfall from Building 9820. Waste fluids from photo processing in the trailer may have been discharged to the ground surface. The drainpipe outfall lies approximately 90 ft southwest of Building 9820 and received effluent from five floor drains and a sink in the building (Figure 7).

### **Operational History**

Available information indicates that Building 9820 was constructed in 1958. The remote location of the building prevented connection to a piped water supply and bottled water was used for drinking. Nonpotable water was trucked to a 1,000-gallon storage tank at the facility. The building has not been occupied since 1988. The trailer had been removed prior to the sampling in 1994. In November 1995, the distal end of the Building 9820 drainpipe was sealed with mortar.

The COCs include VOCs, SVOCs, RCRA metals, hexavalent chromium, cyanide, HE residues and radionuclides.

### **Evaluation of Relevant Information**

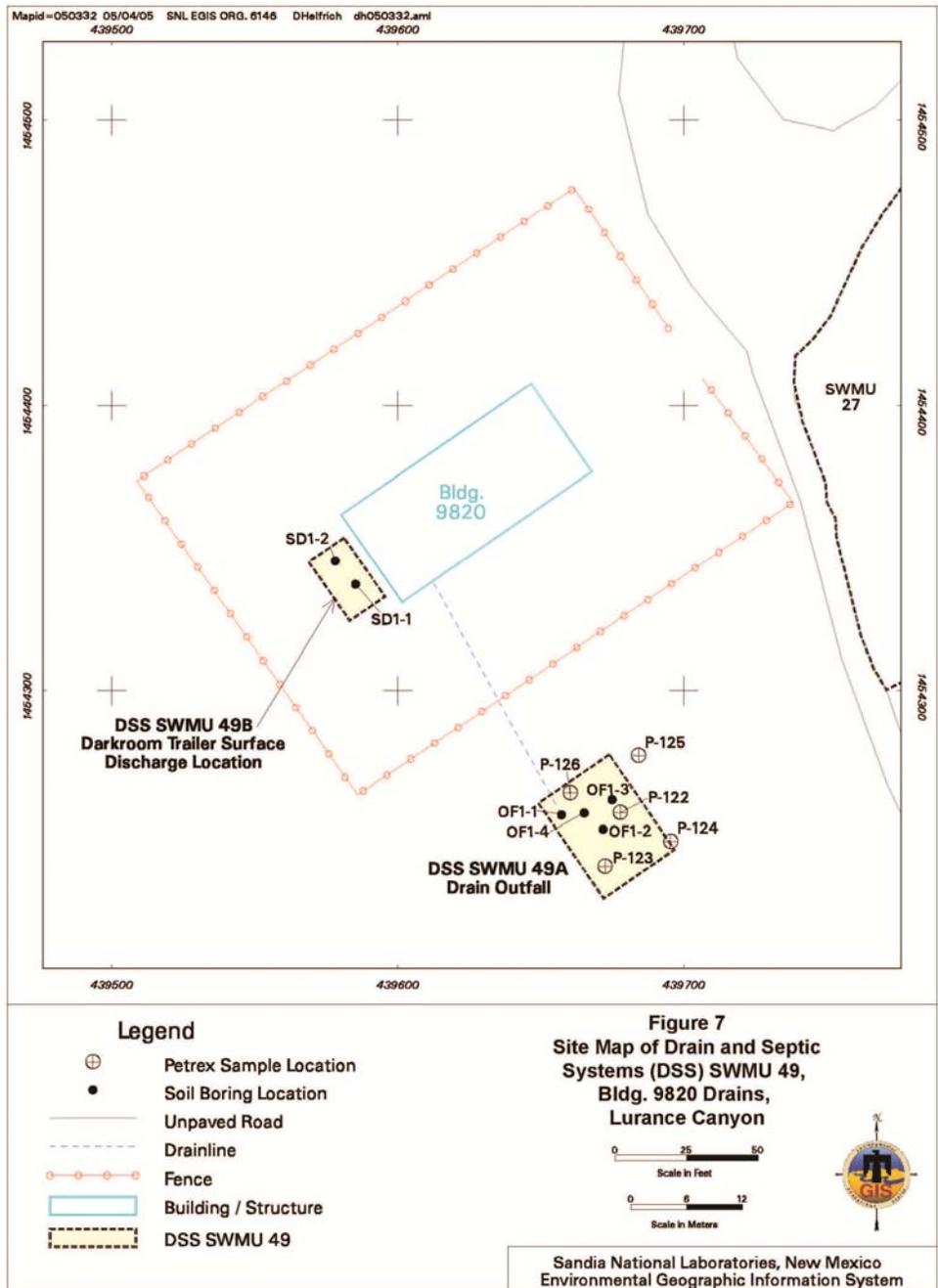
Five different assessment investigations have been conducted at this site. In November 1993, a surface radiological survey was conducted (Investigation 1). A geophysical survey was performed in November 1994 to locate areas of high moisture content (Investigation 2). In June 1994 a passive soil-vapor survey was conducted to identify potential releases of VOCs and SVOCs (Investigation 3). In October 1994, confirmatory soil sampling was conducted in the vicinity of the drain outfall and in May 1995 at the darkroom trailer surface discharge location (Investigation 4). In August 2001, groundwater monitor well CYN-MW5 was installed. This was one of four DSS sites selected by the Department for groundwater monitoring (Investigation 5). These investigations are discussed in the following sections.

#### **Investigation 1 – Surface Radiological Survey**

A surface radiological survey conducted by RUST Geotech in November 1993 did not detect any point or area anomalies above background levels within SWMU 49.

#### **Investigation 2 – Geophysical Survey**

A geophysical survey performed in November 1994 was intended to identify any subsurface areas with high moisture content which might indicate a contaminant plume from past releases. The results of the geophysical survey were inconclusive, with no definitive indications of high moisture concentrations even in the area of reeds at the end of the drainline. Therefore, the geophysical survey results were not used as a guide in the soil sampling effort.



### Investigation 3 – Passive Soil-Gas Survey

The passive soil-gas survey conducted in June 1994 used PETREX™ sampling tubes to attempt to identify any releases of VOCs and SVOCs to the drain outfall. A PETREX™ tube soil-gas survey is a semi-quantitative screening procedure that can be used to evaluate the presence or absence of many VOCs and SVOCs. A PETREX™ sampler was placed at five locations around the drain outfall at this site. Aliphatic compounds (C4-C11 cycloalkanes) were identified at a concentration above the PETREX™ technique detection limit on the single sample wire that was analyzed in sampler P-123, and on the duplicate wire that were analyzed in sampler P-126 (Figure 7). No other VOCs or SVOCs were found in detectable quantities in the other four PETREX™ tubes placed around the drain outfall at this site. Subsequent laboratory analysis of soil samples collected in the immediate vicinity of the PETREX™ sample locations did not detect organic contaminants in the material.

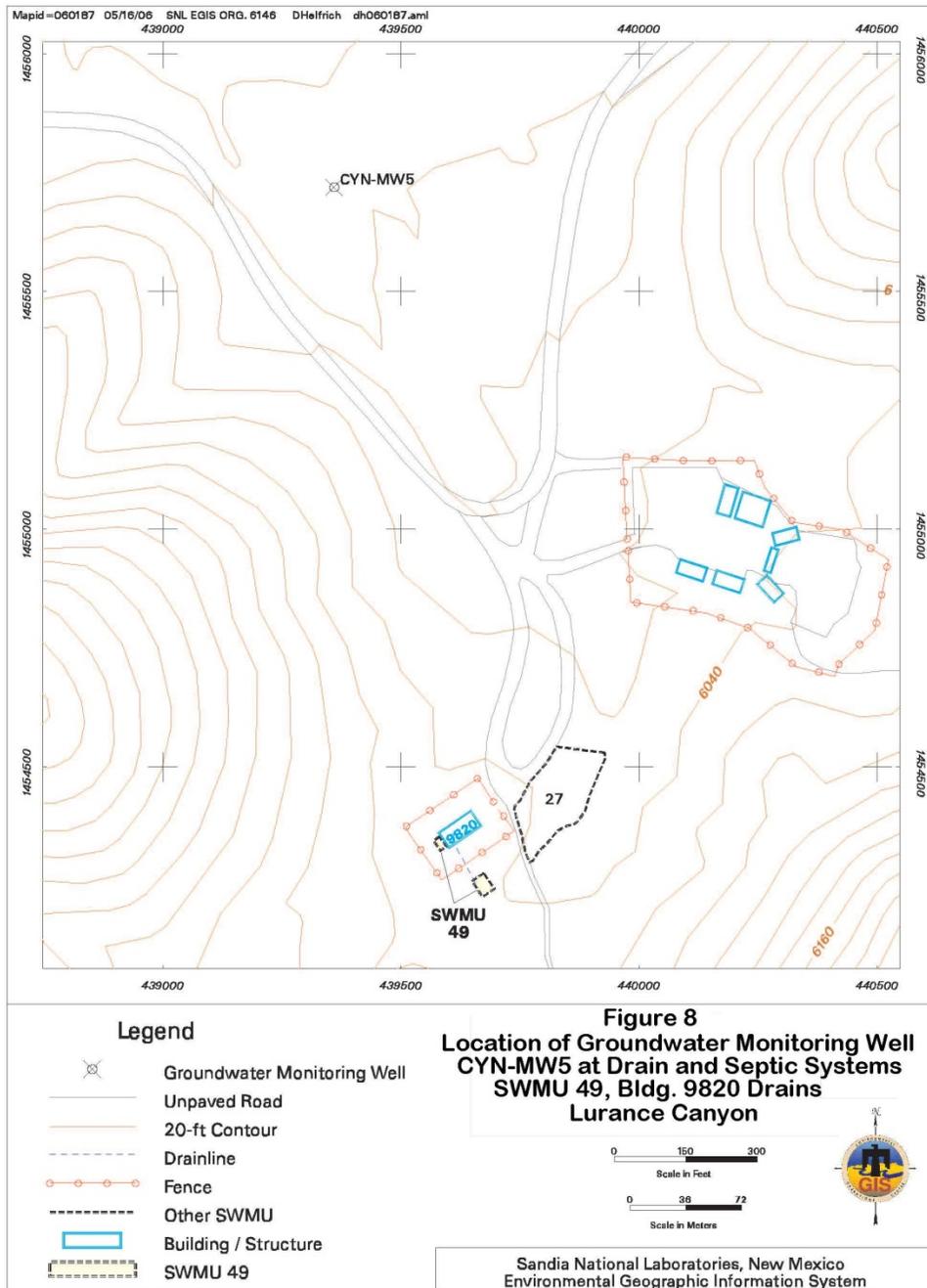
### Investigation 4 – Soil Sampling

Confirmatory soil sampling was conducted in October 1994 from the area immediately around the drain outfall and in May 1995 at the darkroom trailer surface discharge location. Soil samples were collected from one boring immediately under the drain outfall, and from three borings located down slope of the outfall in October 1994 (Figure 7). In three of the four borings, two depth intervals were sampled; the first started at one foot bgs, and the second at 10 feet below the top of the first sampling interval (or 11 feet bgs). Samples were collected only from the shallow interval in OF1-2, as auger refusal repeatedly occurred at seven feet bgs at that location. Soil samples were also collected at the darkroom trailer surface discharge location in May 1995 from two locations on the southwest side of Building 9820 (Figure 7). Soil samples were collected from these boreholes at the same depths below the surface as in the outfall boreholes. The first (or shallow) surface discharge location sampling interval also started at 1 foot bgs and the deep interval started at 11 feet bgs.

Results for the soil samples collected in October 1994 and May 1995 are summarized in this paragraph. Two VOCs, (methylene chloride and toluene) were detected in the soil samples collected at this site. These compounds were detected in the associated trip blank (TB) or equipment blank (EB) samples. One SVOC [bis(2-Ethylhexyl) phthalate] was detected in the soil samples collected at this site. No cyanide or HE compounds were detected in any of the samples collected from the boreholes. Two RCRA metals (mercury and silver) were detected above Department-approved background concentrations. All other metal concentrations were below the corresponding Department-approved background concentrations. One radionuclide (uranium-235) exceeded the background activity in three samples.

### Investigation 5 – Groundwater Monitoring

Monitor well CYN-MW5 was installed using an air rotary-casing hammer drill rig in August 2001. The monitoring well location is shown on (Figure 7). The borehole for the well was drilled to 170 feet bgs and backfilled to 160 feet bgs. The monitor well was subsequently installed with the screened interval from 135 to 155 feet bgs and a sump from 155 to 160 feet bgs. Depth to groundwater was 106.9 feet bgs in January 2005. Monitor well CYN-MW5 was sampled on a quarterly basis from July 2002 to May 2004 to acquire eight quarters of groundwater data. The eight quarters of groundwater samples were analyzed for VOCs, SVOCs, HE compounds, RCRA metals, hexavalent chromium, and gross alpha/beta activity.



Results for the eight quarters of groundwater samples collected from monitor well CYN-MW5 (Figure 8) are summarized in this paragraph. One VOC (acetone) was detected in the groundwater sample collected in July 2002. Bromodichloromethane, bromoform and dibromochloromethane were detected in the March 2004 EB sample associated with this well. No VOCs were detected in any of the trip blanks associated with this well. There are no EPA MCLs established for any of the VOCs that were detected. One SVOC [bis(2-Ethylhexyl) phthalate] was detected in the sample collected in April 2004. The concentration detected was below the EPA MCL of 6.0 micrograms per liter (Title 40, Code of Federal Regulations 141.11) for drinking water. No other SVOCs were detected in samples collected from this well. No HE compounds were detected in any groundwater sample collected from this well. One RCRA metal (barium) slightly exceeded the Department-approved background concentration for all eight quarters of sampling. All other metal concentrations were below Department-approved background concentrations or other promulgated regulatory limits. Hexavalent chromium exceeded the Department-approved background concentration in the first sample collected in July 2002. All other hexavalent chromium concentrations were below the Department-approved background or other promulgated regulatory limits. NPN was not detected at concentrations above any promulgated regulatory limit. Fluoride concentrations did not exceed the regulatory or background limits in any sample collected. No regulatory or background limits have been established for bromide, calcium, chloride, magnesium, potassium, sodium or sulfate in groundwater. The concentrations measured for these individual anions and cations were similar and fairly consistent for the eight quarters of sampling. All gross alpha/beta activity levels were below the EPA MCLs for drinking water.

Annual groundwater monitoring at SWMU 49 (required by the NMED as a control in its letter of April 8, 2010) is to be discontinued as no definitive evidence of groundwater contamination was detected in eight quarters of monitoring. Inorganic constituents are considered to be at background levels.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs and estimated excess cancer risks were acceptable (Table 6).

For the radiological COCs (uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 0.23 millirem (mrem)/year (yr). The estimated excess cancer risk is  $2.3E-6$ .

Ecological risks associated with SWMU 49 are estimated through a risk assessment that incorporates site-specific information when available. HQs slightly greater than unity were predicted. However, closer examination of the exposure assumptions reveals an overestimation of risk primarily attributed to:

- conservative toxicity benchmarks,
- the use of maximum concentrations, maximum bioavailability, and maximum area use to estimate exposure.

Analysis of the uncertainties associated with these predicted values indicate that they are more likely to overestimate actual risk rather than underestimate it. Based upon this final analysis, the potential for ecological risks associated with SWMU 49 is expected to be low.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

**Table 6**  
**Risk Assessment Values for SWMU 49 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Recreational Land-Use Scenario <sup>a,b</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium VI	0.025 <sup>c</sup>	0.00	4E-12	0.00	1E-10
Cyanide	0.5 <sup>c</sup>	0.00		0.00	
Mercury	0.077 J	0.00		0.00	
Silver	1.7	0.00		0.00	
<b>Organic</b>					
Bis(2-Ethylhexyl) phthalate	0.19 J	0.00	1E-10	0.00	4E-9
Methylene chloride	0.0033 J	0.00	2E-9	0.00	5E-8
Toluene	0.0025 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.00</b>	<b>2E-9</b>	<b>0.00</b>	<b>5E-8</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Industrial land-use scenario results presented in error previously; this site has a designated land use of recreational.

<sup>c</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Concentration was qualified as an estimated value.

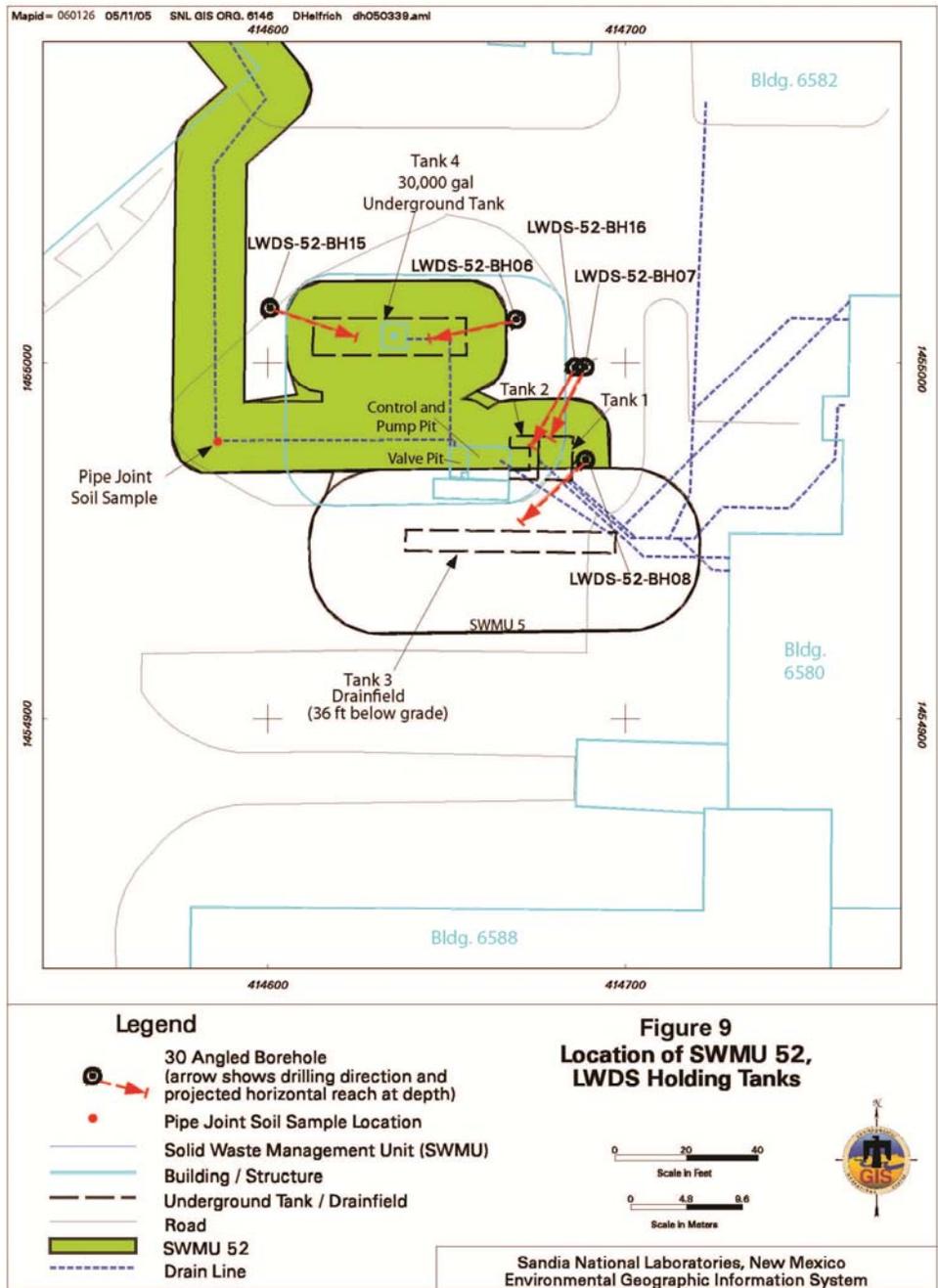
### **Basis for Determination**

SWMU 49 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

### **SWMU 52, Liquid Waste Disposal System (LWDS) Holding Tanks**

#### **Site Location**

The LWDS Holding Tanks at SWMU 52 encompasses approximately 0.6 acre in TA-V. TA-V is a fenced, secured, research and testing area located in the northeast corner of TA-III. The holding tank portion of the site is paved and situated in a flat area west of Building 6580. The piping portion of the site extends out of TA-V to the surface impoundments (Figure 9).



## **Operational History**

The LWDS was designed to receive, monitor and discharge radioactive effluent from the Sandia Experimental Reactor Facility (SERF). The LWDS consists of the holding tanks and piping (SWMU 52), a drainfield (SWMU 5) and two surface impoundments (SWMU 4) (Figure 3). The three holding tanks, a series of two concrete tanks (Tanks 1 and 2) and one steel tank (Tank 4), were designed to allow short-lived radionuclides to decay before discharging to the LWDS drainfield (referred to as Tank 3). The two concrete tanks (Tanks 1 and 2) have capacities of 2,000 and 6,000 gallons, respectively. The steel tank (Tank 4) has a capacity of approximately 30,000 gallons.

The SERF reactor operated from 1962 to 1971. The tanks received liquid wastes from the SERF during this entire period. Since the decommissioning of the SERF in 1971, nonradioactive discharges from various buildings in TA-V have continued to drain to the holding tanks. The tanks were periodically pumped to the LWDS drainfield until its collapse in 1967 and later pumped to surface impoundments until October 1992, when all discharges to the impoundments were stopped. During this time, no logs were maintained to record the frequency of operation and activity measurements. In 1994, a Liquid Effluent Control System (LECS) was constructed to manage all future TA-V liquid discharges. The LECS receives all process water from TA-V, including liquids previously discharged to the holding tanks. This system allows for the water to be held and sampled prior to discharging it to the City of Albuquerque (COA) publicly-owned treatment works.

The COCs include RCRA metals, HE compounds, VOCs, SVOCs and radionuclides.

## **Evaluation of Relevant Information**

In 1992, the contents of the accessible tanks, Tanks 2 and 4 were sampled. The internal tank sampling results identified the presence of several solvents and radionuclides slightly above the detection limit. This level of RCRA-regulated constituents was acceptable for discharge to the COA sanitary sewer system.

In September 1992, a 90-degree joint coupling in the pipe on the down-flow side of the Holding Tanks was disassembled. Swipe samples were collected from inside the pipe and a soil sample was collected immediately below the disassembled joint.

Also in September 1992, three angled boreholes (LWDS-BH06 through LWDS-BH08) were advanced in the vicinity of the LWDS Holding Tanks and Drainfield. Two additional angled boreholes (LWDS-BH15 and LWDS-BH16) were completed in 1994.

Soil samples were collected from the surface to a maximum depth of 43 and 50 ft during the drilling activities in 1992 and 1994, respectively. The five boreholes drilled and sampled were located as closely as possible and adjacent to the holding tanks. Therefore, these soil samples are considered to be representative of the soil directly adjacent to and below the holding tanks. The 1992 and 1994 soil samples were analyzed for VOCs, SVOCs, metals and radionuclides by an off-site laboratory. Eight metals (arsenic, barium, beryllium, cadmium, total chromium, copper, nickel and vanadium) exceeded background values. Three VOCs (acetone, 2-butanone and methylene chloride) and two SVOCs [bis(2-ethylhexyl) phthalate and di-n-butyl phthalate] were detected in the soil samples. One sample had a Th-232 activity above background levels and four samples had a tritium activity above the background level.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For the industrial land-use scenario, the total HI and estimated excess cancer risks were acceptable (Table 7). For the residential land-use scenario, the total HI was acceptable while the estimated excess cancer risk was unacceptable (Table 7).

Although the estimated excess cancer risk is unacceptable for the residential land-use scenario, maximum concentrations were used in the risk calculation. Using the UCL of the mean concentration for the main contributor to excess cancer risk (arsenic), excess cancer risk was reduced to 4E-7. In this situation, both the human health total HI and estimated excess cancer risk are acceptable.

For the radiological COCs (thorium-232 and tritium) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 1.7 millirem (mrem)/year (yr). The estimated excess cancer risk is acceptable for residential land use.

**Table 7**  
**Risk Assessment Values for SWMU 52 Nonradiological COCs**

COC	Maximum Concentration /UCL Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Arsenic	6.7/ <b>3.2</b>	0.03/ <b>Below Background<sup>b</sup></b>	4E-6/ <b>Below Background<sup>b</sup></b>	0.31/ <b>Below Background<sup>b</sup></b>	2E-5/ <b>Below Background<sup>b</sup></b>
Barium	412	0.01		0.08	
Beryllium	1.2	0.00	5E-10	0.01	1E-9
Cadmium	1.3	0.00	4E-10	0.03	9E-10
Chromium, total <sup>c</sup>	28.2	0.01	6E-8	0.13	1E-7
Copper	18.4	0.00		0.01	
Mercury	0.05 <sup>d</sup>	0.00		0.00	
Nickel	15.5	0.00		0.01	
Selenium	0.57	0.00		0.00	
Silver	0.76 J	0.00		0.00	
Vanadium	28.2	0.00		0.05	
<b>Organic</b>					
Acetone	0.15	0.00		0.00	
2-Butanone	0.016	0.00		0.00	
Di-n-butyl phthalate	0.051 J	0.00		0.00	
bis(2-Ethylhexyl) phthalate	1.3	0.00	7E-9	0.00	3E-8
Methylene chloride	0.024	0.00	2E-7	0.00	3E-7
Total		0.05/ <b>0.03</b>	4E-6/ <b>2E-7</b>	0.63/ <b>0.32</b>	2E-5/ <b>4E-7</b>

Note: UCLs are calculated only for risk drivers. UCL concentrations and associated risk are in **bold**.

<sup>a</sup>EPA 1989.

<sup>b</sup>UCL concentration was below background screening level. Therefore risk was not calculated.

<sup>c</sup>Chromium, total assumed to be chromium VI (most conservative).

<sup>d</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

## **SWMU 91, Lead Firing Site**

### **Site Location**

SWMU 91 occupies approximately 20 acres located 1.6 miles west of the Solar Tower Facility and 0.6 miles southwest of TA III, south of Magazine Road. It is in the immediate vicinity of five other SWMUs including the 19-foot diameter Shock Tube (SWMU 89), the General Purpose Heat Source Test Area (SWMU 194), the Gas Cylinder Disposal Pit (SWMU 6), the Scrap Yards/Open Dump (SWMU 17) and the Old Thunderwells (SWMU 56) (Figure 10).

### **Operational History**

The operational name formerly used by the Permittees for SWMU 91 was the Flyer Plate Test Site (FPTS). The flyer plate tests were conducted to determine whether impact fuses in a high-velocity re-entry vehicle (warhead) would activate before the critical firing components were destroyed by vehicle impact. Beginning in 1962, these tests were conducted in a cross-shaped test trench at SWMU 91. The cross-shaped trench was approximately 6 to 8 ft deep at the center point and tapered upwards to local grade at each end. Flyer plates were fired toward a stationary target using TNT and RDX as propellants. After each test, debris in and around the trench was salvaged for reuse, removed from the site and disposed of, or shallowly buried in an area north of the test trench.

In 1979, cast iron barrels were developed to house the explosive and the flyer plate. At a later date, steel-jacketed lead barrels were used. Each barrel was placed inside a corrugated pipe that was buried in the trench where the testing occurred. The barrel was destroyed during each test, and fragmented lead was released to the environment.

Although other explosive tests were performed at SWMU 91 during the flyer plate testing program conducted from 1962 through the late 1980s, the tests involving lead barrels produced the most significant adverse environmental impact because of the large mass of lead released as part of these tests.

The COCs include metals, HE compounds and radionuclides.

### **Evaluation of Relevant Information**

SWMU 91 has been characterized in multiple investigations including two VCMs and a VCA.

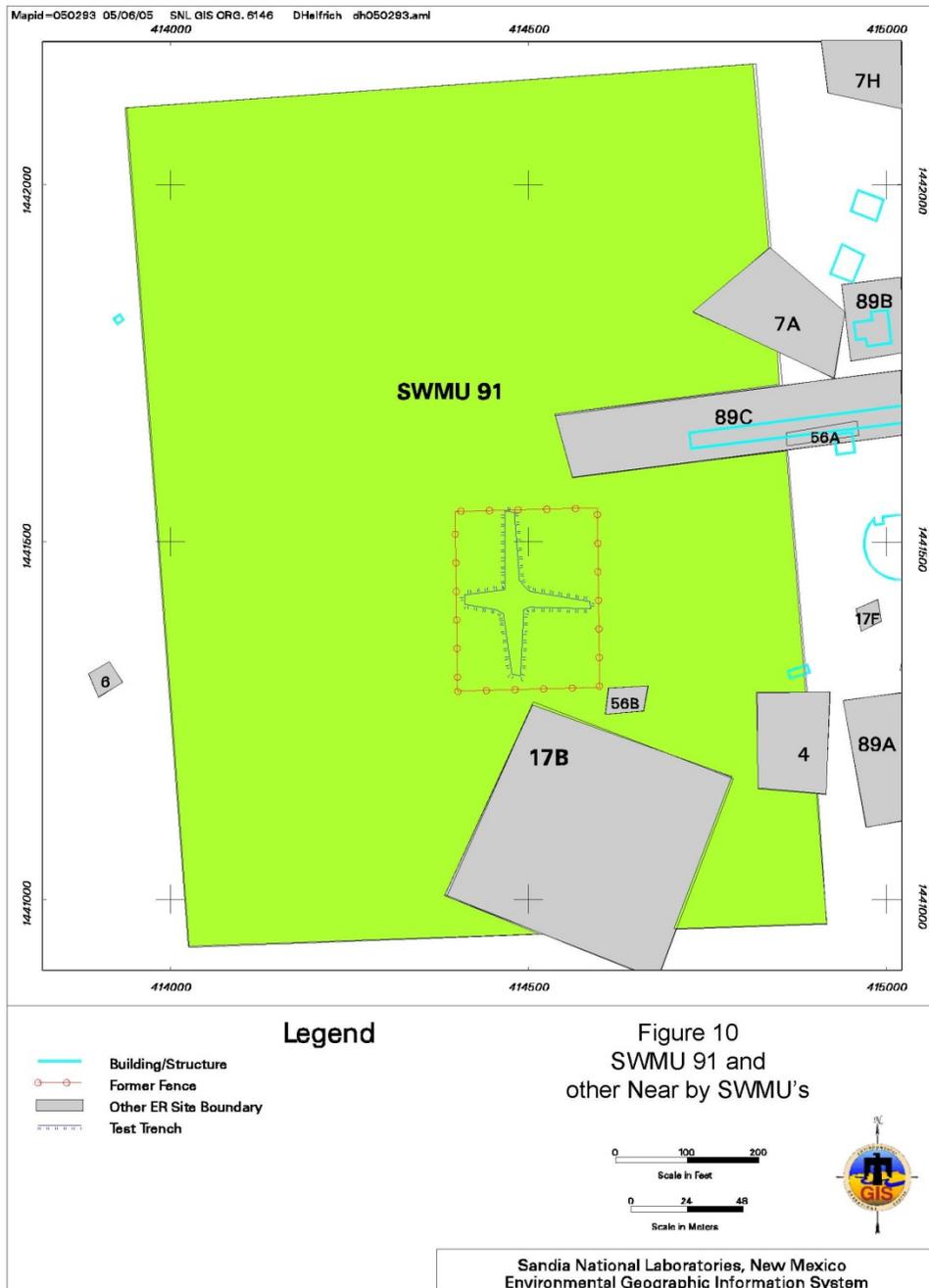
In 1992, surface-soil sampling was conducted on a large scale at the site to determine the extent of lead and other metal contamination. Lead detections ranged from 17.44 to 2,790 mg/kg.

From 1993 to 1996, a detailed site background investigation was conducted including personnel interviews and a review of historical aerial photographs.

From 1993 to 1994, surface radiological surveys and a UXO / HE survey were conducted.

In 1995, scoping soil samples were collected in 5 ft intervals from 0 to 20 ft bgs in three boreholes. The boreholes were placed in areas of known elevated surface lead concentrations in order to determine the vertical extent of contamination. Soil samples were analyzed for metals and radionuclides by both on-site and off-site laboratories. Most of the samples had MDLs that exceeded the background values for arsenic, beryllium, cadmium, selenium and silver. Barium, chromium and lead were detected above background values. The maximum lead value was 17

mg/kg. The MDAs for U-235 and some for U-238 and Cs-137 exceeded background activities. Th-232 exceeded the background activity in two soil samples.



In 1996, shallow subsurface samples were collected at 22 locations. The samples were analyzed for metals, HE compounds and radionuclides by both on-site and off-site laboratories. No HE compounds were detected. Arsenic, barium, beryllium and lead were detected above background values. Most of the samples had MDLs that exceeded the background values for arsenic, silver, cadmium and selenium. The maximum lead value was 8,900 mg/kg. Cs-137, U-235 and U-238 were detected above background activities. The MDAs for Th-232, U-238 and U-235 exceeded background activities.

In 1996, a VCM was conducted that addressed the radiation anomalies identified during the surface radiological surveys conducted in 1993 and 1994. Ten point source anomalies were identified and remediated. Three soil samples were collected and analyzed for radionuclides to confirm that remediation was complete.

A second VCM was conducted from 1996 to 1997 that addressed the lead contamination at the site. Extensive soil sampling and analysis using a field-based XRF laboratory, geophysical survey and confirmatory soil sampling were conducted to clean up specific areas at the site with lead concentrations greater than 2,000 mg/kg in the surface soil. However, after review and evaluation of the XRF results, it was determined that XRF data were not a reliable indicator of lead contamination. A revised approach was developed with Department input and concurrence that involved excavation / scraping of areas greater than 1,400 mg/kg lead based on laboratory analytical results of soil samples that were mainly collected in 1992 and 1996. Sixteen areas of soil contamination were excavated / scraped generating 450 cy of soil of which 276 cy were disposed of off-site and 173 cy remained on-site after characterization sampling of the soil indicated it passed risk criteria. Soil samples were collected and analyzed for metals and HE compounds. No HE compounds were detected. Many samples had cadmium and selenium MDLs above the background values. Barium, beryllium, lead, mercury, selenium, and silver were detected above the background values. Six areas in the northern part of the site were excavated to investigate geophysical anomalies, but significant excavation and removal of shallowly buried debris was not performed. This VCM approach did not adequately address either the fine elemental lead contamination or shallowly buried test debris that included larger fragments of lead.

From 1997 through 2004, reassessment activities were performed, the conceptual site model was revised and the final VCA was designed. The geophysical surveys were used to divide SWMU 91 into the following three areas, referred to as "burial areas" due to the presence of buried test debris (including lead fragments):

- The Test Trench Burial Area (TTBA) consisted of the test trench feature and the immediate vicinity. This area was the most highly contaminated area.
- The Southern Burial Area (SBA) consisted of the area that surrounded the TTBA. This area was the area of lowest contamination.
- The Northern Burial Area (NBA) was the largest of the three areas, located north of the TTBA and SBA. Buried debris was most concentrated in the NBA, as test debris that were not removed from the site were shallowly buried in the NBA as part of routine test clean-up activities. This area was considered to have moderate contamination.

The final VCA approach targeted the areas with larger lead fragments and a higher density of lead fragments in the soil. The clean-up goal for lead in the soil was 750 mg/kg.

In 1999, soil samples were re-collected at eleven locations originally sampled in 1996. The samples collected were analyzed for metals to address sampling results with elevated (relative to background) arsenic and selenium concentrations. Barium, beryllium and lead were detected at concentrations above background values. Arsenic was detected above background levels in four of the samples. There were no detections of selenium.

In 2004, the final VCA was conducted to address the lead contamination at SWMU 91. Soil was excavated and lead fragments and other test debris greater than ½ inch in diameter were mechanically separated from the soil. A total of 16,690 cy of soil was excavated and screened. Approximately 18.8 tons of lead fragments and 100 cy of metal test debris were separated from other debris and managed for recycling. The screened soil was put into piles and soil samples were collected from the piles and analyzed for lead. Approximately 340 cy of soil exceeded the lead clean-up goal of 750 mg/kg and was disposed of as hazardous waste at an off-site facility. The remaining 16,350 cy of soil was below the clean-up goal and was used as fill material and/or left on the site. All other test debris (approximately 42 cy) was disposed of as non-hazardous waste at an off-site facility. A total of 60 confirmatory soil samples were collected from the floor and sidewalls of the areas that were excavated, and were analyzed for lead. The UCL of the mean lead concentrations for each of the three areas was below the clean-up goal of 750 mg/kg.

A human health risk screening assessment was initially performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For the industrial land-use scenario, the total HI was acceptable. The HI for the residential land-use scenario was not acceptable (Table 8). The estimated excess cancer risk was not acceptable for both the residential and industrial land-use scenarios.

**Table 8**  
**Risk Assessment Values for SWMU 91 Nonradiological COCs**

COC	Maximum Concentration /UCL Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Arsenic	86 J/ <b>14.5</b>	0.34/ <b>0.06</b>	5E-5/ <b>9E-6</b>	3.97/ <b>0.67</b>	2E-4/ <b>4E-5</b>
Barium	250	0.00		0.05	
Beryllium	3.1	0.00	1E-9	0.02	3E-9
Cadmium	5 <sup>b</sup>	0.01	2E-9	0.13	3E-9
Chromium, total	17	0.00		0.00	
Mercury	5.4	0.02		0.24	
Selenium	55 J	0.01		0.14	
Silver	5.4	0.00		0.01	
Total		0.38/ <b>0.10</b>	5E-5/ <b>9E-6</b>	4.57/ <b>1.26</b>	2E-4/ <b>4E-5</b>

Note: UCLs are calculated only for risk drivers. UCL concentrations and associated risk are in **bold**.

<sup>a</sup>EPA 1989.

<sup>b</sup> Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Estimated concentration.

mg/kg = Milligram(s) per kilogram.

Maximum concentrations were used in the risk calculation. Using the UCL of the mean concentration for arsenic in the risk analysis reduces the industrial total excess cancer risk value to  $9E-6$ . In this situation, the estimated excess cancer risk is acceptable for the industrial land-use scenario. However, the total human health HI and excess cancer risk are not acceptable for the residential land-use scenario.

For the radiological COCs (cesium-137, thorium-232, uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 2.7 millirem (mrem) /year (yr). The estimated excess cancer risk is  $2.8E-5$  which is not acceptable for residential land use.

Ecological risks associated with SWMU 91 were estimated through a risk assessment that incorporated site-specific information when available. Analysis of the uncertainties associated with these predicted values indicate that they are more likely to overestimate actual risk rather than underestimate it. Based upon this final analysis, the potential for ecological risks associated with SWMU 91 is expected to be low.

In conclusion, human health and ecological risks are acceptable under an industrial land-use scenario.

### **Basis for Determination**

SWMU 91 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use (industrial).

### **SWMU 101, Building 9926 Explosive Contaminated Sumps and Drains**

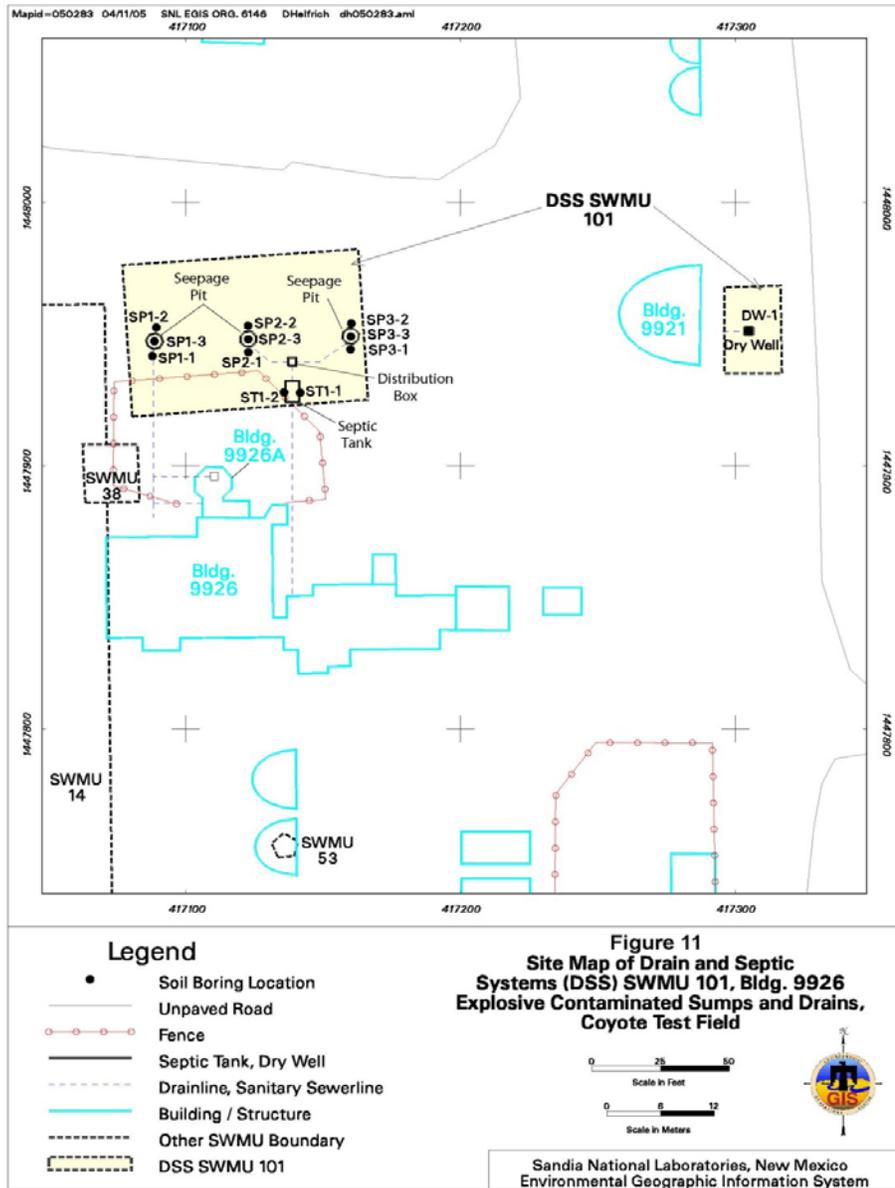
#### **Site Location**

SWMU 101, the Building 9926 Explosive Contaminated Sumps and Drains, is located in the Coyote Test Field area on federally owned land controlled by KAFB and permitted to the DOE. The abandoned system consisted of an 850-gallon septic tank and distribution box connected to two seepage pits that serviced Building 9926, the Shock Wave Studies Laboratory, one seepage pit that serviced Building 9926A, and a drywell that serviced both Building 9921 and an explosives storage igloo (Figure 11).

#### **Operational History**

Available information indicates that Building 9926 was constructed in 1960 and was expanded in 1967 with the addition of the Shock Wave Studies Laboratory and the semi-attached explosive room, designated Building 9926A. It is assumed that the septic system was also constructed during this time period. By June 1991, the septic system discharges were routed to the COA sanitary sewer system. The old septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change. Waste in the septic tank was removed. The empty and decontaminated septic tank was inspected by the Department in December 1995, and a closure form was signed. The septic tank was then backfilled with clean, native soil from the area in late 1995 or early 1996.

The COCs include RCRA metals, hexavalent chromium, cyanide, HE compounds, VOCs, SVOCs and radionuclides.



## **Evaluation of Relevant Information**

Five different assessment investigations have been conducted at this site. In August 1992, April 1994 and November 1994, waste characterization samples were collected from the septic tank (Investigation 1). A geophysical survey was performed at the site in March 1994 to locate the Building 9921 drywell (Investigation 2). In June and July 1994, a passive soil-vapor survey was conducted to identify potential releases of VOCs and SVOCs from the seepage pits (Investigation 3). In September and October 1994 and in January 1995, soil samples were collected from boreholes drilled adjacent to the septic tank and seepage pits, and from a borehole drilled through the center of the drywell. In January 1998, additional soil samples were collected from boreholes drilled through the center of the three seepage pits (Investigation 4). In January 1995, a backhoe was used to determine the location of the Building 9921 drywell (Investigation 5). These investigations are discussed in the following sections.

### Investigation 1 — Septic Tank Sampling

A sludge sample was collected from the septic tank in August 1992 and was analyzed for selected radionuclide constituents. The brief narrative report for that sample indicated that "...no parameters were detected that exceeded U.S. Department of Energy [DOE] derived concentration guidelines [DCG] or the investigation levels established during this investigation."

A second round of septic tank sludge samples was collected for waste characterization purposes in April 1994 and analyzed for VOCs, explosives, cyanide, and RCRA total and TCLP metals. Trace concentrations of seven VOC compounds were identified in the material. Explosive compounds and cyanide were not detected. All eight RCRA metals were detected in two separate samples of the sludge, but only one out of eight metals was detected in the TCLP-derived leachate from two samples of the same material.

A third round of waste characterization sludge samples was collected in November 1994 and analyzed for SVOCs, isotopic uranium and tritium. No SVOCs were detected. Low activity levels of the three isotopic uranium radionuclides and tritium were detected in the material.

### Investigation 2 – Geophysical Survey

A geophysical survey using a magnetic locator was performed in March 1994 to locate the Building 9921 drywell. An area approximately 20 ft south of Building 9921 was identified as the possible location of the unit, but the actual location was later located with a backhoe and was found to be east of the building. No attempt was made to use geophysical techniques to identify areas with high moisture content.

### Investigation 3 – Passive Soil-Gas Survey

The passive soil-gas survey conducted in June and July 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs that may have occurred from the seepage pit. Thirty-four PETREX™ tube samplers were placed in a grid pattern that covered the area around the seepage pits and septic tank, and also covered the area between the seepage pits and the unpaved site access road which lies about 30 feet north of the seepage pits. Aliphatic and/or BTEX compounds at potentially detectable concentrations were identified in soil gas at 6 of the 34 sampling locations. Five of six locations were in or next to the access road, and the sixth location was between the road and the central seepage pit. PCE was also identified in soil-gas above 100,000 ion counts in one of the five roadway locations.

#### Investigation 4 — Soil Sampling

During September and October 1994 and January 1995, soil samples were collected using a Geoprobe™ from boreholes drilled adjacent to the septic tank and seepage pits, and from a borehole drilled through the center of the drywell. The seepage pit sampling depth intervals started at 12 and 22 feet bgs in the west seepage pit boring, and at 16 and 26 feet bgs in the middle and east seepage pit borings. The septic tank borehole sampling intervals started 9 feet bgs, and the drywell sampling interval started at 4 and 14 feet bgs.

During the 1994 sampling event, soil samples were analyzed for VOCs, SVOCs, RCRA metals, hexavalent chromium, cyanide, isotopic uranium and radionuclides by gamma spectroscopy from the seepage pit and septic tank areas. In January 1995 soil samples were collected and analyzed for VOCs, SVOCs, RCRA metals, tritium, isotopic uranium and radionuclides by gamma spectroscopy from the drywell area. Samples were also screened for trinitrotoluene (TNT) at an on-site laboratory. No TNT was detected.

In January 1998, as part of a five site sampling comparison study required by the Department, additional samples were collected from boreholes drilled through the center of the three seepage pits. Samples were collected at 12 and 22 feet bgs in the west seepage pit borehole and at 16 and 26 feet bgs in the east seepage pit borehole. Only one soil sample, at 16 feet bgs, was collected in the middle seepage pit borehole. No deep (26-foot) sample was collected at this borehole due to subsurface refusal that prevented the Geoprobe™ sampler from reaching this depth. These samples were analyzed for VOCs, HE compounds, RCRA metals, cyanide and radionuclides by gamma spectroscopy.

Analytical results for the soil samples are discussed in this section. Four VOCs (acetone, chloromethane, methylene chloride and toluene) were detected in the soil samples collected at this site. All but chloromethane were also detected in the associated TB or EB samples. Two SVOCs (chrysene and phenanthrene) were detected in the soil samples collected at this site. Cyanide was detected in two samples. The RCRA metals, total chromium, silver and selenium, were detected above the Department-approved background level. All other metal concentrations were below the corresponding Department-approved background levels. For radionuclides, with the exception of tritium, no activities above background activities were detected in any of the samples analyzed. However, although not detected, the MDA for all of the uranium-235 and uranium-238 analyses exceeded their respective background activity.

#### Investigation 5 – Backhoe Excavation

In January 1995, a backhoe was used to determine the precise location, dimensions, and depth of the Building 9921 drywell, which had no surface expression. In January 1995, after this small drywell was located, soil samples were collected directly beneath it from a single borehole located in the center of the unit.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total human health HIs and estimated excess cancer risks were acceptable (Table 9).

For the radiological COCs (tritium, uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 0.27 millirem (mrem)/year (yr). The estimated excess cancer risk is 2.7E-6.

**Table 9**  
**Risk Assessment Values for SWMU 101 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium, total	23.6	0.00		0.00	
Cyanide	1.2	0.00		0.00	
Selenium	1.3	0.00		0.00	
Silver	2.34	0.00		0.00	
<b>Organic</b>					
Acetone	0.014	0.00		0.00	
Chloromethane	0.0083	0.00	3E-9	0.00	7E-9
Chrysene	0.165 <sup>b</sup>	0.00	8E-10	0.00	3E-9
Methylene Chloride	0.0088 J	0.00	6E-8	0.00	1E-7
Phenanthrene	0.165 <sup>b</sup>	0.00		0.00	
Toluene	0.011	0.00		0.00	
<b>Total</b>		0.00	6E-8	0.00	1E-7

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

EPA = U.S. Environmental Protection Agency.

J = Concentration was qualified as an estimated value.

mg/kg = Milligram(s) per kilogram.

SWMU = Solid Waste Management Unit.

Ecological risks associated with SWMU 101 are estimated through a risk assessment that incorporates site-specific information when available. All HQ and HI values predicted for the COPECs at this site are found to be less than unity. Analysis of the uncertainties associated with these predicted values indicate that they are more likely to overestimate actual risk rather than underestimate it. Based upon this final analysis, the potential for ecological risks associated with SWMU 101 is expected to be low.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

### **Basis for Determination**

SWMU 101 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

## **SWMU 105, Building 6536, Mercury Spill**

### **Site Location**

The Mercury Spill (Building 6536), SWMU 105, is an approximately 3,600 square ft site located in Technical Area-III (Figure 12).

### **Operational History**

The main part of Building 6536 was built in 1967. Room 113 was added in 1983. The facility was used to simulate many types of high-heat environments. Several releases of mercury from equipment inside the building were reported in the 1970s and 1980s. Mercury was found in Room 113 during the building demolition activities. In June 2005, a subsurface release of mercury to the environment was found outside the foundation wall of Room 113. The outside area had been trenched to remove utilities servicing the building; it was during the trenching activities that the release was discovered.

The COC for this site is mercury.

### **Depth to Groundwater**

The regional aquifer is approximately 500 ft bgs.

### **Evaluation of Relevant Information**

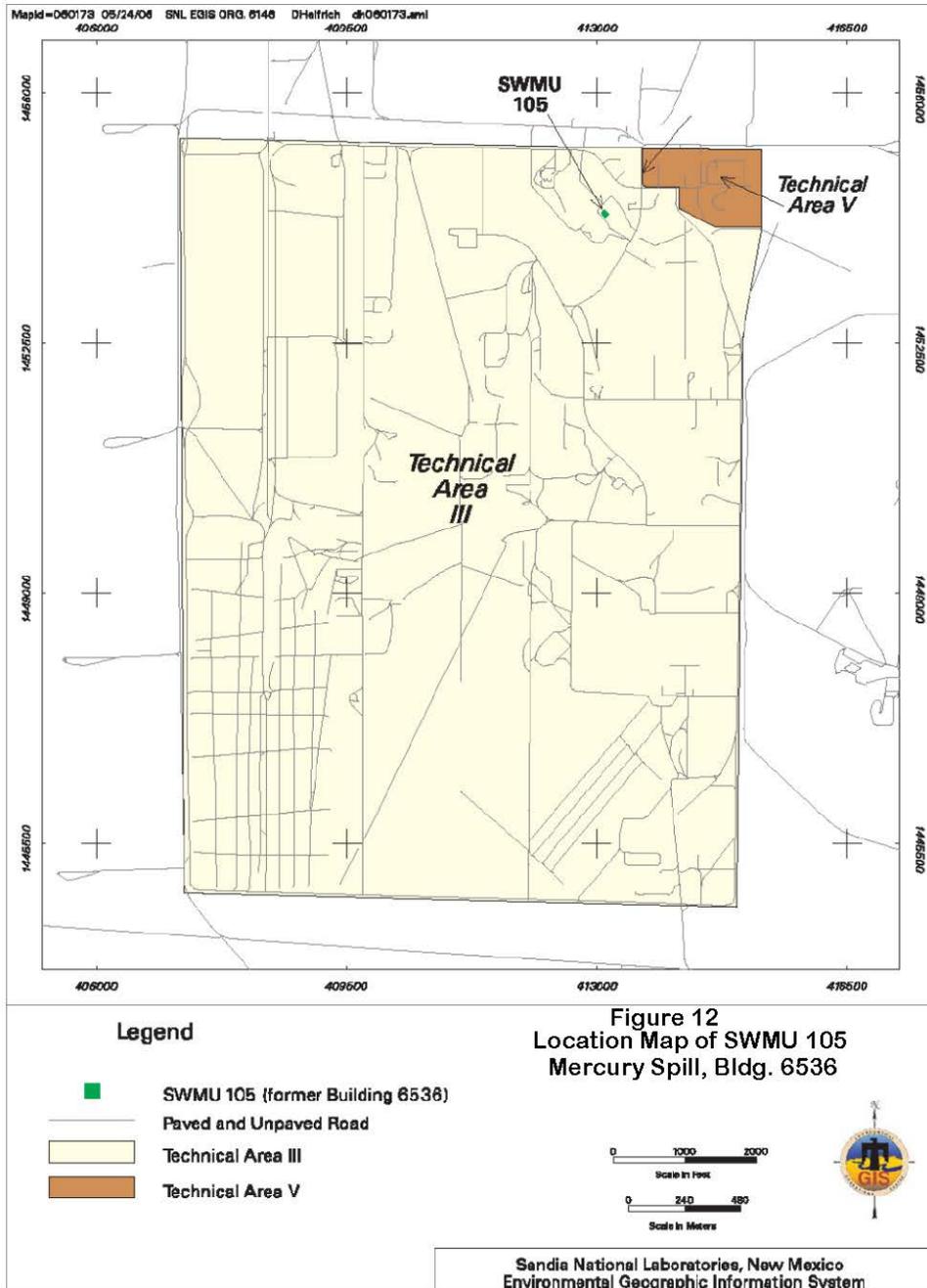
In the early 1990s, the initial investigation determined that the mercury releases at SWMU 105 did not impact the environment and that all releases had been within the building and were cleaned up at the time. In 1995, an administrative no further action was issued by the EPA for SWMU 105.

In June 2005, the discovery of the subsurface release to the environment prompted a VCA in order to characterize the release and remove the contaminated soil.

In September 2005, a Phase 1 Voluntary Corrective Action (P1VCA) was initiated. Six discrete subsurface soil samples collected from the release area for metals analysis revealed mercury contamination at a maximum of 39.6 mg/kg. Following the complete removal of Building 6536, a mercury soil-vapor survey beneath the former Room 113 slab indicated that contamination may have been more widespread than expected. Areas with positive vapor readings were found in the soil beneath the former Room 113 slab. Due to the results of the soil-vapor survey, the P1VCA was suspended and a Phase 2 Voluntary Corrective Action (P2VCA) plan was developed to address the new concerns. Mercury contaminated soil was removed from the trench area during the P1VCA and disposed of.

In January to March 2006, the P2VCA activities included the collection of 574 discrete soil samples in order to characterize the vertical and horizontal extent of contamination (Figure 12A).

The sampling area included the footprint of Room 113, the perimeter of Room 113, and the trench area. Samples were collected at approximately 2 ft depth intervals: maximum depth in trench area was approximately 11 ft, maximum depth under the Room 113 slab was approximately 8 ft, and maximum depth around the perimeter of Room 113 was approximately 4 ft. The sampling area was extended northwest of the trench in order to define the horizontal extent of contamination, as elevated mercury results were revealed in that area. The mercury contamination was found at and northwest of the release point in the trench area.



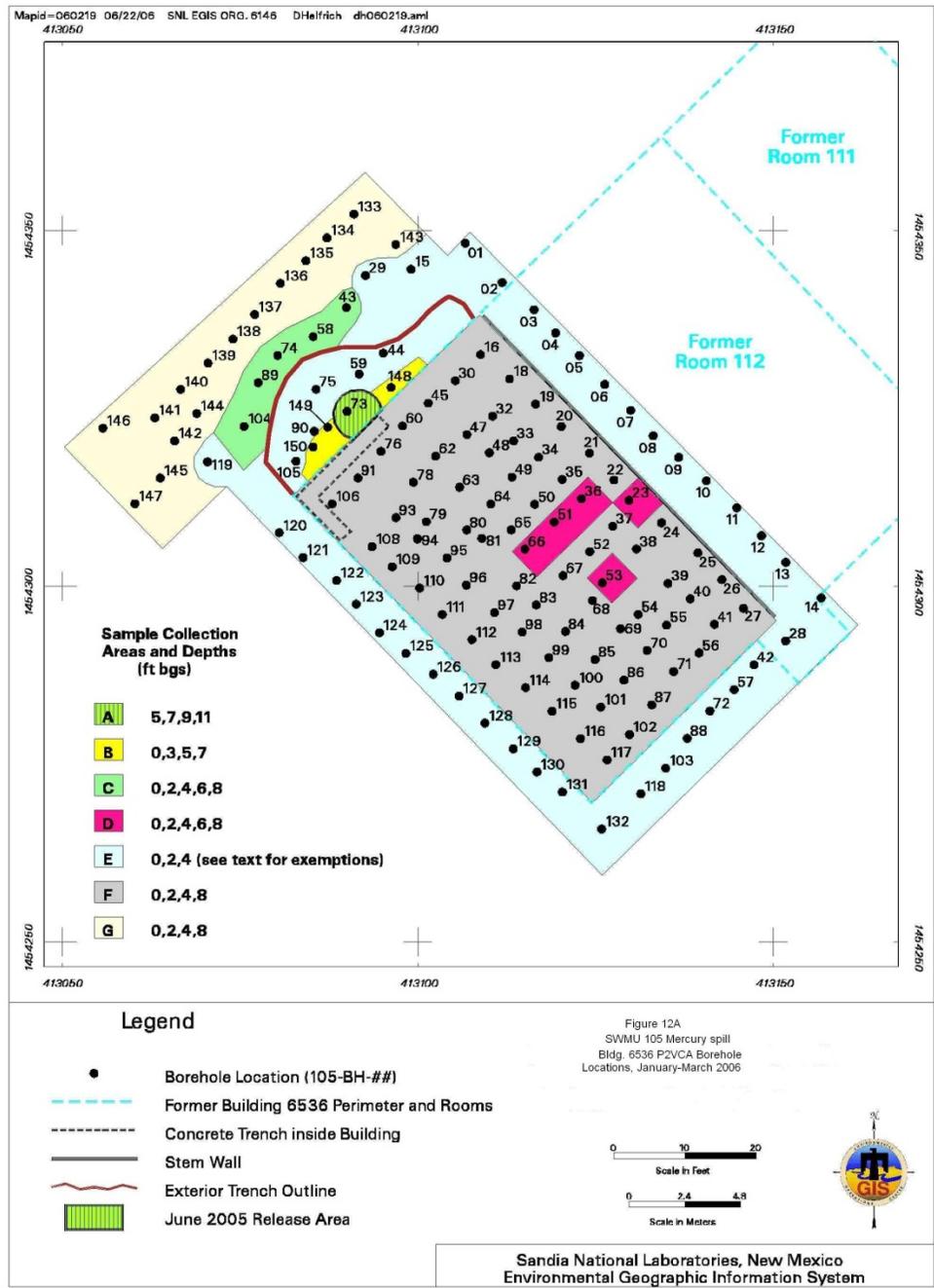


Figure 12A. SWMU 105 Soil Sample Locations

The analytical results of the P2VCA sampling effort revealed 38 samples that exceeded the mercury background value of less than 0.25 mg/kg for surface samples with a maximum of 339 mg/kg, and 73 samples that exceeded the mercury background value less than 0.1 mg/kg for subsurface samples with a maximum value of 342 mg/kg. With the exception of the two samples with the maximum values, the remainder of the sample results ranged from no detection above the method detection limit (MDL) to 147 mg/kg.

Approximately 1 cubic yard of mercury-contaminated soil was removed during the P2VCA and disposed of.

All soil analysis data collected from the P1VCA and the P2VCA were used in the characterization of SWMU 105 and in the risk analyses.

A risk screening assessment was performed for this site, initially using maximum COC concentration, to evaluate the potential for adverse health effects in recreational and residential land-use scenarios.

The distribution of mercury contamination at SWMU 105 could be divided into two sections of the site: the entire site with very little contamination (entire data set), and the trench and adjacent area with mercury contamination (limited data set). As a result, SNL performed two risk analyses. This provided an overall assessment for the entire site, and a conservative assessment for the portion of the site with the highest levels.

Using maximum COC concentrations for the **entire data set**, the total human health HI was 1.19 for the industrial land-use scenario, and the total human health HI was 15 for the residential land-use scenario, both which exceeded the NMED guideline of 1 (Table 10). However, when the UCL of the mean is used in the risk assessment; for the industrial land-use scenario the total human health HI is 0.03, and that for the residential land-use scenario is 0.34; the total human health HI for both the residential and industrial land-use scenario is less than the NMED guideline of 1.

Using maximum COC concentrations for the limited data set, the total human health HI for both the residential and industrial land-use scenario exceeds the NMED guideline of 1 (Table 10A).

Using the UCL of the mean concentration for mercury for the limited data set reduces the total HI to 0.11 for the industrial land-use scenario which is less than the NMED guideline of 1, and to 1.34 for the residential land-use scenario which exceeds the NMED guideline of 1.

**Table 10**  
**Risk Assessment Values for SWMU 105 Nonradiological COCs**  
**Entire Data Set**

COC <sup>a</sup>	Maximum Concentration/UCL (All Samples) (mg/kg)	Industrial Land-Use Scenario		Residential Land-Use Scenario	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Mercury	342/7.8	1.19/0.03	–	15.0/0.34	–
	<b>Total</b>	1.19/0.03	–	15.0/0.34	–

**Bold** values represent UCLs and calculations with UCLs.

<sup>a</sup>Maximum concentration exceeded background value.

– = Information not available.

**Table 10A**  
**Risk Assessment Values for SWMU 105 Nonradiological COCs**  
**Limited Data Set**

COC <sup>a</sup>	Maximum Concentration/UCL (Limited Set) (mg/kg)	Industrial Land-Use Scenario		Residential Land-Use Scenario	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Mercury	342/ <b>30.5</b>	1.19/ <b>0.11</b>	–	15.0/ <b>1.34</b>	–
<b>Total</b>		1.19/ <b>0.11</b>	–	15.0/ <b>1.34</b>	–

**Bold** values represent UCLs and calculations with UCLs.

<sup>a</sup>Maximum concentration exceeded background value.

– = Information not available.

Ecological risks associated with SWMU 105 were estimated through a screening assessment that incorporated site-specific information. Using this methodology, the ecological risk for SWMU 105 is expected to be low.

In conclusion, human health and ecological risk are acceptable per NMED guidance under an industrial land-use scenario. Thus, the entire site boundary of SWMU 105 is proposed for CAC with institutional controls.

### **Basis for Determination**

SWMU 105 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use (industrial).

### **SWMU 116, Building 9990 Septic System**

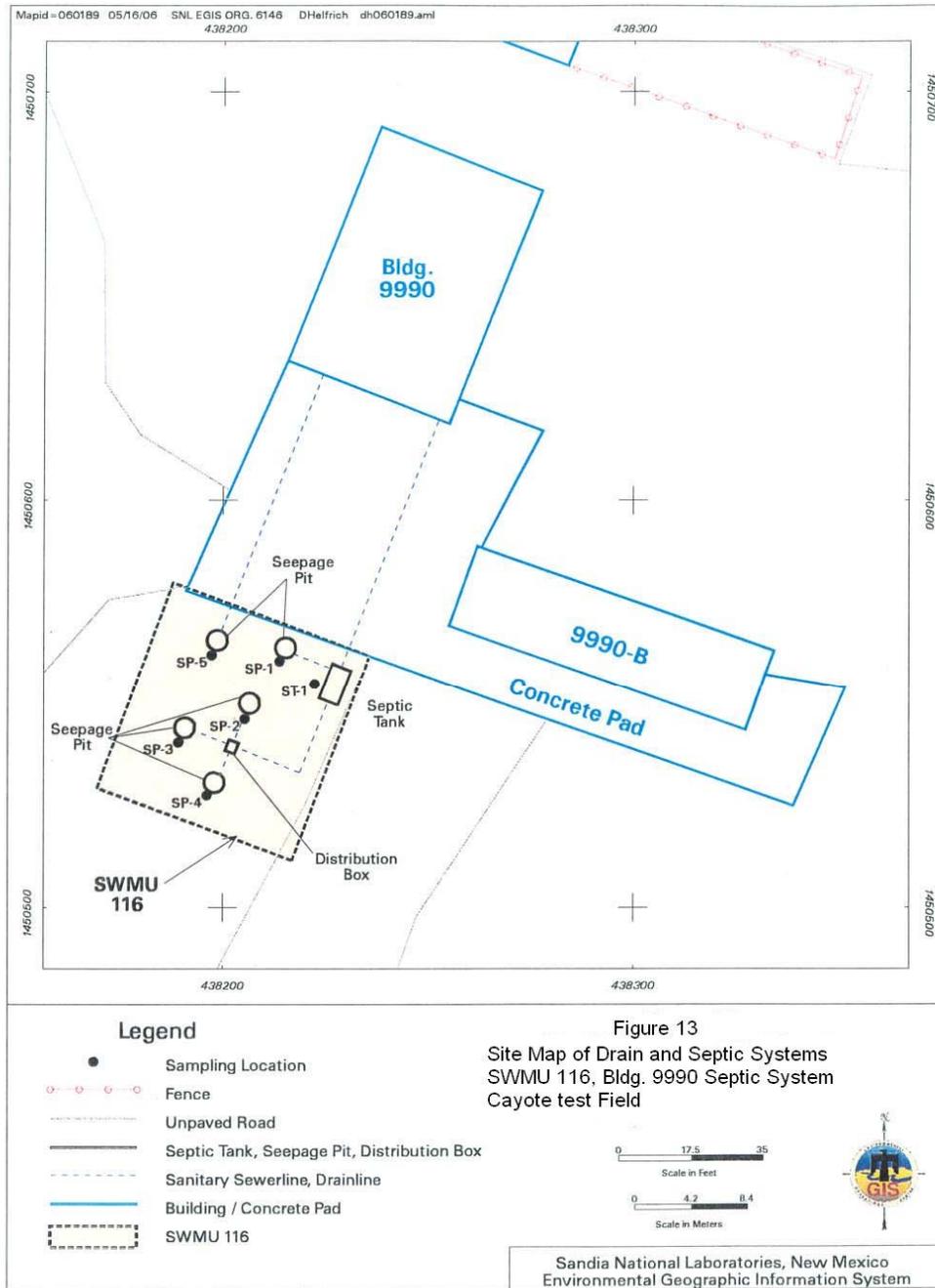
#### **Site Location**

SWMU 116, the Building 9990 Septic System, is located in the Coyote Test Field on federally owned land controlled by KAFB and permitted to the DOE (Figure 13). The abandoned system consisted of two drain systems. The septic system for Building 9990 consisted of one 750-gallon septic tank connected to a distribution box that in turn emptied to four seepage pits. A fifth seepage pit received wastewater from a darkroom sink and floor drains on the west side of the building.

#### **Operational History**

Available information indicates that Building 9990 was constructed in 1971, and it is assumed that the septic system was constructed at the same time. No significant activity has occurred at Building 9990 since 1994, and the septic tank was last pumped in the spring of 1989. Waste in the septic tank was removed. The systems were reportedly abandoned in the early 1990s but the building was not connected to the COA sanitary sewer system. Residual sludge remaining in the tank after the 1989 pumping was removed in December 1995. The empty and decontaminated septic tank was inspected by the Department in December 1995 and a closure form was signed. The septic tank and five seepage pits were then backfilled with clean, native soil from the area in early 1996.

The COCs include RCRA metals, hexavalent chromium, cyanide, PCBs, HE compounds, VOCs, SVOCs and radionuclides.



## **Evaluation of Relevant Information**

Five assessment investigations have been conducted at this site. In June 1992, May 1994 and January 1995, waste characterization samples were collected from the septic tank (Investigation 1). A geophysical survey was performed in February 1994 to help locate areas of high moisture content (Investigation 2). In May and June 1994 and November 1994 passive soil-vapor surveys were conducted to identify releases of VOCs and SVOCs (Investigation 3).

In January 1995, soil samples were collected from backhoe excavation next to each of the five seepage pits and from one excavation next to the septic tank. In 2002 soil samples were collected from boreholes in the vicinity of two of the seepage pits (Investigation 4). In August 2001, monitoring well CTF-MW1 was installed, and eight quarters of groundwater samples were collected and analyzed. This was one of four DSS sites selected by the Department for groundwater monitoring (Investigation 5). These investigations are discussed in the following sections.

### Investigation 1 — Septic Tank Sampling

Aqueous and sludge samples were collected from the septic tank in June 1992 and were analyzed for various organic, inorganic and radionuclide constituents. VOCs, SVOCs, metals, phenolic compounds and several miscellaneous organic compounds were detected in the liquid and/or sludge. Gross alpha, gross beta and individual radionuclide analyses were also performed on the material.

Although some radionuclides were detected, the brief narrative report summarizing the analytical results for those samples stated that “During review of the radiological data, no parameters were detected that exceed U.S. DOE derived concentration guideline (DCG) or the investigation levels established during this investigation.”

A second round of septic tank sludge samples was collected for waste characterization purposes in May 1994; the samples were analyzed for TCLP-list VOCs, SVOCs, metals, hexavalent chromium, cyanide and PCBs. No free liquid remained in the tank when these samples were collected. No VOC or SVOC compounds, and only barium were detected in the TCLP-derived leachate from the sludge. Cyanide and the PCB compound aroclor-1260 were identified in the material; hexavalent chromium was not detected.

A third round of waste characterization sludge samples was collected in January 1995 and the sludge samples analyzed for isotopic uranium by an offsite commercial laboratory and for other radionuclides using SNL in-house gamma spectroscopy. Low activity levels of the three isotopic uranium constituents, and a limited number of other radionuclides were detected in the material.

### Investigation 2 – Geophysical Survey

A geophysical survey using a Geonics™ EM-38 conductivity meter was performed at the site in February 1994 in an attempt to locate moist areas around the seepage pit. The results of the survey were inconclusive, and were not used to as a guide in determining soil sampling locations at this site.

### Investigation 3 – Passive Soil-Gas Survey

A passive soil-gas survey was conducted in two phases. Phase 1 was conducted in May and June 1994 and included 11 sampling locations. The second phase of sampling at seven additional locations was completed in November 1994. This survey used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the seepage pits and septic tank. BTEX and

aliphatic compounds at potentially detectable concentrations were identified in two samplers. These two locations were located in the northern edge of the seepage pit area, downgradient from a parking area.

#### Investigation 4 — Soil Sampling

An attempt was made in October 1994 to collect soil samples with Geoprobe™ sampling equipment but the effort was unsuccessful because of subsurface refusal of the Geoprobe™ sampling device and problems obtaining adequate sample volumes. Thus, in January 1995, samples were collected from backhoe excavations next to each of the five seepage pits and from one excavation next to the septic tank. It was determined that the depth to the natural bedrock subsurface ranged from 3 to 6.5 bgs, and that an excavation into bedrock to a depth of 13 feet bgs had been dug to accommodate the five 13-foot deep seepage pits. The base of the septic tank was also placed in the same bedrock excavation, at 8.5 feet bgs.

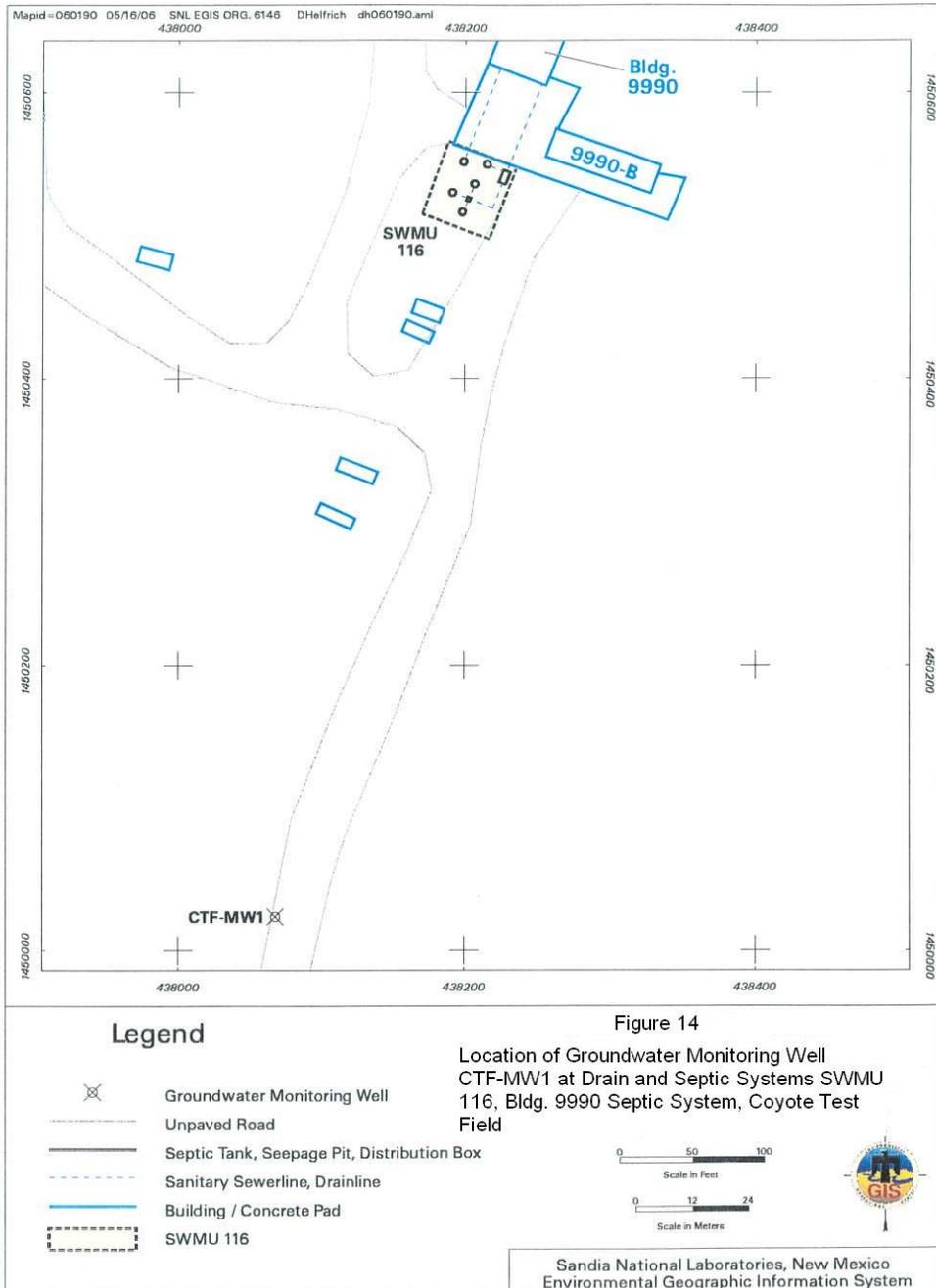
Results for the soil samples from January 1995 are as follows. Six VOCs (acetone, carbon disulfide, 2-hexanone, methylene chloride, methyl isobutyl ketone and xylenes) were detected in the soil samples. Acetone and methylene chloride were detected in the associated TB sample. No SVOCs were detected in any of the samples. One PCB (aroclor-1260) was detected in the soil sample near the septic tank. Cyanide was detected in three of the soil samples. One RCRA metal (silver) was detected above the Department-approved background level. All other metal concentrations were below the Department-approved background concentrations. For radionuclides, no activities above background levels were detected in any of the samples analyzed. However, although not detected, the MDA for the uranium-235 gamma spectroscopy analysis exceeded the background activity.

In October 2002, two additional samples for HE compounds were collected at two locations specified by the Department (locations SP-3 and SP-5, (Figure 13). Boreholes were drilled adjacent to the two seepage pits, and samples for HE analysis were collected at the greatest depth interval reached, 8 feet bgs, using a Geoprobe™ sampler inside the drill rig augers. No HE compounds were detected.

#### Investigation 5 – Groundwater Monitoring

Groundwater monitor well CTF-MW1 was installed with an air-rotary casing hammer (ARCH) drilling rig in August 2001 at a location agreed upon by the Department and the Permittees. Monitor well CTF-MW1 is 265 feet deep and is screened between 240 and 260 feet bgs. Depth to groundwater was 234 feet bgs in January 2005 (Figure 14).

Results for the eight quarters of groundwater samples collected from monitor well CTF-MW1 are summarized in this paragraph. One VOC (acetone) was detected in the groundwater sample collected in July 2002, but not in the associated TB. No VOCs were detected in subsequent groundwater, TB or EB samples. No HE compounds were detected in any groundwater sample collected. The RCRA metal selenium was detected in seven of the eight groundwater samples at concentrations above the Department-approved background concentration. All other metal concentrations were below the Department-approved background levels or other promulgated regulatory limits. No cyanide was detected in any sample collected. NPN detections exceeded the background value in every sampling round. Fluoride detections were all below the corresponding established regulatory and/or background levels. No regulatory or background limits have been established for bromide, calcium, chloride, magnesium, potassium, sodium or sulfate in groundwater.



Annual groundwater monitoring at SWMU 116 (required by the NMED as a control in its letter of April 8, 2010) is to be discontinued as no definitive evidence of groundwater contamination was detected in eight quarters of monitoring. Inorganic constituents are considered to be at background levels.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total human health HIs and estimated excess cancer risks are acceptable (Table 11).

**Table 11**  
**Risk Assessment Values for SWMU 116 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium VI	0.05 <sup>b</sup>	0.00	5E-11	0.00	1E-10
Cyanide	3.7	0.00		0.00	
Silver	1.7	0.00		0.00	
<b>Organic</b>					
Acetone	0.011	0.00		0.00	
Carbon disulfide	0.005 <sup>b</sup>	0.00		0.00	
2-Hexanone	0.005 <sup>b</sup>	0.00		0.00	
Methylene chloride	0.003 J	0.00	2E-8	0.00	4E-8
Methyl isobutyl ketone	0.005 <sup>b</sup>	0.00		0.00	
Total xylenes	0.0025	0.00		0.00	
<b>Total</b>		0.00	2E-8	0.01	4E-8

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

For the radiological COC (uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 5.0E-2 millirem (mrem)/year (yr). The estimated excess cancer risk is 4.8E-7.

The exposure pathway analysis established that no complete ecological pathway exists for exposure of ecological species to contaminants at SWMU 116. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

## **Basis for Determination**

SWMU 116 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

## **SWMU 138, Building 6630 Septic System**

### **Site Location**

SWMU 138, the Building 6630 Septic System, is located in TA-III on federally owned land controlled by KAFB and permitted to the DOE. SWMU 138 consists of a 600-gallon septic tank that discharged to four, approximately 110-ft-long drain lines (Figure 15).

### **Operational History**

Available information indicates that Building 6630 was constructed in 1959 and it is assumed that the septic system was constructed about the same time. In 1991, septic system discharges were routed to the COA sanitary sewer system. The septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change. The empty and decontaminated septic tank was inspected by the Department in November 1995, and a closure form was signed. The septic tank was backfilled with clean, native soil from the area in late 1995.

The COCs include RCRA metals, HE compounds, VOCs, SVOCs and radionuclides.

### **Evaluation of Relevant Information**

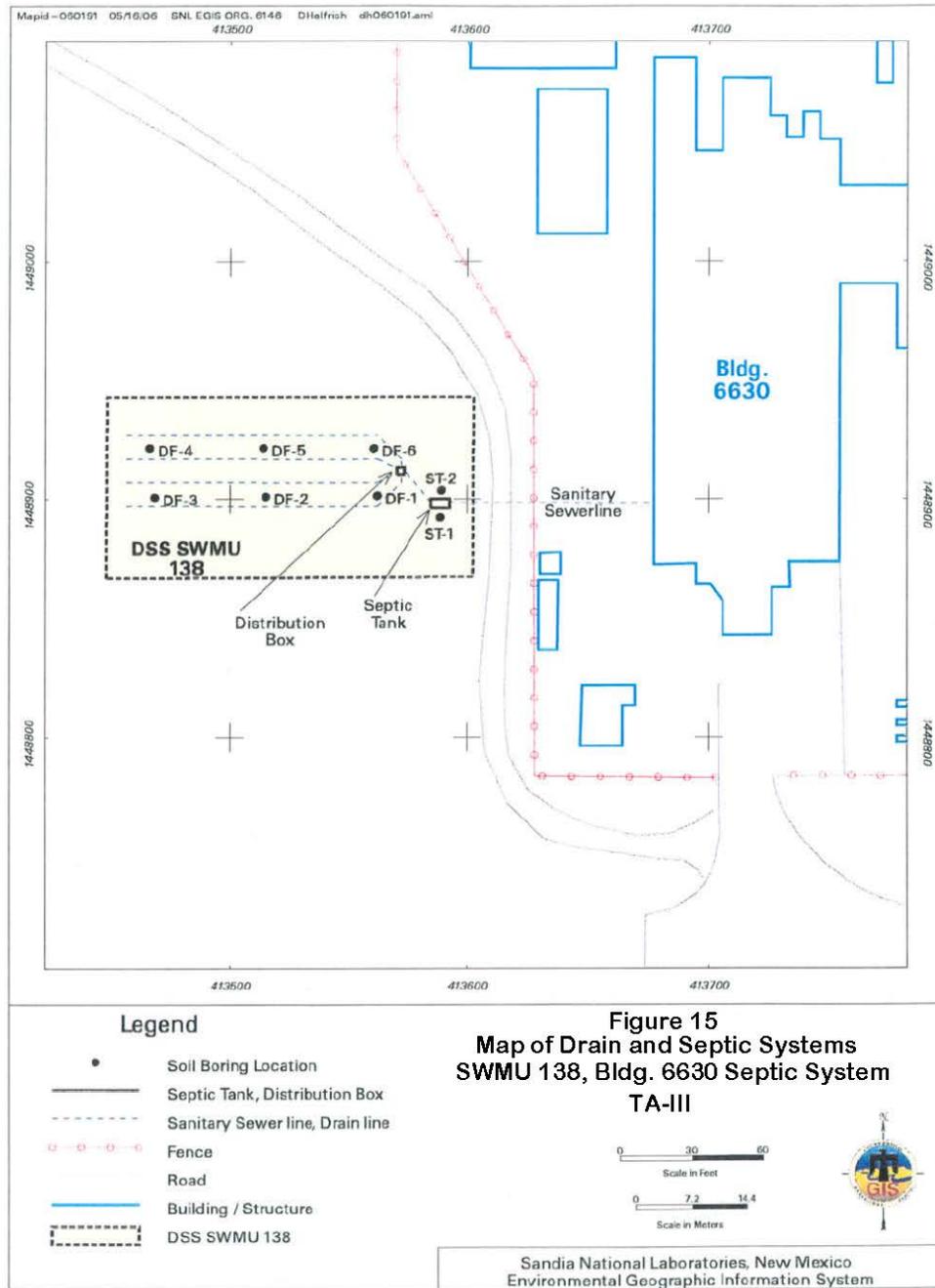
Five assessment investigations have been conducted at this site. In May 1994 and in January 1995, waste characterization samples were collected from the septic tank, and in January 1996 the distribution box was sampled (Investigation 1). A geophysical survey was performed in June 1994 to help locate areas of high moisture content (Investigation 2). In June and November 1994, passive soil-vapor surveys were conducted to identify potential releases of VOCs and SVOCs (Investigation 3). A backhoe was used to locate the drainfield (Investigation 4). In December 1994 soil samples were collected from boreholes within the drainfield, and from either side of the septic tank (Investigation 5). These investigations are discussed in the following sections.

#### **Investigation 1 — Septic Tank and Distribution Box Sampling**

Septic tank sludge samples were collected in May 1994 and January 1995 for waste characterization purposes and were analyzed for VOCs, SVOCs, total and TCLP RCRA metals, isotopic uranium, PCBs, tritium and gamma spectroscopy radionuclides. The septic system was not used after 1990, and the sludge in the tank was dry. Concentrations of a number of RCRA metals were detected. However, only barium and cadmium were detected in the TCLP analysis, and concentrations of both were below regulatory levels. The SVOC analysis identified a phthalate above the detection limit and trace quantities of 11 other SVOCs in the sludge. The PCB analysis detected aroclor-1254 in the sludge. The VOC analysis detected methylene chloride, acetone and 2-butanone in the sludge. Analysis of the septic tank sludge detected a uranium-238 anomaly.

The distribution box had a small amount of sludge that was sampled in January 1996 for RCRA metals, tritium, isotopic uranium and gamma spectroscopy radionuclides. The metal concentrations were all lower than those in the septic tank sludge as expected because of the

precipitation mechanism in the tank. No radiological anomalies were evident, and there was no detectable tritium.



### Investigation 2 – Geophysical Survey

A geophysical survey using a Geonics™ Model EM-38 ground conductivity meter was performed in June 1994 to attempt to locate the drainfield. The technique was not successful in delineating the drainfield or finding areas of higher moisture concentrations.

### Investigation 3 – Passive Soil-Gas Survey

The passive soil-gas survey conducted in the area of the drainfield in June and November 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the drainfield. Fifty-five PETREX™ tube samplers were placed, in two phases, in a grid pattern that covered the drainfield and septic tank area. The soil gas survey detected tetrachloroethene, TCE, BTEX and aliphatic compounds at several locations in and around the drainfield. However, at one of the sample locations where TCE was detected, an additional overlapping PETREX sample did not detect TCE. Also, subsequent confirmatory soil samples that were collected near some of the PETREX sample locations in the drainfield and analyzed for VOCs and SVOCs did not detect any of these constituents.

### Investigation 4 — Backhoe Excavation

A backhoe was used in September 1994 to determine the location, dimensions and depth of the ER Site 138 drainfield, which had no surface expression.

### Investigation 5 — Soil Sampling

In December 1994, soil samples were collected from boreholes within the drainfield, and from either side of the septic tank. Sampling intervals started at 6.5 and 16.5 feet bgs in each of the six drainfield boreholes, and at 10 feet bgs in the two boreholes adjacent to the septic tank. The soil samples were analyzed for VOCs, SVOCs, PCBs, RCRA metals plus nickel, total cyanide, isotopic uranium, tritium and radionuclides by gamma spectroscopy.

Results for the soil samples are discussed in this section. Three VOCs (acetone, methylene chloride and toluene) were detected in the soil samples. All but toluene were also detected in the associated TB or EB samples. Three SVOCs [bis(2-ethylhexyl) phthalate, 2-chloronaphthalene and phenol] were detected in the soil samples. No PCBs or cyanide were detected in any of the samples collected from the boreholes. Three RCRA metals (barium, nickel and silver) were detected above the Department-approved background levels in all three boreholes. All other metal concentrations were below the corresponding Department-approved background concentrations. For radionuclides, no activities above background levels were detected in any of the samples analyzed. However, although not detected, the MDA for tritium analyses exceeded its respective background activity.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total human health HIs and estimated excess cancer risks are acceptable (Table 12).

**Table 12**  
**Risk Assessment Values for SWMU 138 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Barium	497	0.01		0.09	
Cyanide	0.25 <sup>b</sup>	0.00		0.00	
Nickel	108	0.01		0.07	
Silver	11.9	0.00		0.03	
<b>Organic</b>					
Acetone	0.0079 J	0.00		0.00	
2-Chloronaphthalene	0.2 J	0.00		0.00	
bis(2-Ethylhexyl) phthalate	0.165 <sup>b</sup>	0.00	9E-10	0.00	4E-9
Methylene Chloride	0.0039 J	0.00	3E-8	0.00	5E-8
Phenol	0.165 <sup>b</sup>	0.00		0.00	
Toluene	0.0025 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.02</b>	<b>3E-8</b>	<b>0.20</b>	<b>6E-8</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Estimated concentration.

mg/kg = Milligram(s) per kilogram.

For the radiological COC (tritium) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 3.6E-5 millirem (mrem)/year (yr). The estimated excess cancer risk is 4.0E-11.

The exposure pathway analysis established that no ecological pathway exists for exposure of ecological species to contaminants at SWMU 138. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

### **Basis for Determination**

SWMU 138 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

## **SWMU 140, Building 9965 Septic System, Septic Tanks, and Drainfields**

### **Site Location**

SWMU 140, the Building 9965 Septic System, is located in the Thunder Range test area on federally owned land controlled by KAFB and permitted to the DOE. SWMU 140 consists of two abandoned drain systems. The septic system on the southwest side of Building 9965 consisted of a septic tank connected to a single seepage pit. The second drain system discharged to a drywell on the north side of the building (Figure 16).

### **Operational History**

Available information indicates that Building 9965 was constructed in 1965, and it is assumed that the septic system and drywell were also constructed at that time. By 1991, the septic system discharges were routed to the COA sanitary sewer system, and the drywell was deactivated in the early 1990s. The old septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change. Waste in the septic tank was removed. The empty and decontaminated septic tank was inspected by the Department on December 15, 1995, and a closure form was signed. The septic tank was then backfilled with clean, native soil from the area in late 1995 or early 1996.

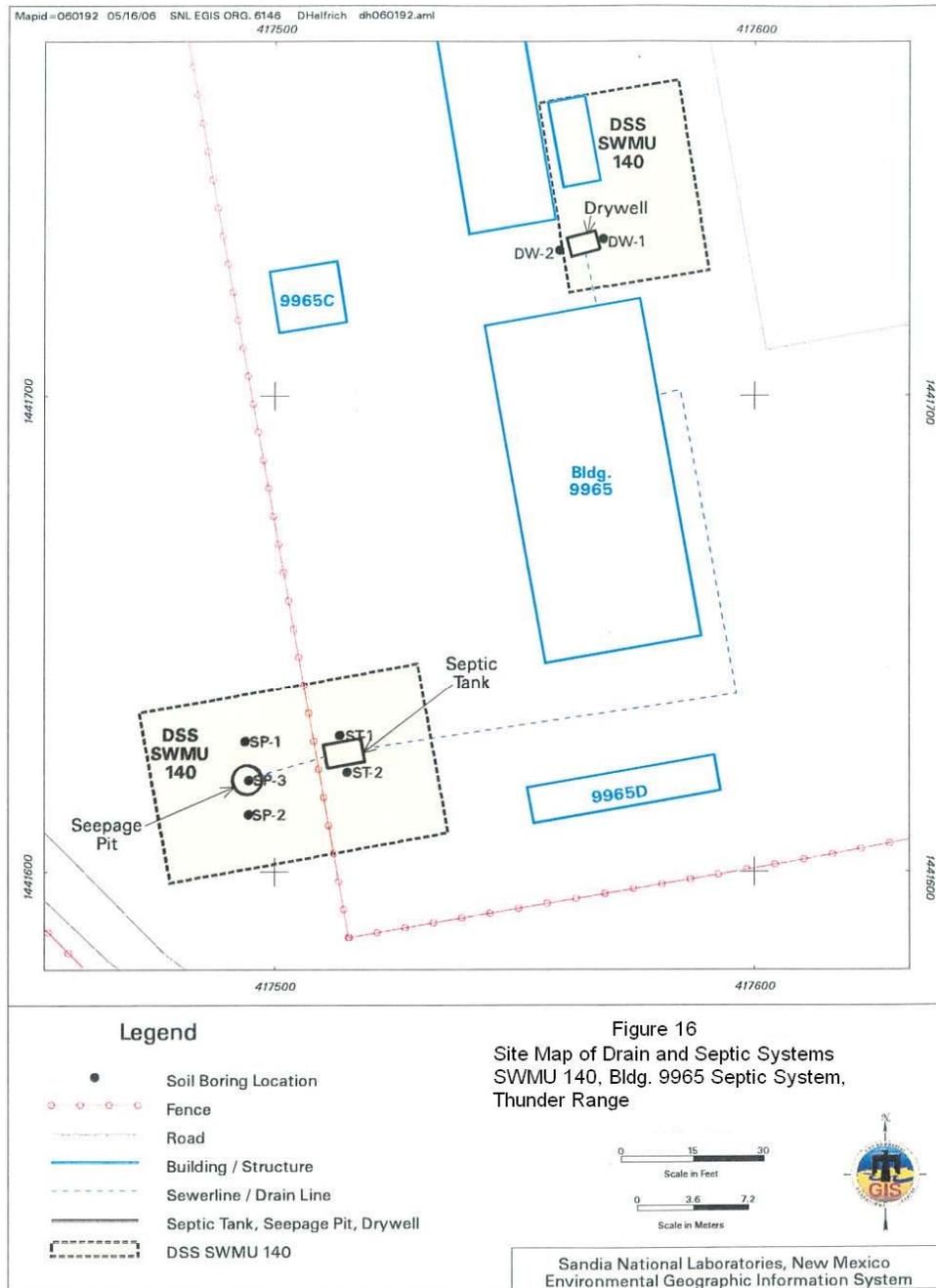
The COCs include RCRA metals, hexavalent chromium, cyanide, VOCs, SVOCs and radionuclides.

### **Evaluation of Relevant Information**

Four assessment investigations have been conducted at this site. In July 1992, April 1994, and November 1994, waste characterization samples were collected from the septic tank (Investigation 1). A geophysical survey was performed in June 1994 to locate the two drywells thought to exist north of Building 9965 (Investigation 2). In June and July 1994, a passive soil-vapor survey was conducted to identify potential releases of VOCs and SVOCs that could have occurred from seepage pit, septic tank, and drywell (Investigation 3). In September 1994, November 1994, January 1995 and September 2003, soil samples were collected from boreholes on opposite sides of the seepage pit, septic tank and drywell and through the center of the seepage pit (Investigation 4). A backhoe excavation was conducted in January 1995 to determine the cause of the resistance when sampling near the seepage pit (Investigation 5). These investigations are discussed in the following sections.

#### **Investigation 1 — Septic Tank Sampling**

Sludge and aqueous samples were collected from the septic tank in July 1992. The aqueous sample was analyzed for VOCs, SVOCs, pesticides, PCBs, metals, selected radionuclide constituents and several miscellaneous analytes. One VOC (TCE) was identified. The pesticides beta-BHC, 4,4-DDD and 4,4-DDE were detected. Several RCRA metals and radionuclides were detected as well as phenolic compounds, nitrates/nitrites, formaldehyde, fluoride, cyanide and oil and grease. No PCBs were detected. The sludge sample was analyzed for heavy metals and selected radionuclide constituents. Several metals and radionuclides were detected.



A second round of septic tank sludge samples was collected for waste characterization purposes in April 1994 and analyzed for VOCs and RCRA TCLP metals. Concentrations of eight VOC compounds (acetone, benzene, 2-butanone, carbon disulfide, ethyl benzene, methylene chloride, toluene and total xylenes) were identified in the material. Two RCRA TCLP metals (barium and mercury) were detected in the sludge.

A third round of waste characterization sludge and liquid samples was collected in November 1994 and were analyzed for SVOCs, isotopic uranium, gamma spectroscopy radionuclides and tritium. No SVOCs were detected. Several radionuclides were detected.

### Investigation 2 – Geophysical Survey

A geophysical survey was conducted in June 1994 using a Schonstedt 52B magnetic locator. The purpose of this survey was to locate the two drywells thought to exist north of Building 9965. The active drywell generated a distinct magnetic signature and was located with high confidence. Another feature west of the active drywell generated a weak magnetic signature and was thought to be the second drywell. However, because the second feature had such a poor magnetic signature, it was thought that what was identified as a second drywell might actually be a magnetic anomaly due to other buried metal.

### Investigation 3 – Passive Soil-Gas Survey

A passive soil-gas survey was conducted in June and July 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs that may have occurred from the seepage pit, septic tank and drywell. Six PETREX™ tube samplers were placed in a grid pattern surrounding the seepage pit and septic tank, and another six were placed in a grid pattern surrounding the drywell.

### Investigation 4 — Soil Sampling

Soil samples were collected from borings located on opposite sides of the seepage pit, septic tank and drywell in September and November 1994, and January 1995 respectively (Figure 16). Sampling around the seepage pit was started at 11 ft bgs. The Geoprobe™ met resistance at about 14 ft bgs at all locations around the seepage pit. This difficulty meant that the shallow samples had to be collected from six separate closely-spaced locations. Four of the locations were north of the seepage pit within two ft of the SP-1 location, and two were south of the seepage pit within two ft of the location of SP-2 shown on (Figure 16). The four tries are thus identified as SP-1 and the two tries SP-2. Also, because of the refusal at 14 ft bgs, a deep sample was not obtained. In November 1994, one soil sample was collected from each of the two septic tank borings, the depth interval for the sample started at a depth level with the bottom of the septic tank which was measured to be 7 ft bgs. Finally, in January 1995 soil samples were collected from two different intervals in boreholes near the drywell. The shallow sampling interval started at the bottom of the drywell at 8 ft bgs and the deeper interval started at 10 feet below the top of the upper interval, or 18 ft bgs. Subsurface refusal problems of the Geoprobe™ sampler were not encountered in either of the two drywell boreholes. The soil samples were analyzed for VOCs, SVOCs, hexavalent chromium, cyanide, nitrate, RCRA metals, tritium, isotopic uranium and radionuclides by gamma spectroscopy.

Results for the soil samples are discussed in this paragraph. Four VOCs (acetone, methylene chloride, methyl ethyl ketone and methyl isobutyl ketone) were detected in the soil samples. These compounds were detected in one or more of the associated TB or EB samples. No SVOCs or hexavalent chromium were detected. Cyanide was detected in three of the samples. Nitrate

was detected in five of the samples. Three RCRA metals (arsenic, barium and selenium) were detected above Department-approved background concentrations. All other metal concentrations were below the Department-approved background concentrations. For radionuclides, no activities above background levels were detected in any of the samples analyzed. However, although not detected, the MDA for all of the uranium-235 and uranium-238 analyses exceeded the corresponding background activity.

In September 2003, a truck-mounted auger drill rig was used to collect two additional soil samples for VOC analysis and four soil samples for total cyanide analysis from a borehole drilled through, and beneath, the seepage pit. The VOC samples were collected at depths of 11 and 16 feet bgs and the total cyanide samples were collected at depths of 11, 16, 21 and 26 feet bgs at the SP-3 seepage pit borehole location (Figure 16). One VOC (acetone) was detected only in the EB associated with these samples. Low concentrations of toluene were detected in the two VOC soil samples but not in the TB or EB associated with these samples. Cyanide was not detected in any soil sample or in the EB associated with these samples.

#### Investigation 5 — Backhoe Excavation

A backhoe excavation was conducted in January 1995 to determine the cause of the resistance when sampling near the seepage pit. The excavation uncovered two caliche layers at this site. One layer was 0.5 to 1.0 ft thick at 8 to 9 ft bgs. The other layer started at about 13 ft bgs and could not be penetrated with a backhoe.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HI and estimated excess cancer risk are acceptable (Table 13).

For the radiological COCs (uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 0.13 millirem (mrem)/year (yr). The estimated excess cancer risk is  $1.1E-6$ .

The exposure pathway analysis established that no complete ecological pathway exists for exposure of ecological species to contaminants at SWMU 140. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

#### **Basis for Determination**

SWMU 140 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

**Table 13**  
**Risk Assessment Values for SWMU 140 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Arsenic	5.7	0.02	4E-6	0.26	1E-5
Barium	254	0.00		0.05	
Cyanide	1.8	0.00		0.00	
Nitrate	3.9	0.00		0.00	
Selenium	4.6	0.00		0.01	
<b>Organic</b>					
Acetone	0.016	0.00		0.00	
Methylene chloride	0.0038 J	0.00	2E-8	0.00	5E-8
Methyl ethyl ketone	0.026	0.00		0.00	
Methyl isobutyl ketone	0.005 <sup>b</sup>	0.00		0.00	
Toluene	0.0025 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.03</b>	<b>4E-6</b>	<b>0.33</b>	<b>1E-5</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

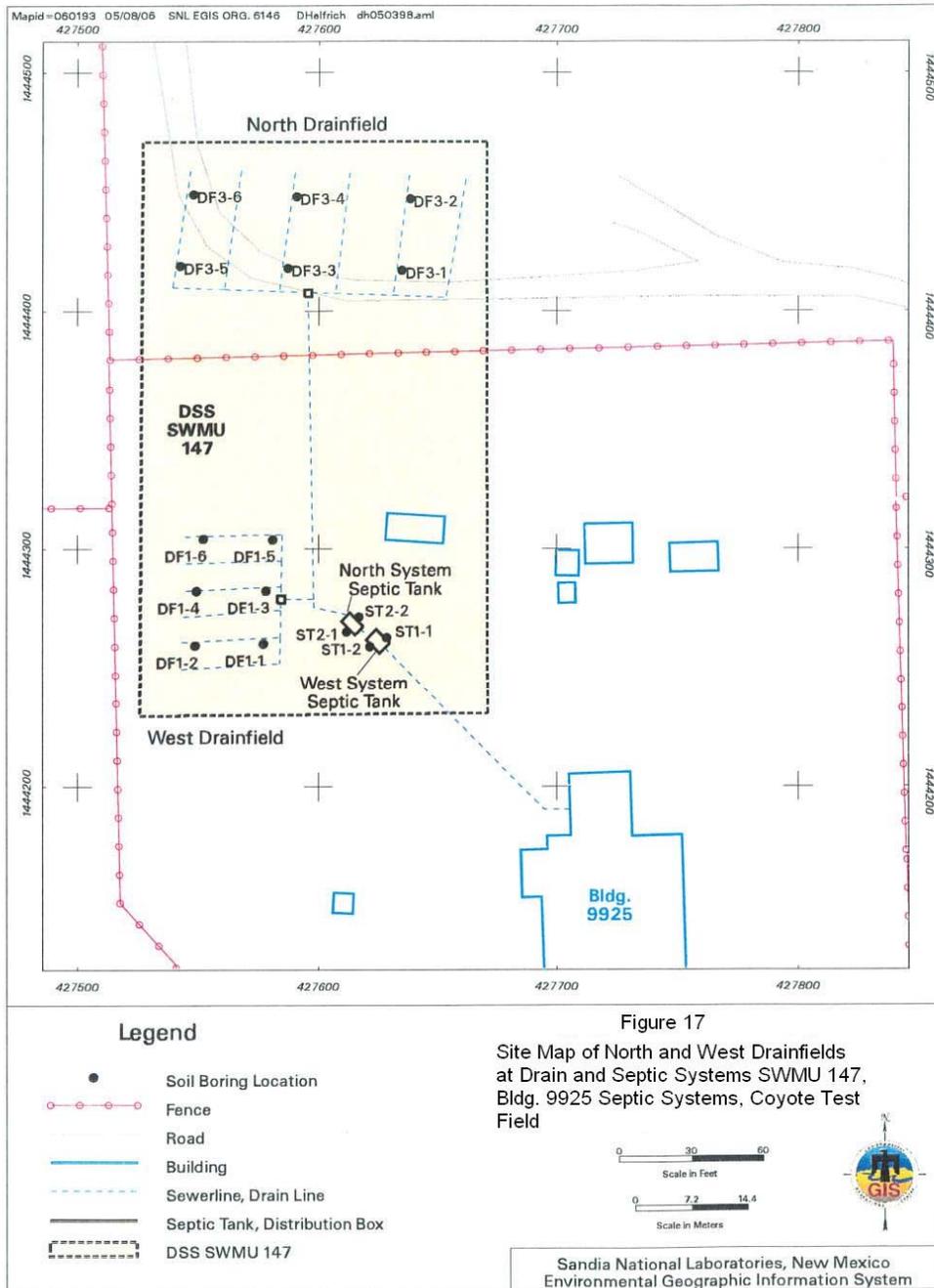
J = Estimated concentration.

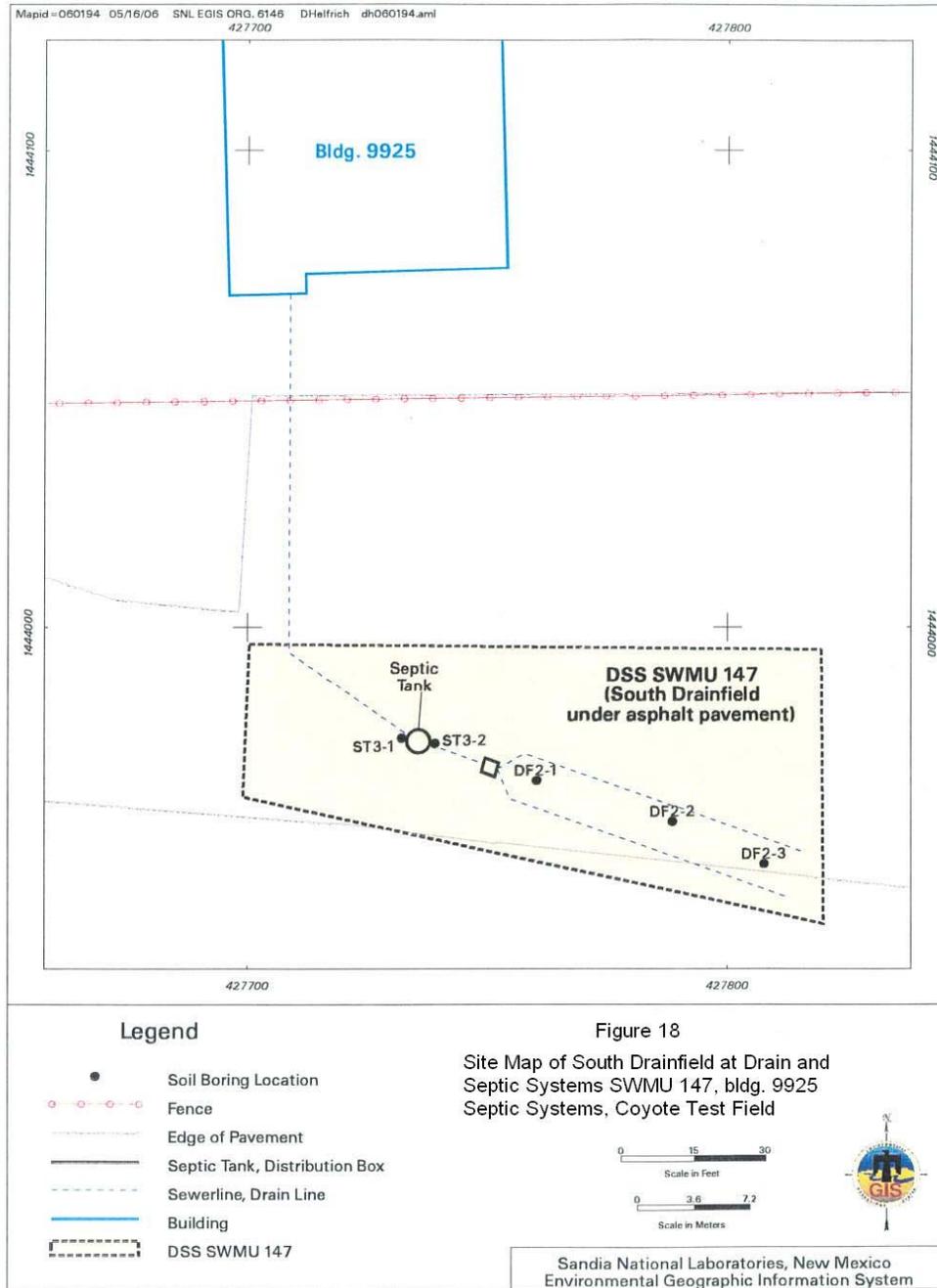
mg/kg = Milligram(s) per kilogram.

### **SWMU 147, Building 9925 Septic System, Septic Tanks, and Drainfields**

#### **Site Location**

SWMU 147, the Building 9925 Septic System, is located in the Coyote Test Field area on federally owned land controlled by KAFB and permitted to the DOE. Building 9925 had three septic systems. The west septic system consisted of a 1,500-gallon septic tank that discharged to a drainfield with six, approximately 40-ft-long drain lines. The west drainfield was abandoned and replaced by the north system consisting of a drainfield with six, approximately 50-ft-long drain lines. The west system septic tank was connected to a second 1,500-gallon septic tank when the west drainfield was abandoned (Figure 17). The south septic system consisted of a 750-gallon septic tank that discharged to a drainfield with two, approximately 60-ft-long drain lines (Figure 18).





## **Operational History**

Available information indicates that Building 9925 was constructed in 1959, and it is assumed that the south septic system was also constructed at that time. The west system, which was constructed around 1965 to 1966, was replaced by the north system in the late 1980s. By 1991, all septic system discharges were routed to the COA sanitary sewer system. The old septic system lines were disconnected and capped and the systems were abandoned in place concurrent with this change. Waste in the north and west system septic tanks was removed. The empty and decontaminated septic tanks were inspected by the Department on January 26, 1996, and a closure form was signed. The septic tanks were then backfilled with clean, native soil from the area in early 1996. The south system septic tank had been abandoned in place prior to 1994.

The COCs include RCRA metals, HE compounds, VOCs, SVOCs and radionuclides.

## **Evaluation of Relevant Information**

Five assessment investigations have been conducted at this site. In May 1994 and January 1994, waste characterization samples were collected from the west septic tank, and in January 1995, from the north septic tank (Investigation 1). A geophysical survey was performed in late 1993 to early 1994 to locate areas of moist soils around these systems (Investigation 2). In June and November 1994, passive soil-vapor surveys were conducted to identify potential releases of VOCs and SVOCs from the septic systems (Investigation 3). In September 1994, a backhoe was used to locate the north system drainfields (Investigation 4). In January 1995, soil samples were collected from boreholes in the drainfields (Investigation 5). These investigations are discussed in the following sections.

### Investigation 1 — Septic Tank Sampling

Septage samples were collected from the SWMU 147 north and west system septic tanks for waste characterization purposes.

#### *West System Septic Tank Samples*

Waste characterization liquid and sludge samples were collected from the west system septic tank in May 1994. The liquid samples were analyzed for phenolic compounds, RCRA metals, isotopic uranium, tritium and additional radionuclides using gamma spectroscopy screening. A low concentration of barium and below-reporting limits concentrations of arsenic and silver were identified in the liquid samples. The sludge samples were analyzed for VOCs, SVOCs, phenolic compounds, RCRA TCLP metals, explosive compounds and radionuclides using gamma spectroscopy screening. Explosives compounds were selected as an analyte for the west tank because it was in service from the late 1960s through the early 1980s when it was likely that explosives were used at the Test Field. Below-reporting-limit concentrations of two VOCs, seven SVOCs, and phenolic compounds were identified in the material. No explosive compounds were detected, and low activity levels of seven radionuclides were identified in the gamma spectroscopy screening.

A waste characterization sludge sample was collected from the west system tank in January 1995 and was analyzed for isotopic uranium. Low activity levels of uranium isotopes were detected in the sludge.

#### *North System Septic Tank Samples*

A second round of liquid and sludge waste characterization samples was collected from the north system septic tank in January 1995. The liquid samples were analyzed for SVOCs, explosive compounds, RCRA metals, isotopic uranium and tritium. Explosive compounds were selected as an analyte for the north tank liquid only because the two tanks are in series, and the line to the drainfield is connected to the north tank. SVOCs and explosive constituents were not detected, and low concentrations of two metals (barium and lead) were identified in the liquid. Low activity levels of isotopic uranium were detected, but tritium was not identified in the liquid. The sludge samples were analyzed for VOCs, SVOCs, RCRA metals, uranium isotopes and for additional radionuclides using gamma spectroscopy. Five VOCs, one SVOC, seven of the eight RCRA metals and low activity levels of uranium isotopes were detected in the samples. A number of additional radionuclides were also identified in the gamma spectroscopy screening of the sludge.

### Investigation 2 – Geophysical Survey

Several geophysical surveys using Geonics™ Model EM-31 and EM-38 ground conductivity meters were performed in the area of the west and south systems in late 1993 and early 1994 to attempt to locate areas of moist soils around these systems, and to identify locations of pipe runs. The EM-31 instrument was used for deeper surveys (up to 18 ft bgs), and the EM-38 was employed for shallower work (within 5 ft of the surface). A possible moist area was identified north of the west drainfield. Geophysical techniques were unable to determine the locations of the drainlines in the west and south drainfields; the actual drainline locations were later determined using a backhoe.

### Investigation 3 – Passive Soil-Gas Surveys

Two separate passive soil-gas surveys were conducted in the south and west system areas in June 1994. A third survey was conducted in the north system drainfield area in November 1994. PETREX™ sampling tubes were used to identify any releases of VOCs and SVOCs that occurred via the septic systems. Eighteen PETREX™ tube samplers were placed in a grid pattern that covered the north system drainfield area. Twenty-four PETREX™ samplers were placed in a grid pattern that covered the west system drainfield area, and also covered the area around the north and west system septic tanks. Finally, twelve more samplers were placed in a grid arrangement that covered the south system septic tank and drainfield area under the Optical Range Road pavement. Seven of the twelve south system PETREX™ samplers were inserted through small boreholes drilled through the asphalt paving and installed in soil immediately beneath the pavement. Four other samplers were placed in an unpaved area on the south side of the road, and the twelfth sampler was installed in the center of the soil-filled septic tank manhole. All of the PETREX™ samplers were analyzed for two individual constituents (PCE and TCE) and two groups of compounds (BTEX and aliphatic compounds). Potentially significant levels of PCE, BTEX and aliphatic compounds in soil gas were detected at a number of the south system PETREX™ samplers located beneath the pavement, while significant levels were not detected in soil gas at any of the five samplers placed at unpaved locations. However, no VOCs were detected except for those that could be laboratory-introduced contaminants in the follow-up soil samples collected from around the south system septic tank and drainfield. Potentially significant levels of PCE, BTEX and aliphatic compounds were detected in soil gas at a number of the PETREX™ sampling locations in the west system drainfield area, and in the vicinity of the west and north septic tanks. However, the locations with higher ion counts were somewhat randomly scattered and did not appear to correspond to the configuration of the drainfield, and also were not in the immediate area of the two septic tanks. VOCs were not detected in any of

the soil samples collected from boreholes in the west system drainfield, or around the two septic tanks. Finally, potentially significant levels of BTEX or aliphatic compounds in soil gas were identified at two of the eighteen PETREX™ sampling locations in the north system drainfield area. Except for those that could be laboratory-introduced compounds, VOCs were not detected in any of the soil samples collected from the north system drainfield boreholes.

#### Investigation 4 — Backhoe Excavation

A backhoe was used in September 1994 to determine the location, dimensions and depths of the west and north system drainfields, which have no surface expressions. A faint organic-type odor was noted in some of the soil excavated in the west drainfield. No visible evidence of soil discoloration, staining, or odors indicating residual contamination was observed when the north drainfield was being located. Also, no odors or other evidence of contamination was noted when soil samples were collected from the three drainfield areas and around the three septic tanks in January 1995, or in soil excavated from around the north and west system septic tanks as part of septic tank waste removal and decontamination operation in January 1996.

#### Investigation 5 — Soil Sampling

In January 1995, soil samples were collected from boreholes drilled in the drainfields and adjacent to the septic tanks using a Geoprobe™. The 1995 drainfield sampling intervals started at 9 feet bgs in the boreholes next to the north system septic tank, at 9 and 19 feet bgs in the north system drainfield boreholes, 9 feet bgs in the boreholes next to the west system septic tank, at 5 and 15 feet bgs in the west system drainfield boreholes, and 10 feet bgs in the boreholes next to the south system septic tank, and at 5 and 15 feet bgs in the south system drainfield boreholes. The soil samples were analyzed for VOCs, SVOCs, RCRA metals, isotopic uranium, tritium and radionuclides by gamma spectroscopy. The samples were also screened for TNT.

Analytical results for the January 1995 soil samples are discussed in this section. Six VOCs (acetone, 2-hexanone, methylene chloride, methyl ethyl ketone, methyl isobutyl ketone and toluene) were detected in the soil samples. These compounds were detected in some of the associated TB or EB samples. Three SVOCs (di-n-butyl phthalate, bis(2-Ethylhexyl) phthalate and phenol) were detected in the soil samples collected at this site. Two RCRA metals (barium and lead) were detected above the Department-approved background concentrations. All other metal concentrations were below the Department-approved background concentrations. There was no TNT detected in the screening samples. One radionuclide (tritium) was detected at a maximum activity of 0.0225 pCi/g which is above the background activity of 0.021 pCi/g. With the exception of tritium no activities were detected above background levels in any of the samples analyzed. However, although not detected, the MDA for most of the uranium-235 and uranium-238 gamma spectroscopic analyses exceeded the background activity.

In October 2002, additional soil samples were collected for HE compound analysis at five previously sampled locations in the three drainfields at Building 9925. Samples were collected from boreholes DF3-1 and DF3-6 in the north drainfield (Figure 17) from boreholes DF1-1 and DF1-6 in the west drainfield (Figure 17) and from borehole DF2-2 in the south drainfield (Figure 18). The samples were collected from a depth of 9 ft bgs in boreholes DF3-1 and DF3-6 in the north drainfield and from a depth of 5 ft bgs in boreholes DF1-1, DF1-6, and DF2-2 in the west and south drainfields (Figure 17 and 18). No HE compounds were detected in any of the five soil samples collected.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total human health HIs and estimated excess cancer risks are acceptable (Table 14).

For the radiological COCs (tritium, uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 0.11 millirem (mrem)/year (yr). The estimated excess cancer risk is 1.1E-6.

The exposure pathway analysis established that no complete ecological pathway exists for exposure of ecological species to contaminants at SWMU 147. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

### Basis for Determination

SWMU 147 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

**Table 14**  
**Risk Assessment Values for SWMU 147 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Barium	355	0.01		0.07	
<b>Organic</b>					
Acetone	0.047	0.00		0.00	
Di-n-butylphthalate	0.165 <sup>b</sup>	0.00		0.00	
bis(2-Ethylhexyl) phthalate	0.165 <sup>b</sup>	0.00	9E-10	0.00	4E-9
2-Hexanone	0.011	0.00		0.00	
Methylene chloride	0.0033 J	0.00	2E-8	0.00	5E-8
Methyl ethyl ketone	0.0062 J	0.00		0.00	
Methyl isobutyl ketone	0.005 <sup>b</sup>	0.00		0.00	
Phenol	0.165 <sup>b</sup>	0.00		0.00	
Toluene	0.0025 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.01</b>	<b>2E-8</b>	<b>0.07</b>	<b>5E-8</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.  
J = Estimated concentration.  
mg/kg = Milligram(s) per kilogram.

## **SWMU 150, Building 9939/9939A Septic System, Septic Tanks, and Drainfields**

### **Site Location**

SWMU 150, the Building 9939/9939A Septic System, is located in the Coyote Test Field area on federally owned land controlled by KAFB and permitted to the DOE (Figure 19). The abandoned system includes a 750-gallon septic tank and two 5-ft-diameter, 8-ft-deep seepage pits southeast of Building 9939, and a drainfield north of Building 9939A that consists of two 12-ft-long drain lines.

### **Operational History**

Available information indicates that Building 9939 was constructed in 1974 and Building 9939A in 1982, and it is assumed that the septic and drain systems were constructed at those respective times. The floor drains in Building 9939A that discharged to the drainfield were sealed sometime in the early 1990s. By 1993, the septic system discharges were routed to the COA sanitary sewer system. The old septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change. Waste in the septic tank was removed. The empty and decontaminated septic tank was inspected by the Department in January 1996, and a closure form was signed. The septic tank was then backfilled with clean, native soil in early 1996.

The COCs include RCRA metals, PCBs, VOCs, SVOCs and radionuclides.

### **Evaluation of Relevant Information**

Four assessment investigations have been conducted at this site. In June 1992, September 1992 and May 1994, waste characterization samples were collected from the septic tank (Investigation 1). A geophysical survey was performed in February 1994 to locate areas of high moisture content (Investigation 2). In May 1994, a passive soil-vapor survey was conducted to identify potential releases of VOCs and SVOCs (Investigation 3). In January 1995, a backhoe was used to locate the cause of borehole resistance near the seepage pit and to locate the drainfield. Soil samples were collected near the seepage pit using the backhoe and a geoprobe was used to collect samples from within the drainfield (Investigation 4). These investigations are discussed in the following sections.

#### **Investigation 1 — Septic Tank Sampling**

Sludge and aqueous samples were collected from the septic tank in June and September 1992. The sampling report indicated that there was a primary and a secondary chamber to the septic tank. Removal of the septage waste in 1996 revealed that the tank consisted of only one chamber instead of two. The discussion of the survey results presented here follows the original sampling report as though there were samples from two separate chambers. The aqueous samples were analyzed for VOCs, SVOCs, pesticides, PCBs, total metals, selected radionuclide constituents and several miscellaneous analytes. Two VOCs were identified in both aqueous samples (TCE and 1,2-dichloroethene), and a third VOC (acetone) was identified in one of the samples. One SVOC (4-methylphenol) was identified in both samples and a second SVOC (benzoic acid) was identified in one of the samples. No pesticides, cyanide, or PCBs were detected. Phenolic compounds and fluoride were detected in both samples. Oil and grease were detected in one of the samples.

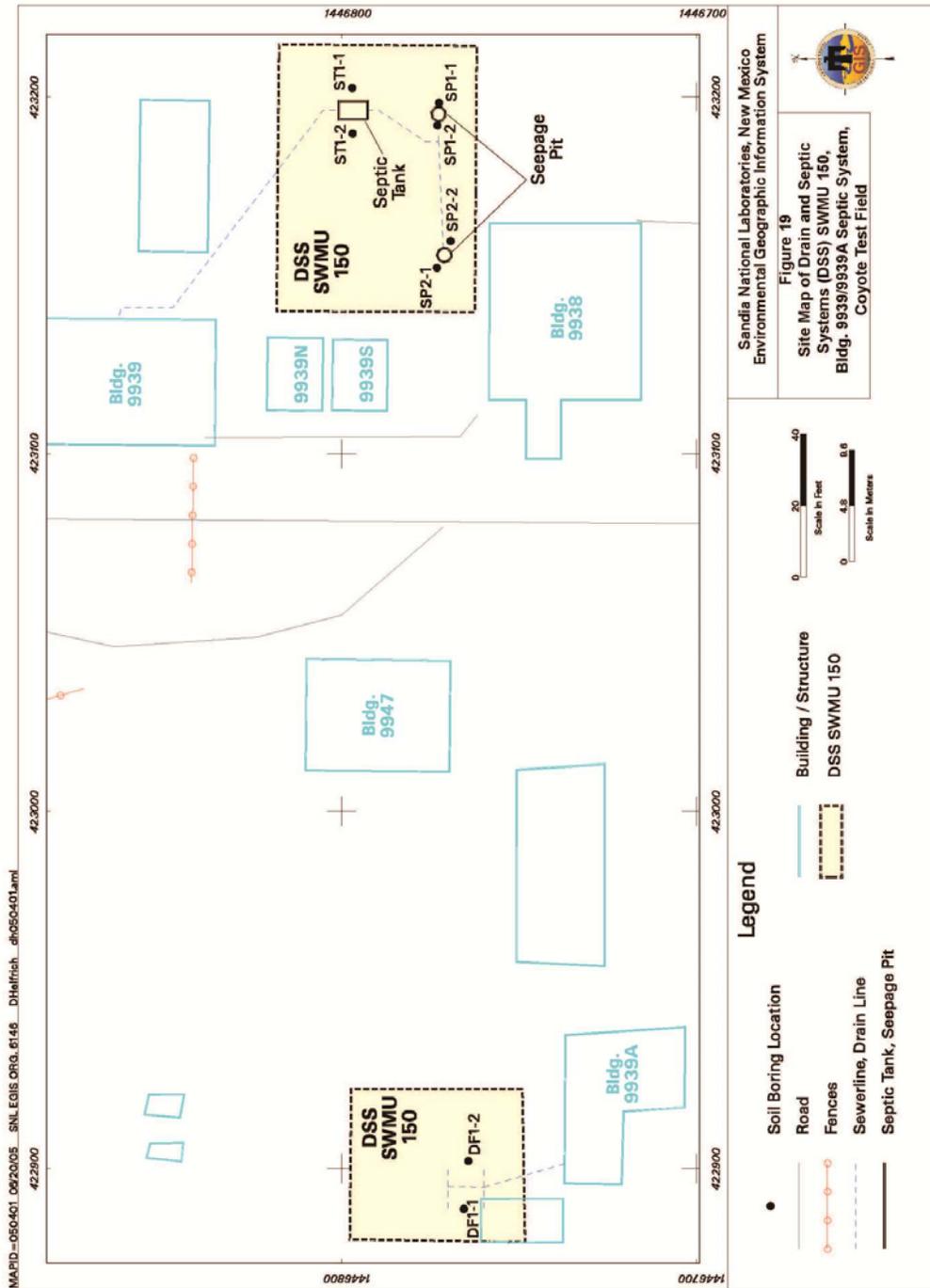


Figure 19  
Sandia National Laboratories, New Mexico  
Environmental Geographic Information System

Site Map of Drain and Septic  
Systems (DSS) SWMU 150,  
Bldg. 9939/9939A Septic System,  
Coyote Test Field

Several metals and radionuclides were detected. The sludge samples were analyzed for gross alpha and beta and selected radionuclide constituents. Several radionuclides were detected.

Septic tank sludge samples were collected in May 1994 for waste characterization purposes and were analyzed for VOCs, SVOCs, TCLP RCRA metals, isotopic uranium, and other radionuclides by gamma spectroscopy. Two VOCs (TCE and 1,2-dichloroethene) and two SVOCs (phenol and 4-methylphenol) were detected. Barium was detected in the TCLP RCRA metal analysis and in the laboratory blank. Uranium isotopes were detected in the isotopic uranium analysis. Several radionuclides were identified in the gamma spectroscopy analysis.

Septic tank liquid samples were collected in May 1994 for waste characterization purposes. They were analyzed for VOCs, isotopic uranium and tritium. Two VOCs (1,2-dichloroethene and TCE) were detected. Uranium isotopes were detected in the isotopic uranium analysis, and tritium was also identified.

### Investigation 2 – Geophysical Survey

A geophysical survey using Geonics™ Model EM-31 and EM-38 ground conductivity meters was performed north of Building 9939A and in the vicinity of the seepage pits and septic tank near Building 9939 in February 1994. An area of high electromagnetic conductivity was found at each of the survey locations. The high area near Building 9939A originally was interpreted to be the location of the drainfield and indicative of shallow and deep septic infiltration. However, this information was not considered to be reliable and was not used to determine sample locations; instead, backhoe excavation was used to locate the drainfield lines and determine sample locations. At the other survey location, the area of high electromagnetic conductivity was found trending to the southeast from the eastern seepage pit. It was thought that this could be a septic leachate plume.

### Investigation 3 – Passive Soil-Gas Survey

A passive soil-gas survey was conducted in the area of the septic tank and seepage pits in May 1994 using PETREX™ sampling tubes to identify any releases of VOCs and SVOCs that occurred from the septic tank and seepage pit. Sixteen PETREX™ tube samplers were placed in a grid pattern that covered the area surrounding the septic tank and two seepage pits. The soil gas survey detected BTEX and aliphatics at four locations in the grid pattern surrounding the septic tank and seepage pits. Two of the locations were near one of the concrete pads adjacent to Building 9939N and 9939S. The other two locations were within 15 ft of the seepage pits. Subsequent confirmatory soil samples collected immediately adjacent to the septic tank and seepage pits were analyzed for VOCs and SVOCs. No BTEX or aliphatics were detected in the soil samples. No PCE or TCE were found in detectable amounts in the passive soil-gas survey or subsequent soil samples.

### Investigation 4 — Soil Sampling and Backhoe Excavation

In October 1994, a Geoprobe™ was used to try to obtain soil samples near the septic tank and seepage pits. The Geoprobe™ met refusal at six different locations ranging from 6.5 to 9 ft bgs, which is the approximate depths at the bottom of these units. In January 1995, a backhoe was used to determine the cause of the borehole refusal problems at the septic tank and seepage pits. From this backhoe work, it was determined that there was a surface of caliche or cemented conglomerate with rock fragments up to 6 inches in diameter at 7 to 8.5 ft bgs. Because this shallow caliche/cemented conglomerate surface prevented any Geoprobe™ sampling, soil samples near the septic tank and seepage pits were collected with the backhoe. Shallow interval

confirmatory soil samples were collected on either side of the septic tank and on either side of each of the seepage pits on top of the caliche/cemented conglomerate surface. As part of the backhoe work at this site, the configuration of the small drainfield north of Building 9939A was verified. The Geoprobe™ was used to obtain soil samples from two locations in the drainfield, one on the eastern side and the other on the western side. Soil samples were collected easily from the shallow depth interval of 4 to 8 feet at the eastern location, but four tries were necessary to obtain the sample for the shallow depth interval at the western location. Again, the caliche cemented conglomerate surface prevented deep interval soil sampling in the drainfield.

Results for the soil samples from January 1995 are discussed in this paragraph. Four VOCs (acetone, methylene chloride, methyl ethyl ketone and toluene) were detected in the soil samples. No SVOCs or PCBs were detected in any of the samples collected from the boreholes. All of the RCRA metals were detected below the Department-approved background concentrations. No radionuclides had activities above background levels in any of the samples analyzed. However, although not detected, the MDA for all of the uranium-235 and uranium-238 gamma spectroscopic analyses exceeded the corresponding background activity.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs and estimated excess cancer risks are acceptable (Table 15).

For the radiological COCs (uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 0.16 millirem (mrem)/year (yr). The estimated excess cancer risk is  $1.6E-6$ .

Ecological risks associated with SWMU 150 are estimated through a risk assessment that incorporates site-specific information when available. All HQ values predicted for the COPECs at this site are found to be less than unity. Analysis of the uncertainties associated with these predicted values indicate that they are more likely to overestimate actual risk rather than underestimate it. Based upon this final analysis, the potential for ecological risks associated with SWMU 150 is expected to be low.

### **Basis for Determination**

SWMU 150 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

**Table 15**  
**Risk Assessment Values for SWMU 150 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Acetone	0.0084 J	0.00		0.00	
Methylene chloride	0.0028 J	0.00	2E-8	0.00	4E-8
Methyl ethyl ketone	0.005 <sup>b</sup>	0.00		0.00	
Toluene	0.0025 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.00</b>	<b>2E-8</b>	<b>0.00</b>	<b>4E-8</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Estimated concentration.

mg/kg = Milligram(s) per kilogram.

### **SWMU 161, Building 6636 Septic System**

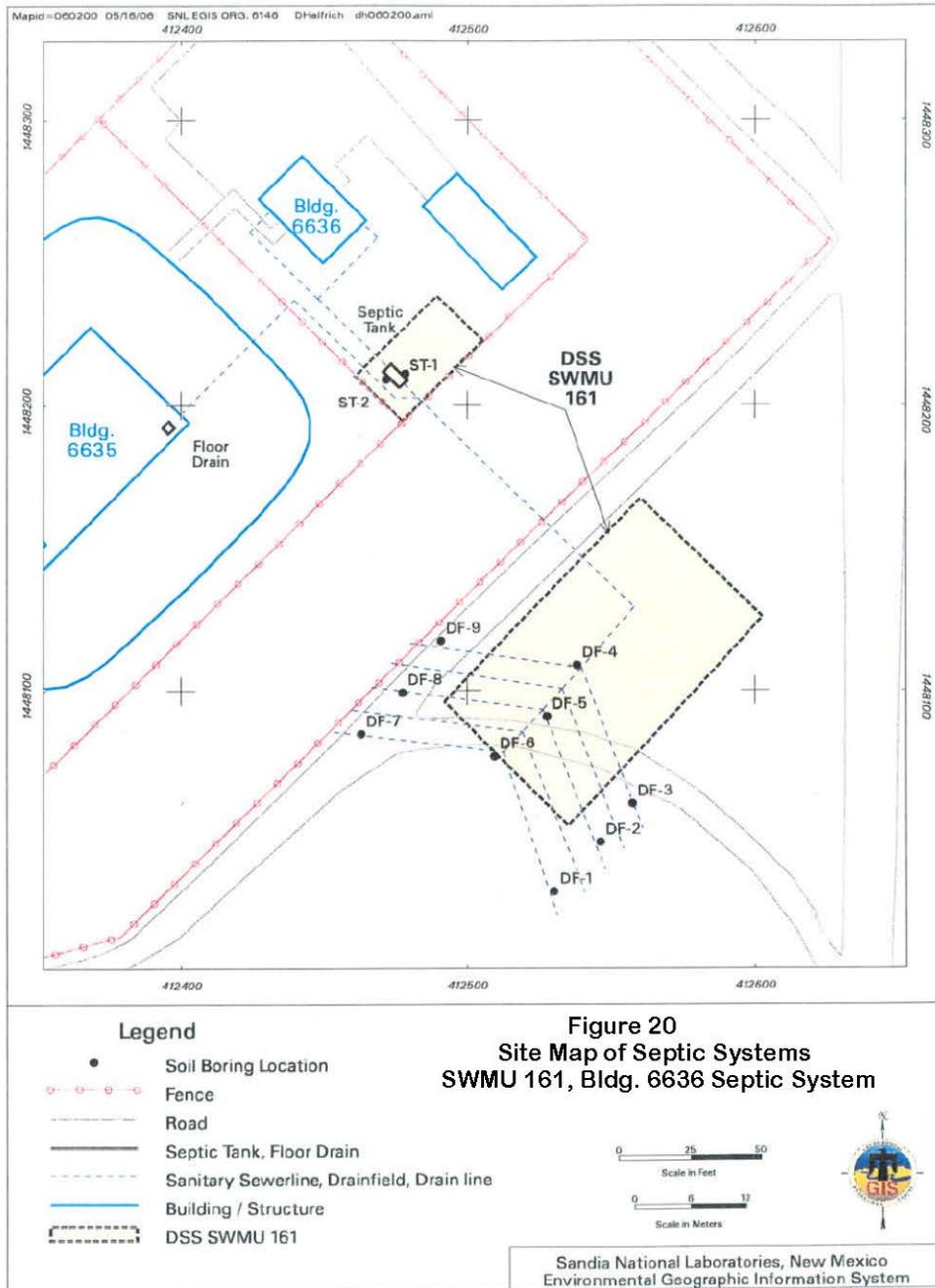
#### **Site Location**

SWMU 161, the Building 6636 Septic System, is located in TA III on federally owned land controlled by KAFB and permitted to the DOE. The abandoned septic system consisted of a 750-gallon septic tank connected to a drainfield consisting of 10, 60-ft-long, 4-inch-diameter, perforated clay pipe drain lines. In addition, Building 6635, located immediately southwest of Building 6636, contains floor drains in the east and west corners of the building that also discharge to the drainfield (Figure 20).

#### **Operational History**

Available information indicates that Buildings 6635 and 6636 were constructed in 1971, and it is assumed that the septic system was also constructed at that time. By 1993, discharges from the buildings were routed to the COA sanitary sewer system. The old septic system lines were disconnected and capped, and the system was abandoned in place concurrent with this change. Waste in the septic tank was removed. The empty and decontaminated septic tank was inspected by the Department in January 1996, and a closure form was signed. The septic tank was backfilled with clean, native soil in early 1996.

The COCs include RCRA metals, hexavalent chromium, cyanide, VOCs, SVOCs and radionuclides.



## **Evaluation of Relevant Information**

Four assessment investigations have been conducted at this site. In August 1992 and May 1994, waste characterization samples were collected from the septic tank (Investigation 1). A geophysical survey was performed in June 1994 to locate areas of high moisture content (Investigation 2). In November and December 1994, a passive soil-vapor survey was conducted to identify potential releases of VOCs and SVOCs (Investigation 3). In September 1994 soil samples were collected from boreholes drilled in the drainfield and adjacent to the septic tank (Investigation 4). These investigations are discussed in the following sections.

### Investigation 1 — Septic Tank Sampling

A sludge sample was collected from the SWMU 161 septic tank in August 1992 and was analyzed for selected radionuclide constituents. The brief narrative report for that sample indicated that "...no parameters were detected that exceed U.S. DOE derived concentration guidelines (DCG) limits or the investigation levels (IL) established during this investigation."

A second round of septic tank sludge samples and a sample of the liquid fraction were collected for waste characterization purposes in May 1994 and were analyzed for total and TCLP VOCs, total and TCLP RCRA metals, hexavalent chromium, cyanide, isotopic uranium, tritium and gamma spectroscopy radionuclides. Trace concentrations of three VOC compounds were identified in the liquid, but none was found in the sludge. One RCRA metal (barium) was detected in the liquid fraction.

Seven total RCRA metals were identified in the sludge, but only one of these metals (barium) was detected in the TCLP-derived leachate from the same material. Hexavalent chromium was not detected in the sludge and cyanide was not identified in either the liquid or sludge. Anomalous activity levels of isotopic uranium, tritium, or other radionuclides analyzed by gamma spectroscopy were not found in the liquid or sludge.

### Investigation 2 – Geophysical Survey

A geophysical survey using a Geonics™ Model EM-38 ground conductivity meter was performed in June 1994 to locate the drainfield. An area southeast of Building 6636 and between the two perimeter fences was identified as the possible location of the unit, but the actual location was later determined with a backhoe to be outside of the outer fence.

### Investigation 3 – Passive Soil-Gas Survey

The passive soil-gas survey conducted in the drainfield area in November and December 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the drainfield. Twenty-five PETREX™ tube samplers were placed in a grid pattern that covered the drainfield area. PCE or TCE compounds were not detected in soil gas at any of the twenty-five PETREX™ sampling locations, and BTEX and/or aliphatic compounds at potentially significant concentrations were identified at 3 of the 25 locations. However, significant concentrations of VOCs and SVOCs were not detected in confirmatory soil samples collected within 7 to 15 ft of these three PETREX™ locations, or in any of the other soil samples.

### Investigation 4 — Soil Sampling

In September 1994, soil samples were collected from boreholes drilled in the drainfield and adjacent to the septic tank using a Geoprobe™. The 1994 drainfield sampling intervals started at 10 and 20 feet bgs in each of the drainfield borings. The septic tank borehole sampling intervals

started at 7.5 feet bgs; a depth equal to the base of the septic tank. The soil samples were analyzed for VOCs, SVOCs, RCRA metals, hexavalent chromium, cyanide, tritium and radionuclides by gamma spectroscopy.

Four VOCs (acetone, methylene chloride, methyl ethyl ketone and methyl isobutyl ketone) were detected in the soil samples from September 1994. All but methyl isobutyl ketone were detected in the associated TB or EB samples. No SVOCs were detected in any of the samples. Two RCRA metals (chromium and silver) were detected above Department-approved background concentrations. All other metal concentrations were below Department-approved background concentrations. Cyanide was detected. For radionuclides, no activities above the background levels were detected in any of the samples analyzed. However, although not detected, the MDA for one of the uranium-235 analyses exceeded the respective background activity.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs and estimated excess cancer risks are acceptable (Table 16).

For the radiological COC (uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of  $1.0E-2$  millirem (mrem)/year (yr). The estimated excess cancer risk is  $9.6E-8$ .

The exposure pathway analysis established that no complete ecological pathway exists for exposure of ecological species to contaminants at SWMU 161. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

### **Basis for Determination**

SWMU 161 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

**Table 16**  
**Risk Assessment Values for SWMU 161 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium	22	0.00		0.00	
Cyanide	0.0006	0.00		0.00	
Silver	40.8	0.01		0.11	
<b>Organic</b>					
Acetone	0.017	0.00		0.00	
Methylene chloride	0.0035 J	0.00	2E-8	0.00	5E-8
Methyl ethyl ketone	0.0058 J	0.00		0.00	
Methyl isobutyl ketone	0.005 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.01</b>	<b>2E-8</b>	<b>0.11</b>	<b>5E-8</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

### **SWMU 196, Building 6597 Cistern**

#### **Site Location**

SWMU 196, the Building 6597 Cistern, is approximately 1,600 sq ft (0.037 acre) area located in the central portion of TA-5. The Cistern is a concrete-walled tank (open bottom) approximately 25 ft in diameter, vertically-oriented, concrete cylinder that extends approximately 22 ft bgs with an unlined earthen bottom. The concrete cylinder also extended approximately 3 ft above the ground surface. The Cistern is located approximately 37 ft west of Building 6597 (Figure 21).

#### **Operational History**

Building 6597 housed the PROTO 1 facility used to test radiation effects on weapons and instruments. From 1978 to 1989, the Cistern received insulation oil and wash water from the PROTO 1 facility. The Cistern also served as an emergency catch basin for the series of underground storage tanks (SWMU 37) previously connected to the PROTO 1 facility. No records of discharges to the Cistern were maintained. No discharges to the Cistern have occurred since 1989 when the PROTO 1 facility was closed. The Cistern was not connected to any surface or storm water systems.

The COCs include TPH, VOCs, SVOCs, metals and radionuclides.

#### **Evaluation of Relevant Information**

During sampling activities at the bottom of the Cistern in 1994, it was determined that there was not a concrete bottom to the Cistern, as previously thought. The bottom of the Cistern is native soil and is open to the ground beneath it. In June 1994, a grab sample was collected from the

bottom surface of the Cistern. It was analyzed at an off-site laboratory for VOCs, PCBs, TPH and metals. Five metals (cadmium, copper, lead, nickel and silver) had concentrations above background values. No VOCs, PCBs or SVOCs were detected above the MDLs. The TPH concentration was 60,500 mg/kg.

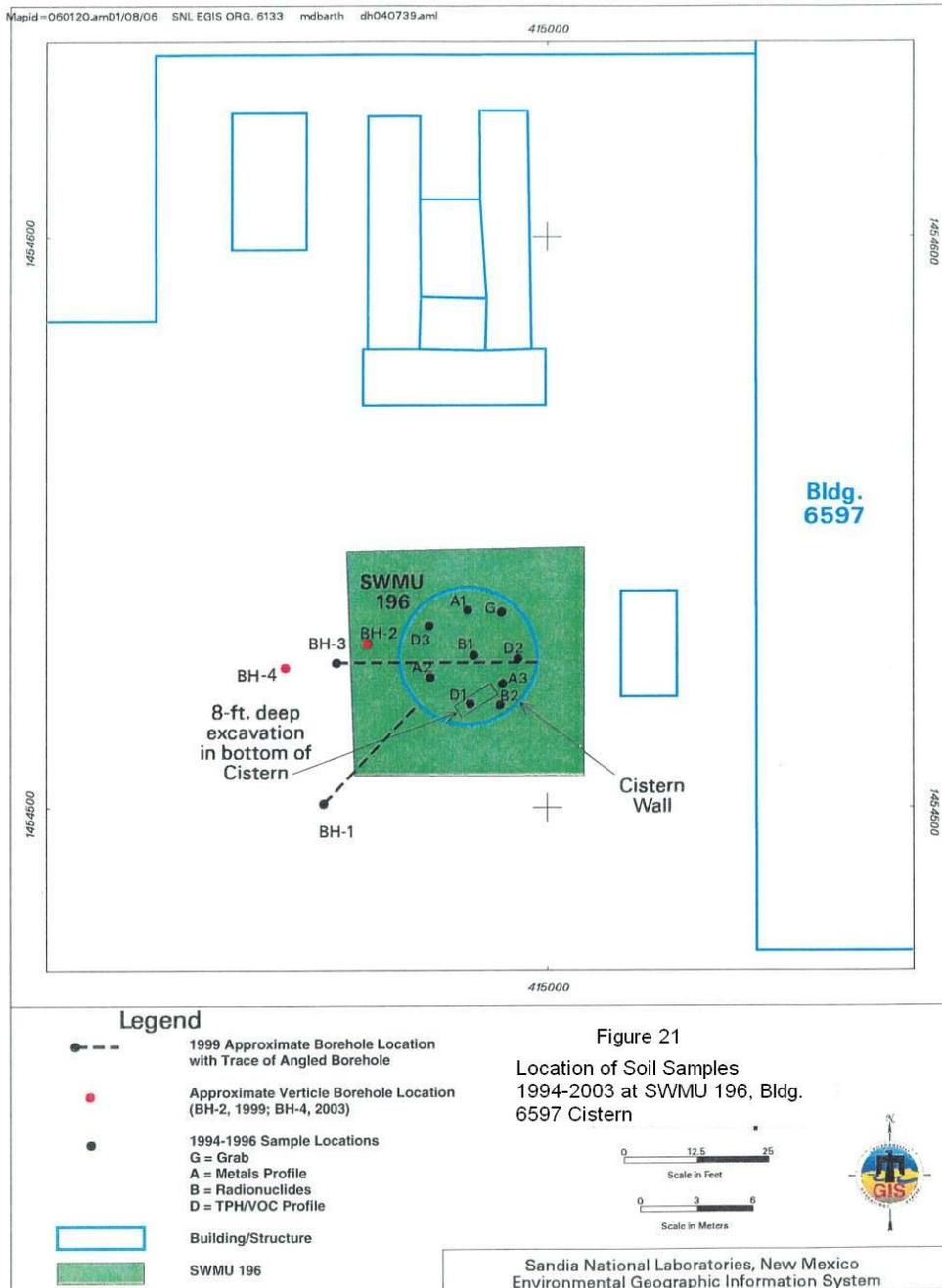
In April 1995, two composite soil samples were collected from the bottom of the Cistern for radionuclide analyses. There was a detection of U-235 slightly above the background value. Tritium exceeded its background value. The MDAs for U-235 and U-238 exceeded background levels.

In May 1995, 21 soil samples plus one duplicate were collected from three locations from the surface to 3 ft below the bottom of the Cistern in 0.5 ft intervals. These samples were analyzed for selected metals using a field-screening method. These field-screening results were not used in the final risk assessment.

In March 1996, an 8-ft deep trench was excavated in the bottom of the Cistern and 12 soil samples plus one duplicate were collected using a hand auger from one location within the trench and two locations outside the trench to a maximum depth of 13 ft below the bottom of the Cistern. The samples were analyzed for VOCs and TPH at an off-site laboratory. No VOCs were detected. A maximum TPH concentration of 40,000 mg/kg was detected in a sample collected at 12 ft below the Cistern bottom.

In September 1999, a drill rig was employed to collect soil samples from the subsurface at SWMU 196. As it was not possible to place the drill rig in the Cistern, borehole locations were placed as close to the Cistern as possible. Two angled boreholes were advanced to obtain soil samples from beneath the Cistern and one vertical borehole was placed approximately 5 ft west of the Cistern wall. The first attempted angled borehole was unsuccessful at obtaining samples and was plugged and abandoned. Auger refusal was encountered in the second angled borehole at a depth of 75 linear ft along the borehole, although soil samples were collected. The vertical borehole was advanced to 100 ft bgs. Nineteen samples plus duplicates were collected in the boreholes and analyzed at an off-site laboratory for VOCs, SVOCs, TPH and RCRA metals plus beryllium. A maximum TPH concentration of 25,300 mg/kg was detected in the last sample from the angled borehole. Five VOCs (carbon disulfide, ethylbenzene, methylene chloride, toluene and xylene) were detected. Two samples in the angled borehole had barium concentrations that exceeded the background value. The presence of insulating oil in the soil caused matrix interference and many of the analytical results were rejected in the data validation process.

Due to problems encountered in 1999 (refusal and rejected data), additional characterization was needed and a larger drill rig was employed to collect soil samples. A sampling plan was devised that consisted of advancing another borehole and collecting soil samples for TPH analysis until two consecutive, field-screened samples had concentrations of less than 100 mg/kg TPH. In June 2003, the vertical borehole was located approximately 20 ft west of the Cistern wall and was advanced to a total depth of 300 ft.



Nineteen soil samples were collected at intervals beginning at 100 ft to a maximum depth of 300 ft. Each soil sample was split; one fraction was used for screening and the other for confirmation. The screening fraction was analyzed for TPH by a local off-site laboratory. The confirmatory fraction was analyzed by an off-site laboratory for VOCs, SVOCs and TPH. Nine VOCs (1,1,1-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, 1,2-dichloropropane, 2-butanone, chloromethane, methylene chloride, tetrachloroethene, toluene and trichloroethene) and six SVOCs (chrysene, pyrene, diethylphthalate, bis(2-Ethylhexyl) phthalate, fluoranthene and phenanthrene) were detected in the soil samples, most with J codes.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs and the estimated excess cancer risks were acceptable (Table 17). However, the high concentration of total petroleum hydrocarbons in the soil precludes future use of the site without controls.

The Cistern was backfilled as requested by the Department in September 2005.

For the radiological COCs (tritium, uranium-233, uranium-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 1.2E-1 millirem (mrem)/year (yr). The estimated excess cancer risk is 1.0E-6.

Ecological risks associated with SWMU 196 were estimated before the Cistern was backfilled through a risk assessment that incorporated site-specific information when available. Initial predictions of potential risk to plants from exposure to several metals were based upon maximum measured soil concentrations, highly conservative plant toxicity benchmarks, and assumptions of high bioavailability. Actual risk to this receptor is expected to be low based upon more realistic exposure assumptions. All of the remaining receptor HQs were less than unity. Based upon this final analysis, the potential for ecological risks associated with SWMU 196 was expected to be low before it was backfilled.

Since the Cistern was backfilled, no complete ecological exposure pathway exists for exposure of ecological species to contaminants at SWMU 196. All COCs are now located at depths greater than 5 feet bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under an industrial land-use scenario.

### **Basis for Determination**

SWMU 196 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use (industrial).

**Table 17**  
**Risk Assessment Values for SWMU 196 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Barium	286	0.00		0.05	
Cadmium	2.5	0.00	8E-10	0.06	2E-9
Copper	213	0.01		0.08	
Nickel	17.8	0.00		0.01	
Silver	2.9	0.00		0.01	
<b>Organic</b>					
2-Butanone	0.5 <sup>b</sup>	0.00		0.01	
Carbon disulfide	0.0043 J	0.00		0.00	
Chloromethane	0.5 <sup>b</sup>	0.00	2E-7	0.01	4E-7
Chrysene	0.086 J	0.00	4E-10	0.00	1E-9
1,2-Dichloroethane	0.25 <sup>b</sup>	0.00	3E-7	0.01	7E-7
1,1-Dichloroethene	0.25 <sup>b</sup>	0.00	2E-7	0.00	4E-7
Diethylphthalate	0.39	0.00		0.00	
Ethyl benzene	0.25 <sup>b</sup>	0.00	2E-8	0.00	4E-8
bis(2-Ethylhexyl) phthalate	0.43	0.00	2E-9	0.00	1E-8
Fluoranthene	0.33	0.00		0.00	
Methylene chloride	0.25 <sup>b</sup>	0.00	1E-8	0.00	3E-8
Phenanthrene	0.14 J	0.00		0.00	
Pyrene	0.22 J	0.00		0.00	
1,1,1-Trichloroethane	0.25 <sup>b</sup>	0.00		0.00	
Tetrachloroethene	0.25 <sup>b</sup>	0.00	7E-8	0.00	2E-7
Toluene	0.25 <sup>b</sup>	0.00		0.00	
Trichloroethene	0.25 <sup>b</sup>	0.00	2E-6	0.02	5E-6
Xylene	0.25 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.03</b>	<b>3E-6</b>	<b>0.27</b>	<b>6E-6</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Estimated concentration.

mg/kg = Milligram(s) per kilogram.

## **AOC 1090, Building 6721 Septic System**

### **Site Location**

AOC 1090 is located in TA-III on federally owned land controlled by KAFB and permitted to the DOE. The site is located approximately 2,400 ft west of the entrance to TA-III. The abandoned septic system consisted of a 1,000-gallon septic tank and distribution box that emptied to three branching laterals, each approximately 60 ft long (Figure 24). The drainfield laterals were determined to be composed of bituminous (tar) fiber pipe. Construction details are based upon engineering drawings, site inspections, and backhoe excavations of the system. The system received discharges from Building 6721, approximately 100 ft to the northeast.

### **Operational History**

Available information indicates that Building 6721, currently known as the control facility for Building 6720 (the Explosive Loading Facility), was constructed in 1959, and it is assumed the septic system was constructed at the same time. By the early 1990s, the septic system discharge was routed to the COA sanitary sewer system. The old septic system line would have been disconnected, capped, and the system abandoned in place concurrent with this change. The septic tank has been backfilled but the exact date is unknown; it may have been backfilled in the mid 1990s.

The COCs include RCRA metals, hexavalent chromium, cyanide, HE compounds, VOCs, SVOCs, PCBs and radionuclides.

### **Evaluation of Relevant Information**

Three assessment investigations have been conducted at AOC 1090. In December 1990 or January 1991 and in July 1995, waste characterization samples were collected from the septic tank (Investigation 1). In March 2002, a backhoe was used to physically locate the buried drainfield drain lines (Investigation 2). In September 2002 and August 2005, subsurface soil samples were collected from three borings drilled in the drainfield area (Investigation 3).

#### **Investigation 1 — Septic Tank Sampling**

Investigation 1 consisted of sampling efforts to characterize the waste contents for chemical and radiological contamination. The primary goal of the sampling was to identify types and concentrations of potential contaminants in the waste within the tank so that the appropriate waste disposal and remedial activities could be planned.

In December 1990 or January 1991 and again in July 1995, as part of the SNL Septic System Monitoring Program, aqueous and sludge samples were collected from the Building 6721 septic tank. Aqueous samples collected in 1990/1991 were analyzed at an off-site laboratory for VOCs, SVOCs, oil and grease, PCBs, total metals, phenolic compounds, nitrates/nitrites, total cyanide, gross alpha/beta activity, isotopic uranium, plutonium, tritium and radionuclides by gamma spectroscopy. An aqueous sample collected in July 1995 was analyzed at an off-site laboratory for VOCs, SVOCs, pesticides, PCBs, metals, formaldehyde, fluoride, nitrate/nitrite, oil and grease, total phenol, and gross alpha/beta activity, isotopic uranium, tritium and radionuclides by gamma spectroscopy.

In February 1996, the residual contents, approximately 825 gallons of waste and added water, were pumped out.



### Investigation 2—Backhoe Excavation

In March 2002, a backhoe was used to determine the location, dimensions and average depth of the drainfield system. The drainfield was found to have three laterals composed of bituminous fiber piping, arranged as shown on Figure 27, with an average drain line depth of approximately 3 ft bgs. The distribution box was also located, but it appeared that the septic tank had been removed some time after February 1996 when buried electrical utilities were installed in the area of the former septic tank location. No visible evidence of stained or discolored soil or odors indicating residual contamination was observed during the excavation. No samples were collected during the backhoe excavation.

### Investigation 3—Soil Sampling

In September 2002, soil samples were collected from three drainfield boreholes. Soil boring locations are shown on Figure 24. An auger drill rig was used to sample all boreholes at two depth intervals. In drainfields, the top of the shallow interval started at the bottom of the drain line, as determined by the backhoe excavation, and the lower (deep) interval started at 5 feet below the top of the upper sample interval.

Results for the six soil samples and one duplicate soil sample collected are presented and discussed in this section. One VOC (2-butanone) was detected in all the samples. Acetone was detected in the 4-ft bgs samples from boreholes BH1 and BH3 and in the 9-ft bgs sample from borehole BH2. These compounds were not detected in the associated TB. Fourteen SVOCs were detected in the 4-ft bgs deep sample from BH2. Twelve of the fourteen SVOCs were also detected in the duplicate sample collected from the 4-ft bgs depth interval in BH2 as well as in the 4-ft bgs sample collected from BH3. The compounds detected are polycyclic aromatic hydrocarbons commonly found in asphalt and may indicate the presence in samples of fragments of the bituminous fiber pipe used to construct the drainfield. The almost total absence of SVOCs in the three deepest samples collected at this site also suggests a shallow SVOC source (such as bituminous pipe fragments). No PCBs or HE compounds were detected in any of the soil samples collected. One RCRA metal (arsenic) was detected above the Department-approved background concentration in the duplicate sample collected from BH2. Barium was detected above background concentration in the 4-ft bgs samples from BH1 and BH2 as well as in the duplicate sample collected from BH2. Cyanide was detected in all but the 9-ft bgs sample in BH1. Uranium-235 was detected above the background activity in the 4-ft-bgs sample from borehole BH1. In addition, although not detected, the MDA for five other uranium-235 analyses exceeded the corresponding background activity because the standard gamma spectroscopy count time for soil samples (6,000 seconds) was not adequate to achieve a lower and more appropriate MDA. Regardless, the MDA was sufficiently low that the Department accepts the sampling results. Elevated gross beta activity was measured in the 9-foot bgs sample in borehole BH2. However, no gross alpha or beta activity was detected greater than an order-of-magnitude above background levels in any of the samples.

In August 2005, additional SVOC soil samples were collected from the same three shallow sampling intervals from which samples were collected in September 2002 (Figure 24). At each of the three previous sampling locations, a short 4-ft deep trench was excavated with a backhoe to remove any potentially contaminated soil above the sampling interval, and an auger drilling machine was then positioned over the trench. The base of the auger was lowered to the bottom of the trench and a 3-ft long sample was collected from 4 to 7 ft bgs. The three trenches were

backfilled to grade upon completion of the sampling. SVOCs were not detected in any of the four additional shallow interval soil samples.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs were acceptable (Table 18).

SVOCs were the main risk drivers. SVOCs at high concentrations were detected in only one of the seven SVOC soil samples collected. The sample was located in the shallow (4-ft interval) soil sample in borehole BH2. The SVOC compounds detected in this sample are suggestive of bituminous pipe fragments. This area was resampled and no SVOCs were detected. In addition, no significant VOC or metal contamination, with the exception of arsenic slightly above background, was detected in any of the samples. The estimated excess cancer risk for the industrial land-use scenario is  $3E-6$  which is acceptable for an industrial land-use scenario. The estimated excess cancer risk for the residential land-use scenario is  $4E-5$  which does not meet Department requirements for a residential land-use scenario.

For the radiological COC (uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of  $9.9E-3$  millirem (mrem)/year (yr). The estimated excess cancer risk is  $8.4E-8$ .

Ecological risks associated with AOC 1090 were estimated through a risk assessment that incorporates site-specific information when available. Initial predictions of potential risk to omnivorous and insectivorous deer mice from exposures to seven SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo [g,h,i] perylene, chrysene, indeno[1,2,3-cd]pyrene and phenanthrene) can be attributed to conservative toxicity benchmarks, as well as the assumption of 100-percent bioavailability and the use of maximum detected concentrations to estimate exposure. In addition, initial predictions of potential risk to omnivorous and insectivorous deer mice from exposures to two metals (arsenic and barium) can be attributed to conservatism used in the modeling of risk. For arsenic and barium the contribution to risk due to background accounts for the majority (89 and 82 percent, respectively) of the HQ values. Based upon this final analysis, the potential for ecological risk associated with AOC 1090 is acceptable.

In conclusion, human health and ecological risks are acceptable under an industrial land-use scenario.

### **Basis for Determination**

AOC 1090 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future (industrial) land use.

**Table 18**  
**Risk Assessment Values for AOC 1090 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Arsenic	4.96 J	0.02	3E-6	0.23	1E-5
Barium	260	0.00		0.05	
Cyanide	0.278	0.00		0.00	
<b>Organic</b>					
Acenaphthene	0.14	0.00		0.00	
Acetone	0.00535	0.00		0.00	
Anthracene	0.519	0.00		0.00	
Benzo(a)anthracene	1.17	0.00	6E-7	0.00	2E-6
Benzo(a)pyrene	0.848	0.00	4E-6	0.00	1E-5
Benzo(b)fluoranthene	1.49	0.00	7E-7	0.00	2E-6
Benzo(g,h,i)perylene	0.466	0.00	2E-6	0.00	8E-6
2-Butanone	0.0365	0.00		0.00	
Carbazole	0.403	0.00	3E-9	0.00	1E-8
Chrysene	1.13	0.00	5E-9	0.00	2E-8
Dibenzofuran	0.063 J	0.00		0.00	
Fluoranthene	2.13	0.00		0.00	
Fluorene	0.179	0.00		0.00	
Indeno(1,2,3-cd)pyrene	0.511	0.00	2E-7	0.00	8E-7
Phenanthrene	2.05	0.00		0.00	
Pyrene	1.8 J	0.00		0.00	
<b>Total</b>		<b>0.02</b>	<b>1E-5</b>	<b>0.28</b>	<b>4E-5</b>

<sup>a</sup>EPA 1989.

**AOC 1094, Live Fire Range East Septic System, Lurance Canyon**

**Site Location**

AOC 1094 is located in Lurance Canyon within the boundaries of the USFS Withdrawn Area on federally owned land controlled by KAFB and permitted to the DOE. The site is located on Coyote Springs Road approximately 3.6 miles east of its intersection with Lovelace Road. The active septic system septic tank is located approximately 50 ft southeast of the perimeter fence around the maintenance building and trailer complex that support the Live Fire Range activities (Figure 25). The system consists of a 1,000-gallon septic tank that empties to a drainfield with

two 110-ft long, parallel drain lines. Construction details are based upon engineering drawings, site inspections and backhoe excavations of the system. The system is still active and receives discharges from the Live Fire Range support building and trailer complex, approximately 50 ft to the northwest.

### **Operational History**

Although no precise construction information is available, records indicate that the Live Fire Range support building complex was in operation and discharging to the septic system by about 1983. The system is still active and receives discharges from the support buildings associated with Live Fire Range operations. The COCs include RCRA metals, hexavalent chromium, cyanide, HE compounds, VOCs, SVOCs, PCBs and radionuclides.

### **Evaluation of Relevant Information**

Three assessment investigations have been conducted at this site. In August 1999, a backhoe was used to physically locate the buried drainfield drain lines (Investigation 1). In September 1999 and April 2005, subsurface soil samples were collected from three borings in the drainfield (Investigation 2). In May 2002, a passive soil-vapor survey was conducted to determine whether areas of VOC contamination were present in the soil around the drainfield (Investigation 3). These investigations are discussed in the following sections.

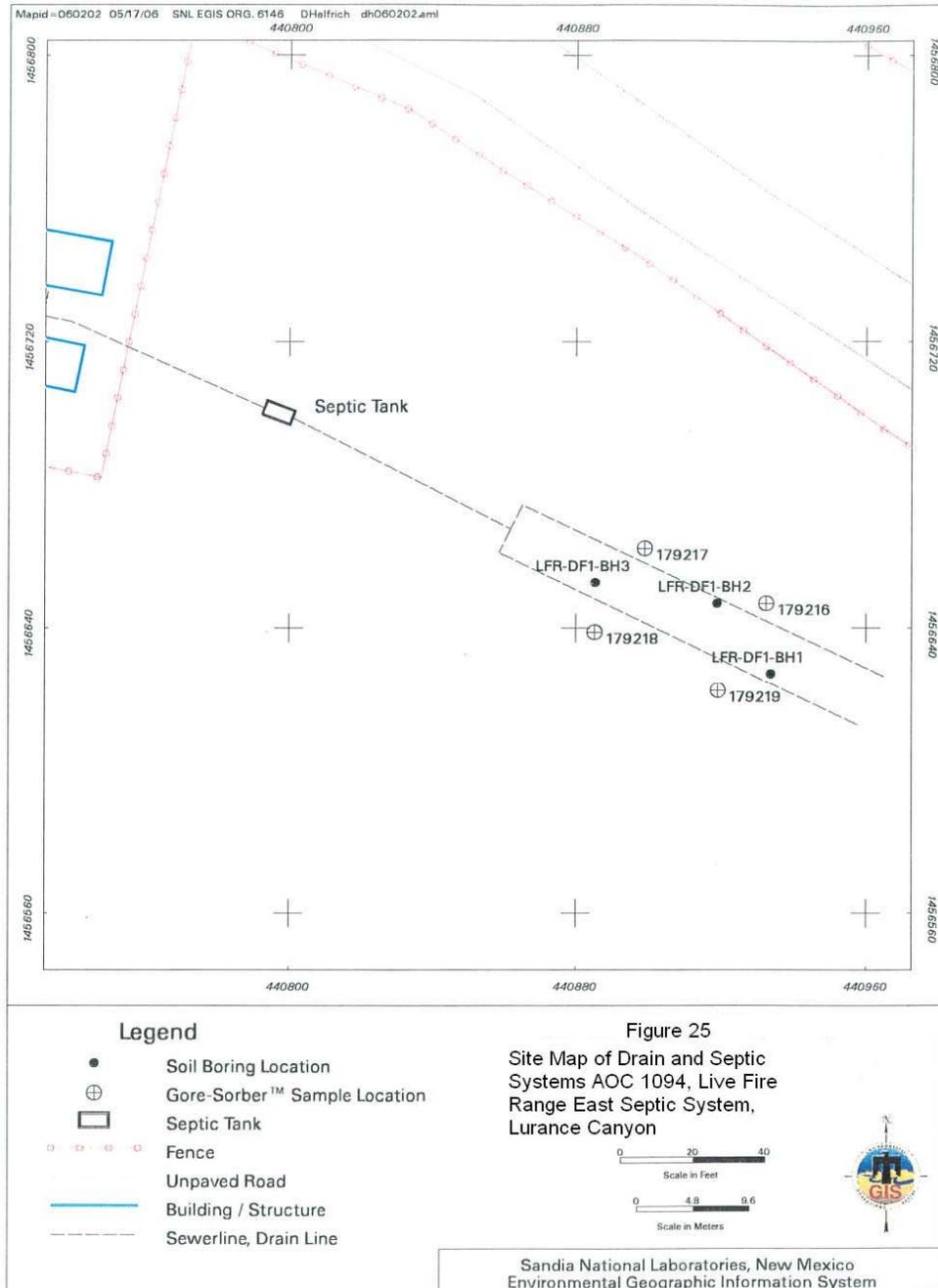
#### Investigation 1—Backhoe Excavation

In August 1999, a backhoe was used to determine the location, dimensions and average depth of the drainfield system. The drainfield was found to have two laterals, constructed of 4-inch diameter, polyvinyl chloride pipe with an average drain line trench depth of 7 ft bgs. Although damp soil was observed beneath the east ends of the two drain lines, no visible evidence of stained or discolored soil or an odor indicating residual contamination was observed during the excavation. No samples were collected during the backhoe excavation, and care was taken not to damage the drain lines of this still-active system.

#### Investigation 2— Soil Sampling

Once the system drain lines were located, soil sampling was conducted. In September 1999, soil samples were collected from three drainfield boreholes. An auger drill rig was used to sample all boreholes at two depth intervals. The top of the shallow interval started at the bottom of the drain line, as determined by the backhoe excavation, and the lower (deep) interval started at 7 feet below the top of the upper sample interval.

AOC 1094 was one of five shallow groundwater DSS sites that had 2-butanone concentrations above the 10 µg/kg VOC trigger level specified in the DSS sampling and analysis plan, and therefore required additional sampling. The samples collected at these five sites were all analyzed at the same time, and the laboratory reported detections of the same three VOCs (2-butanone, methylene chloride and toluene) in generally similar concentrations for all five sites. After meeting with the Department, it was decided to resample DSS Site 1094 and the other four sites for VOCs only, at the original 1999 locations and depths, and to collect additional samples at 5 and 10 feet below the original sample depths at AOC 1094 and some of the other sites, as specified by the Department. The VOC resampling at AOC 1094 was conducted in April 2005.



However, subsurface refusal prevented the collection of the deeper, 17- and 22-foot bgs samples at the DF1-BH-1 location (Figure 25). Only toluene was detected in the April 2005 samples at a maximum concentration of 6.63  $\mu\text{g}/\text{kg}$ . It was concluded that the 1999 VOC samples were affected by laboratory contamination. Therefore, the 1999 VOC data were replaced with the 2005 VOC analytical results in the risk assessment.

Analytical results for the ten soil samples and one duplicate collected in September 1999 and April 2005 from the three drainfield boreholes are presented and discussed in this section. Because of the laboratory contamination concerns regarding the 1999 VOC data, and because the site was resampled, the original 1999 VOC data were replaced with the 2005 VOC analytical results in the data tables and in the risk assessment. Two VOCs were detected in the soil samples collected in April 2005. Low concentrations of toluene were detected in every sample collected, while a trace of xylene was detected only in the 17-ft bgs sample from borehole BH2. No SVOCs, PCBs, cyanide or HE compounds were detected in any of the samples collected from the boreholes. One RCRA metal (silver) was detected above Department-approved background in all three boreholes. All other metal concentrations were below Department-approved background concentrations. For radionuclides, no activities above background levels were detected in any of the samples analyzed. However, although not detected, the MDA for some of the uranium-235 analyses exceeded the respective background activity because the standard gamma spectroscopy count time for soil samples (6,000 seconds) was not adequate to achieve a lower and more appropriate MDA. Regardless, the MDA was sufficiently low that the Department accepts the sampling results. No gross alpha or beta activity above background levels was detected in any of the samples.

### Investigation 3— Passive Soil-Vapor Sampling

In May 2002, a passive soil-vapor survey was conducted in the Live Fire Range East Septic System area. This survey was conducted to determine whether significant VOC contamination was present in the soil at the site. Four Gore-Sorber™ (GS) passive soil-vapor samplers were placed in the drainfield area on May 1, 2002, and were retrieved on May 16, 2002. The GS samplers were analyzed for a total of 30 individual or groups of VOCs including TCE, BTEX, tetrachloroethene and cis- and trans-dichloroethene. Low to trace-level (but quantifiable) amounts of 18 individual or groups of VOCs were detected in the GS samplers installed.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the recreational and residential land-use scenarios. For both the recreational and residential land-use scenarios, the total HIs and estimated excess cancer risks are acceptable (Table 19).

For the radiological COC (uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 1.9E-3 millirem (mrem)/year (yr) for the recreational land-use scenario and 4.8E-3 mrem/yr for the residential scenario. The estimated excess cancer risk is 1.6E-8 for the recreational land-use scenario and 4.6E-8 for the residential scenario.

The exposure pathway analysis established that no complete ecological exposure pathway exists for exposure of ecological species to contaminants at AOC 1094. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

**Table 19**  
**Risk Assessment Values for AOC 1094 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Recreational Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium VI	0.159 J	0.00	3E-11	0.00	7E-10
Cyanide	0.0695 <sup>b</sup>	0.00		0.00	
Silver	0.602 J	0.00		0.00	
<b>Organic</b>					
Toluene	0.00663	0.00		0.00	
Total xylenes	0.00129	0.00		0.00	
<b>Total</b>		<b>0.00</b>	<b>3E-11</b>	<b>0.00</b>	<b>7E-10</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

J = Estimated concentration.

In conclusion, human health and ecological risks are acceptable under both a residential and a recreational land-use scenario.

### **Basis for Determination**

AOC 1094 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

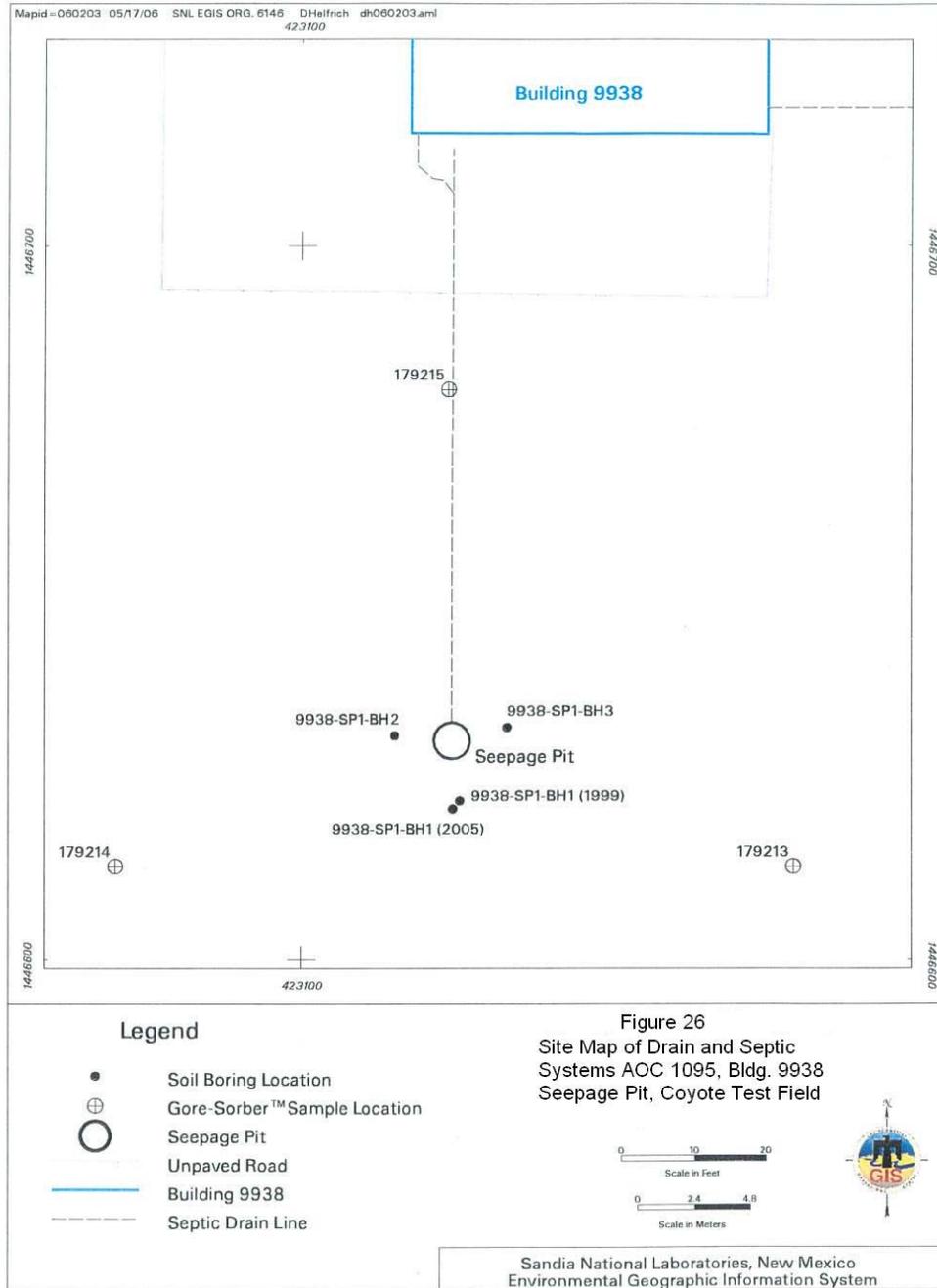
### **AOC 1095, Building 9938 Seepage Pit (Coyote Test Field)**

#### **Site Location**

AOC 1095 is located in the Coyote Test Field area on federally owned land controlled by KAFB and permitted to the DOE. The seepage pit on the south side of Building 9938 was constructed by excavating a 9- to 10-ft diameter hole down to bedrock, approximately 9.5 ft bgs, placing a 4-ft diameter section of steel culvert vertically inside the hole, and filling the culvert and annular space with gravel. Construction details are based upon engineering drawings and a site inspection of the system. The system received discharges from Building 9938, approximately 85 ft to the north (Figure 26).

#### **Operational History**

Available information indicates that Building 9938 was constructed in 1971 and it is assumed the seepage pit was constructed at the same time. Building 9938 is currently a support building at the Large Melt Facility. The facility is currently inactive and the seepage pit was removed and the excavation backfilled in accordance with 20.7.3.410 NMAC in August 2005.



The COCs include RCRA metals, hexavalent chromium, cyanide, HE compounds, VOCs, SVOCs, PCBs and radionuclides.

### **Evaluation of Relevant Information**

Two assessment investigations were conducted at this site. In August 1999, subsurface soil samples were collected from one boring adjacent to the seepage pit. In April 2005, additional subsurface soil samples were collected for VOCs from three borings adjacent to the seepage pit (Investigation 1). In May 2002, a passive soil-vapor survey (Investigation 2) was conducted to determine whether areas of VOC contamination were present in the soil around the drainfield.

#### Investigation 1— Soil Sampling

Soil sampling was conducted in August 1999. It was determined at that time, that the seepage pit rested directly on bedrock and the soil samples had to be collected from one borehole adjacent to, and on the south side of the seepage pit. In April 2005, additional samples for VOCs only were collected from three boreholes adjacent to the seepage pit.

AOC 1095 was one of five shallow groundwater DSS sites that had 2-butanone concentrations above the 10 µg/kg VOC trigger level specified in the SAP and therefore required additional sampling. The samples collected at these five sites were all analyzed at the same time, and the laboratory reported detections of the same three VOCs (2-butanone, methylene chloride and toluene) in generally similar concentrations for all five sites. After meeting with the Department, it was decided to resample AOC 1095 and the other four sites for VOCs only. At AOC 1095, it was agreed that additional VOC samples would be collected from the original 1999 location and depth, and additional samples would be collected from the same depth at two additional borehole locations equidistant from the seepage pit (Figure 26). The VOC resampling at AOC 1095 was conducted on April 12, 2005. However, due to subsurface refusal, the April 2005 sample from borehole BH1 had to be collected approximately 2 feet away from the August 1999 location.

Because no VOCs were detected in the April 2005 samples, it was concluded that the 1999 VOC samples were probably affected by laboratory contamination. Therefore, the 1999 VOC data were replaced with the 2005 VOC analytical results in the data tables and in the risk assessment.

An auger drill rig was used to sample each borehole at one depth interval. In the boreholes drilled adjacent to the seepage pit, the sample interval started at the estimated base of the gravel aggregate in the seepage pit and seepage pit excavation.

Discussed in this paragraph are the results for the soil sample that was collected in August 1999 and analyzed for SVOCs, PCBs, cyanide, RCRA metals, HE compounds and radionuclides, and the results for three soil samples and one duplicate that were collected in April 2005 and analyzed for VOCs. No VOCs, SVOCs, PCBs, cyanide or HE compounds were detected. All RCRA metal concentrations were below the Department-approved background values. Hexavalent chromium was detected at a concentration of 0.112 mg/kg J. For radionuclides, no activities above background levels were detected in any sample analyzed. However, although not detected, the MDA for uranium-235 analyzed by the off-site laboratory exceeded the background activity. No elevated readings of gross alpha/beta activity were detected in any of the samples.

#### Investigation 2— Passive Soil-Vapor Sampling

In May 2002, a passive soil-vapor survey was conducted in the Building 9938 seepage pit area. This survey was conducted to determine whether VOC contamination was present in soil.

Three GS passive soil-vapor samplers were placed in the seepage pit area on May 1, 2002, and were retrieved on May 16, 2002. The GS samplers were analyzed for a total of 30 individual or groups of VOCs, including TCE, tetrachloroethene, cis- and trans-dichloroethene and BTEX. Twelve individual or groups of VOCs were detected in the GS samplers.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total human HIs and estimated excess cancer risks were acceptable (Table 20).

For the radiological COC (uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 1.9E-3 millirem (mrem)/year (yr). The estimated excess cancer risk is 1.9E-8.

The exposure pathway analysis established that no complete ecological exposure pathway exists for exposure of ecological species to contaminants at AOC 1095. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

**Table 20**  
**Risk Assessment Values for AOC 1095 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Industrial Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium VI	0.12 J	0.00	3E-11	0.00	6E-10
Cyanide	0.0695 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.00</b>	<b>3E-11</b>	<b>0.00</b>	<b>6E-10</b>

<sup>a</sup>EPA 1989.; <sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

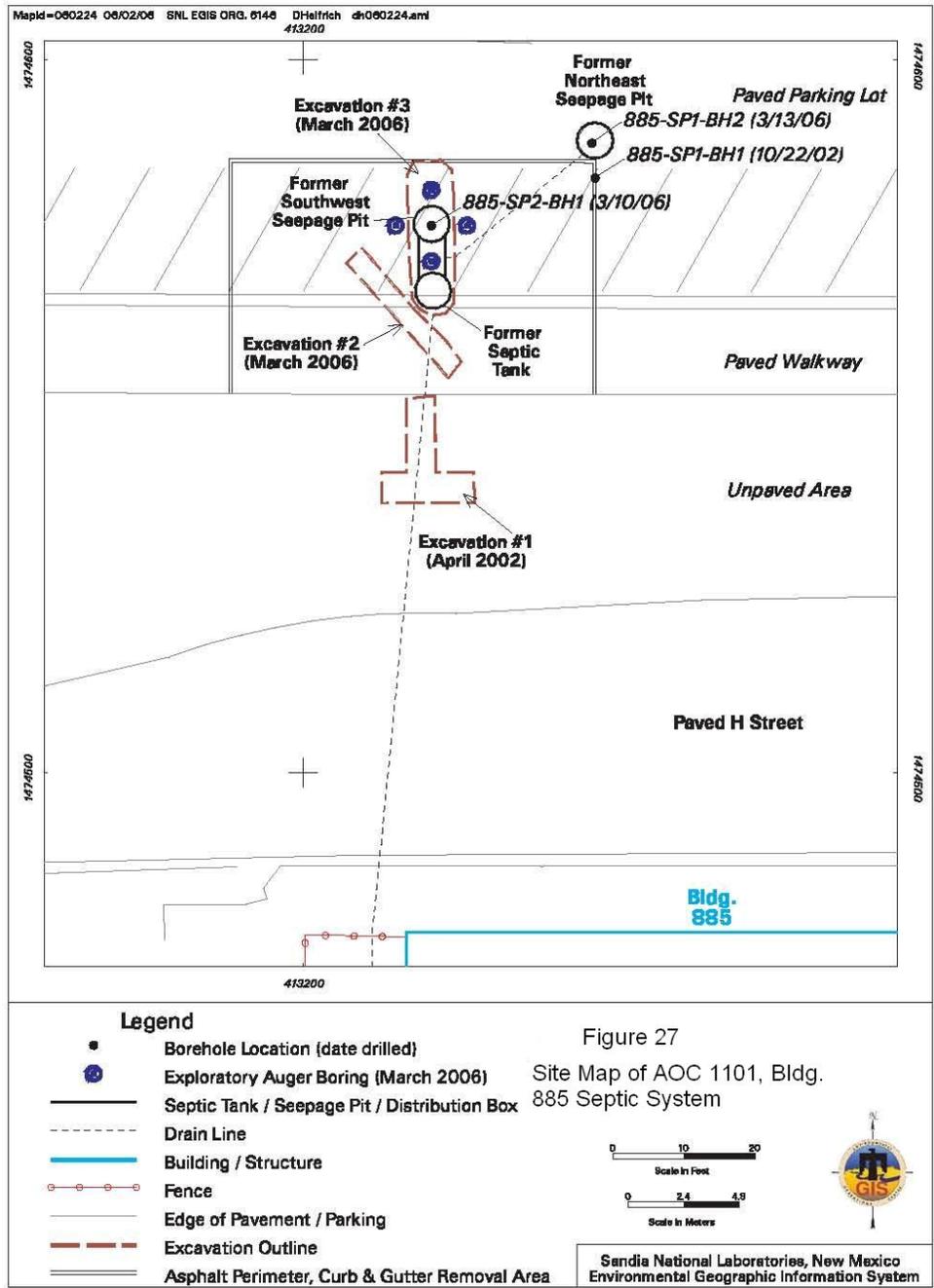
### **Basis for Determination**

AOC 1095 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

### **AOC 1101, Building 885 Septic System**

#### **Site Location**

AOC 1101 is located on the north side of SNL Technical Area 1 on federally owned land controlled by KAFB and permitted to the DOE (Figure 27). An SNL Facilities Engineering drawing indicates that the Building 885 septic system was situated approximately 100 ft north of the northwest corner of Building 885.



## **Operational History**

Bldg. 885 was constructed as a building materials warehouse in 1953, and it is assumed that the septic system (septic tank and one or two seepage pits) was also constructed at that time.

A June 1980 SNL Facilities Engineering drawing indicates that the Building 885 septic system was situated approximately 100 ft north of the northwestern corner of Building 885. The drawing shows that the abandoned septic system consisted of a septic tank and distribution box that emptied to a 5-ft diameter by an estimated 25-ft deep seepage pit (referred to as the northeast seepage pit). An older drawing (1963) indicates that a second seepage pit (referred to as the southwest seepage pit) may have been located approximately 3 ft north of the septic tank. This location is now beneath a large asphalt parking lot. In 1988, Building 885 was connected to the City of Albuquerque sanitary sewer system. It is assumed that the septic system was abandoned and paved over at about that time.

COCs for the site include VOCs, SVOCs, polychlorinated biphenyls (PCBs), HE compounds, RCRA metals, hexavalent chromium, total cyanide, and radionuclides.

## **Depth to Regional Groundwater**

The shallow groundwater system and regional aquifer are approximately 310 and 560 ft beneath the site, respectively.

## **Evaluation of Relevant Information**

In March 2002, an initial backhoe excavation attempted to locate the old drain line shown in the engineering drawings to run north from Building 885 to the septic tank. The line was located at an average depth of 5 ft bgs and was followed north until it passed under the asphalt walkway and parking lot. The excavation was stopped in order to avoid damaging the walkway.

In June 2002, a ground penetration radar survey was conducted at the apparent location of the septic system beneath the parking lot. The results of the survey were inconclusive; no definitive remains of the buried system were identified.

In October 2002, an initial borehole (885-SP1-BH1) was drilled in the center of the northeast seepage pit as shown on the 1980 drawing. At a depth of 23 ft bgs, a subsurface obstruction caused auger refusal and was assumed at the time to be the remains of the northeast seepage pit.

To avoid a lodged auger string due to the obstruction, a second borehole was drilled 5 ft south of the first boring.

Soil samples were successfully collected from the 2002 borehole from both an upper interval (approximately 25 ft bgs) and from a deeper interval (approximately 30 ft bgs). Soil samples were analyzed for VOCs, SVOCs, PCBs, HE compounds, RCRA metals and hexavalent chromium, total cyanide, radionuclides, and gross alpha/beta activity.

In March 2006, a section of the parking lot was removed and two additional excavations were completed to determine if remains of the tank or southwest seepage pit were still present at the site. No indication, or remains, of a septic tank, seepage pit, seepage pit aggregate, or a northeast-trending drain line was found. It was concluded that the system components had been completely removed from the site before the parking lot and walkway were constructed. Also in March 2006, four exploratory borings were drilled around the center of the southwest seepage pit as it was shown on the 1980 drawing. No buried aggregate or seepage pit remains were detected.

Two additional soil borings were advanced at the site during the March 2006 activities. The first borehole (885-SP2-BH1) was advanced in the theoretical center of the southwest seepage pit and the second (885-SP1-BH2) was advanced in the theoretical center of the northeast seepage pit. Soil samples were collected from the two 2006 boreholes at 25 ft bgs and 30 ft bgs. The soil samples were analyzed at off-site laboratories for VOCs, SVOCs, PCBs, HE compounds, RCRA metals, hexavalent chromium, cyanide, and gross alpha/beta activity, and at an on-site laboratory for radionuclides by gamma spectroscopy.

A total of 6 soil samples were collected during the 2002 and 2006 sampling events. The analytical results from both sampling events were used for the CAC justification. No VOCs were detected above the MDL in any of the soil samples. Low J-value concentrations of six SVOCs were detected in the two 2002 soil samples collected from the northeast seepage pit. There were no SVOCs detected in the 2006 soil samples. No PCBs and no HE compounds were detected in any of soil samples collected in 2002 and 2006. There were no RCRA metals detected above NMED-approved background concentrations in any of the soil samples from 2002 and 2006. Hexavalent chromium was detected at 0.0844 J mg/kg in one soil sample collected from the southwest seepage pit in 2006. Cyanide was detected at 0.184 J mg/kg in one 2002 soil sample collected from the northeast seepage pit. No activities above NMED-approved background levels for the four representative radionuclides were detected in any of the samples. However, although not detected, the MDAs for two of the uranium-235 and one of the uranium-238 samples collected in March 2006 exceeded their representative background activities. Gross alpha/beta results for the 2002 and 2006 soil samples collected did not exceed the background activities.

A risk screening assessment was performed for this site using maximum COC concentrations to evaluate the potential for adverse health effects in industrial and residential land-use scenarios. For the industrial and residential land-use scenarios, the total and incremental human health HIs and the estimated excess cancer risks were less than NMED guidelines for risk (Table 21).

The human health industrial and residential land use incremental doses for radiological COCs were below the EPA and numerical guidelines. In conclusion, human health and ecological risks were acceptable per NMED guidance.

### **Basis for Determination**

AOC 1101 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

**Table 21**  
**Risk Assessment Values for AOC 1101 Nonradiological COCs**

COC Name	Maximum Concentration (mg/kg)	Residential Land Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk
<b>Inorganics</b>			
Chromium VI	0.0844 J	0.00	4E-10
Cyanide	0.184 J	0.00	--
Mercury	0.00459 J	0.00	--
Selenium	0.613 J	0.00	--
Silver	0.0487 <sup>b</sup>	0.00	--
<b>Organics</b>			
Acenaphthene	0.0107 J	0.00	--
2-Chlorophenol	0.0169 J	0.00	--
Chrysene	0.0185 J	0.00	3E-10
Di-n-octylphthalate	0.15 J	0.00	--
Bis (2-ethylhexyl) phthalate	0.182 J	0.00	4E-9
Fluoranthene	0.0174 J	0.00	--
Fluorene	0.0104 J	0.00	--
<b>Total</b>		<b>0.00</b>	<b>5E-9</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (i.e., one-half the maximum detection limit is greater than the maximum detected concentration).

COC = Constituent of concern.

J = Concentration was qualified as an estimated value.

mg/kg = Milligram(s) per kilogram.

-- = Information not available

## **AOC 1114, Building 9978 Drywell**

### **Site Location**

AOC 1114 is located in the Coyote Test Field on federally owned land controlled by KAFB and permitted to the DOE. The site is located approximately 1,700 ft east of the intersection of Optical Range Road with Lovelace Road. The drywell is southeast of Building 9978 and consists of a vertically buried piece of metal culvert, 3 ft in diameter and 5.5 ft deep, filled with aggregate to within 1.5 ft of the surface. Construction details are based upon engineering drawings, site inspections, and a backhoe excavation of the system. The system is still active and receives discharges from a sink and water fountain in Building 9978, approximately 21 ft to the northwest (Figure 28).

### **Operational History**

Available information indicates that Building 9978 was constructed in 1971, and it is assumed the drywell was constructed at the same time. Building 9978 is currently used as a shop and

storage facility to support the ER Project field operations. The system is still active and receives discharges from a sink and water fountain inside Building 9978.

The COCs include RCRA metals, hexavalent chromium, cyanide, HE compounds, VOCs, SVOCs, PCBs and radionuclides.

### **Evaluation of Relevant Information**

Two assessment investigations have been conducted at this site. In March 2002, a backhoe was used to physically locate the buried drywell (Investigation 1). In September 2002, subsurface soil samples were collected from a boring drilled through the center of, and beneath, the drywell (Investigation 2).

#### Investigation 1—Backhoe Excavation

On March 22, 2002, a backhoe was used to determine the location, dimensions and depth of the drywell. The drywell was found to consist of a vertically buried piece of metal culvert, 3 ft in diameter, 5.5 ft deep, and filled with aggregate to within 1.5 ft of the surface. No visible evidence of stained or discolored soil or odors indicating residual contamination was observed during the excavation. No samples were collected during the backhoe excavation.

#### Investigation 2—Soil Sampling

In September 2002, soil samples were collected from a borehole drilled through the center of, and beneath, the drywell. An auger drill rig was used to sample the borehole at two depth intervals. The shallow sample interval started at the estimated base of the gravel aggregate in the drywell bottom, and the lower (deep) interval started at 5 feet below the top of the upper sample interval.

Two VOCs (2-butanone and toluene) were detected in the 11-ft-bgs sample. Only 2-butanone was detected in the 6-ft-bgs sample. Acetone and 1,2-dichloropropane were detected in the TB associated with these samples. No SVOCs, PCBs or HE compounds were detected. No RCRA metal concentrations detected exceeded the Department-approved background concentrations. Cyanide was detected in the 6-ft-bgs sample. For radionuclides, no activities above background levels were detected in any sample analyzed. However, although not detected, the MDA for uranium-235 exceeded the background activity because the standard gamma spectroscopy count time for soil samples (6,000 seconds) was not adequate to achieve a lower and more appropriate MDA. Regardless, the MDA was sufficiently low that the Department accepts the sampling results. No gross alpha or beta activity was detected above background levels in any of the samples.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs and estimated excess cancer risks were acceptable (Table 22).

For the radiological COC (uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 1.1E-2 millirem (mrem)/year (yr). The estimated excess cancer risk is 1.1E-7.

The exposure pathway analysis established that no complete ecological exposure pathway exists for exposure of ecological species to contaminants at AOC 1114. All COCs are located at depths

greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs. In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.



**Table 22**  
**Risk Assessment Values for AOC 1114 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium VI	0.0271 <sup>b</sup>	0.00	6E-11	0.00	1E-10
Cyanide	0.0713 J	0.00		0.00	
<b>Organic</b>					
2-Butanone	0.00856	0.00		0.00	
Toluene	0.00038 J	0.00		0.00	
<b>Total</b>		<b>0.00</b>	<b>6E-11</b>	<b>0.00</b>	<b>1E-10</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Estimated concentration.

mg/kg = Milligram(s) per kilogram.

### **Basis for Determination**

AOC 1114 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

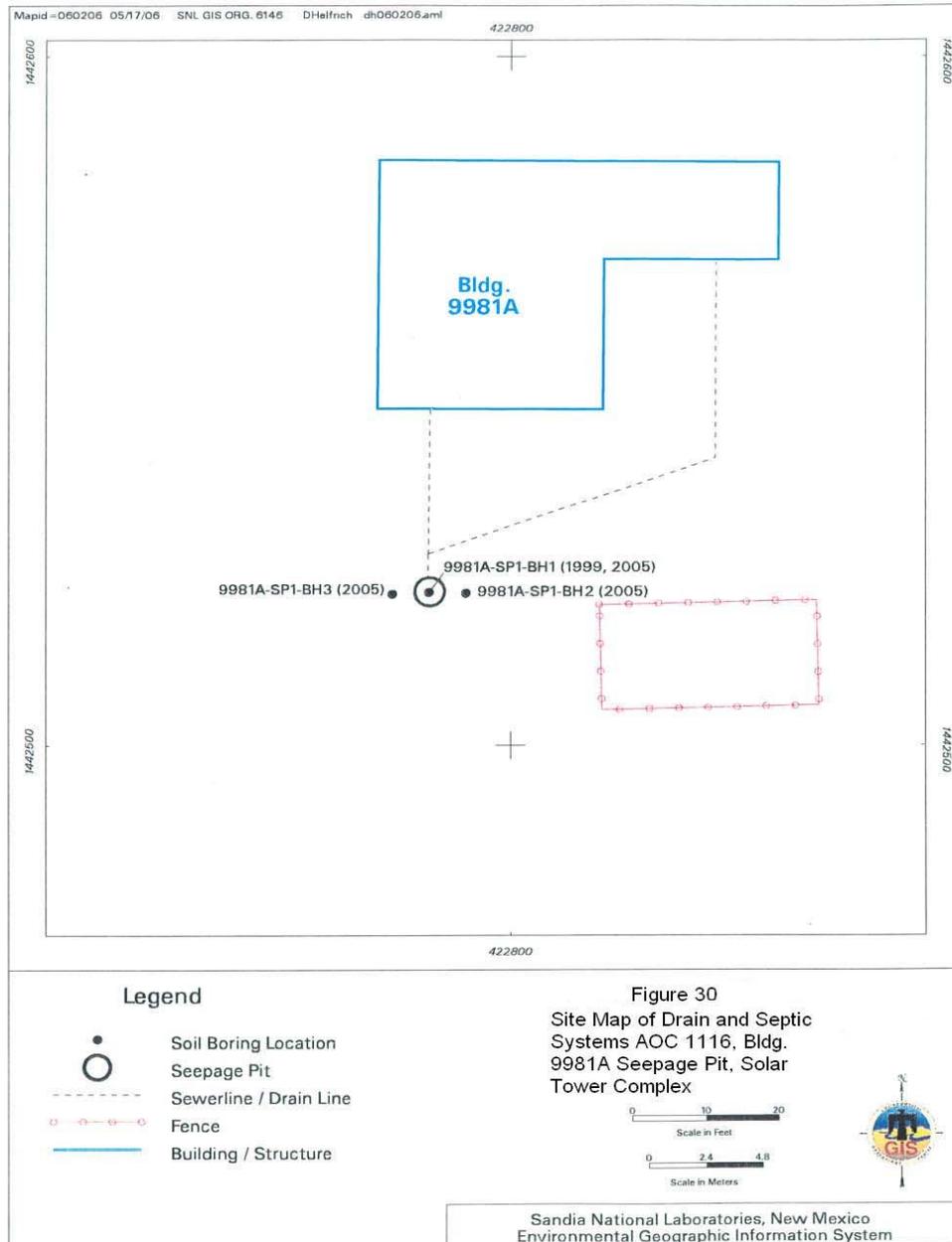
### **AOC 1116, Building 9981A Seepage Pit**

#### **Site Location**

AOC 1116 is located at the Solar Tower Testing Complex on federal land controlled by KAFB and permitted to the DOE. The site is located approximately 1,500 ft northeast of the solar tower. The seepage pit is on the south side of Building 9981A and was constructed by excavating a 6-ft-diameter hole to a depth of approximately 8.5 ft bgs, placing a 4-ft diameter section of steel culvert vertically in the hole with the upper end at the ground surface, and filling the annular space and lower 3.5 ft of the culvert with gravel aggregate (Figure 30). Construction details are based upon engineering drawings, and a site inspection.

#### **Operational History**

Available information indicates that Building 9981A was constructed in 1981 and it is assumed the seepage pit was constructed at the same time. Building 9981A is currently known as the flux gauge calibration station. Discussions with Solar Tower Complex personnel in September 2004 confirmed that the seepage pit was still active and receives cooling water from occasional tests conducted in Building 9981A. There are no current plans to abandon and backfill this unit.



The COCs include RCRA metals, hexavalent chromium, cyanide, HE compounds, VOCs, SVOCs, PCBs and radionuclides.

### **Evaluation of Relevant Information**

In August 1999, soil samples were collected from one borehole drilled through the center of, and beneath the seepage pit. In April 2005, additional samples for VOC analysis only were collected from the approximate center of, and beneath, the seepage pit and, because of subsurface refusals, from two additional boreholes adjacent to the seepage pit. An auger drill rig was used to sample all boreholes at two depth intervals. In boreholes drilled through the center of, and adjacent to the seepage pit, the shallow sample interval started at the estimated base of the gravel aggregate in the seepage pit bottom, and the lower (deep) interval started at 5 feet below the top of the upper sample interval.

AOC 1116 was one of five shallow groundwater DSS sites that had 2-butanone concentrations above the 10 µg/kg VOC trigger level specified in the DSS SAP, and therefore required additional sampling. The samples collected at these five sites were all analyzed at the same time, and the laboratory reported detections of the same VOCs (2-butanone, methylene chloride and toluene) at similar concentrations for all five sites. After meeting with the Department, it was decided to resample AOC 1116 and the other four sites for VOCs only. At AOC 1116, it was agreed that the additional VOC samples would be collected at the original 1999 sample location and depth, and additional samples would be collected at 5 and 10 feet below the original sample depths. The VOC resampling was conducted in April 2005. Repeated attempts to collect the additional VOC soil samples below the two original 1999 depths in the center seepage pit boring were unsuccessful due to shallow bedrock. Therefore, the additional VOC samples were collected at the two original 1999 depths in the center boring, and from the two step-out borings on either side of the seepage pit (Figure 30). Only toluene was detected in the April 2005 samples at a maximum concentration of 6.65 µg/kg. It was concluded that the 1999 VOC samples were probably affected by laboratory contamination. Therefore, the 1999 VOC data were replaced with the 2005 VOC results in the data tables and in the risk assessment. VOC results for the six soil samples collected in April 2005 from the three boreholes documented one VOC toluene in the 8-ft bgs sample from borehole BH2.

No SVOCs, PCBs, cyanide or HE compounds were detected in any of the soil samples collected in August 1999. None of the RCRA metal concentrations detected in the samples exceeded the Department-approved background concentrations. Thorium-232 was detected at an activity slightly above background activity in the 8-ft bgs sample from borehole BH1. Although not detected, the MDA for one uranium-235 analysis exceeded the background activity. Although the MDA is elevated, the MDA is low, and the risk assessment is not significantly impacted by its use. No gross alpha or beta activity above background levels was detected in any of the samples.

A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs and estimated excess cancer risks were acceptable (Table 23).

For the radiological COCs (thorium-232 and uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 6.4E-2 millirem (mrem)/year (yr). The estimated excess cancer risk is 7.4E-7.

The exposure pathway analysis established that no complete ecological exposure pathway exists for exposure of ecological species to contaminants at AOC 1116. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

### Basis for Determination

AOC 1116 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

**Table 23**  
**Risk Assessment Values for AOC 1116 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium VI	0.16 J	0.00	3E-10	0.00	7E-10
Cyanide	0.069 <sup>b</sup>	0.00		0.00	
<b>Organic</b>					
Toluene	0.00067 J	0.00		0.00	
<b>Total</b>		<b>0.00</b>	<b>3E-10</b>	<b>0.00</b>	<b>7E-10</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Estimated concentration.

mg/kg = Milligram(s) per kilogram.

## AOC 1117, Building 9982 Drywell, Solar Tower Complex

### Site Location

AOC 1117 is located at the Solar Tower Testing Complex on federally owned land controlled by KAFB and permitted to the DOE. The site is located approximately 1,300 ft northwest of the solar tower (Figure 31).

The abandoned drywell is at the northwest corner of Building 9982 and consisted of a gravel-filled hole approximately 4 ft in diameter and 11 ft deep. Construction details are based upon engineering drawings, site inspections and auger drilling during sample collection. The system received discharges from floor drains in Building 9982, approximately seven ft to the south.

### Operational History

Available information indicates that Building 9982 was constructed in 1980 and it is assumed the drywell was constructed at the same time. Building 9982 is currently known as the 5 MW Solar

Assembly Building. A site inspection in August 1999 determined that the Building 9982 floor drains that discharged to the drywell had been plugged with concrete.

The COCs include RCRA metals, hexavalent chromium, cyanide, HE compounds, VOCs, SVOCs, PCBs and radionuclides.

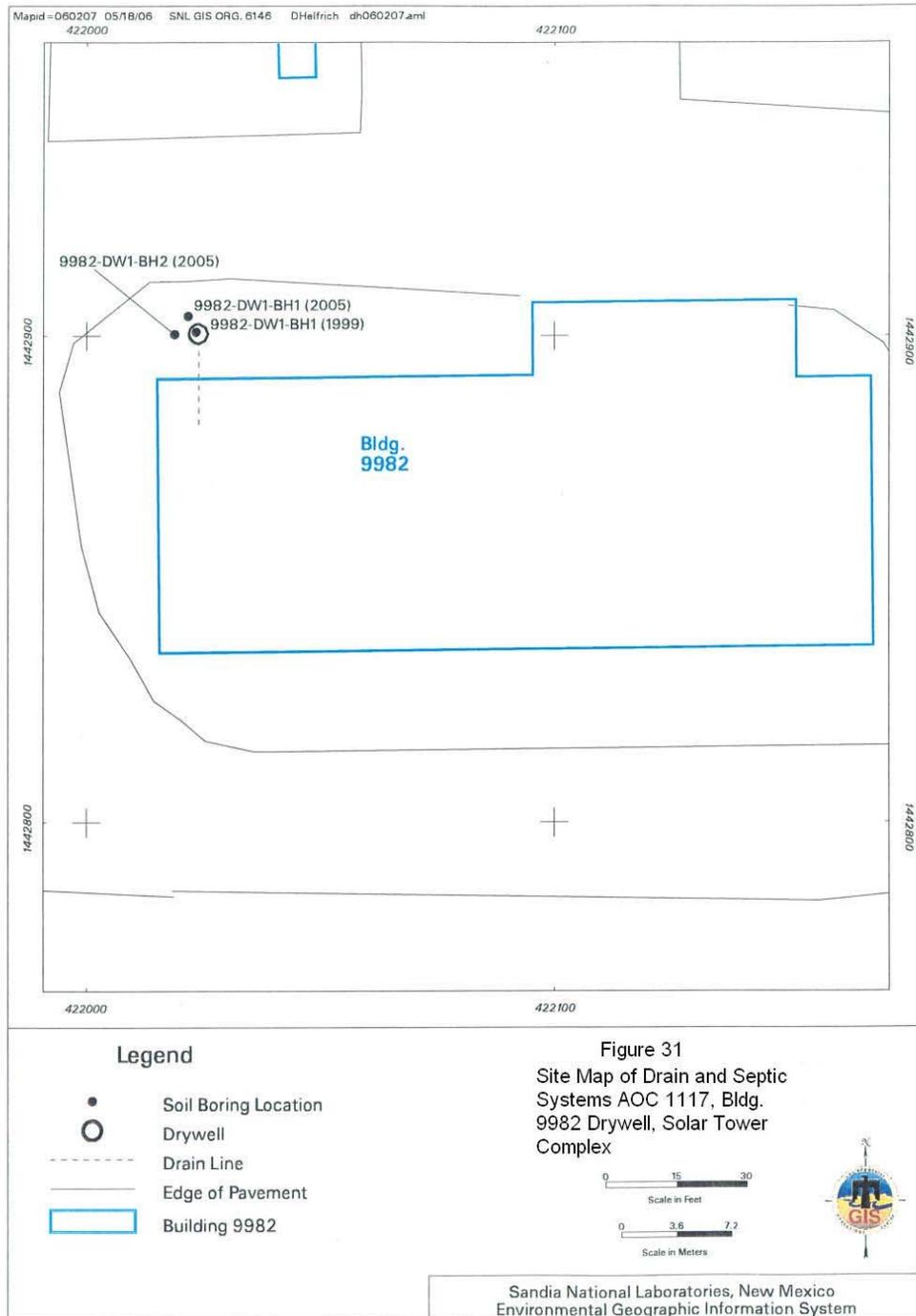
### **Evaluation of Relevant Information**

In August 1999, soil samples were collected from a borehole drilled through the center of, and beneath the drywell. In April 2005, additional samples for VOC analysis only were collected from the approximate original borehole location through the center of, and beneath, the drywell and, because of subsurface refusals, from two additional boreholes adjacent to the seepage pit. An auger drill rig was used to sample the boreholes at two depth intervals. In the borehole drilled through the center of the drywell, the shallow sample depth interval started at the estimated base of the gravel aggregate at the drywell bottom, and the lower (deep) interval started at 5 feet below the top of the upper sample interval.

AOC 1117 was one of five shallow groundwater DSS sites that had 2-butanone soil sample concentrations above the 10 µg/kg VOC trigger level specified in the DSS SAP, and therefore required additional sampling. The samples collected at these five sites were all analyzed at the same time, and the laboratory reported detections of the same three VOCs (2-butanone, methylene chloride and toluene) at similar concentrations for all five sites. It was decided to resample the five sites for VOCs only. At AOC 1117, it was agreed that additional VOC samples would be collected at the 1999 sample location and depth, and additional samples would be collected at 5 and 10 feet below the original sample depths. The resampling was conducted in April 2005. However, due to subsurface refusals below the original sample depths, some of the April 2005 samples had to be collected from two additional step-out boreholes approximately 2.5 and 4 feet away, respectively, from the sides of the drywell.

Figure 31 shows the locations of the three boreholes drilled at AOC 1117. Because no VOCs were detected in the April 2005 samples, it was concluded that the 1999 VOC samples were probably affected by laboratory contamination. Therefore, the 1999 VOC data were replaced with the 2005 VOC results in the data tables and in the risk assessment. The four samples and one duplicate collected in April 2005 were analyzed for VOCs. There were no detections of VOCs.

The two soil samples and one duplicate collected in August 1999 were analyzed for SVOCs, PCBs, cyanide, HE compounds, RCRA metals, hexavalent chromium and radionuclides. No VOCs, SVOCs, PCBs, cyanide or HE compounds were detected in any of the soil samples. For RCRA metals and hexavalent chromium, none of the metals were greater than the Department-approved background concentrations. For radionuclides, no activities above background levels were detected in any sample analyzed. However, although not detected, the MDA for one uranium-235 analysis exceeded the background activity because the standard gamma spectroscopy count time for soil samples (6,000 seconds) was not adequate to achieve a lower and more adequate MDA. Regardless, the MDA was sufficiently low that the Department accepts the sampling results. No gross alpha or beta activity above the background levels was detected in any of the samples.





A human health risk screening assessment was performed to evaluate the potential for adverse health effects for the industrial and residential land-use scenarios. For both the industrial and residential land-use scenarios, the total HIs and estimated excess cancer risks were below Department guidelines (Table 24).

For the radiological COC (uranium-235) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 5.3E-2 millirem (mrem)/year (yr). The estimated excess cancer risk is 5.3E-7.

**Table 24**  
**Risk Assessment Values for AOC 1117 Nonradiological COCs**

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
<b>Inorganic</b>					
Chromium VI	0.105 J	0.00	2E-10	0.00	5E-10
Cyanide	0.069 <sup>b</sup>	0.00		0.00	
<b>Total</b>		<b>0.00</b>	<b>2E-10</b>	<b>0.00</b>	<b>5E-10</b>

<sup>a</sup>EPA 1989.

<sup>b</sup>Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

COC = Constituent of concern.

J = Estimated concentration.

The exposure pathway analysis established that no complete ecological exposure pathway exists for exposure of ecological species to contaminants at AOC 1117. All COCs are located at depths greater than 5 ft bgs. Therefore, no COCs are considered to be COPECs.

In conclusion, human health and ecological risks are acceptable under a residential land-use scenario.

### **Basis for Determination**

AOC 1117 has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

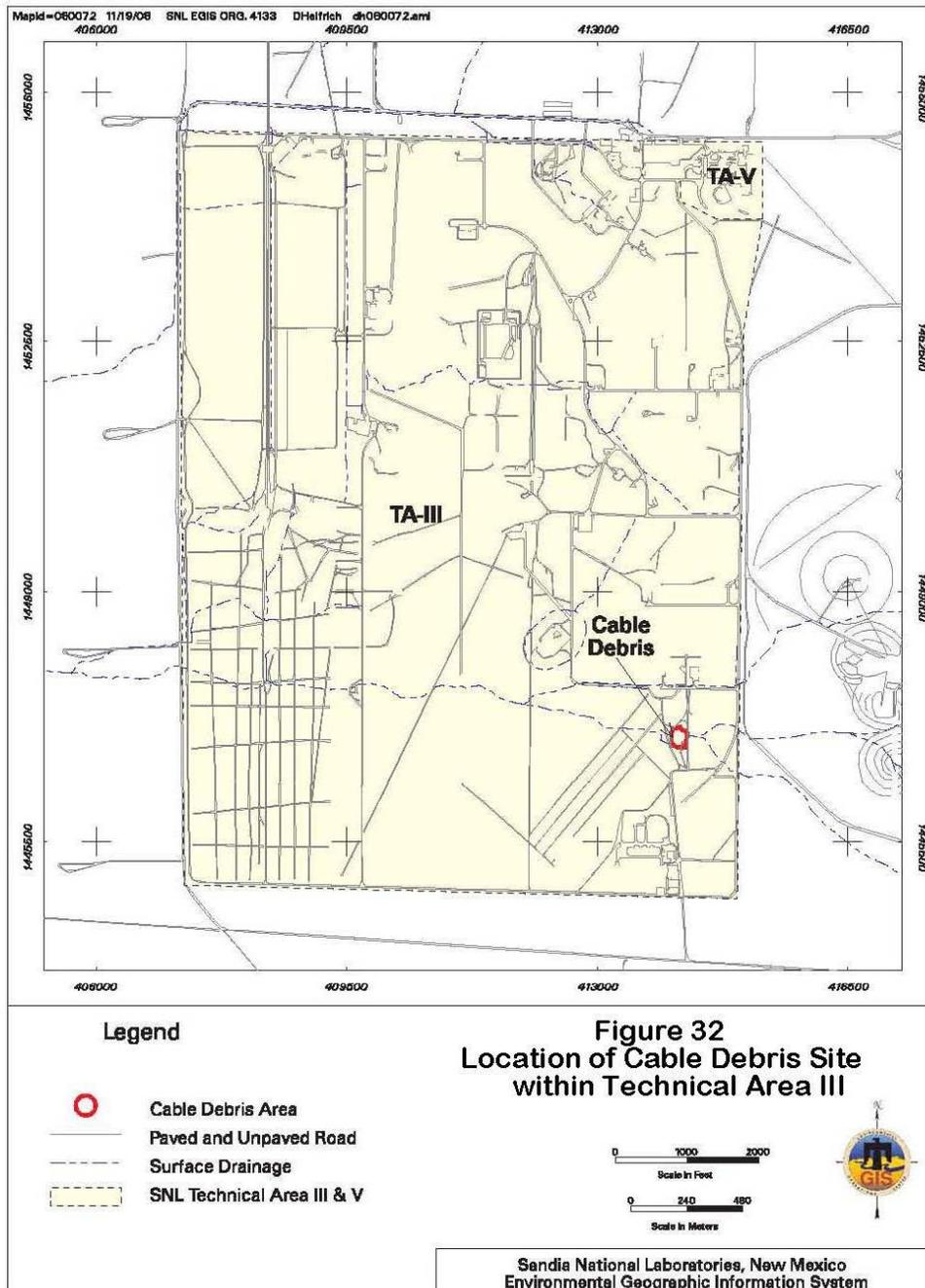
### **SWMU LTES-1, Cable Debris Site**

#### **Site Location**

The Cable Debris Site is an approximately 1.3 acre site located in Technical Area (TA)-III (Figure 32).

## **Operational History**

The complete operational history at the LTES 1 is unknown. However, based on the available information, this location has never been an active site and the contamination is limited to the surface debris (i.e., solid waste) that was probably transported to the area from various test areas.



However, prior to 1995, no information is available and the precise origin of the debris is unknown.

A Voluntary Corrective Action (VCA) was completed for the site in January 2009 (SNL March 2009). The VCA focused on debris segregation, sizing, and final disposition. The debris was processed to a manageable size, segregated based on material types (metal, concrete, and other assorted solid wastes) and disposed of either through recycling or waste disposal paths.

The site consisted of surface debris piles located primarily within a surge basin, with some minor debris located outside the surge basin in the general vicinity. A surge basin is a hole or depression that is part of a drainage system that provides additional storage and retention of water during heavy rainfall or flood events. The surge basin at the LTES Site 1 is a circular depression approximately 1.3 acres in size.

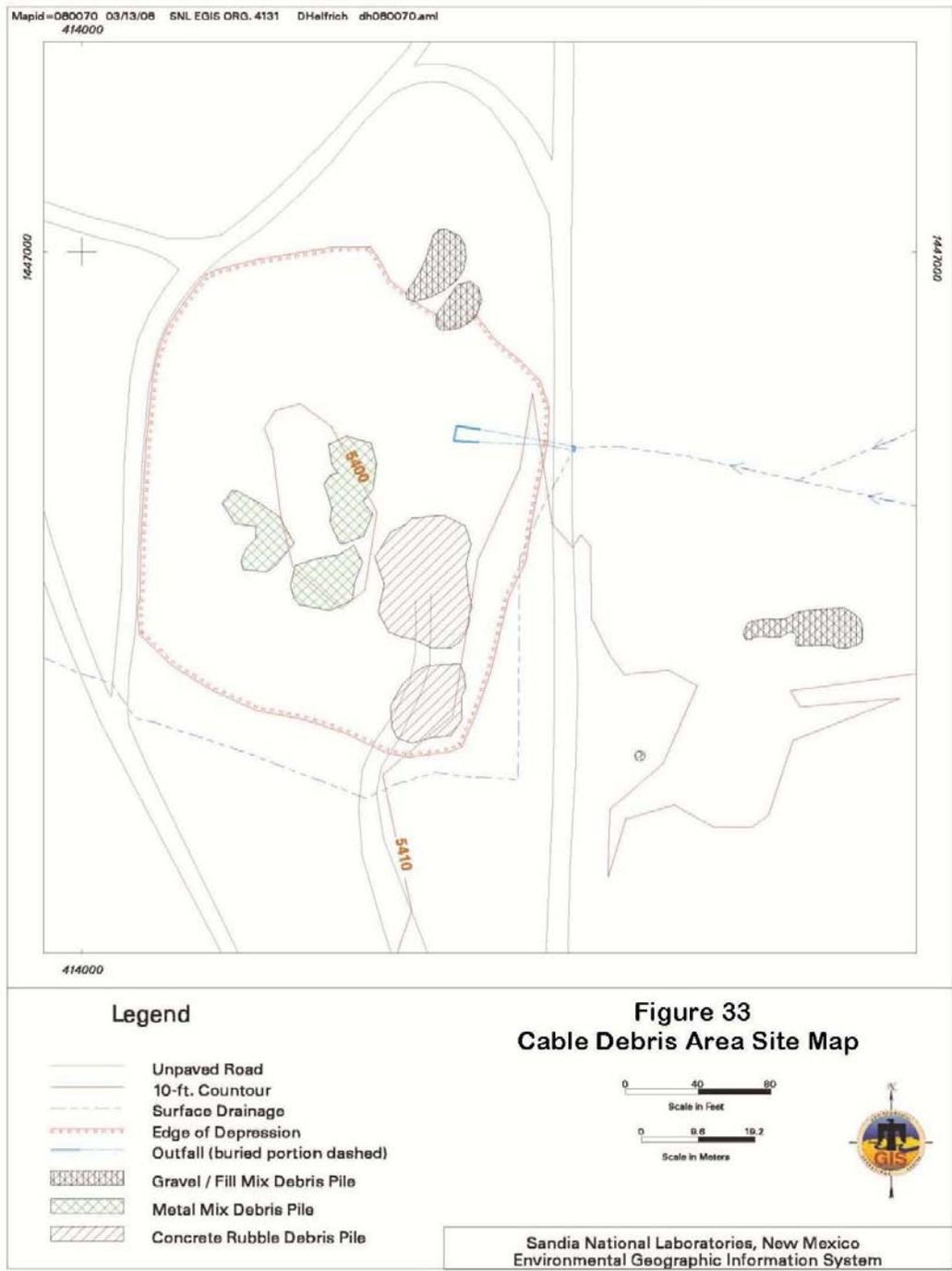
Three of the debris piles were primarily comprised of metal cables with other metal debris, including rebar, steel pipe, tubes, weldments, welded steel fixtures, spent rocket motors and powder actuated cable cutters. The remaining two piles in the surge basin comprised primarily concrete rubble and rebar; one of these piles is located on the edge of the basin. In addition, there are five smaller debris piles directly east of the surge basin which are primarily composed of small cobbles, fill dirt and some minor solid waste that includes paper, plastic, and small metal debris (Figure 33).

Based upon visual inspection, there was no indication that these piles contained anything other than minor solid waste because no soil staining or other signs of contamination were observed. The area surrounding the surge basin is part of the east mesa and generally flat with a gentle slope to the southwest (i.e., towards the Rio Grande). No major arroyo channels occur in the area. Precipitation is low in the region (approximately 8 inches per year) and surface runoff is minimal, except during major precipitation events. The area has been previously disturbed and vegetation primarily consists of desert grasses, cacti, tumbleweeds, and other annual species typical of disturbed areas of the east mesa ecosystem. The two primary waste types were metals and concrete. In addition, assorted solid waste was generated during the sorting and segregation process. All three of these waste types are discussed below.

### *Metal*

Segregation and sizing of the metal debris was conducted using a shear attachment on an excavator. Once sized, all metal was placed into roll-off containers for recycling. A large round steel target filled with concrete was dismantled during the metal segregation. The concrete was removed from the steel target casing using a hammer attachment on the excavator, and the resulting debris was then separated into its respective debris waste types. The Unexploded Ordnance Safety Officer performed an initial visual inspection on the metal debris piles for potential Unexploded Ordnance (UXO) debris. Potential UXO items found included six powder actuated cable cutters, and several spent rocket motors and rocket motor casings. These items were placed in a segregated staging area. None of the rocket motors were live. Of the 6 powder actuated cable cutters found onsite, only one of the cutters was potentially “live”, and was taken by KAFB Explosive Ordnance Disposal (EOD) before disposal.

An SNL Radiation Control Technician (RCT) performed radiological surveys of approximately 10% of metal debris. No radioactive contamination was detected as part of these confirmatory surveys. Metal debris staged in roll-off containers was transported and recycled offsite by a SNL contractor.



### Concrete

Concrete debris piles were mechanically screened using a Screen-All Plant. The Screen-All Plant was fitted with a 2-inch screen deck to segregate the concrete from soil. Concrete for recycling was required to meet the size specification of approximately 2-feet, by 2-feet, by 2-feet maximum dimensions. Concrete determined to be greater than this size specification, after screening, was sized using a hammer attachment on the excavator. A water truck was used to spray water on the concrete debris piles to control dust throughout the screening activities. A front-end loader with a bucket attachment was used to place the concrete debris onto the screen deck. The concrete and other potential debris (metal, wood, and solid waste) was then segregated from soil. The screened concrete was stockpiled directly on the ground surface and later loaded and transported to the existing SNL concrete recycling area in TA- III. The screened soil was stockpiled in the bottom of the retention basin and confirmation soil samples were collected.

Specific debris items, including a poly-lined 55-gallon drum full of stained soil, a burlap wrangler bag containing activated carbon, and a lead acid battery were placed in a segregated staging area. The lead acid battery was disposed of as hazardous waste through the SNL Hazardous Waste Handling (HWHF). In addition, several fragments of lead were found along the east slope of the storm water retention basin. The lead fragments were separated from the soil and other debris using the Screen-All Plant, screened for radiological contamination, and re-used through the SNL Lead Bank.

The UXOSO performed an initial visual inspection on the concrete debris piles. As this work progressed the UXOSO continually inspected both the initial concrete debris piles and the screened debris piles generated by the Screen-All Plant operations for any potential UXO debris or items. No UXO debris or items were present in the initial or screened debris piles.

An SNL RCT performed radiological surveys of approximately 10% of the concrete debris. No radioactive contamination was detected as part of these confirmatory surveys. All concrete debris was processed for re-use through the SNL concrete recycling program in TA-III.

### Solid Waste

A small volume of solid waste was generated during the concrete screening process. The solid waste was segregated into the following three primary waste types; general solid waste (including metals, plastics, some construction debris, and trash), electrical cable of various sizes, and wood. The quantity and disposition of the solid waste is summarized in Table 25.

Once the debris was sized, segregated, and stock piled; confirmatory soil sampling was conducted in accordance with the technical approach, requirements, and procedures in the VCA Plan (SNL, 2008). On September 4 and September 9, 2008, surface soil samples were collected from 25 locations, including four samples collected from the screened soil stockpile that will remain onsite for use as fill material (Figure 34). Samples CDS-A1-0006-SS, CDS-A1-0006D-SS, CDS-A1-0022-SS, and CDS-A1-0025-SS characterize the screened soil stockpile.

All 25 confirmatory soil samples (plus the three duplicates for a total of 28 samples) that represent post-VCA site conditions were analyzed for metals and HE. In addition, five of the 25 soil samples were also analyzed for radionuclides.

Analytical results revealed elevated levels of 10 metals, no detections of HE, and the presence of Cesium-137 above the NMED approved background value. The NMED issued a Notice of

Deficiency (NOD) due to the elevated metals (cadmium and thallium) and Cesium-137 values stating that additional samples were required.

A review of the confirmatory sampling results revealed an analytical laboratory error in the reporting of the cadmium and thallium results. The responses to the NOD detailed the error and presented the corrected information. The cadmium detection limits were significantly below the soil screening level and the thallium values were below corresponding background values. The Cesium-137 value for the subsurface sample did exceed the subsurface background value, but was well within the range of overall background values. The NMED accepted the NOD comments and did not require any further action at the site. Following all the VCA activities, the site was graded and reseeded.

Risk assessment results for the residential scenario are calculated per NMED risk assessment guidance in 2003 as presented in the “Supplemental Risk Document Supporting Class 3 Permit Modification Process” (SNL 2003).

**Table 25**  
**SWMU LTES-1, Cable Debris Site**  
**Quantity and Disposition of General Debris**

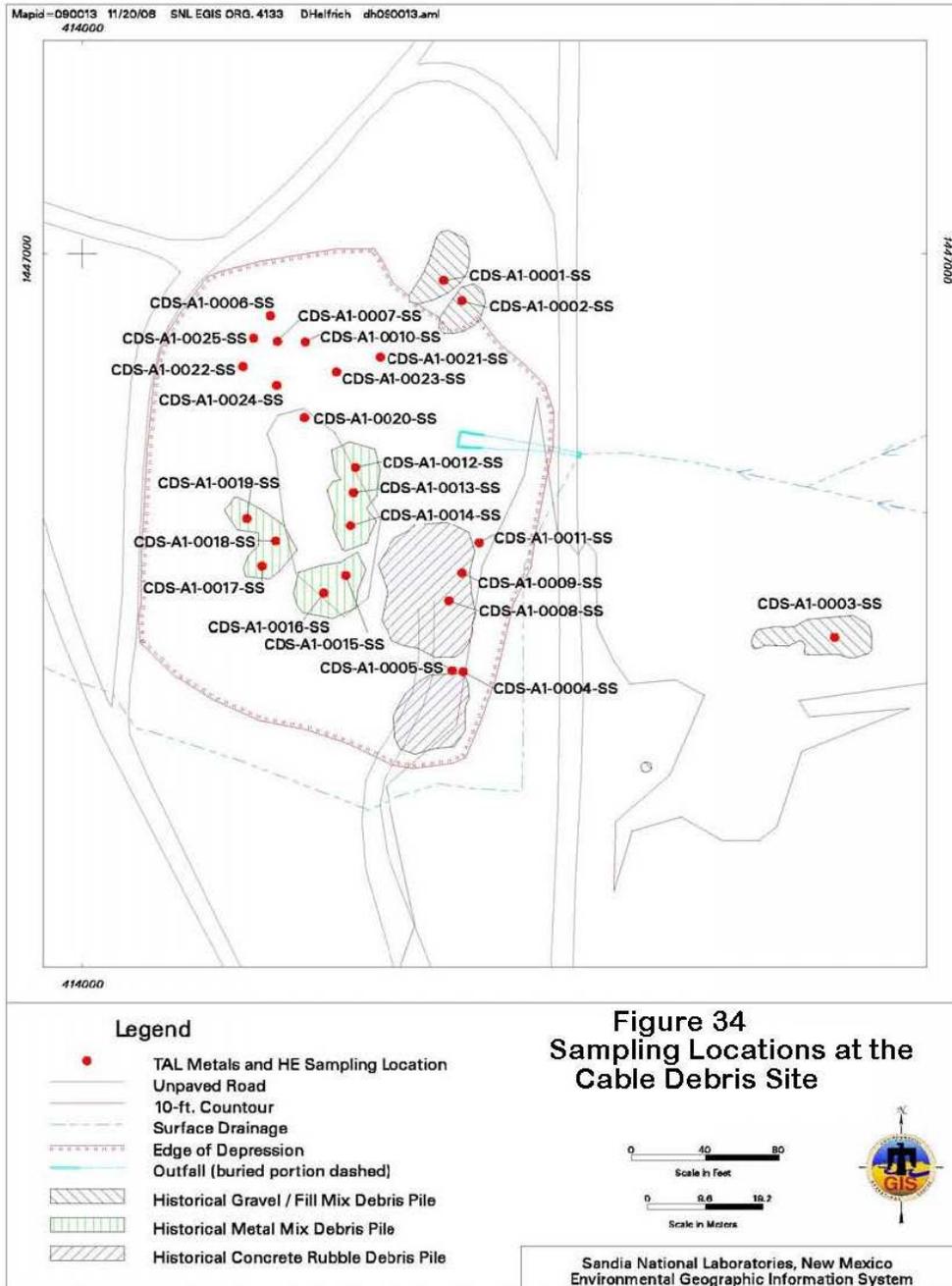
<b>Debris Type</b>	<b>Approximate Quantity</b>	<b>Unit</b>	<b>Disposition</b>
Metal	5	30 cubic yard roll off container	Recycled Offsite
Concrete Rubble	150	Tons	Recycled
Lead Fragments	1000-1500	Pounds	SNL Lead Bank
General Solid Waste	10	Cubic yards	Sanitary Landfill via the SNL Solid Waste Transfer Facility
Wood	400	Pounds	Recycled
Electrical Cable	400	Pounds	Recycled

SNL = Sandia National Laboratories/New Mexico.

Because COCs were present in concentrations or activities greater than background-screening levels or because constituents were present that did not have background-screening levels, it was necessary to perform a risk assessment for the site. The risk assessment analysis evaluated the potential for adverse health effects for the residential land-use scenario.

The maximum concentration value for lead was 2,000 milligrams per kilogram (mg/kg); this value exceeds the background value. The EPA does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. However, the NMED guidance for lead screening concentrations for construction and industrial land use scenarios is 800 mg/kg. The EPA screening guidance value for a residential land use scenario is 400 mg/kg. The 95% upper confidence level (UCL) of the mean concentration for all three land use

scenarios at the site are less than the screening values; therefore, lead is eliminated from further consideration in the human health risk assessment.



The results of the risk assessment are provided in Table 26. The total human health hazard index (HI) was 0.08 for the industrial land-use scenario, which is less than the NMED guideline of 1. The total estimated excess cancer risk was 4E-6 for the industrial land-use scenario, which is less than the NMED guideline of 1E-5.

The total human health HI was 1.01 for the residential land-use scenario, which is greater than the NMED guideline of 1. The total estimated excess cancer risk was 2E-5 for the residential land-use scenario, which is greater than the NMED guideline of 1E-5. Using the UCLs of the mean concentrations for the main contributors to risk (arsenic and iron), the total HI was reduced to 0.5 and the total estimated excess cancer risk was reduced to 1.1E-8.

### Depth to Groundwater

The regional aquifer is approximately 500 feet below ground surface.

**Table 26**  
**Risk Assessment Values for LTES 1 Nonradiological COCs**

COC	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup> (Maximum Concentration)		Residential Land-Use Scenario <sup>a</sup> (UCL Concentration)	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	6.06 J/3.8	0.02	3.8E-6	0.28	1.6E-5	Below Background <sup>b</sup>	Below Background <sup>b</sup>
Barium	245	0.00	–	0.02	–	0.02	–
Beryllium	1.13	0.00	4.9E-10	0.01	1.0E-9	0.01	1.0E-9
Chromium, total	22.6 J	0.00	–	0.00	–	0.00	–
Cobalt	8.91	0.00	4.5E-9	0.01	9.6E-9	0.01	9.6E-9
Copper	261	0.01	–	0.09	–	0.09	–
Iron	26900/14830	0.04	–	0.49	–	0.27	–
Nickel	20.3	0.00	–	0.01	–	0.01	–
Vanadium	33.2	0.00	–	0.06	–	0.06	–
Zinc	816	0.00	–	0.04	–	0.04	–
<b>Total</b>		0.08	3.8E-6	1.01	1.6E-5	<b>0.50</b>	<b>1.1E-8</b>

<sup>a</sup>EPA 1989.

<sup>a</sup>UCL concentration was below background and therefore risk was not calculated.

J = Concentration was qualified as an estimated value.

## **Basis for Determination**

The Cable Debris Site (LTES 1) has been characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use (residential).

## **J. References**

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