FACT SHEET / STATEMENT OF BASIS

Sandia National Laboratories

March 2006 Request for Corrective Action Complete
(No Further Action) Status

for

26 Solid Waste Management Units / Areas of Concern

(RCRA Permit No. NM5890110518-1)

December 2007

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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
NFA	no further action
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
PCB	polychlorinated biphenyl
pCi	picocurie(s)
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

ACRONYMS AND ABBREVIATIONS (Concluded)

RPSD	Radiation Protection Sample Diagnostics
RSI	Request for Supplemental Information
SAP	Sampling and Analysis Plan
SEM	scanning electron microscope
SERF	Sandia Engineering Reactor Facility
SNAP	Space Nuclear Program
SNL	Sandia National Laboratories/New Mexico
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
TPH	total petroleum hydrocarbons
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

Request for Corrective Action Complete (No Further Action) Status for 26 Solid Waste Management Units / Areas of Concern

Sandia National Laboratories, EPA ID No. NM5890110518

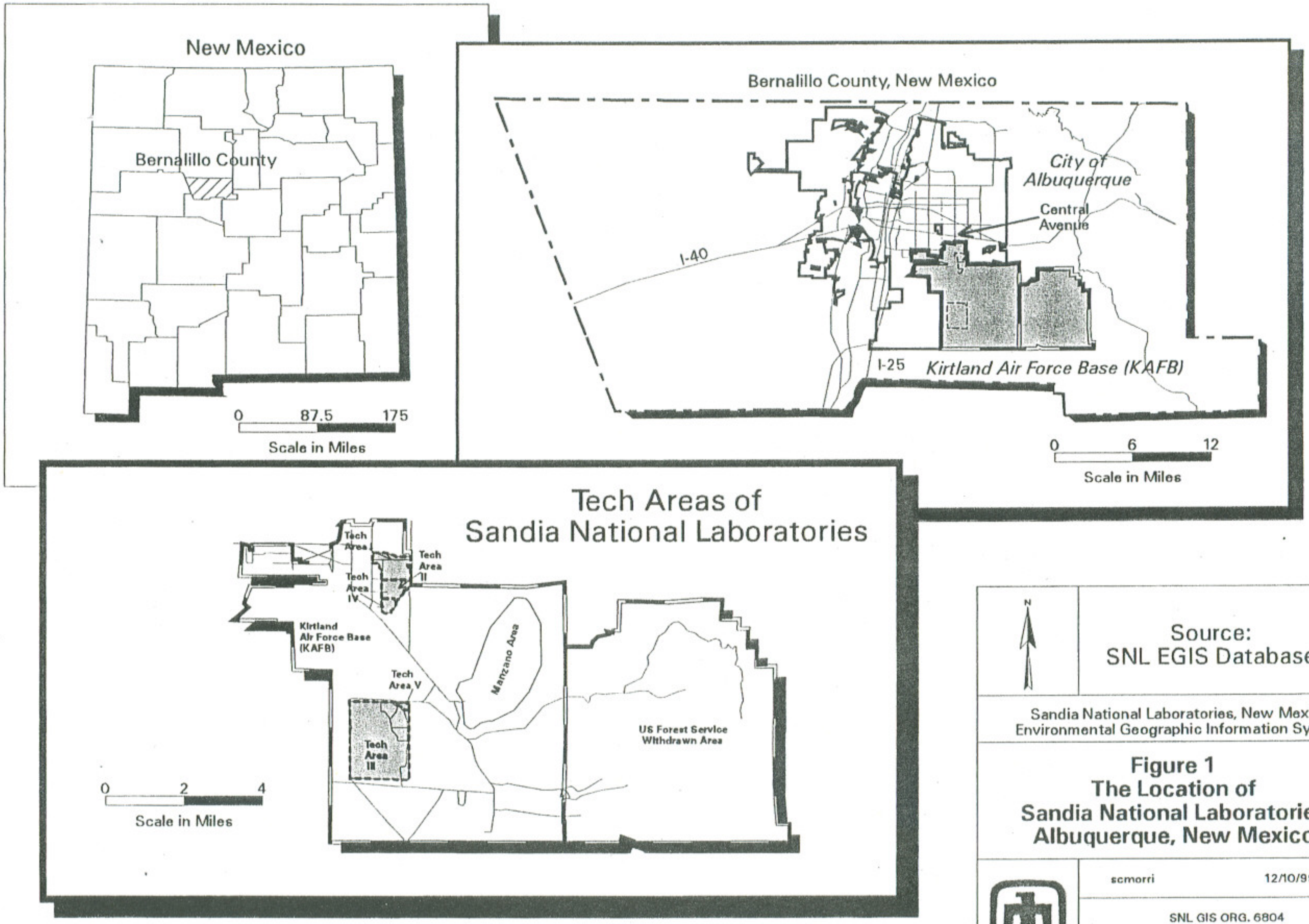
Under authority of the New Mexico Hazardous Waste Act (Section 74-4-1 et seq., NMSA 1978, as amended, 1992) and the New Mexico Hazardous Waste Management Regulations (20.4.1 NMAC), the New Mexico Environment Department (Department) can approve or deny hazardous waste permits, closure plans, permit modifications, and amendments. Under this authority, the Department intends, pending public input, to approve a March 14, 2006, Class 3 permit modification request from the U.S. Department of Energy (DOE)/Sandia Corporation (Permittees) for corrective action complete (CAC) status for 26 Solid Waste Management Units (SWMUs)/Areas of Concern (AOCs) at the Sandia National Laboratories/New Mexico (SNL) Facility. The Class 3 Permit modification request is 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' Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit (NM5890110518-1).

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 RCRA Permit

A. Facility Description

SNL is located within the boundaries of Kirtland Air Force Base (KAFB) near Albuquerque in Bernalillo County, New Mexico (Figure 1). KAFB covers 52,223 acres on a high arid mesa approximately 5 miles east of the Rio Grande. SNL occupies 2,829 acres of land owned by the DOE and an additional 14,920 acres of land provided through land-use permits with KAFB, the U.S. Forest Service (USFS), the State of New Mexico, and the Isleta Indian Reservation. Sandia Corporation, a former subsidiary of American Telephone and Telegraph (AT&T) Corporation, operated the properties for the DOE from the time of its opening in 1945 until September 1993, when Martin Marietta Corporation (now Lockheed Martin) took over operations from AT&T. Sandia Corporation is now owned by Lockheed-Martin, Inc. The Facility is owned by the DOE and co-operated by the DOE and Sandia Corporation.

SNL is engaged in research and development of conventional and nuclear weapons, alternative energy sources and a wide variety of national security related research and development. SNL consists of five technical areas (TAs) and several test areas. The primary mission of SNL is to provide engineering and testing support for nuclear weapons components and related systems. During the late 1940s, the final assembly of weapons was conducted at SNL. Since 1949, SNL has been dedicated to research, development and testing. SNL currently employs approximately 9,300 people. As a result of its testing and research activities, SNL generates hazardous, radioactive, mixed (those wastes containing both hazardous and radioactive components) and solid wastes. From 1945 to 1988 most of these wastes were disposed of at SNL at numerous



Source:
SNL EGIS Database

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Figure 1
The Location of
Sandia National Laboratories
Albuquerque, New Mexico

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SNL GIS ORG. 6804	
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locations which have been classified by the Department as SWMUs or AOCs. The SWMUs/AOCs include unpermitted landfills, septic system drainfields and seepage pits, outfalls, waste piles and test areas. Past waste management activities at SNL have caused the release of hazardous, mixed and radioactive contaminants into the environment.

SNL is located at 1515 Eubank SE, Albuquerque, New Mexico, 87123. The National Nuclear Security Administration (NNSA)/DOE Sandia Site Office (SSO) is located at KAFB-East, Pennsylvania & H Street, Albuquerque, NM 87116. The Permittee's primary contact for this action is Mr. John Gould, NNSA/SSO, DOE, P. O. Box 5400, Albuquerque, NM 87185.

B. Background

The U.S. Environmental Protection Agency (EPA) issued Module IV to the RCRA Operating 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). On January 2, 1996, the Department received authorization from the EPA for corrective action under the HSWA and became the administrative authority for this action.

The Permittees have submitted a total of 28 batches of NFA documents to EPA and/or the Department for approval. This Statement of Basis describes 26 SWMU/AOCs. Table 1 lists the regulatory correspondence related to the submittal, review and responses for each of these SWMU/AOCs. Prior to the 10th submission, all SWMU/AOCs were referred to as *ER Sites*.

If approved, the proposed modification would grant CAC (NFA) Status for 26 SWMU/AOCs. Table A.1, Module IV of the Permittees' RCRA Permit lists SWMU/AOCs at the SNL facility where corrective action is necessary to characterize and/or remediate past releases of hazardous wastes or hazardous waste constituents. Based on public comments, it is possible that CAC status will not be approved for some of the SWMU/AOCs included in this permit modification request. If any SWMU/AOCs are not approved for CAC status, their names will remain listed on Table A.1. If this modification is approved by the Department for some or all of the 26 SWMU/AOCs the listings of the approved SWMU/AOCs would be transferred from Table A.1 to Table A.2. Table A.2 lists SWMU/AOCs for which corrective action is not required.

Because of the need to restrict land use to industrial, the Department also intends to make the following change to Table A.2: the comment "controls needed" is being added to SWMU/AOCs 4, 46, 52, 68, 91, 154, 196, 234 and 1090. In addition, NMED intends to list the contaminated groundwater at Technical Area V as a SWMU on the Permittees'RCRA Permit, given the relationship of the contaminated groundwater in particular to SWMU 5 (Liquid Waste Disposal System Drainfield). SWMU 5 is among those being proposed for CAC; however, additional corrective action is required for the groundwater, which is listed in Table XI-3 of the Sandia Order on Consent (April 29, 2004) as "TA-V Groundwater". Similarly, the NMED also intends to list the contaminated groundwater at the Burn Site as a SWMU (also listed on Table XI-3 of the Order on Consent as "Burn Site Groundwater").

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 the case of this Class 3 Permit Modification request, 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).

Section I, below, briefly describes the location, history, evaluation of relevant information and the basis for determination for each of the 26 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. The CAC proposal for each SWMU/AOC is correlated to a NFA/CAC batch (refer to Table 1; a batch is a collection of corrective-action-related reports submitted on a given date).

Table 1
Regulatory Correspondence by SWMU/AOC Number

SWMU/ AOC Number	OU	Date Submitted / CAC (NFA) Batch (AOC Round)	Latest Date Submittal of NOD, RSI, or Supplemental Information	NMED Criterion for NFA Proposal
4	1307	September 1995 / LWDS RFI Report	January 2006	5
5	1307	September 1995 / LWDS RFI Report	June 2005	5
46	1309	August 1995 / 2	August 2005	5
49	1295	July 1996 / 4 (9)	June 2005	5
52	1307	September 1995 / LWDS RFI Report	June 2005	5
68	1334	September 2005 / --	March 2006	5
91	1335	June 2005 / --	June 2005	5
101	1295	July 1996 / 4 (9)	June 2005	5
116	1295	July 1996 / 4 (9)	June 2005	5
138	1295	July 1996 / 4 (9)	June 2005	5
140	1295	January 1997 / 6 (10)	September 2005	5
147	1295	May 1997 / 7 (10)	September 2005	5
149	1295	July 1996 / 4 (9)	June 2005	5
150	1295	January 1997 / 6 (10)	September 2005	5
154	1295	August 1997 / 8 (9)	January 2006	5
161	1295	July 1996 / 4 (9)	June 2005	5
196	1306	June 1996 / TA 3/5 RFI Report	October 2005	5
233	1309	August 1995 / 2	June 2005	5
234	1309	August 1995 / 2	June 2005	5
1090	1295	December 2004 / 25 (7)	December 2005	5
1094	1295	September 2005 / 28 (10)	April 2005	5
1095	1295	September 2005 / 28 (10)	April 2005	5
1114	1295	September 2005 / 28 (10)	April 2005	5
1115	1295	September 2005 / 28 (10)	April 2005	5
1116	1295	September 2005 / 28 (10)	April 2005	5
1117	1295	September 2005 / 28 (10)	April 2005	5

AOC = Area of Concern.
CAC = Corrective Action Complete

NA = Not applicable.
NFA = No Further Action.
NMED = New Mexico Environment Department.
NOD = Notice of Deficiency.
OU = Operable Unit.
RSI = Request for Supplemental Information.
SWMU = Solid Waste Management Unit.

D. Administrative Record

The Administrative Record for this proposed action consists of the SNL Permit modification request, the Statement of Basis/Fact Sheet, this Public Notice, the draft Permit that consists of the proposed Tables A.1 and A.2, and the referenced supporting documentation. 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 the Statement of Basis/Fact Sheet, the Public Notice, and the draft Permit that consists of the proposed Tables A.1 and A.2, are available electronically on the NMED website at: 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 regarding this notice or the draft permit may also contact:

Mr. John E. Kieling, Program Manager
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, in addition to further information, 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.

The 26 SWMU/AOCs are proposed for CAC by the Permittees on the basis that they were characterized and/or remediated in accordance with current applicable state or federal regulations (Criterion 5). Based on risk assessment results, future land use at SWMU/AOCs 4, 46, 52, 68, 91, 154, 196, 234 and 1090 will be restricted to industrial use only.

F. Public Participation

Twenty-eight people (including representatives from DOE, SNL and the Department) attended a public meeting arranged by the Permittees on March 22, 2006 at the Cesar Chavez Community Center. Written comments from the public included concerns that the determination of Corrective Action Complete with Institutional Controls be clarified as to type and duration; that institutional controls be placed on SWMU 116 as it lies within the boundaries of SWMU 154 which is recommended for institutional controls; that the US Forest Service be given the opportunity to review the Corrective Action Complete proposals in the Withdrawn Area; that a cost benefit analysis be performed upon each ER site; that public outreach efforts in relation to these poster sessions be improved to bring in more people, in particular those living adjacent to the ER sites such as those at Isleta Pueblo; that the assessment of potential ground water impacts from the ER sites may be inadequate due to the de-coupling of the soil impacts from potential ground water impacts by assessing regional ground water impacts and whether the Department was involved in this decision and whether efforts by SNL and KAFB to assess ground water impacts are being coordinated; and, a request for further clarification as to the difference between a SWMU and an AOC, a NFA and a CAC and as to why NFA or CAC is being proposed for sites that are still active.

NMED issues this public notice on **December 10, 2007** to announce the beginning of a 60-day comment period that will end at **5:00 p.m., February 8, 2008**. 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, February 8, 2008** will be considered.

John E. Kieling, Program Manager
Hazardous Waste Bureau - New Mexico Environment Department
2905 Rodeo Park Drive East, Bldg 1
Santa Fe, NM 87505-6303
Ref: Sandia National Laboratories – 26 SWMUs/AOCs
E-mail: john.kieling@state.nm.us

Written comments must be based on the Administrative Record. Documents in the Administrative Record need not be re-submitted if 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 proposed action, including specific references; and (4) a statement of the issues which such persons propose 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, February 8, 2007**. The NMED will provide a thirty (30) day notice of a public hearing, if scheduled.

Any person with a disability requiring assistance or auxiliary aid to participate in this process should contact Judy Bentley by 10 days prior to the end of the public comment period at the following address: New Mexico Environment Department, Room N-4030, P.O. Box 26110, 1190 St. Francis Drive, Santa Fe, New Mexico 87502-6110, (505) 827-9872. TDD or TDY users please access Ms. Bentley's number via the New Mexico Relay Network at 1-800-659-8331.

G. Next Steps

The Department must ensure that the approved final Permit will be consistent with the New Mexico Hazardous Waste Management Regulations. All written comments submitted on the draft Permit will become part of the administrative record, will be considered in formulating a final decision, and may cause the draft Permit to be modified. The Department will respond in writing to all significant public comment. The response will specify which provisions, if any, of the draft Permit have been changed in the final Permit decision, and the reasons for the change.

The response will also be posted on the Department website in addition to the Department notifying all persons providing written comments.

After consideration of all written public comments received, the Department will issue, or modify and issue, or disapprove the Permit modification. If the Department modifies the Permit, the Permittees shall be provided by mail a copy of the modified Permit and a detailed written statement of the reasons for the modifications. The Department Secretary 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 Hazardous Waste Act. All persons on the mailing list, or that provided written comments, or who requested notification in writing, will be notified of the final decision by mail.

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.E, *Hearings*.

H. Contact Person for Additional Information

For additional information, contact the following individuals:

John E. Kieling, Program Manager
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Ref: SNL – 26 No Further Actions March 2006
Email: john.kieling@state.nm.us
Telephone: (505) 476-6000
Fax: (505) 476-6030

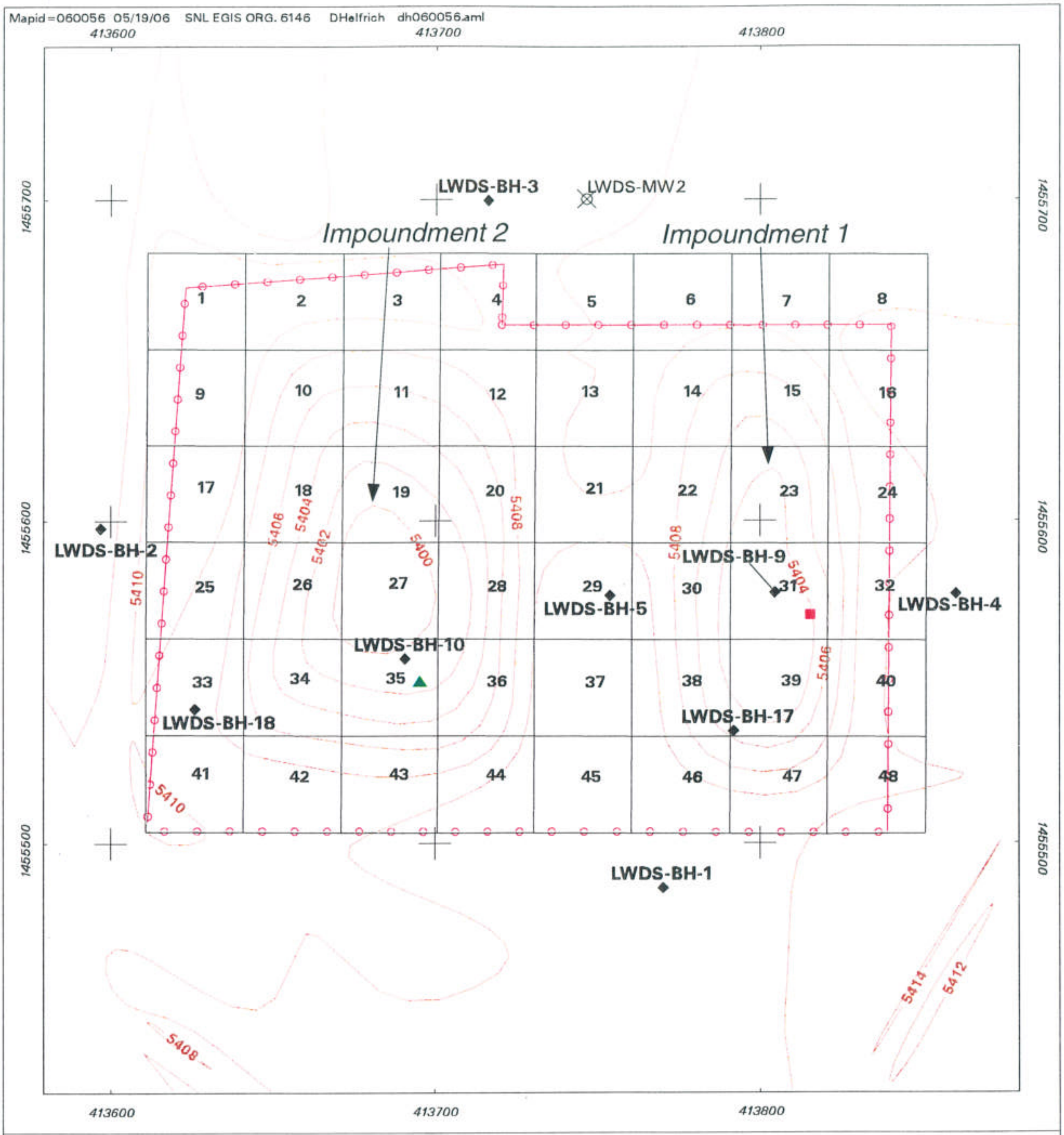
Mr. William Moats
New Mexico Environment Department
Hazardous Waste Bureau
5500 San Antonio NE
Albuquerque, New Mexico 87109
Ref: SNL – 26 No Further Actions March 2006
Email: william.moats@state.nm.us
Telephone: (505) 222-9551
Fax: (505) 222-9510

I.   Description of SWMUs and AOCs Proposed for CAC

<u>SWMU 4, LWDS Surface Impoundments/Liquid Disposal System</u>

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).



Legend

- ☒ Monitoring Well
- ◆ Borehole
- ▲ Soil Sample at Drain Outfall*
  (collected at ~ 1.5-ft bgs)
- 🟥 Hot Spot (HS) Soil Sample at Drain Outfall
  (collected at surface & ~ 1.5-ft bgs)
- –o–o–o– Fence / SWMU 4 Boundary
- —— 1992 Sample Grid (sample numbers prefixed with LWDS-SS-##)
- —— 2-ft Contour Interval

* Sample location may be incorrect.
See analytical results tables.

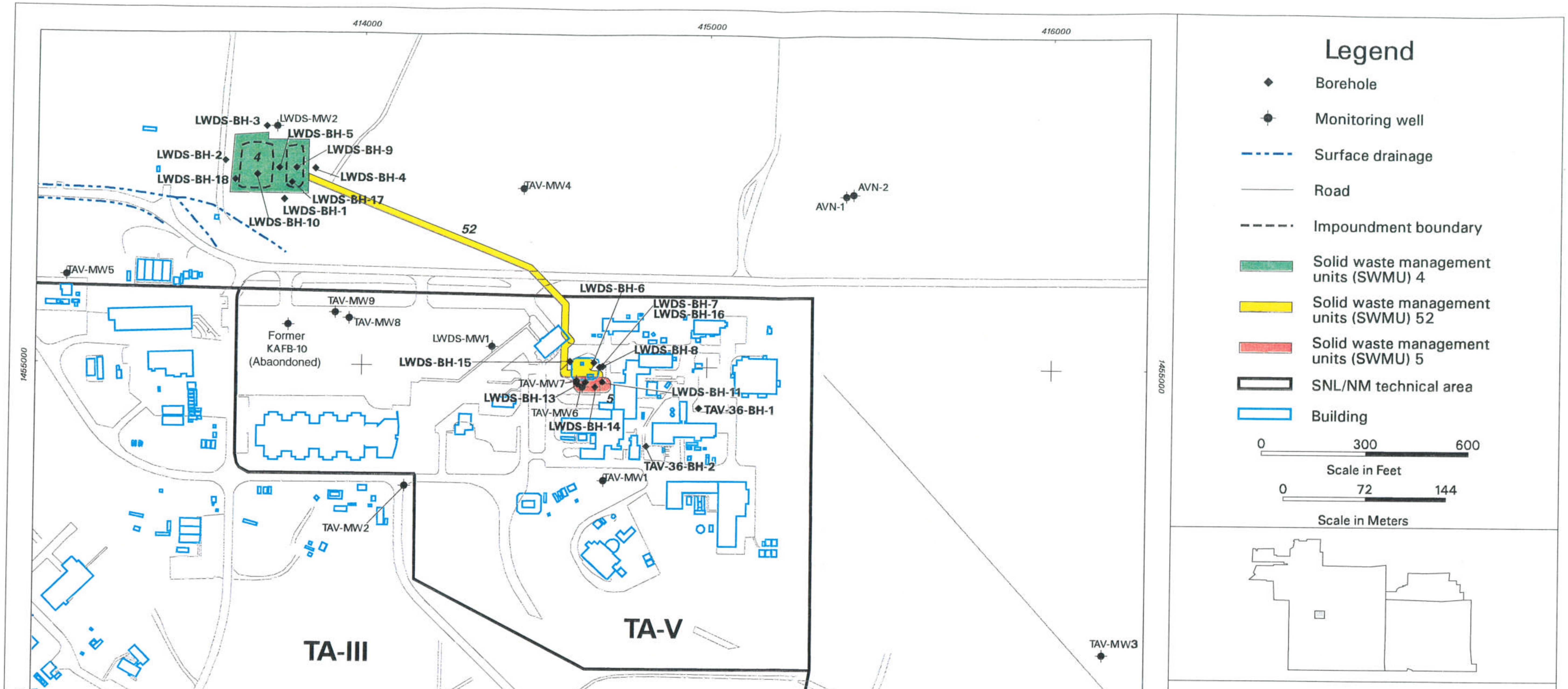
Figure 2
Site Map of SWMU 4,
LWDS Surface Impoundments

0 25 50
Scale in Feet

0 6 12
Scale in Meters

N

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Figure 3
Site Map of Liquid Waste Disposal System (SWMUs 4, 5, and 52)

Transverse Mercator Projection, New Mexico State Plane Coordinate System, Central Zone, 1927 North American Horizontal Datum, 1929 North American Vertical Datum

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		SNL GIS ORG. 6146
DHelfrich	dh60057.aml	12/21/05

Operational History

SWMU 4 consists of two unlined surface impoundments constructed to receive coolant water discharges from the Sandia Engineering Reactor Facility (SERF) and possibly contaminated waste water from experiments and operations in the SERF buildings. Beginning in 1963, radioactive discharges drained to holding tanks, were monitored and then pumped to the drainfield. The drainfield collapsed in 1967 and the unlined Surface Impoundments were built to receive effluent from the SERF. The impoundments received radioactive effluent until 1971, and continued to receive effluent from TA-V operations until 1992. From 1967 until 1980, the impoundments received approximately 12 million gallons of effluent containing approximately 14 curies of measured radioactivity.

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

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, uranuim-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.

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).

Table 2
Risk Assessment Values for SWMU 4 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Antimony	9.3	0.02		0.31	
Arsenic	7.6/**2.7**	0.03/ **Below Background[b]**	5E-6 **/Below Background[b]**	0.35/**Below Background[b]**	2E-5/**Below Background[b]**
Barium	849	0.01		0.16	
Beryllium	4.9	0.00	2E-9	0.03	5E-9
Cadmium	154/**11.1**	0.30/**0.02**	5E-8/**4E-9**	3.95/**0.28**	1E-7/**8E-9**
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	
Organic					
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/**0.34**	0.26/**0.12**		0.84/**0.39**	
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/**0.24**	6E-6/**6E-7**	6.58/**2.10**	2E-5/**2E-6**

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

[a] EPA 1989.

[b] UCL concentration was below background screening level. Therefore risk was not calculated.

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

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.

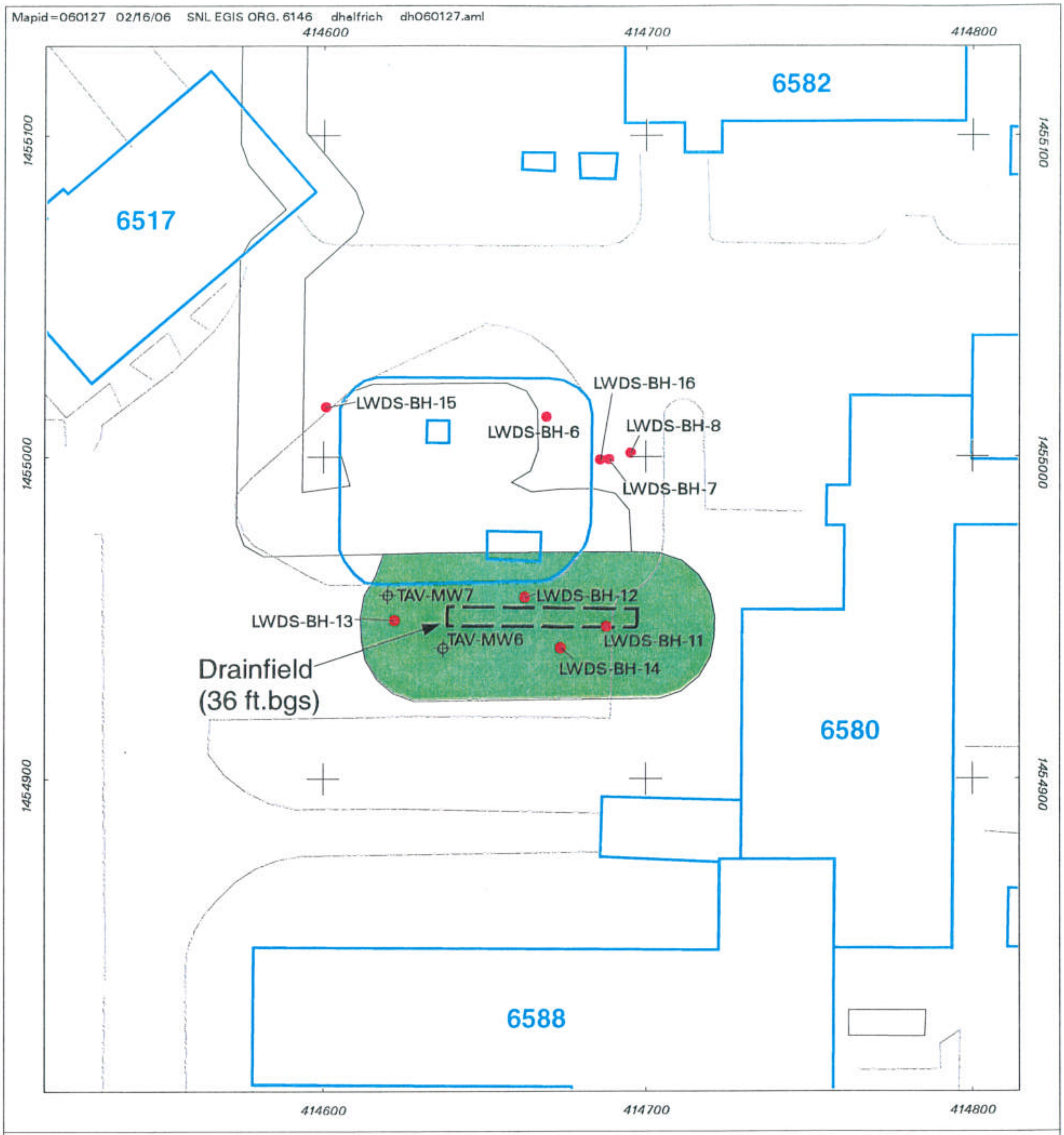
The SERF operated from 1962 to 1967. Effluent from the SERF was released to the holding tanks to allow short-lived radionuclides to decay before discharge to the Drainfield. The drainfield collapsed in 1967 and the unlined Surface Impoundments (SWMU 4) were built to receive effluent from the SERF.

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.



Legend

⌖	Monitoring Well
●	Borehole
┈┈┈	Road
──	Other SWMU Boundary
━ ━ ━	Underground Drainfield
▭	Building / Structure
🟩	SWMU 5

Figure 4
SWMU 5
Sample Locations

0 25 50
Scale in Feet

0 6 12
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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).

Table 3
Risk Assessment Values for SWMU 5 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Antimony	15[c]/**5.34**	0.04	–	0.49/**0.17**	–/–
Arsenic	5.39/**3.89**	0.02/ **Below Background**[c]	3E-6/ **Below Background**[c]	0.25/**Below Background**[c]	1E-5/**Below Background**[c]
Barium	258	0.00		0.05	
Beryllium	0.735	0.00	3E-10	0.00	7E-10
Cadmium	51.1/**9.85**	0.10/**0.02**	2E-8/**3E-9**	1.31/**0.25**	4E-8/**7E-9**
Chromium, total[b]	42.4/**18.18**	0.02/**0.01**	9E-8/**3E-8**	0.19/**0.08**	2E-7/**8E-8**
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/**1.09**	0.06/ **Below Background**[c]	–/ **Below Background**[c]	0.77/**Below Background**[c]	–/ **Below Background**[c]
Vanadium	35.7	0.01		0.07	
Zinc	67.3	0.00		0.00	
Organic					
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/**0.08**	3E-6/**5E-8**	3.23/**0.73**	1E-5/**4E-7**

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

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

[c] 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.

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 caner risk are acceptable for the residential land-use scenario.

For the radiological COCs (cesium-137, cobalt-60, thorium-232, tritium and uranuim-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 46, Old Acid Waste Line Outfall

Site Location

SWMU 46 is at the southwest corner of TA-IV (Figure 5). 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.

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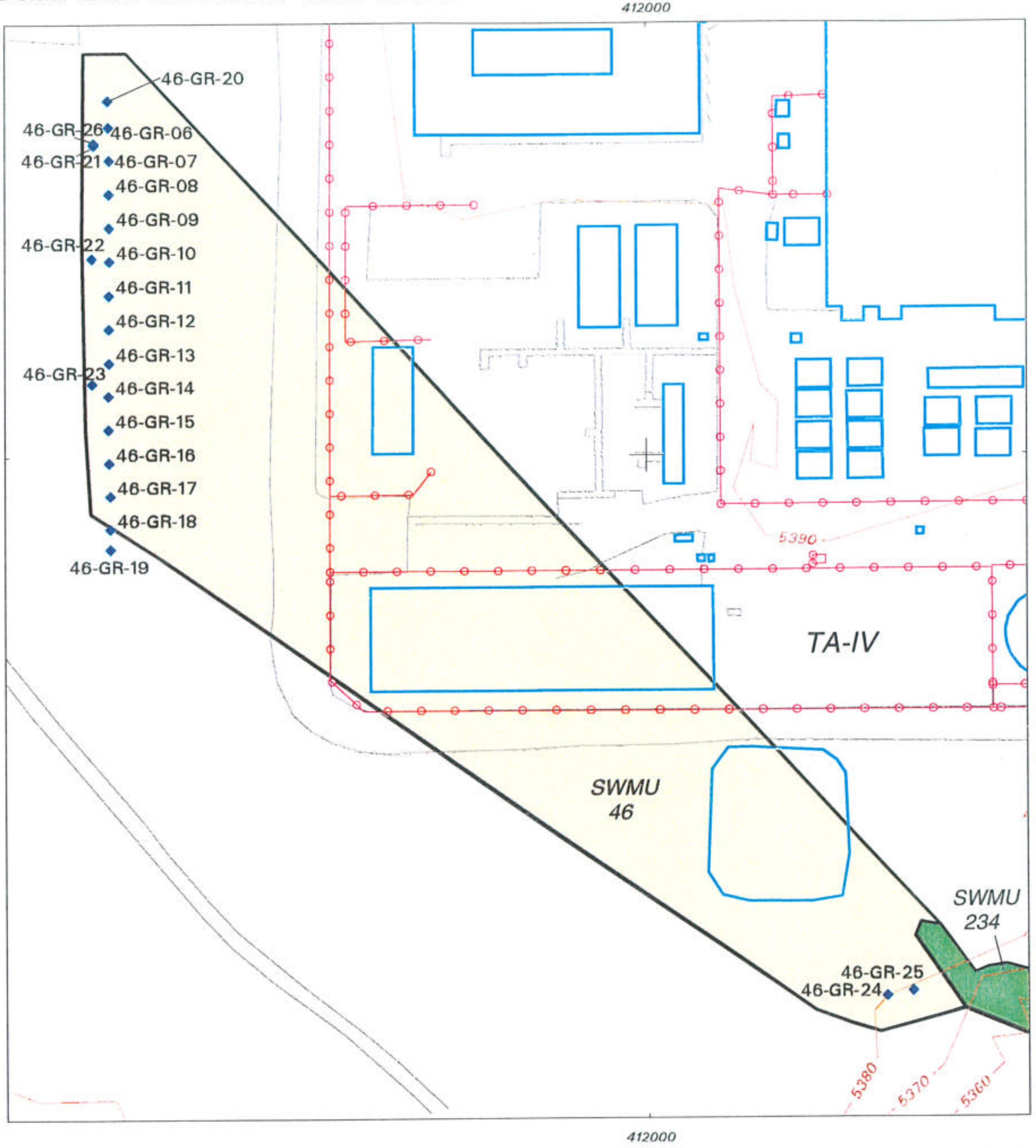


Legend

- ◆ Soil Sample Location
- o—o—o—o Fence
- ---- Pavement / Unpaved Road
- ▭ Building / Structure
- ▭ SWMU 46
- 🟩 SWMU 234

Figure 5
Confirmatory Soil Sample Locations for SWMU 46 Voluntary Corrective Action

0 50 100
Scale in Feet

0 12 24
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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 pf 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 4). For the residential land-use scenario, the total HI and excess cancer risks were unacceptable (Table 4).

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, uranuim-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.

Table 4
Risk Assessment Values for SWMU 46 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	5.23/**2.8**	0.02/ **Below Background**[b]	3E-6/ **Below Background**[b]	0.24/ **Below Background**[b]	1E-5/ **Below Background**[b]
Barium	572	0.01		0.11	
Beryllium	0.891	0.00	4E-10	0.01	8E-10
Cadmium	213/**40.6**	0.42/**0.08**	7E-8/**1E-8**	5.46/**1.03**	1E-7/**1E-7**
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/**87.5**	0.02/**0.00**		0.25/**0.03**	
Selenium	1.28	0.00		0.00	
Silver	16.2	0.00		0.04	
Thallium	2.19/**1.1**	0.03/**0.02**		0.44/**0.22**	
Vanadium	46.5	0.01		0.09	
Zinc	149 J	0.00		0.01	

Cyanide-total	12.7	0.00		0.01	
VOCs					
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	
SVOCs					
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/**0.06**	0.00/**0.00**	2E-6/**3E-7**	0.00/**0.00**	7E-6/**1E-6**
Benzo(b)fluoranthene	0.506	0.00	2E-7	0.00	8E-7
Benzo(ghi)perylene	0.309/**0.05**	0.00/**0.00**	1E-6/**2E-7**	0.00/**0.00**	5E-6/**8E-7**
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	
HE Compound					
2-Nitrotoluene	0.0152	0.00		0.00	
Total		0.52/**0.13**	7E-6/**1E-6**	6.72/**1.61**	3E-5/**4E-6**

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

[a] EPA 1989.

[b] 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.
HE = High explosive(s).
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SVOC = Semivolatile organic compounds.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compounds.

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 6).

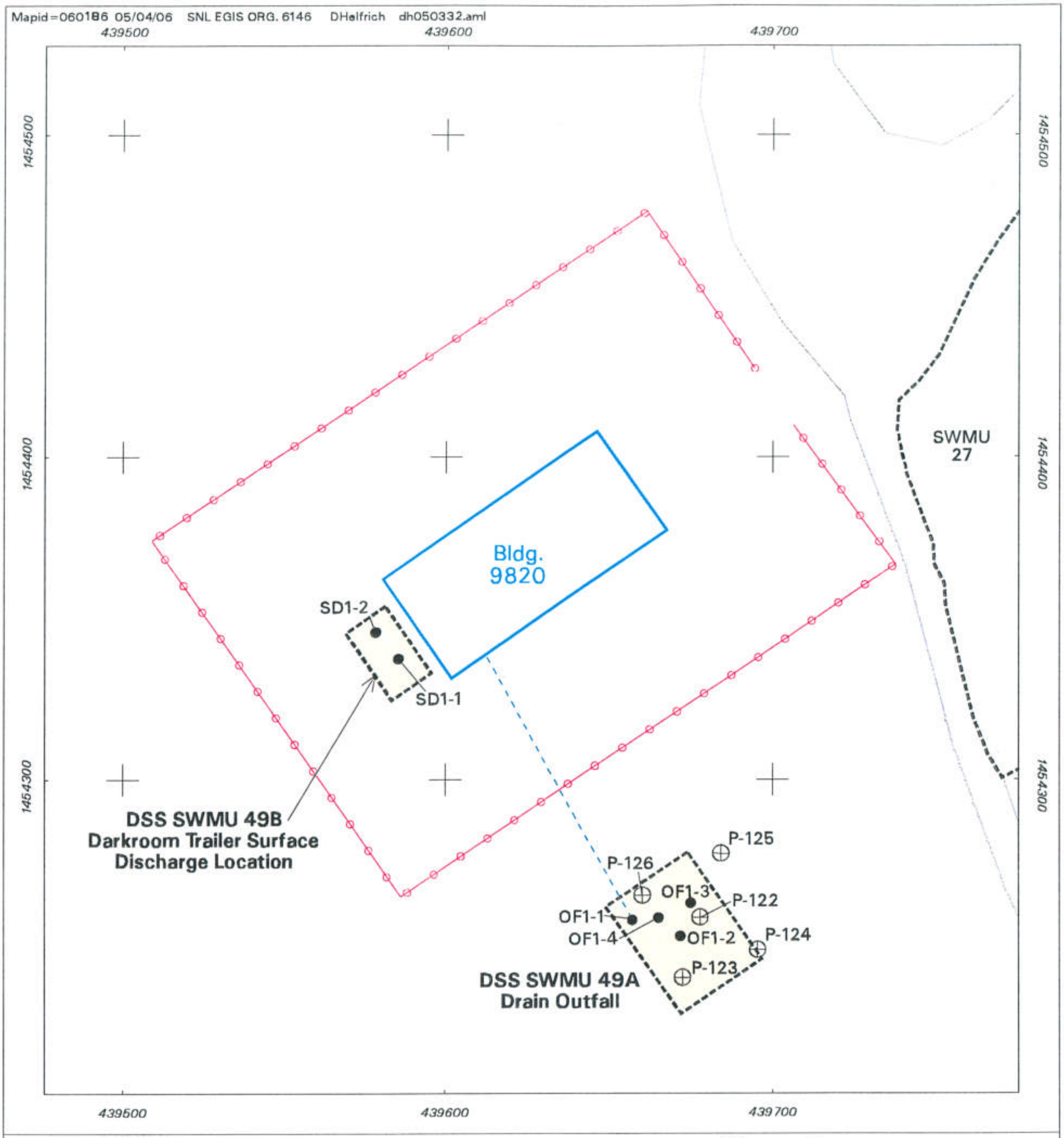
Operational History

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.



Legend

⊕	Petrex Sample Location
●	Soil Boring Location
┄	Unpaved Road
- - -	Drainline
-o-o-o-	Fence
▭	Building / Structure
▨	DSS SWMU 49

Figure 6
Site Map of Drain and Septic Systems (DSS) SWMU 49, Bldg. 9820 Drains, Lurance Canyon

0 25 50
Scale in Feet

0 6 12
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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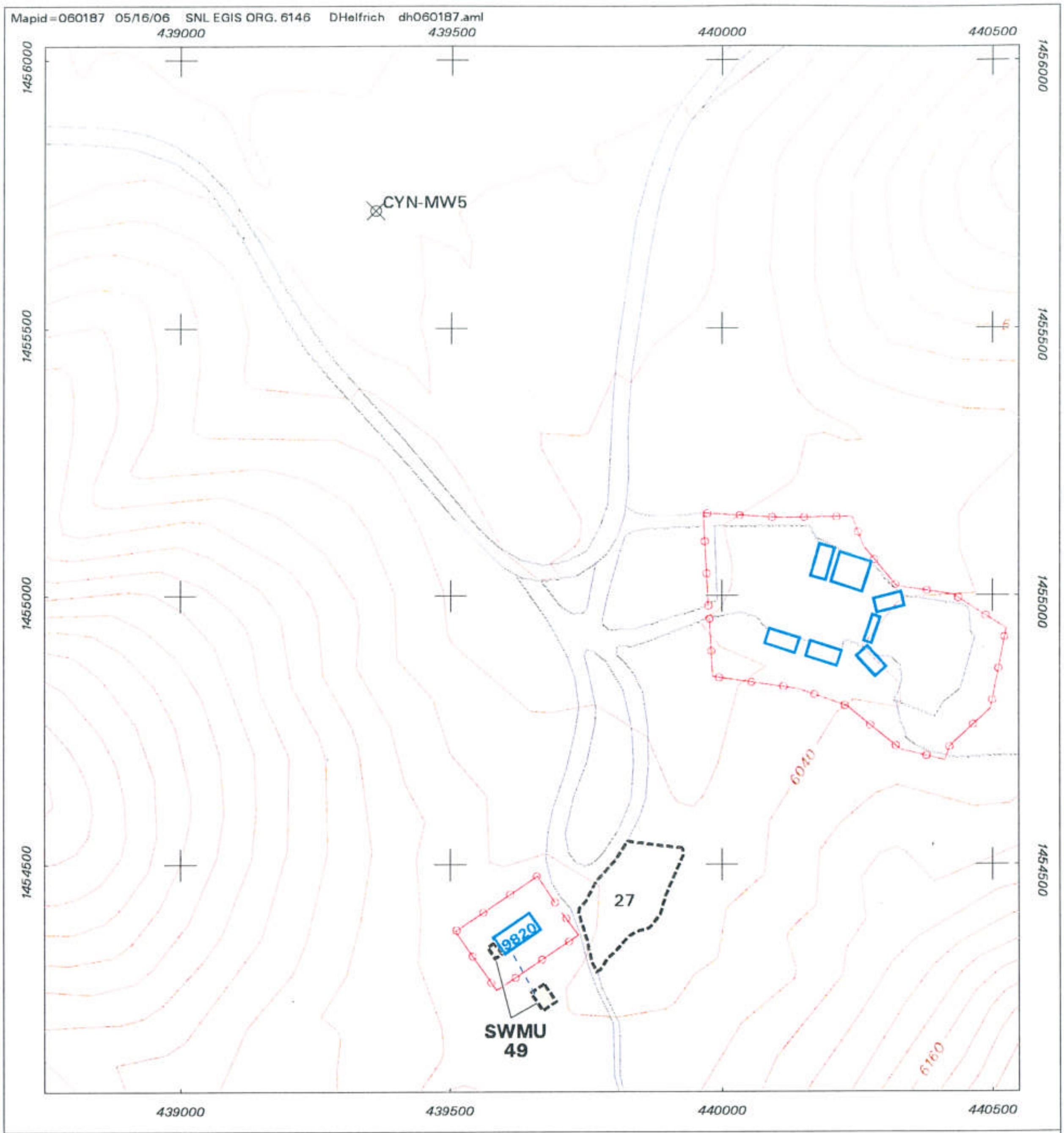

Legend

⊠	Groundwater Monitoring Well
----	Unpaved Road
----	20-ft Contour
- - - -	Drainline
o-o-o-o	Fence
----------	Other SWMU
▭	Building / Structure
▭	SWMU 49

Figure 7
Location Map of Groundwater Monitoring Well CYN-MW5 at Drain and Septic Systems (DSS) SWMU 49, Bldg. 9820 Drains
Lurance Canyon

0 150 300
Scale in Feet

0 36 72
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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 6). 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 downslope of the outfall in October 1994 (Figure 6). 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 6). 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 7) 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.

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 5).

For the radiological COCs (uranuim-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 5
Risk Assessment Values for SWMU 49 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Recreational Land-Use Scenario[a,b]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Chromium VI	0.025[c]	0.00	4E-12	0.00	1E-10
Cyanide	0.5[c]	0.00		0.00	
Mercury	0.077 J	0.00		0.00	
Silver	1.7	0.00		0.00	
Organic					
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[b]	0.00		0.00	
Total		**0.00**	**2E-9**	**0.00**	**5E-8**

[a] EPA 1989.
[b] Industrial land-use scenario results presented in error previously; this site has a designated land use of recreational.
[c] 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.

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, LWDS Holding Tanks

Site Location

SWMU 52, the LWDS Holding Tanks at SNL, 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 8).

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.

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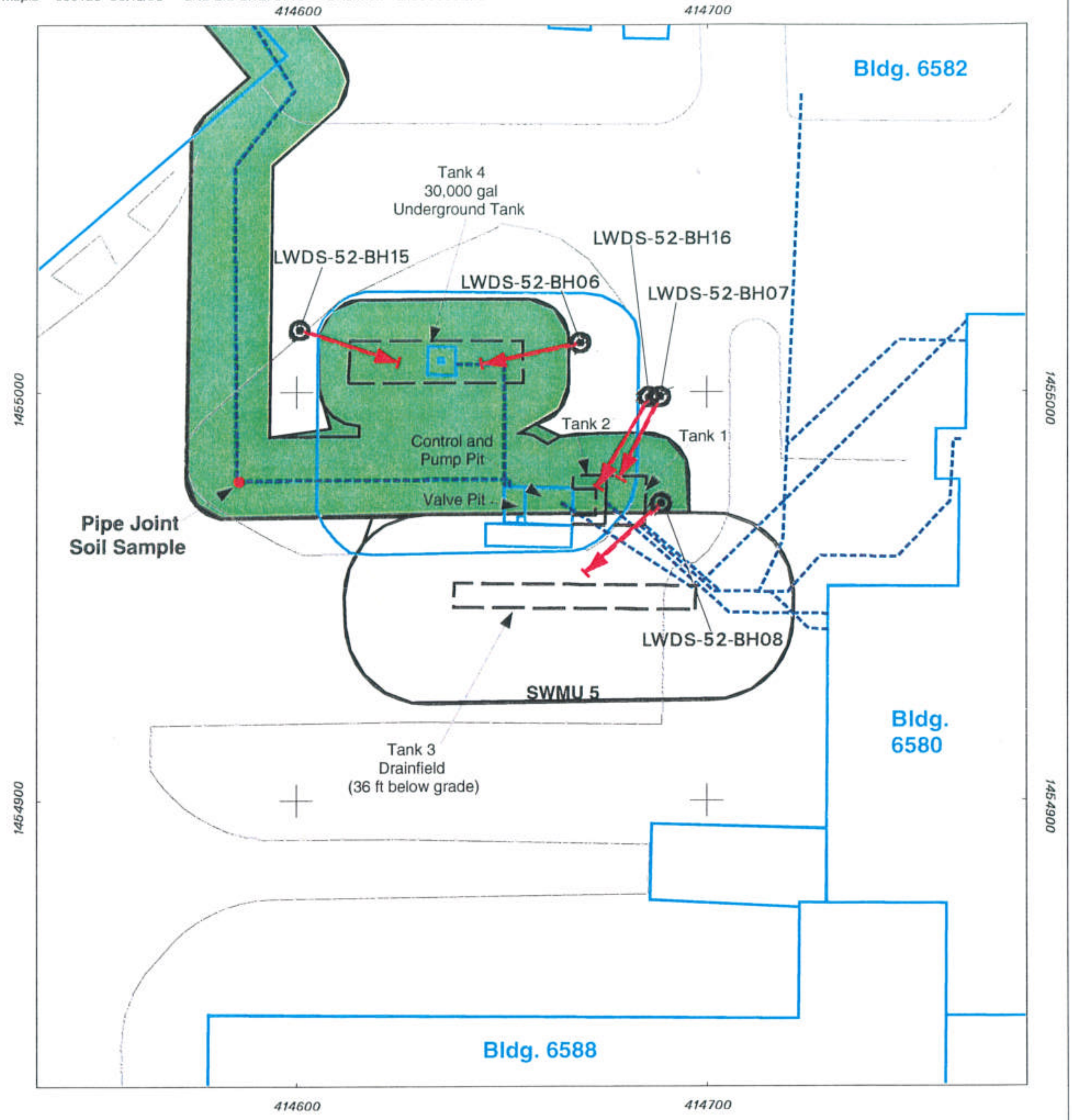

Legend

◎	30 Angled Borehole (arrow shows drilling direction and projected horizontal reach at depth)
●	Pipe Joint Soil Sample Location
—	Solid Waste Management Unit (SWMU)
—	Building / Structure
— — —	Underground Tank / Drainfield
- - - -	Road
🟩	SWMU 152
- - - - - -	Drain Line

Figure 8
Location of SWMU 52, LWDS Holding Tanks

0 20 40
Scale in Feet

0 4.8 9.6
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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 6); for the residential land-use scenario, the total HI was acceptable while the estimated excess cancer risk was unacceptable (Table 6).

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 of 2.9E-5 is not acceptable, thus future land use is restricted to industrial use.

The exposure pathway analysis established that no complete ecological pathway exists for exposure of ecological species to contaminants at SWMU 52. 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 an industrial land-use scenario.

Basis for Determination

SWMU 52 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 6
Risk Assessment Values for SWMU 52 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	6.7/**3.2**	0.03/ **Below Background**[b]	4E-6/ **Below Background**[b]	0.31/**Below Background**[b]	2E-5/**Below Background**[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[c]	28.2	0.01	6E-8	0.13	1E-7
Copper	18.4	0.00		0.01	
Mercury	0.05[d]	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	
Organic					
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/**0.03**	4E-6/**2E-7**	0.63/**0.32**	2E-5/**4E-7**

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

[a] EPA 1989.

[b] UCL concentration was below background screening level. Therefore risk was not calculated.

[c] Chromium, total assumed to be chromium VI (most conservative).

[d] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

B = Parameter was found in associated blank.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

SWMU 68, Old Burn Site

Site Location

SWMU 68, the Old Burn Site, encompasses approximately 6.5 acres on federally owned land controlled by the USAF. The site is located on the north side of Isleta Road, across from the 20-ft shock tube facility, approximately 1 mile east of the intersection of Lovelace and Isleta Roads.

Although not within the geographical boundary of SWMU 68 an area northwest of SWMU 68, designated as the 68A Mound, was administratively combined with SWMU 68 in 1996 because the debris was assumed to be associated with activities conducted at SWMU 68. Immediately south of the 68A Mound is a small, east-west trending arroyo.

Operational History

From 1965 to 1978, pool fire tests were conducted at SWMU 68 to study the effects of fire on weapons components and to determine the potential for release of radioactive material in case of a transportation (air, truck or rail) accident. The type of pool fire tests conducted was related to the development of shipping containers, space nuclear power reactors (the Space Nuclear Auxiliary Program [SNAP] reactor) and survivability of nuclear weapons.

The testing procedure included preparing the instrumentation for the fire, placing the test unit on stands within the burn pan, filling the burn pan with water and floating a defined amount of fuel on top of the water to provide the desired burn time. Magnesium scrap was also ignited in some of the burn tests involving SNAP reactors. The types of materials in the instrumentation included steel, fiberglass, asbestos and magnesium oxide. When tests were performed, all equipment was brought to the site in a trailer and a diesel generator was used for power. Water for the tests was brought by tanker truck and a USAF fuel truck delivered fuel.

Burn tests commonly lasted 30 minutes. The normal rate of burn was 0.25 inches of fuel per minute. Based upon the size of the burn pan, approximately 1,500 gallons of fuel would be used for a 30-minute test. All of the fuel was normally consumed during the test. An interviewee involved in the testing indicated that jet petroleum-4 fuel was predominantly used for the burn tests because of its availability from the USAF.

After a pool fire test was performed, the remaining water was released through the valve at the southwest corner of the burn pan and discharged into the drainage ditch, which drained to the overflow basin southwest of the burn pan. The test unit would then be recovered and returned to the project group for a post-test examination. However, in some tests, depending upon what materials were used in the test unit, the unit was taken directly to either the Chemical Waste or Mixed Waste Landfills in TA-III for disposal.

Burn tests with magnesium scrap and the SNAP reactors were conducted in the plastic-lined pit. The residual polyethylene was normally cleaned up and disposed of after the tests were completed. However, prior to investigation and remedial activities, burned remains of plastic and wooden frames were visible in the pit.

The materials for each test depended upon the item being tested. Shipping containers were tested without any weapons materials present. The containers used at the time were two basic types: one composite was made of redwood overlain by steel, and one was a lead-lined steel vessel.

Beryllium and small amounts of depleted uranium were present in some of the weapons components tested. Lead was not present in weapon components. Some of the alloys used contained thorium. A magnesium-thorium alloy was used for structural simulations.

Evaluation of Relevant Information

During 1991 to 1994, several nonintrusive investigations were conducted including a UXO/HE visual survey, a Phase I surface radiological survey, personnel interviews and a review of historical aerial photographs.

RFI confirmatory sampling took place in August, September and December 1996 and from October to November 1998. Soil samples were collected and analyzed for metals, VOCs, SVOCs and radionuclides.

A surface radiological voluntary corrective measure (VCM) was conducted during January to March 1995 and January to March 1996. VCM activities were initially based upon findings of the Phase I radiological survey. Of the sources identified during the Phase I survey, 240 point sources and 8 small area sources were remediated during the initial cleanup activities conducted from January to March 1995.

From January to March 1996, resurveying (scanning) was performed on 6-ft centers (100-percent coverage) and point and area sources identified during this resurvey were removed during cleanup activities. Cleanup activities included radiation scanning to verify anomaly location, removal of fragment and / or soil until readings were at levels less than 1.3 times site-specific background levels and post-cleanup (verification) soil sampling for gamma spectroscopy analysis. After the removal of soil contaminated with radionuclides, seven post-cleanup (verification) samples were collected. Samples were collected in the immediate vicinity of point sources and at a frequency of one in every ten locations from area sources exhibiting the highest residual gamma radiation readings.

The cleanup activities conducted from January to March 1995 and from January to March 1996 produced 15 drums of soil, 2 drums of metal fragments and 3 drums of PPE. All waste streams were characterized as low-level radioactive waste and disposed of at an approved off-site facility.

Radiological VCM activities were continued from May to June 1998 to complete remediation of area source anomalies. During the remediation of area sources, buried debris and other materials were identified. An area approximately 30 by 36 by 4 ft was excavated resulting in 144 drums, 100 cy of soil, and 5 to 10 cy of contaminated scrap metal pieces, concrete, wire and other debris. The drums were disposed of off site as low-level radioactive waste.

At the conclusion of the radiological VCM, geophysical surveys were conducted around the burn pan and surrounding area to detect possible locations of additional buried waste. The 68A Mound was also surveyed. No anomalies were identified.

RFI confirmatory sampling took place in August, September and December 1996 and from October to November 1998. Samples were analyzed for metals, VOCs, SVOCs and radionuclides. Arsenic, barium, beryllium, chromium, lead, nickel, thallium and vanadium were detected above background values. Some of the lead concentrations in the overflow basin exceeded the Department-approved industrial concentration for lead of 750 mg/kg. Six VOCs and five SVOCs were detected. Some samples had detections of cesium-137, thorium-232, uranium-235 and uranium-238 above background activities.

In 2004, a VCM was conducted to remove the soil from the overflow basin with elevated lead concentrations, the burn pan and earthen berm surrounding it and man-made objects remaining on the site. Approximately 425 cy of lead-contaminated soil from the overflow basin was excavated and disposed of off-site as hazardous waste. A concrete pad (12.5 by 11.5 ft by 1 ft deep) at the base of the basin was uncovered, broken into manageable pieces and disposed of as construction debris. The final excavation of the overflow basin measured approximately 61 by 44 by 3.5 ft deep. Fifteen confirmatory soil samples were collected from the excavation floor and sidewall. The samples were analyzed for lead and SVOCs. None of the samples had detections above the Department-approved industrial concentration for lead of 750 mg/kg. No SVOCs were detected in any of the samples. The soil from the earthen berm was spread over the ground surface to a thickness of less than 6 inches and then surveyed for radiological anomalies. Approximately 1/8 cy of low-level, radiologically-contaminated soil was identified and disposed of at an appropriate off-site facility. The burn pan was then disassembled and the concrete pad beneath the burn pan was broken into manageable pieces. All test debris was disposed of as solid waste based upon radiological survey results. Six confirmatory soil samples were collected for gamma spectroscopy analysis. No radionuclides were detected above background values. However, although not detected, the MDAs for uranium-235 and uranium-238 exceeded the background values. The 2004 VCM also consisted of housekeeping measures to remove any man-made objects from the site. All scrap wood, concrete chunks, plastic, fencing, cardboard, and burn test debris were collected and sent off site as solid waste. As a final measure, the disturbed areas were graded and reseeded.

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 risk were acceptable (Table 7). For the residential land-use scenario, the total HI and estimated excess cancer risk were unacceptable (Table 7).

Using the UCL of the mean concentration for arsenic, the main contributor to excess cancer risk and hazards, the total HI and excess cancer risk are acceptable.

For the radiological COCs (cesium-137, thorium-232, uranuim-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 3.2 millirem (mrem)/year (yr). The estimated excess cancer risk of 4.3E-5 is not acceptable for residential land use for radiological contaminants.

Ecological risks associated with SWMU 68 were estimated through a risk assessment that incorporates site-specific information when available. Initial predictions of potential risk to plants and deer mice 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. Predictions of potential risk to the deer mouse from exposures to metals can also be attributed to conservative exposure assumptions. Based upon this final analysis, the potential for ecological risks associated with SWMU 68 is expected to be low.

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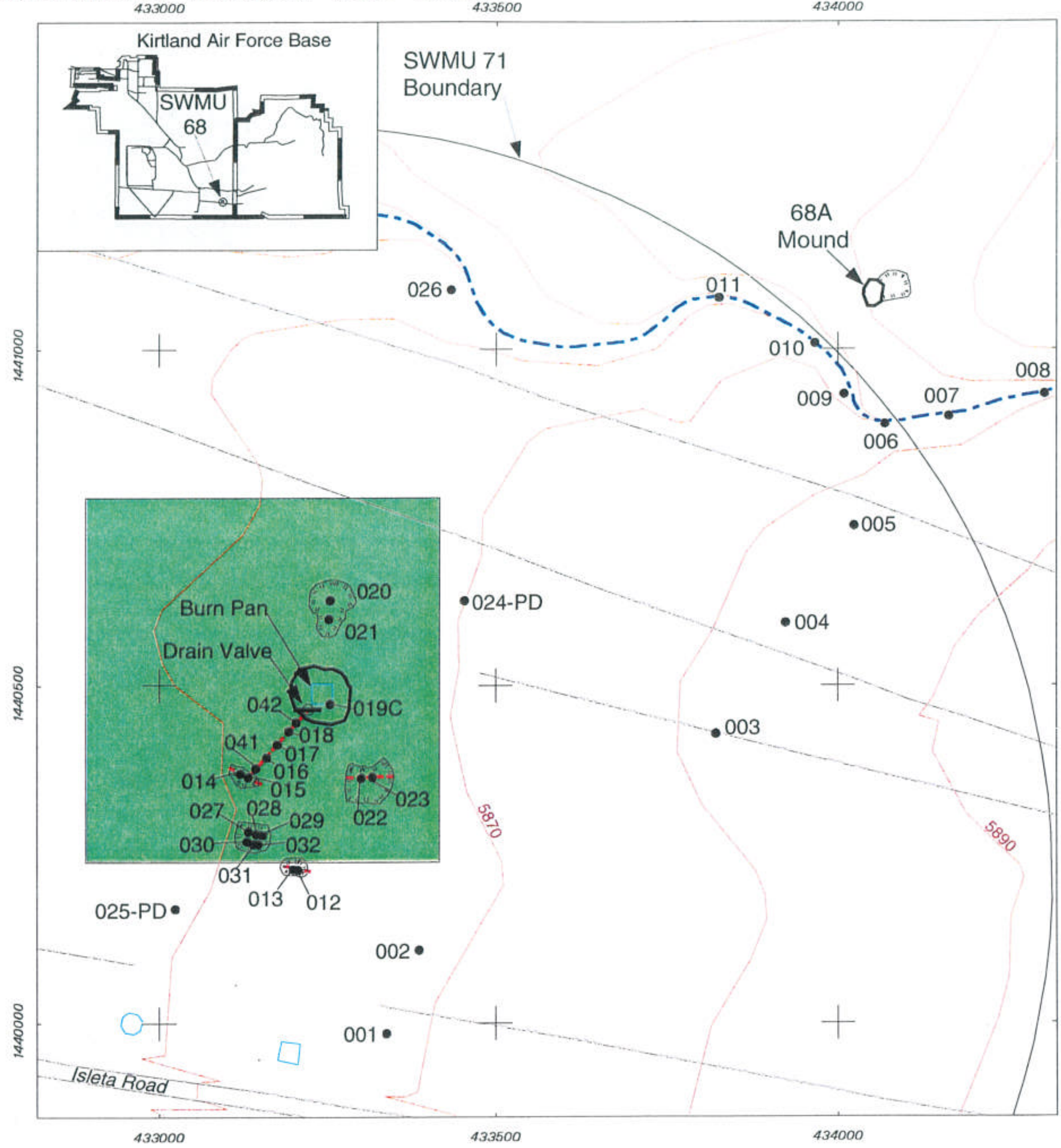

Legend

- ● 001 Sampling Location & Identification
- Drain Valve
- Road
- 10 Foot Contour
- Concrete or Asphalt Pad
- Mound Outline
- Pit/Depression Outline
- Trench
- Surface Drainage
- 🟩 SWMU 68

Figure 9
SWMU 68 RFI
Sampling Locations

0 125 250
Scale in Feet

0 30 60
Scale in Meters

GIS

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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

Table 7
Risk Assessment Values for SWMU 68 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	13.4/**5.04**	0.05/**Below Background**[b]	8E-6/**Below Background**[b]	0.62/**Below Background**[b]	3E-5/ **Below Background**[b]
Barium	429	0.01		0.08	
Beryllium	1.3	0.00	6E-10	0.01	1E-9
Chromium, total	17.6	0.00		0.00	
Cobalt	6.6	0.00	3E-9	0.00	7E-9
Nickel	15.2	0.00		0.01	
Thallium	1.8	0.03		0.36	
Vanadium	24.7	0.00		0.05	
Organic					
Acetone	0.11 J	0.00		0.00	
Benzene	0.055	0.00	4E-8	0.00	9E-8
Benzoic acid	1.12	0.00		0.00	
Bromomethane	0.0036 J	0.00		0.00	
2-Butanone	0.012 J	0.00		0.00	
Chloromethane	0.005 J	0.00	2E-9	0.00	4E-9
Diethylphthalate	0.93	0.00		0.00	
Di-n-butyl phthalate	0.067 J	0.00		0.00	
2,4-Dinitrotoluene	5.1	0.00		0.04	
bis(2-Ethylhexyl) phthalate	0.1495[c]	0.00	8E-10	0.00	3E-9
Methylene chloride	0.0304	0.00	2E-7	0.00	4E-7
Total		0.10/**0.05**	9E-6/**2E-7**	1.18/**0.56**	4E-5/**5E-7**

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

[a] EPA 1989.

[b] UCL concentration was below background screening level. Therefore risk was not calculated.

[c] 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.

Basis for Determination

SWMU 68 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 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

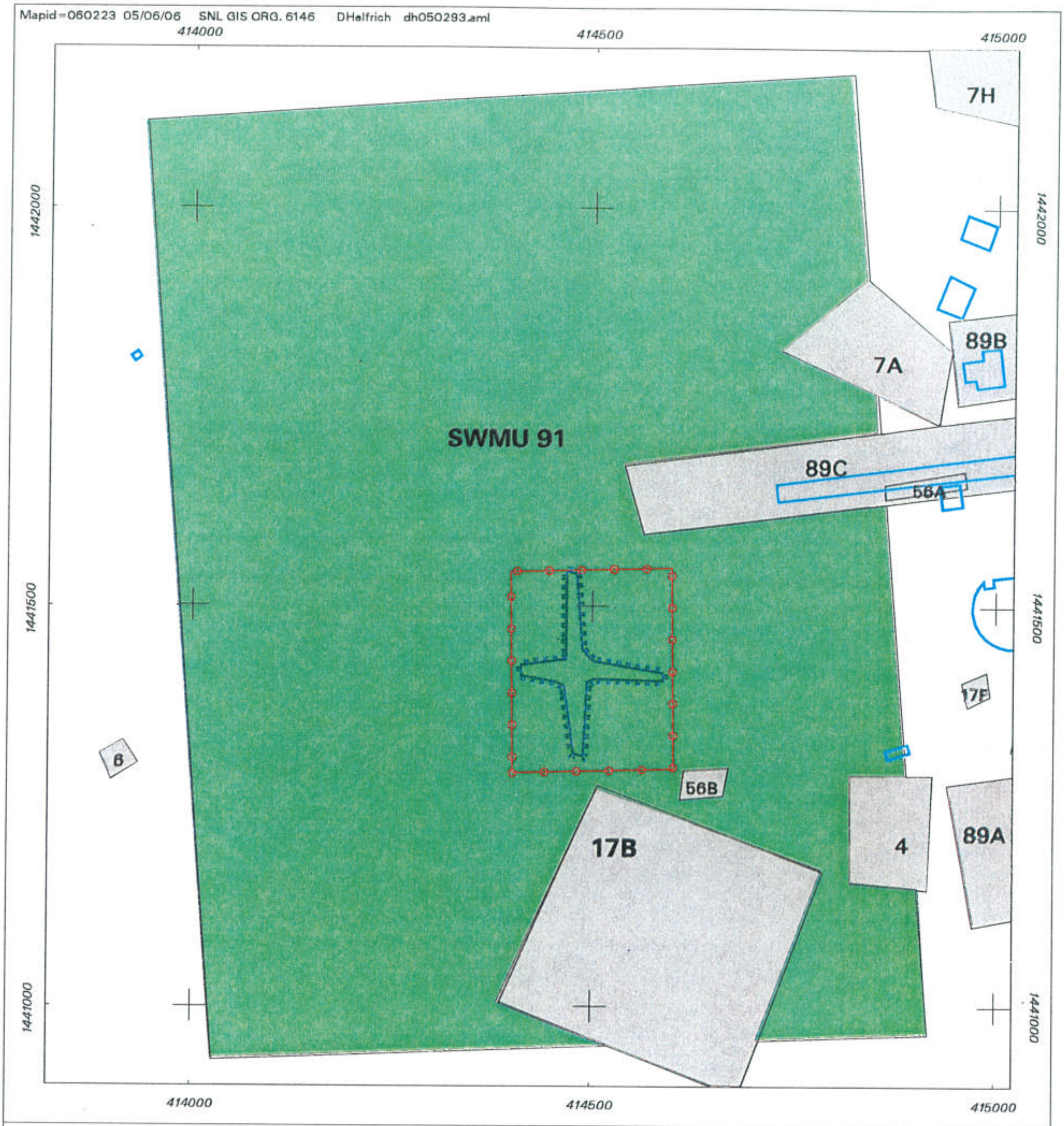

Figure 10
SWMU 91 and
other Near by SWMU's

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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.

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, uranuim-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.

Table 8
Risk Assessment Values for SWMU 91 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	86 J/**14.5**	0.34/**0.06**	5E-5/**9E-6**	3.97/**0.67**	2E-4/**4E-5**
Barium	250	0.00		0.05	
Beryllium	3.1	0.00	1E-9	0.02	3E-9
Cadmium	5[b]	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/**0.10**	5E-5/**9E-6**	4.57/**1.26**	2E-4/**4E-5**

Note: UCLs are calculated only for risk drivers. UCL concentrations and associated risk are in **bold**.
[a] EPA 1989.
[b] 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 = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

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.

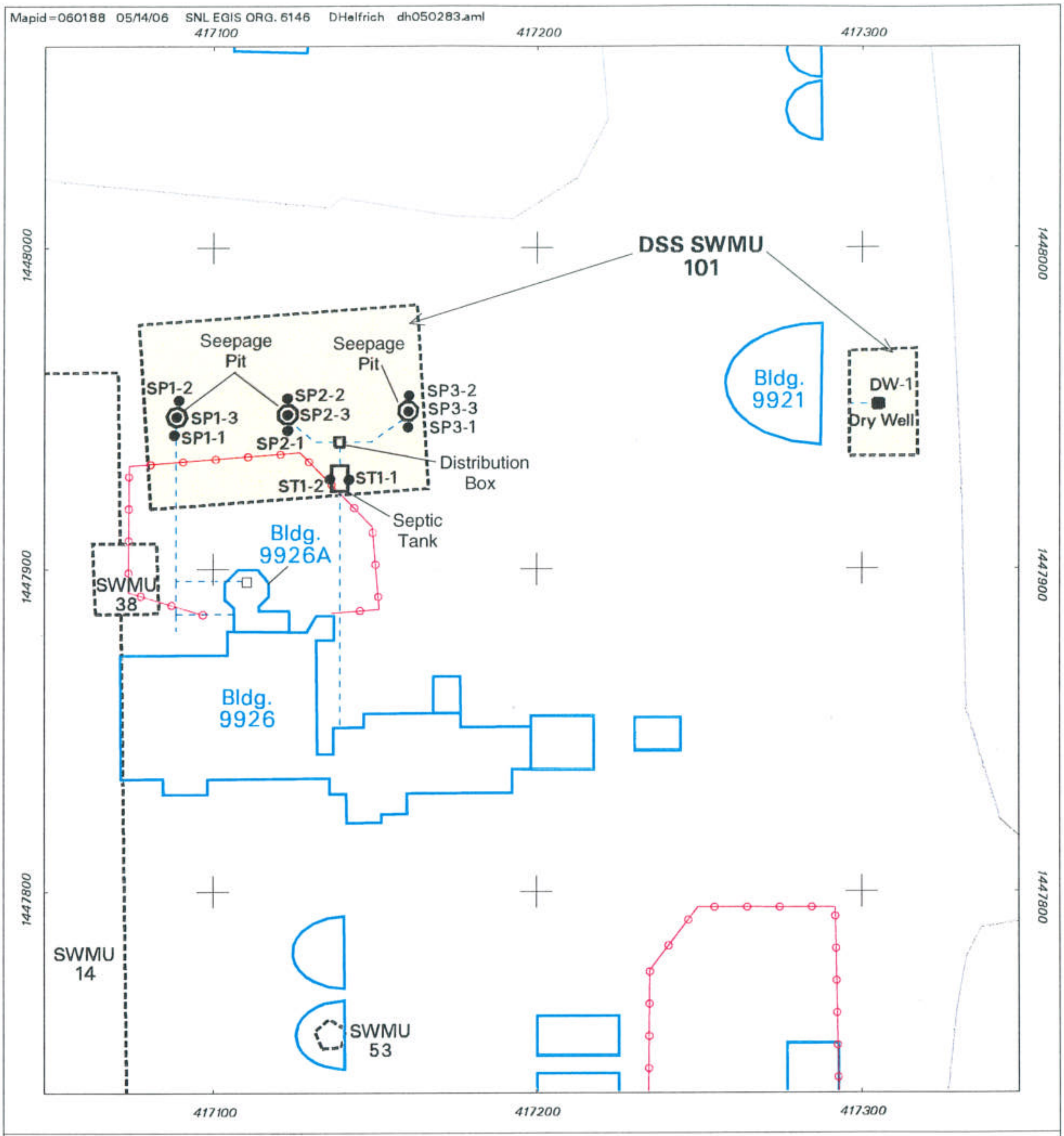
Evaluation of Relevant Information

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.



Legend

- ● Soil Boring Location
- Unpaved Road
- Fence
- Septic Tank, Dry Well
- Drainline, Sanitary Sewerline
- Building / Structure
- Other SWMU Boundary
- DSS SWMU 101

Figure 11
Site Map of Drain and Septic Systems (DSS) SWMU 101, Bldg. 9926 Explosive Contaminated Sumps and Drains, Coyote Test Field

0 25 50
Scale in Feet

0 6 12
Scale in Meters

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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^{TM} 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, uranuim-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.

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.

Table 9
Risk Assessment Values for SWMU 101 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
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	
Organic					
Acetone	0.014	0.00		0.00	
Chloromethane	0.0083	0.00	3E-9	0.00	7E-9
Chrysene	0.165[b]	0.00	8E-10	0.00	3E-9
Methylene Chloride	0.0088 J	0.00	6E-8	0.00	1E-7
Phenanthrene	0.165[b]	0.00		0.00	
Toluene	0.011	0.00		0.00	
Total		0.00	6E-8	0.00	1E-7

[a] EPA 1989.

[b] 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.

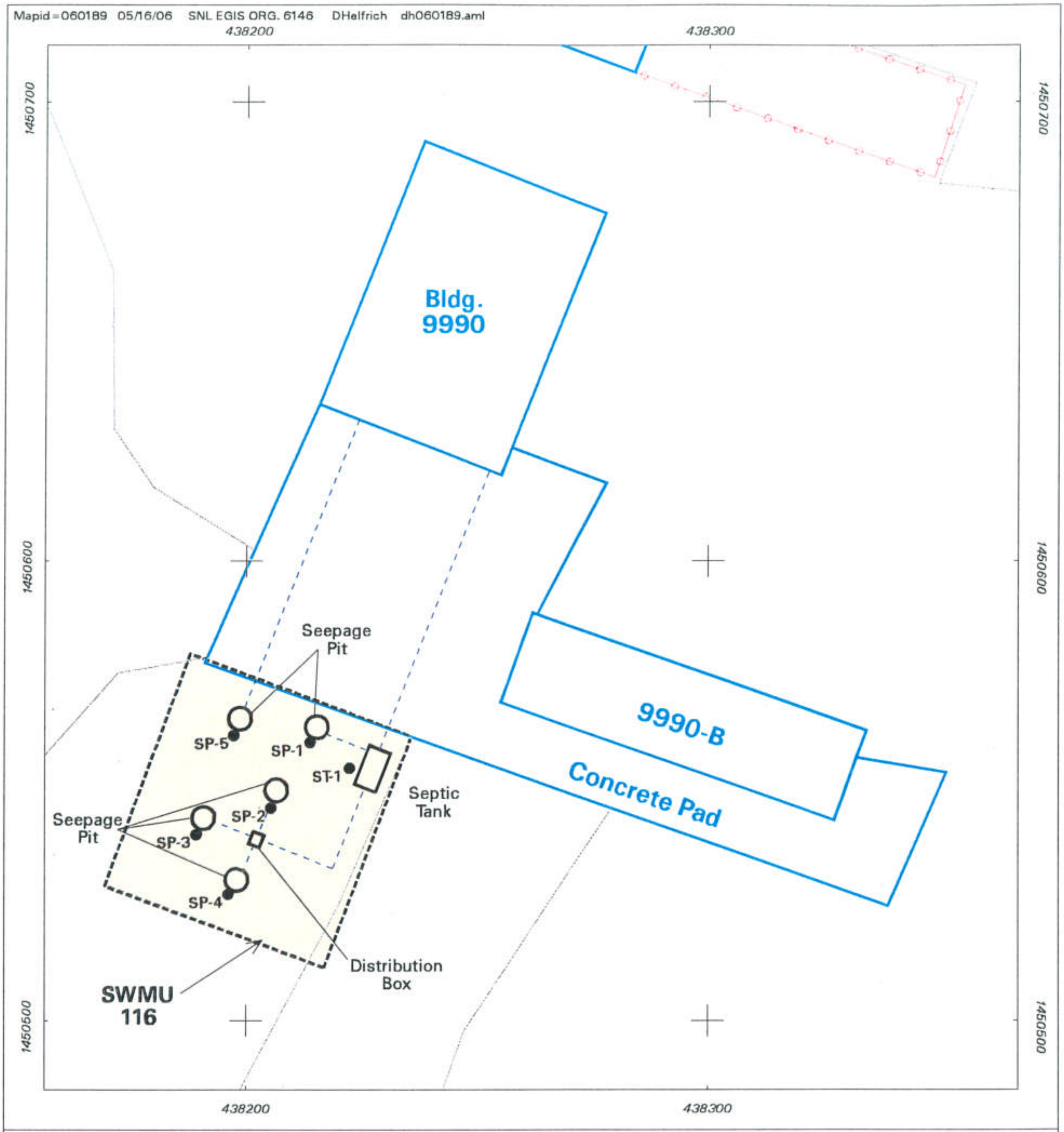
SWMU 116, Building 9990 Septic System

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. 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 (Figure 12).

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.



Legend

●	Sampling Location
o—o—o—o	Fence
······	Unpaved Road
━━━	Septic Tank, Seepage Pit, Distribution Box
- - - -	Sanitary Sewerline, Drainline
━━━	Building / Concrete Pad
▭	SWMU 116

Figure 12
Site Map of Drain and Septic Systems (DSS) SWMU 116, Bldg. 9990 Septic System Coyote Test Field

0 17.5 35
Scale in Feet

0 4.2 8.4
Scale in Meters

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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^{TM} 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 12). 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 (Figure 13) 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.

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.

Table 10
Risk Assessment Values for SWMU 116 Nonradiological COCs

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

[a] EPA 1989.

[b] 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 = Estimated concentration.
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 both the industrial and residential land-use scenarios, the total human health HIs and estimated excess cancer risks are acceptable (Table 10).

For the radiological COC (uranuim-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.

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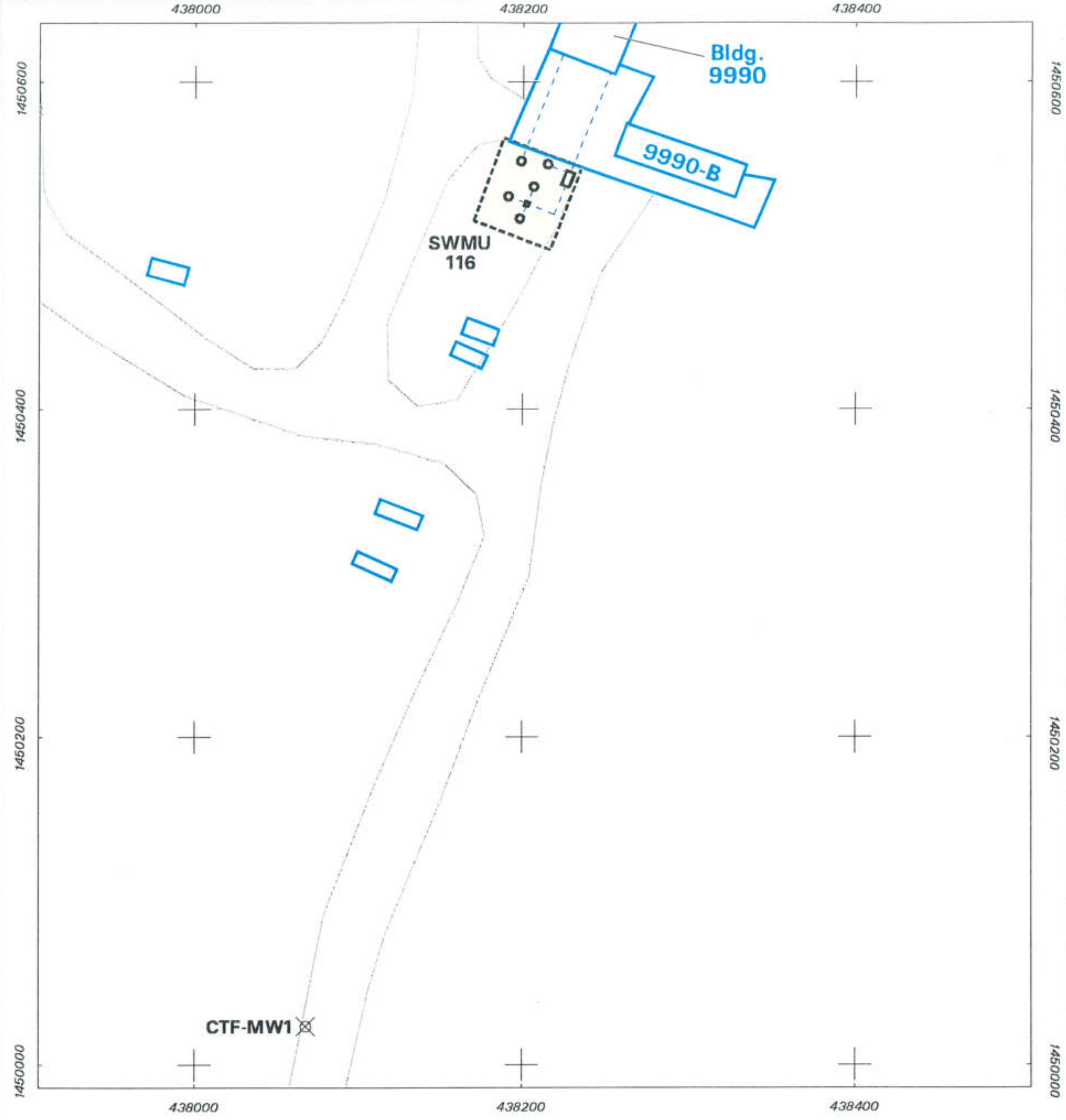

Legend

- ⊠ Groundwater Monitoring Well
- ┈ Unpaved Road
- ━ Septic Tank, Seepage Pit, Distribution Box
- ╌ Sanitary Sewerline, Drainline
- ━ Building / Concrete Pad
- ▭ SWMU 116

Figure 13
Location Map of Groundwater
Monitoring Well CTF-MW1 at
Drain and Septic Systems (DSS) SWMU 116,
Bldg. 9990 Septic System
Coyote Test Field

0 50 100
Scale in Feet

0 12 24
Scale in Meters

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Environmental Geographic Information System

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 14).

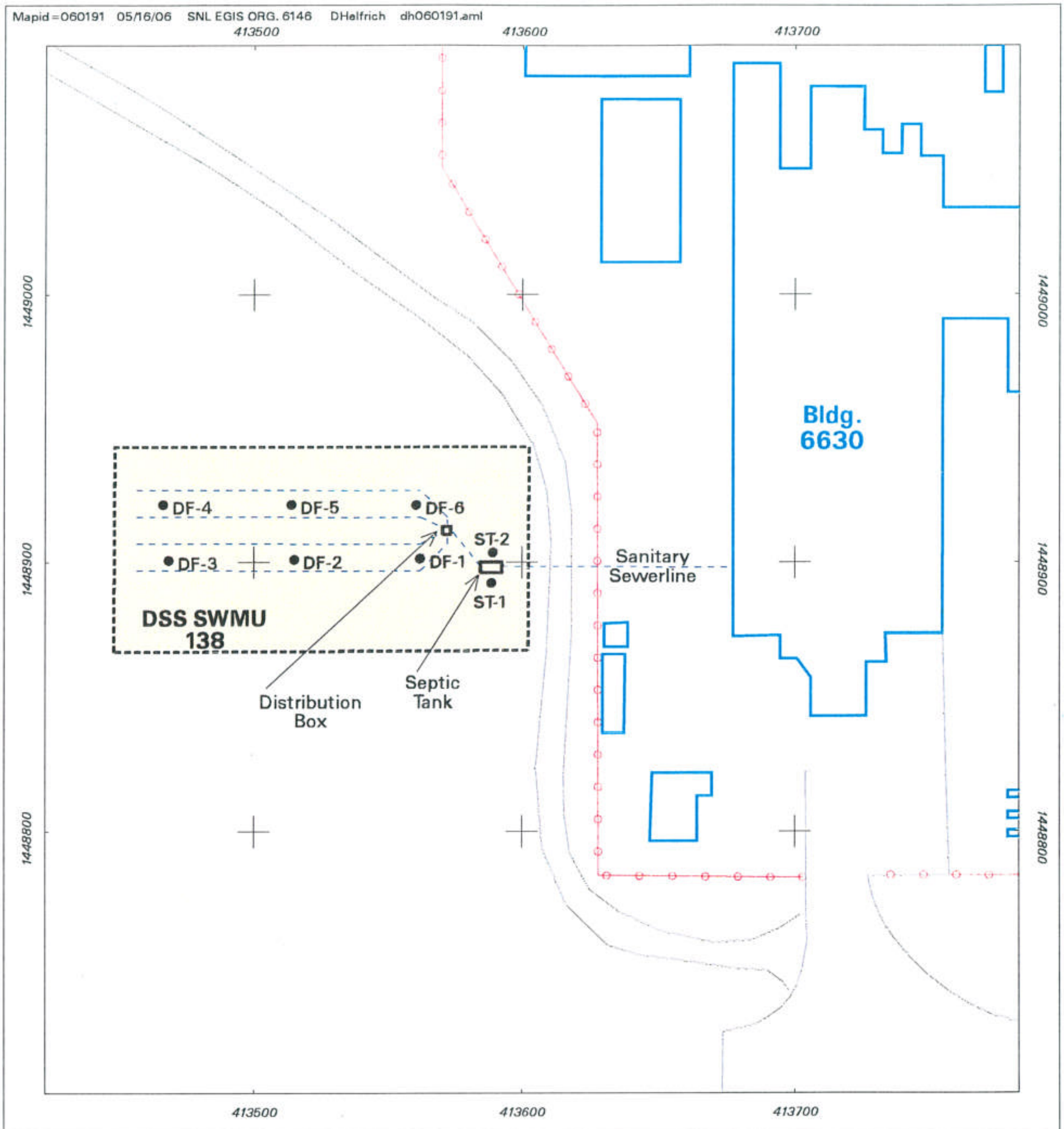
Operational History

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.



Legend

●	Soil Boring Location
▬	Septic Tank, Distribution Box
- - - -	Sanitary Sewer line, Drain line
o—o—o—o	Fence
—	Road
▬	Building / Structure
▭	DSS SWMU 138

Figure 14
Site Map of Drain and Septic Systems (DSS) SWMU 138, Bldg. 6630 Septic System, TA-III

0 30 60
Scale in Feet

0 7.2 14.4
Scale in Meters

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Environmental Geographic Information System

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.

Table 11
Risk Assessment Values for SWMU 138 Nonradiological COCs

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

[a] EPA 1989.

[b] 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 = Estimated concentration.
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 both the industrial and residential land-use scenarios, the total human health HIs and estimated excess cancer risks are acceptable (Table 11).

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 15).

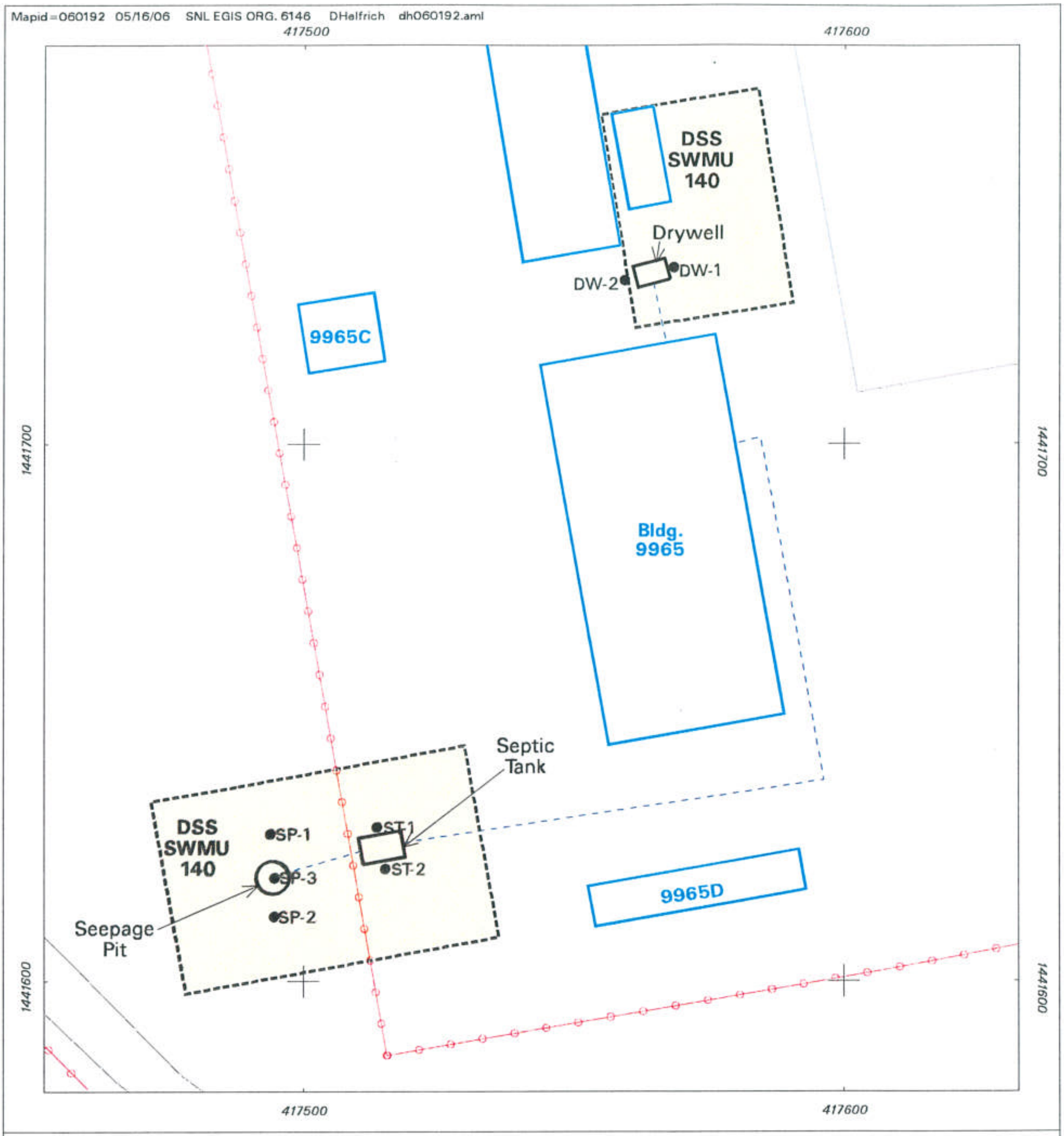
Operational History

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



Legend

●	Soil Boring Location
-○-○-○-	Fence
········	Road
━━━━	Building / Structure
- - - -	Sewerline / Drain Line
━━━━	Septic Tank, Seepage Pit, Drywell
▭	DSS SWMU 140

Figure 15
Site Map of Drain and Septic Systems (DSS) SWMU 140, Bldg. 9965 Septic System, Thunder Range

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Environmental Geographic Information System

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 15). Sampling around the seepage pit was started at 11 ft bgs. The Geoprobe ^{TM} 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 15. 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 ^{TM} 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 15). 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 12).

For the radiological COCs (uranuim-235and 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.

Table 12
Risk Assessment Values for SWMU 140 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
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	
Organic					
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[b]	0.00		0.00	
Toluene	0.0025[b]	0.00		0.00	
Total		**0.03**	**4E-6**	**0.33**	**1E-5**

[a] EPA 1989.

[b] 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 = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

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.

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 16). 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 17).

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.

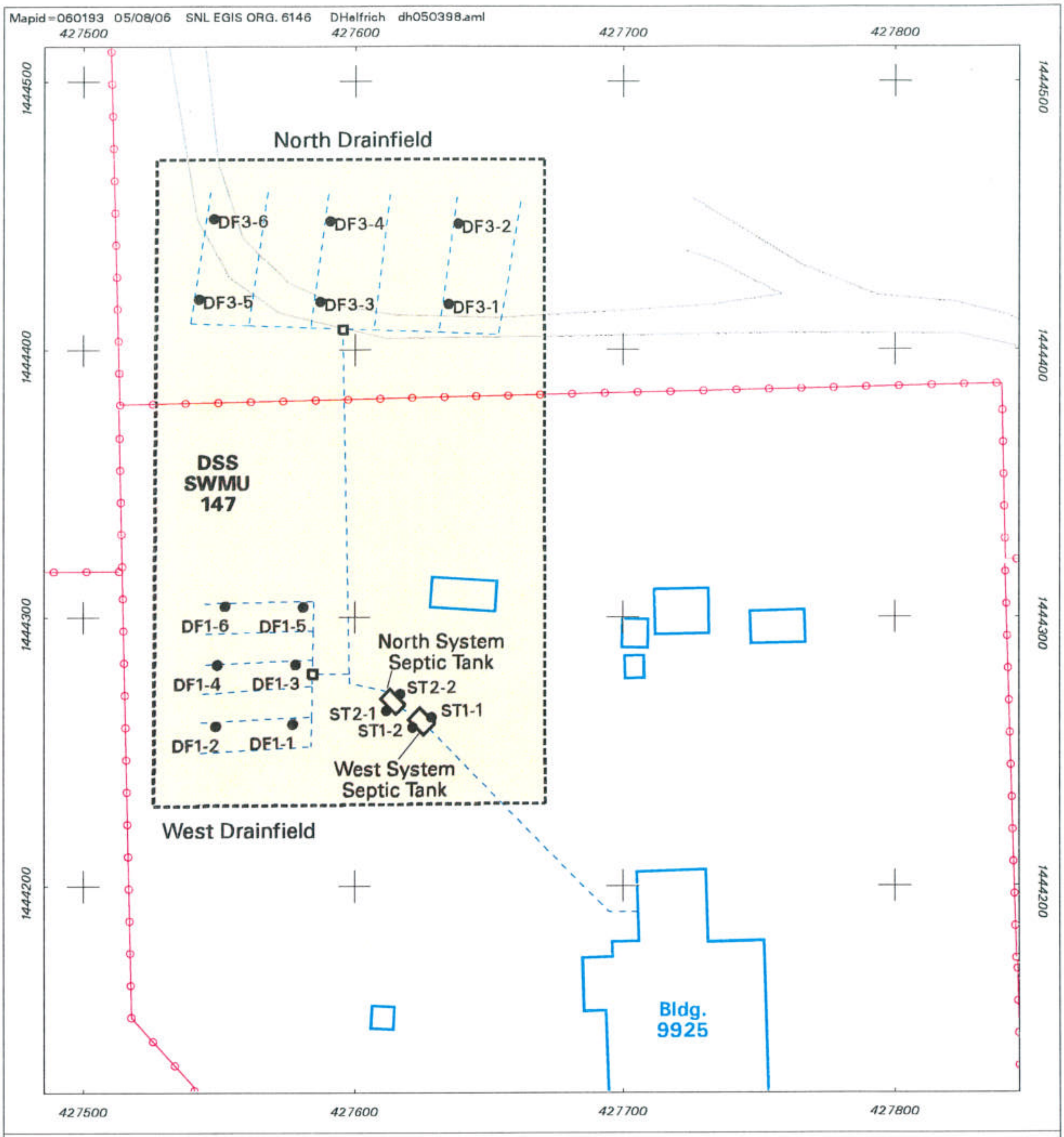
A waste characterization sludge sample was collected from the west system tank in January 1995 and was analyzed for isotopic uranium. Low activity levels of uranium isotopes were detected in the sludge.

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.



Legend

●	Soil Boring Location
o—o—o—o	Fence
	Road
───	Building
- - - - -	Sewerline, Drain Line
───	Septic Tank, Distribution Box
▭	DSS SWMU 147

Figure 16
Site Map of the North and West Drainfields at Drain and Septic Systems (DSS) SWMU 147, Bldg. 9925 Septic Systems Coyote Test Field

0 30 60
Scale in Feet

0 7.2 14.4
Scale in Meters

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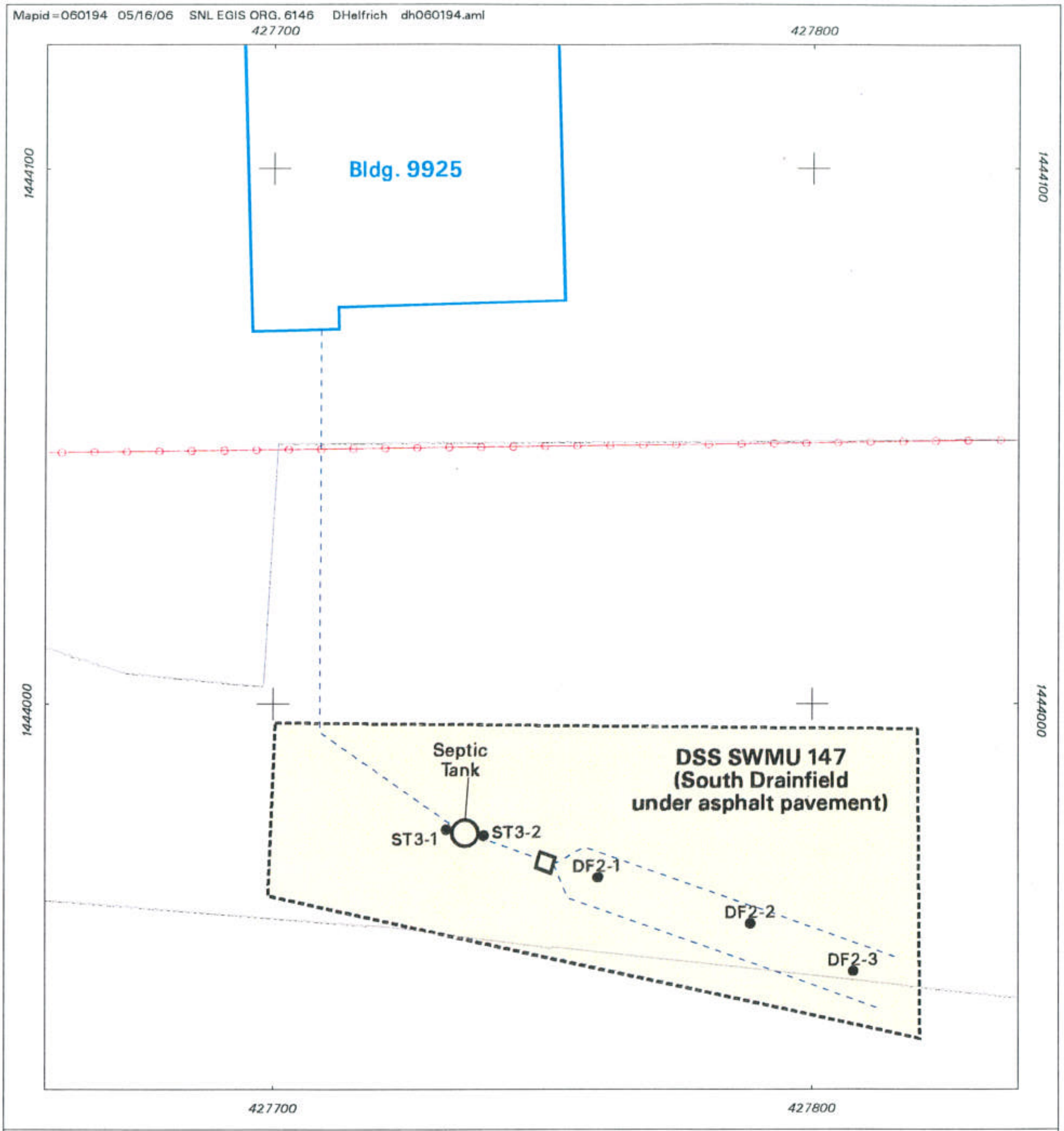


Legend

- ● Soil Boring Location
- Fence
- Edge of Pavement
- Septic Tank, Distribution Box
- Sewerline, Drain Line
- Building
- DSS SWMU 147

Figure 17
Site Map of the South Drainfield at Drain and Septic Systems (DSS) SWMU 147, Bldg. 9925 Septic Systems Coyote Test Field

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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 16), from boreholes DF1-1 and DF1-6 in the west drainfield (Figure 16), and from borehole DF2-2 in the south drainfield (Figure 17). 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 (Figures 16 and 17). 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 13).

For the radiological COCs (tritium, uranuim-235and 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 13
Risk Assessment Values for SWMU 147 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Barium	355	0.01		0.07	
Organic					
Acetone	0.047	0.00		0.00	
Di-n-butylphthalate	0.165[b]	0.00		0.00	
bis(2-Ethylhexyl) phthalate	0.165[b]	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[b]	0.00		0.00	
Phenol	0.165[b]	0.00		0.00	
Toluene	0.0025[b]	0.00		0.00	
Total		**0.01**	**2E-8**	**0.07**	**5E-8**

[a]EPA 1989.
[b]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 = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

SWMU 149, Building 9930 Septic System

Site Location

SWMU 149, the Building 9930 Septic System, is located in the Coyote Test Field 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 single seepage pit (Figure 18).

Operational History

Available information indicates that Building 9930 was constructed in 1961, and it is assumed that the septic system was constructed at the same time. 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 November 1995, and a closure form was signed.

The septic tank and seepage pit were then backfilled with clean, native soil in early 1996.

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

Evaluation of Relevant Information

Five assessment investigations have been conducted at this site. In June 1992, April 1994 and November 1994, waste characterization samples were collected from the septic tank (Investigation 1). A geophysical survey was performed in May 1994 to help locate areas of high moisture content (Investigation 2). In June and July 1994, a passive soil-vapor survey was conducted to identify potential releases of VOCs and SVOCs (Investigation 3). In January 1995, soil samples were collected near the septic tank and adjacent to the seepage pit, and in October 2002 one soil sample was collected near the seepage pit (Investigation 4). In August 2001, groundwater monitor well CTF-MW3 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 in June 1992. The sludge sample was analyzed for selected heavy metal and radionuclide constituents. The liquid sample was analyzed for VOCs, SVOCs, PCBs, pesticides, total cyanide, phenolics, nitrate/nitrite, oil and grease, total metals and selected radionuclide constituents. Phenol was detected in the aqueous sample at a level of 0.120 mg/L and total phenolic compounds were detected at a level of 0.18 mg/L.; chromium was detected in the aqueous sample at a level of 0.14 mg/L; and silver was detected in the aqueous sample at a level of 0.16 mg/L. There were no significant findings regarding the radiological data.

A second round of septic tank sludge samples were collected for waste characterization purposes in April 1994 and were analyzed for VOCs, explosives, cyanide, total phenols and TCLP metals. Concentrations of four VOC compounds (acetone, 1,1-dichloroethane, methylene chloride and toluene), cyanide and total phenols were identified in the sludge. Explosive compounds were not detected. One RCRA metal (barium) was detected in the sludge sample.

A third round of waste characterization sludge and liquid samples was collected in November 1994. The sludge and liquid samples were analyzed for isotopic uranium, tritium, and gamma spectroscopy radionuclides. The isotopic uranium, tritium, and gamma spectroscopy results did not include any significant readings. The sludge was also analyzed for SVOCs. One SVOC (4-methylphenol) was identified in the sludge sample.

Investigation 2 – Geophysical Survey

A geophysical survey using a Geonics™ Model EM-38 ground conductivity meter was performed in May 1994 to try to determine if there were any areas of higher moisture surrounding the seepage pit. The area around the seepage pit at SWMU 149 was highly disturbed, with much metal scrap visible at the surface. Although an attempt was made to remove the visible metal, interference by metal prevented a definitive interpretation regarding areas of higher moisture content.

Investigation 3 – Passive Soil-Gas Survey

A passive soil-gas survey conducted in June and July 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the seepage pit that may have occurred. Six PETREX™ tube samplers were placed in a grid pattern that covered the seepage pit and septic tank areas. Aliphatic and/or BTEX compounds at potentially significant concentrations were identified in soil gas at three of the six sampling locations. There were no detectable levels of PCE or TCE at any of the sample locations.

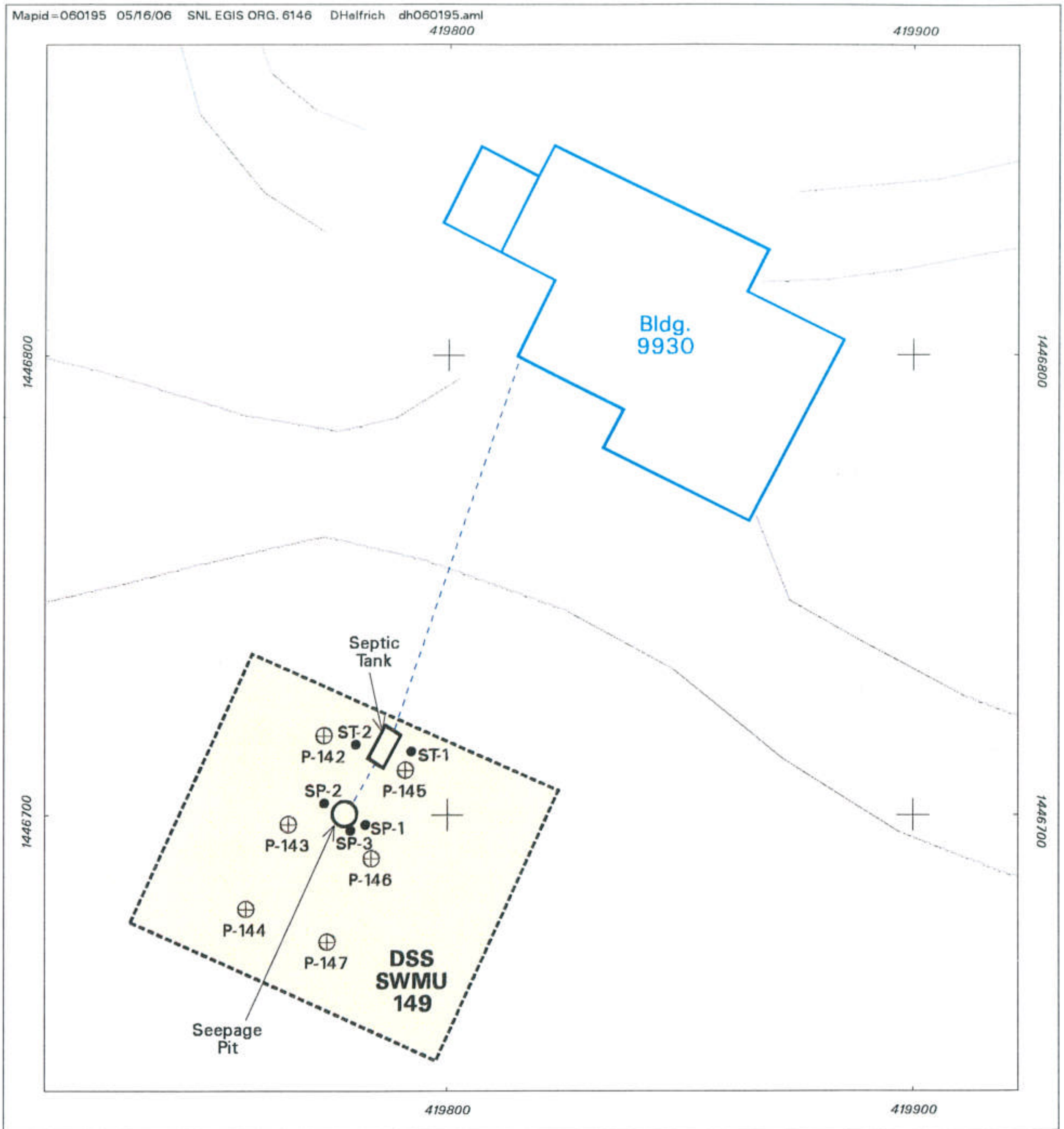
Investigation 4 — Soil Sampling

In October 1994, subsurface soil samples were collected from boreholes drilled at five locations adjacent to the effluent release points and areas (septic tank and seepage pit) to assess whether releases of effluent from the septic system caused any environmental contamination.

The soil samples were collected at sampling depths starting at 7 feet bgs adjacent to the septic tank and 8 feet bgs adjacent to the seepage pit. An attempt was made to collect both shallow and deep samples using the Geoprobe™ near the seepage pit. After several attempts, it proved impossible to obtain any samples below 12 to 12.5 ft bgs. Thus, there are only shallow soil samples available. The intent was to have the shallow sampling intervals start at the depths at which effluent discharged from the septic tank and seepage pit would have entered the subsurface environment. However, because of the shallow refusal depth, the sampling interval for the seepage pit samples was started at 8 ft bgs rather than 10 ft bgs (10 ft bgs was projected to be the bottom of the septic tank). The soil samples were analyzed for VOCs, SVOCs, RCRA metals, hexavalent chromium, cyanide, tritium and radionuclides by gamma spectroscopy. They were also screened for HE compounds.

Results for the soil samples are discussed in this section. Two VOCs (acetone and methylene chloride) were detected in the soil samples. These compounds were detected in the associated TB samples. No SVOCs, cyanide, hexavalent chromium or HE compounds were detected in any of the samples. No RCRA metals were detected above Department-approved background concentrations. One radionuclide (tritium) was detected at 0.0255 pCi/g, slightly above the background activity of 0.021 pCi/g. With the exception of tritium, no activities above background levels were detected in any of the samples analyzed. However, although not detected, the MDA for the one uranium-235 analysis exceeded the respective background activity.

In October 2002, one additional sample was collected and analyzed for HE compounds. The original intent was to collect the sample from a borehole drilled through the center of, and beneath, the seepage pit. However, underground utilities had been installed across the abandoned seepage pit, and the borehole had to be shifted approximately 3 feet further to the



Legend

● Soil Boring Location

⊕ Petrex™ Sample Location

Unpaved Road

Septic Tank, Seepage Pit

Drainline, Sanitary Sewerline

Building / Structure

DSS SWMU 149

Figure 18
Site Map of Drain and Septic Systems (DSS) SWMU 149, Bldg. 9930 Septic System, Coyote Test Field

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south (location SP-3 on Figure 18). The HE sample was collected starting at 8 feet bgs, using a Geoprobe™ sampler inside the drill rig augers. No HE compounds were detected in the soil sample.

Investigation 5 – Groundwater Monitoring

Groundwater monitor well CTF-MW3 was installed with an air-rotary casing hammer drilling rig in August 2001 (Figure 19). The borehole for the well was drilled to 430 feet bgs and backfilled to 365 feet bgs. The screened interval is from 340 to 360 feet bgs, with a sump from 360 to 365 feet bgs. Depth to groundwater was 302.2 feet bgs in January 2005. The well was sampled on a quarterly basis from July 2002 to June 2004 to acquire eight quarters of groundwater data. The eight quarters of groundwater samples were analyzed for VOCs, HE compounds, RCRA metals and cyanide.

Results for the eight quarters of groundwater samples collected from monitor well CTF-MW3 are summarized in this paragraph. Five VOCs were detected in the groundwater samples. Acetone was detected in one sample. Bromodichloromethane was detected in the last two samples. Dibromochloromethane was detected in three samples. Chloroform was detected six samples. Toluene was detected in one sample and its associated TB. No other VOCs were detected in the TBs associated with these samples. One HE compound (2-amino-4,6-dinitrotoluene) was detected in the first sampling event. No HE compounds were detected in any subsequent groundwater sample collected from this well. One RCRA metal (selenium) was detected in all eight groundwater samples at concentrations slightly above the Department-approved background concentration. All other metal concentrations were below the Department -approved background concentrations or other promulgated regulatory limits. Cyanide was detected in one of the eight samples collected. NPN was detected at concentrations slightly above the Department-approved background in the first five samples collected. No regulatory or background limits have been established in groundwater for the anions and cations of bromide, calcium, chloride, magnesium, potassium, sodium or sulfate. The concentrations measured for these individual anions and cations were similar for the eight quarters of sampling. Fluoride concentrations exceeded the maximum allowable concentration in all eight samples collected. The fluoride detected in monitor well CTF-MW3 is most likely naturally occurring.

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 14).

For the radiological COCs (tritium and uranuim-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 5.1E-7.

The exposure pathway analysis established that no complete ecological pathway exists for exposure of ecological species to contaminants at SWMU 149. 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 14
Risk Assessment Values for SWMU 149 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Chromium VI	0.5[b]	0.00	1E-9	0.00	2E-9
Cyanide	0.5[b]	0.00		0.00	
Organic					
Acetone	0.0091 J	0.00		0.00	
Methylene Chloride	0.0022 J	0.00	1E-8	0.00	3E-8
Total		**0.00**	**1E-8**	**0.00**	**3E-8**

[a] EPA 1989.
[b] 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 = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

Basis for Determination

SWMU 149 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.

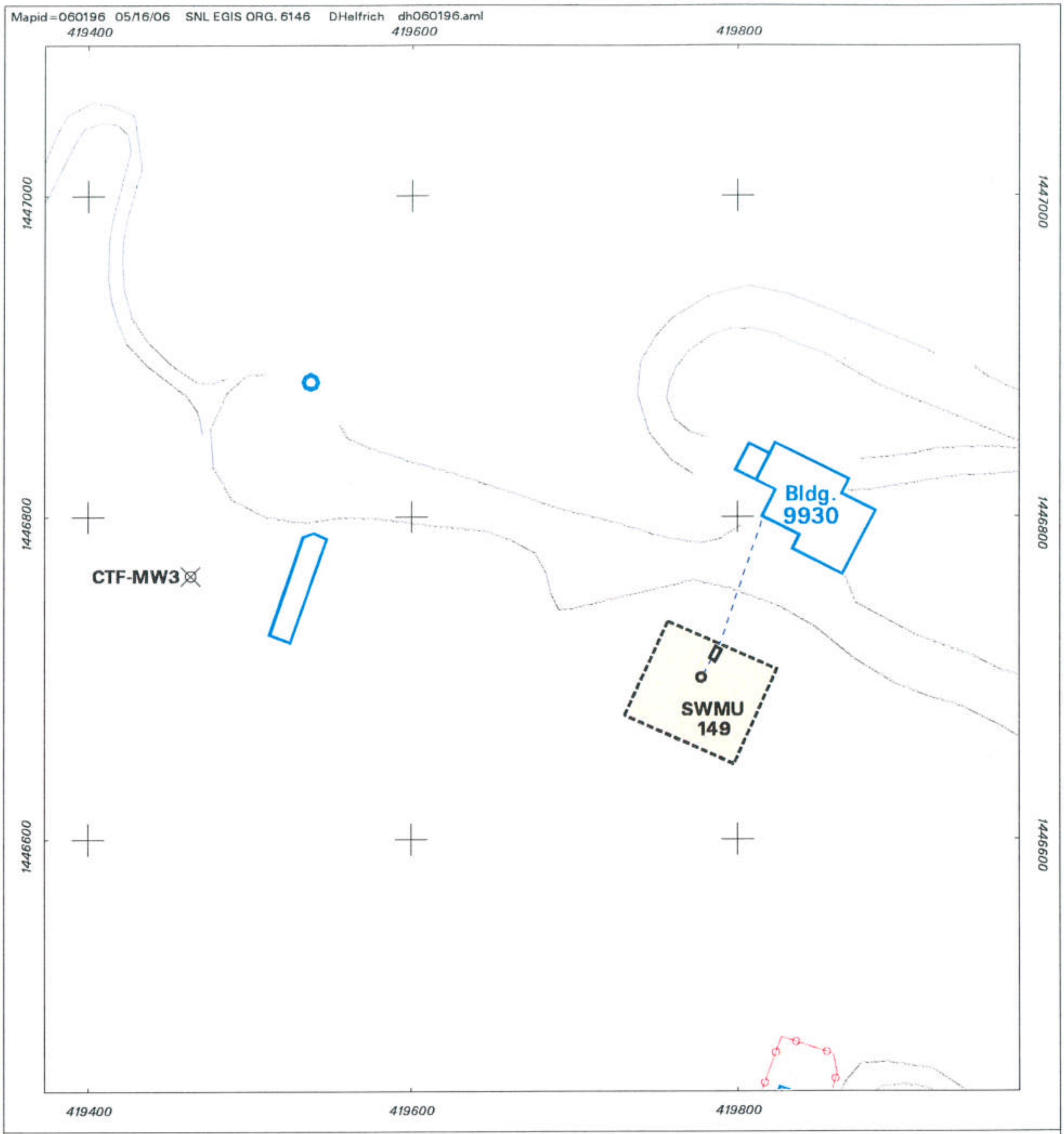
SWMU 150, Building 9939/9939A Septic System, Septic Tanks, and Drainfields

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. 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 (Figure 20).

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



Legend

- ☒ Groundwater Monitoring Well
- - - - Sanitary Sewerline, Drainline
- ▬ Septic Tank, Seepage Pit
- Unpaved Road
- o—o—o Fence
- ▬ Building / Structure
- ▭ SWMU 149

Figure 19
Location Map of Groundwater Monitoring Well CTF-MW3 at Drain and Septic Systems (DSS) SWMU 149, Bldg. 9930 Septic System Coyote Test Field

0 50 100
Scale in Feet

0 12 24
Scale in Meters

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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. 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.

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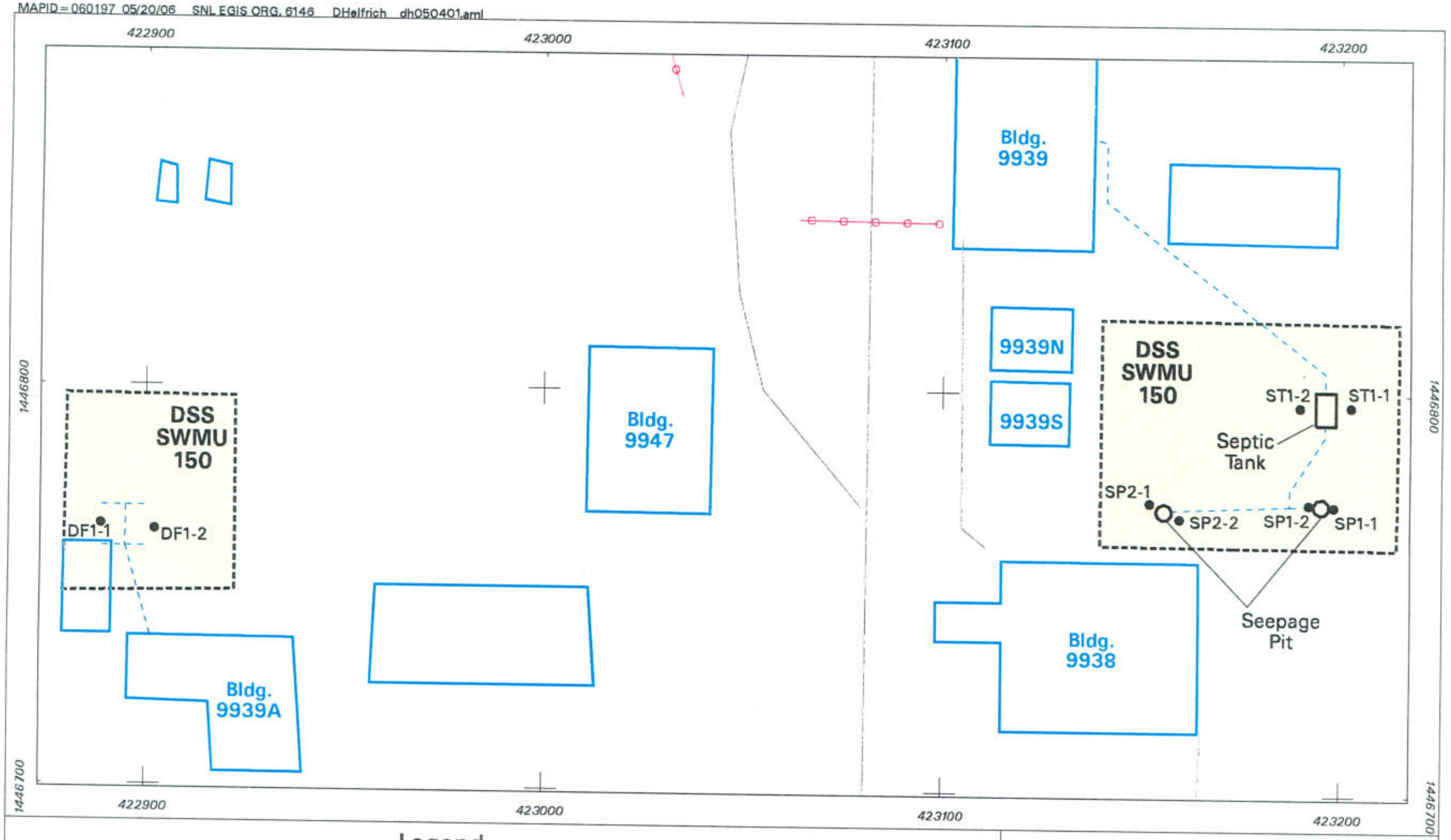

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Figure 20
Site Map of Drain and Septic Systems (DSS) SWMU 150, Bldg. 9939/9939A Septic System, Coyote Test Field

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 (uranuim-235and 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.

Table 15
Risk Assessment Values for SWMU 150 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		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[b]	0.00		0.00	
Toluene	0.0025[b]	0.00		0.00	
Total		**0.00**	**2E-8**	**0.00**	**4E-8**

[a] EPA 1989.

[b] 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 = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

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

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.

SWMU 154, Building 9960 Septic System, Septic Tanks, and Drainfields

Site Location

SWMU 154, the Building 9960 (and 9961) Septic System, is located in the Coyote Test Field on federally owned land controlled by KAFB and permitted to the DOE. SWMU 154 included two adjacent but separate systems associated with Building 9960 and a system associated with Building 9961. The Building 9960 east septic system consisted of a 900-gallon septic tank that discharged to a 5-ft-diameter, 10-ft-deep seepage pit. The west HE drain system consisted of two, 5-ft diameter, approximately 23-ft-deep seepage pits (Figure 21). The Building 9961 system consisted of a small (4-ft diameter by 7-ft deep) seepage pit located approximately 43 ft northwest of the building (Figure 22). There is a hand washing sink in the northeast corner of a small 16-ft long by 7-ft wide addition on the north side of Building 9961 that drained to the seepage pit.

Operational History

Available information indicates that Building 9960 was constructed in 1965, and it is assumed that the septic and HE drain systems were constructed at that time. It was constructed for the purpose of machining and preparing explosive assemblies for tests at various locations in Coyote Test Field. 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 and associated seepage pit were then backfilled with clean, native soil in early 1996. The HE drain system seepage pits were backfilled with clean, native soil in accordance with 20.7.3.410 NMAC in August 2005.

Building 9961, a small earth-covered bunker-type building, was constructed either in 1965 or soon after, and is located approximately 100 feet southwest of Building 9960. Facility personnel report that the building was originally used as a 1000-pound capacity HE storage bunker, and in the mid-1970s it was modified for use as an explosives powder pressing and component assembly building, and it continues to be used as such. Explosive powders composed of RDX (hexahydro-1,3,5-trinitro-1,3,5 triazine), PETN (pentaerythritol tetranitrate), HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine), Composition C-4 and other HE compounds are periodically pelletized, or pressed or hand-tamped into various configurations in this building. During these operations, personnel wear protective gloves and other PPE, and contaminated wipes are disposed as part of the explosives waste stream generated at this facility. The building sink has been used for personal hygiene (washing) after removal of the PPE. The drain line from the sink to the seepage pit was disconnected and re-routed to a branch of an extension of the COA sanitary sewer system that was constructed in the TA-III and CTF areas in the early 1990s. The seepage pit was backfilled with clean soil in August 2005.

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

Evaluation of Relevant Information

Five assessment investigations have been conducted at this site. In June 1992 and May 1994, waste characterization samples were collected from the septic tank (Investigation 1). Several geophysical surveys were performed in March 1994 to locate areas of high moisture content (Investigation 2). In May and June 1994 a passive soil-vapor survey was conducted to identify potential releases of VOCs and SVOCs (Investigation 3). In October 1994, October 1995, June and July 1996, March 1997, and January 1998, confirmatory soil sampling was conducted in the vicinity of the Building 9960 septic tank and seepage pits. In August 2005, confirmatory soil sampling was conducted through the center of the seepage pit associated with Building 9961 (Investigation 4). In August 2001, groundwater monitor well CTF-MW2 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 — Septic Tank Sampling

Two rounds of samples were collected from the Building 9960 septic tank for waste characterization purposes. The first round of liquid and sludge septage samples were collected from the septic tank in June 1992. The liquid (supernate) samples were analyzed for VOCs, SVOCs, PCBs, explosive compounds, pesticides, total metals, selected radionuclides and several other miscellaneous analytes. Trace levels of one VOC (TCE) and two SVOCs (bis [2-ethylhexyl] phthalate and phenol) were identified. Explosives compounds, pesticides, PCBs, nitrates/nitrites and cyanide were not detected. Low levels of a number of metals, phenolic compounds, formaldehyde, fluoride, oil and grease and radium-226 and radium-228 were also detected. The sludge samples (composed of 93.3 percent water) were analyzed for total metals, gross alpha and beta activity, tritium and selected radionuclide constituents. A number of metals, gross alpha and beta activity, tritium, and a few radionuclides were detected in the material.

A second round of liquid and sludge septage samples were collected from the septic tank in May 1994. The liquid (supernate) samples were analyzed for isotopic uranium, tritium and also for additional radionuclides by gamma spectroscopy. Trace activity levels of isotopic uranium and tritium were detected, but additional radionuclides were not detected by gamma spectroscopy. The sludge samples were analyzed for VOCs, SVOCs, phenolic and explosives compounds, total RCRA metals, isotopic uranium and for additional radionuclides using gamma spectroscopy. Trace levels of one VOC (methylene chloride), six SVOCs, phenolic compounds, isotopic uranium and several other radionuclides were identified. Explosives compounds were not detected.

Investigation 2 – Geophysical Survey

Several geophysical surveys using Geonics™ Model EM-31 and EM-38 ground conductivity meters were performed in the Building 9960 septic system and HE pit areas in March 1994. The purpose of the geophysical surveys was to attempt to locate any wetted areas around the seepage pit septic system or HE pits. The EM-31 instrument was used for deeper surveys (up to 18 ft

Legend

● Soil Boring Location

Road

Septic Tank, Distribution Box, Seepage Pit

Drainline, Sanitary Sewerline

Building / Structure

DSS SWMU 154

Figure 21
Site Map of Drain and Septic Systems (DSS) SWMU 154, Bldg. 9960 Septic System, Coyote Test Field

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

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bgs), and the EM-38 was employed for more shallow work (within 5 ft of the surface). Information generated by these surveys did not identify any areas of moist soil in the subsurface and was not useful in guiding the soil sampling effort.

Investigation 3 – Passive Soil-Gas Survey

A passive soil-gas survey was conducted in the Building 9960 septic system and HE pits in May and June 1994. PETREX™ sampling tubes were used to help identify any releases of VOCs and SVOCs that occurred via the septic systems. Six PETREX™ tube samplers were placed in a grid pattern that covered the area around and west of the septic system seepage pit. Six other PETREX™ samplers were placed in a grid pattern around the north and south HE pits. All of the PETREX™ samplers placed at this site were analyzed for two individual constituents (PCE and TCE) and two groups of other organic compounds (BTEX and aliphatic compounds). Significant levels of PCE and TCE were not detected in soil gas at any of the 12 PETREX™ sampling locations. BTEX compounds were identified in soil gas at concentrations that could be significant at three out of the six sampling locations around the septic system, but at none of the six locations around the HE pits. Potentially significant concentrations of aliphatic compounds in soil gas were identified at two of the six septic system locations, and at one of the six PETREX™ locations around the HE pits. VOCs were detected at trace levels in some of the confirmatory soil samples.

Investigation 4 – Soil Sampling

Six rounds of confirmatory soil sampling were performed and are described in the following paragraphs. The first five rounds of soil sampling were conducted on the systems attached to Building 9960, and the sixth round of soil sampling was conducted at the seepage pit attached to Building 9961.

The first round of soil samples was collected in October 1994 from borings on either side of the east system septic tank and seepage pit, and also from borings on either side of each of the two HE pits. Septic tank soil samples were collected from one interval in each of the two boreholes starting at the outside bottom of the tank, which was measured to be 9.5 feet bgs. Soil samples were also collected from two intervals in each of the two east system seepage pit boreholes. The top of the shallow intervals started at the bottom of the unit, which was estimated to be 10 feet bgs based on a SNL facility engineering drawing and field measurements to the top of the gravel inside the unit. The lower (deep) intervals started at 10 feet below the top of the upper intervals. A similar procedure was intended to be used to characterize soil around each of the two west system HE pits; the original intent was to collect samples from two vertical intervals in each borehole. One sample interval was to start at the base of each HE pit, which was estimated to be approximately 23 feet bgs based on an SNL Facilities Engineering drawing, and a second sample interval was to be 10 feet lower. However, subsurface refusal due to shallow bedrock was encountered at 25 to 26 feet bgs around these two units. As a result, soil from only one interval starting at the base of the HE pits and ending immediately above the subsurface bedrock was collected in each of the four HE pit boreholes.

The first-round septic system and HE pit soil samples were analyzed for VOCs, SVOCs, RCRA metals and hexavalent chromium. Also, to determine if radionuclides were released to the environment, two composite samples from both the septic system seepage pit boreholes and a single composite sample from the four HE pit boreholes were analyzed for isotopic uranium. Composite samples from both the shallow and deep septic system seepage pit sampling intervals were also analyzed for additional radionuclides using gamma spectroscopy.

Low to trace concentrations of the three VOC compounds, acetone, methylene chloride and toluene were detected in the first-round soil samples. Below-reporting-limit concentrations of one SVOC (2,4-dinitrotoluene) were detected in two of the samples from the HE pit boreholes, but no SVOCs were identified in samples from around the east system septic tank and seepage pit. Elevated barium concentrations of 1,460 and 1,230 mg/kg were detected in the north HE pit borehole SP2-2 and the south HE pit borehole SP1-1, respectively. There was a barium concentration of 241 mg/kg in septic tank soil boring ST-1 which is above the Department background concentration of 214 mg/kg. 15.2 mg/kg of chromium was detected in the deep soil sample from the east system seepage pit borehole SP3-1 which is above the Department background concentration of 12.8 mg/kg.

The second round of sampling was conducted in October 1995. The original plan was to collect samples from the four previous borehole locations next to the HE pits and from six new step-out borings to determine the extent of the elevated barium concentrations and to analyze for explosives compounds. However, sample collection and volume limitations due to drilling difficulties and associated equipment problems precluded completing the second-round sampling task as planned. As a result, one composite sample consisting of equal fractions of soil from north HE pit boring location SP2-2 and south HE pit SP1-1 was successfully collected at this time. The soil was retrieved from depths of 23 to 25 ft in each of the two borings. Analysis for explosives compounds detected 1,430 mg/kg of 2,4,6-trinitrotoluene in the material.

The third round of soil sampling was completed in June and July 1996. Samples were collected from two previous boring locations around the north HE pit (SP2-1 and SP2-2) and from three new step-out locations around this unit (SP2-3, SP2-4 and SP2-5). Samples were also collected from two previous boring locations around the south HE pit (SP1-1 and SP1-2) and from three new step-out locations around this unit (SP1-3, SP1-4 and SP1-5). The samples from the four previous boring locations next to the HE pits were analyzed only for explosives compounds, which had not been done previously. Samples from the six step-out borings were analyzed for explosives compounds and RCRA metals. Samples from six of the ten third-round sampling locations were also analyzed for nitrate plus nitrite. Soil was collected from 23 to 27 ft bgs in north HE pit borings, and 21.5 to 26.5 ft bgs in south HE pit borings. Sample collection depths varied in each borehole because of a slightly undulating bedrock surface and variations in the amount of soil recovered from each boring, which in turn dictated the length of each sampling interval. Explosives compounds were detected in all four of the third-round samples collected next to the HE pits. Explosives compounds were also detected in two of the six step-out locations (SP1-3 and SP2-3) located on the west side of the units but, for the most part, were at lower concentrations than those detected in samples from immediately adjacent to the HE pits. Samples from the other four step-out borings SP1-4, SP1-5, SP2-4 and SP2-5 and on the south, east and north sides of the HE pits did not contain detectable levels of HE compounds. Nitrate plus nitrite were not identified in the six samples that were analyzed for these compounds. The RCRA metals analytical results of samples from the six step-out borings indicated that only silver was elevated relative to the Department approved background concentration.

The fourth round of soil sampling was completed in March 1997. Samples were collected from two more step-out boring locations west and northwest of the north HE pit (SP2-6 and SP2-7, Figure 21) and from two additional step-out locations (SP1-6 and SP1-7) west and southwest of the south HE pit. Sampling depths ranged from 24.3 to 26 ft bgs in these boreholes. As before, the sample collection rationale was to retrieve soil from immediately above the bedrock surface since this material was considered to have the highest probability of containing explosives residue. The samples were analyzed for RCRA metals and explosives compounds. Explosives constituents were not detected in any of these boreholes, and with the exception of a lead concentration of 30 mg/kg in one borehole (SP2-6), elevated metals concentrations were not identified in any of the four fourth-round samples.

The fifth round of sampling was conducted 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, and beneath, the two HE seepage pits (locations SP1-8 and SP2-8 in Figure 21). Samples were collected starting at a depth of 24 feet bgs in borehole SP1-8 and starting at a depth of 23 feet bgs in borehole SP2-8. The samples were analyzed for VOCs, SVOCs, metals and HE compounds. The results were submitted to the Department, and were evaluated and summarized in an internal Department report

The sixth round of sampling was completed in August 2005. Soil samples were collected from a borehole drilled through the center of, and beneath, the Building 9961 seepage pit. An auger drill rig was used to sample the borehole at two depth intervals. The shallow sample interval started at 7 feet bgs, the estimated base of the gravel aggregate in the bottom of the seepage pit, and the lower (deep) interval started at 5 feet below the top of the upper sample interval, or 12 feet bgs. The soil samples were analyzed for VOCs, SVOCs, HE compounds, RCRA metals, hexavalent chromium, cyanide and radionuclides. No VOCs, SVOCs, HE compounds, cyanide or hexavalent chromium were detected. All metal concentrations in the two samples were below the Department-approved background values for those metals, with the exception of selenium in the 12-ft deep sample. Although not detected, the selenium MDL of 2.46 mg/kg was higher than the selenium background concentration of <1 mg/kg. For radionuclides, no activities above background levels were detected in the two samples. However, although not detected, the MDA for the two uranium-238 analyses exceeded the approved 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 either of the samples.

Investigation 5 – Groundwater Monitoring

The groundwater monitor well, CTF-MW2, was installed in August 2001. The monitor well location is shown in Figure 22. Although the borehole for the well was drilled to 190 feet bgs, the borehole caved in up to 135 feet bgs when the drill string was removed. The monitor well was subsequently installed with the screened interval from 110 to 130 feet bgs and a sump from 130 to 135 feet bgs. The groundwater level rose significantly in the borehole after the well was installed and depth to groundwater was 44 feet bgs on January 7, 2005.

The monitor well was sampled on a quarterly basis from July 2002 to June 2004 to acquire eight quarters of groundwater data. The results are discussed in this paragraph. One VOC (acetone) was detected only in the first groundwater sample collected in July 2002 as well as in the August 2003 TB and EB samples associated with this well. Bromoform was detected only in the December 2003 EB sample and dibromochloromethane was detected in the February and April 2003 EB samples. Methylene chloride and toluene were detected only in TB samples. One HE compound (1,3,5-trinitrobenzene) was detected in the February 2003 groundwater sample. No other HE compounds were detected in the groundwater samples associated with this monitor well. A trace of tetryl (methyl-2,4,6-trinitrophenylnitramine) and 4-amino-2,6-dinitrotoluene were detected in separate EB samples associated with sampling of this well. One RCRA metal (arsenic) concentration exceeded background and promulgated limits. However, these concentrations were likely due to natural origin. All other metal concentrations were below Department-approved background or other promulgated regulatory limits. NPN was not detected at concentrations above any promulgated regulatory limit. No regulatory or background limits have been established for anions and cations that include bromide, calcium, chloride, magnesium, potassium, sodium or sulfate in groundwater. With the exception of chloride and bromide in the August 2003 sample, the concentrations measured for these individual anions and cations were similar and generally consistent for the eight quarters of sampling. Fluoride concentrations slightly exceeded the maximum allowable concentration in all eight primary and two duplicate samples collected, but were in all cases less than the MCL of 4.0 mg/L. The fluoride detected in monitor well CTF-MW2 is most likely naturally occurring. None of the known activities conducted at Building 9960 would have produced a discharge of fluoride contamination to the environment.

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 scenario, the total HIs and estimated excess cancer risks are not acceptable (Table 16).

Although both the HI and estimated excess cancer risk are not acceptable for the industrial land-use scenario, maximum concentrations were used in the risk calculation. The maximum concentration for 2,4,6-trinitrotoluene (the main contributor to the risk) was from a single composite sample collected in October 1995 from two borings next to the north and south HE seepage pits.

In June 1996, in order to confirm the high 2,4,6-trinitrotoluene concentration and to define the size of the release, additional discrete (i.e., noncomposited) samples were collected from boreholes at the same two locations used for the composited HE compound sample (SP1-1 and SP2-2 in Figure 21). In June 1996 and January 1998, additional samples were collected from boreholes drilled directly beneath, and surrounding, the two seepage pits. The maximum 2,4,6-trinitrotoluene concentration measured in the additional discrete samples was 102 mg/kg in sample SP1-1-24-26. Using the maximum concentration in discrete samples from the additional sampling for the main contributor to excess cancer risk and hazards, 2,4,6-trinitrotoluene (102 mg/kg), reduces the total human health HI and estimated excess cancer risk to 0.40 and 7E-6, respectively. Thus, by using the discrete sampling maximum concentration in the risk calculations, both the total human health HI and estimated excess cancer risk for an industrial scenario are acceptable, but not for a residential land-use scenario.

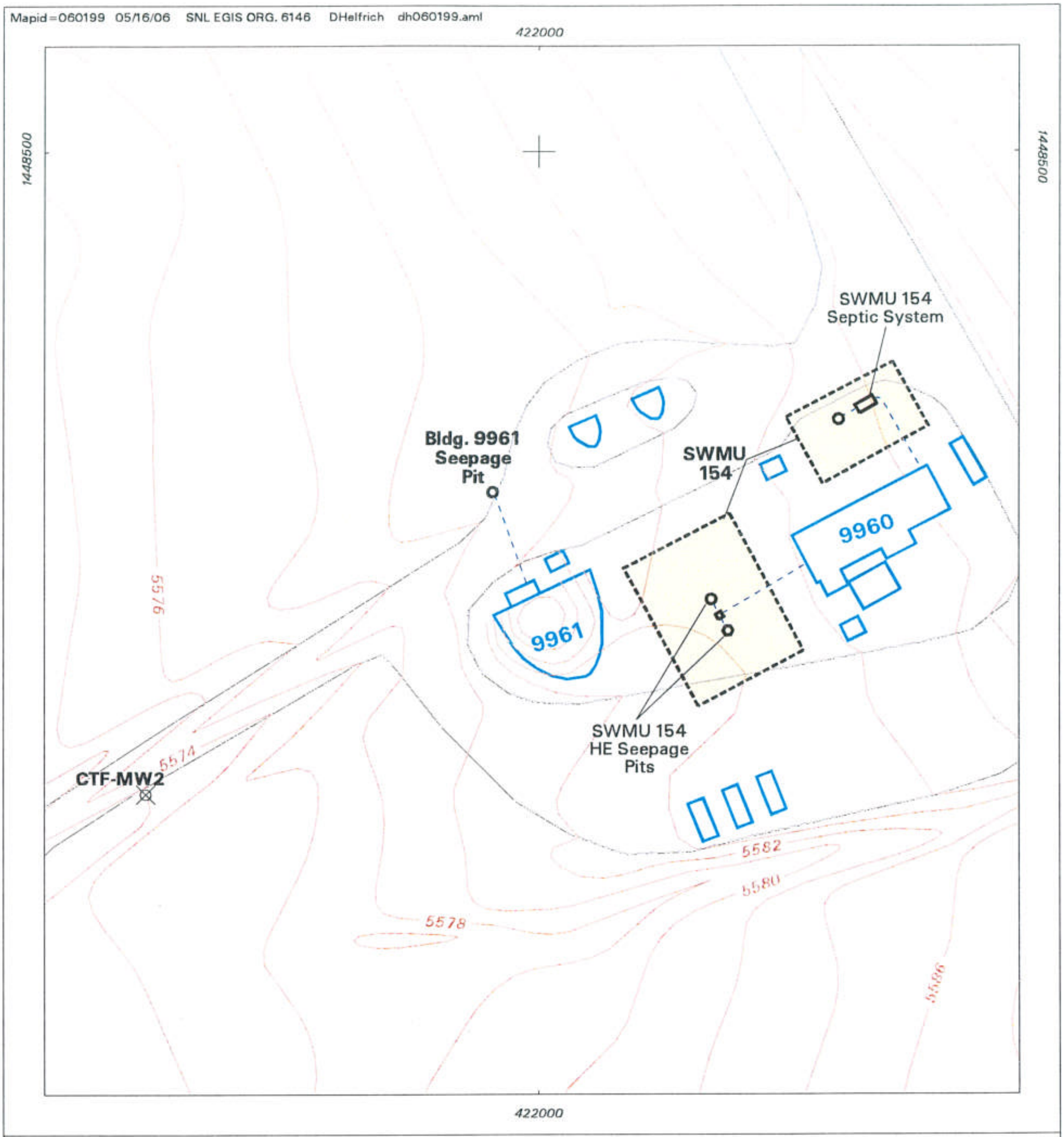


Figure 22
Location Map of the Bldg. 9961
Seepage Pit, near Drain and Septic Systems
(DSS) SWMU 154 and Groundwater
Monitoring Well CTF-MW2

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Table 16
Risk Assessment Values for SWMU 154 Nonradiological COCs

COC	Maximum Concentration/**Discrete Maximum Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	7.25	0.03	5E-6	0.33	2E-5
Barium	1,740	0.03		0.33	
Chromium	15.2	0.00		0.00	
Chromium VI	0.1[b]	0.00	2E-10	0.00	5E-10
Selenium	5.0[b]	0.00		0.01	
Silver	6.2	0.00		0.02	
Organic					
Acetone	0.0073 J	0.00		0.00	
2-Amino-4,6-dinitrotoluene[c]	1.9	0.00		0.02	
4-Amino-2,6-dinitrotoluene[c]	1.2	0.00		0.02	
2,4-Dinitrotoluene	0.75	0.00		0.01	
HMX	81	0.00		0.03	
Methylene Chloride	0.0038 J	0.00	2E-8	0.00	5E-8
3-Nitrotoluene	0.098	0.00		0.00	
4-Nitrotoluene	0.190	0.00		0.00	–
RDX	12.0	0.00	8E-7	0.07	3E-6
Toluene	0.0025[b]	0.00		0.00	
1,3,5-Trinitrobenzene	5.2	0.00		0.00	
2,4,6-Trinitrotoluene	1,430/**102**	4.65/**0.33**	3E-5/**2E-6**	46.81/**3.34**	9E-5/**6E-6**
Total		4.72/**0.40**	3E-5/**7E-6**	47.65/**4.15**	1E-4/**3E-5**

Note: Maximum value from discrete samples and associated risk are in **bold.**

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

[c] 2,6-Dinitrotoluene was used as a surrogate chemical.

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
SWMU = Solid Waste Management Unit.

For the radiological COCs (uranuim-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 1.5E-1 millirem (mrem)/year (yr). The estimated excess cancer risk is 1.3E-6.

The exposure pathway analysis established that no complete ecological exposure pathway exists for exposure of ecological species to contaminants at SWMU. All COCs are 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 154 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 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 23).

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

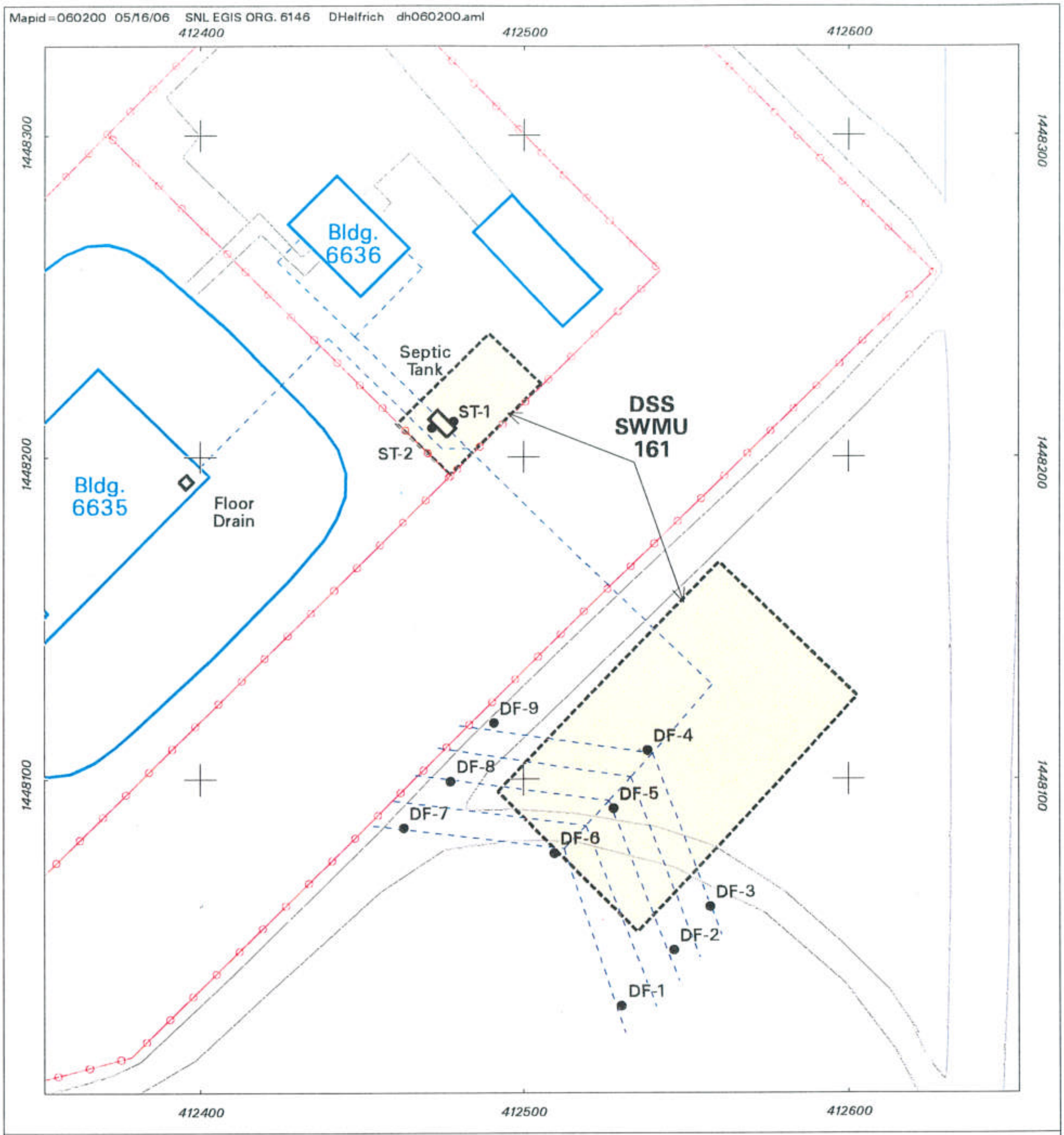
A geophysical survey using a Geonics™ Model EM-38 ground conductivity meter was performed in June 1994 to locate the drainfield. An area southeast of Building 6636 and between the two perimeter fences was identified as the possible location of the unit, but the actual location was later determined with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



Legend

● Soil Boring Location

-o-o-o- Fence

Road

Septic Tank, Floor Drain

Sanitary Sewerline, Drainfield, Drain line

Building / Structure

DSS SWMU 161

Figure 23
Site Map of Drain and Septic Systems (DSS) SWMU 161, Bldg. 6636 Septic System, TA-III

0 25 50
Scale in Feet

0 6 12
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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 17).

For the radiological COC (uranuim-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.

Table 17
Risk Assessment Values for SWMU 161 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Chromium	22	0.00		0.00	
Cyanide	0.0006	0.00		0.00	
Silver	40.8	0.01		0.11	
Organic					
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[b]	0.00		0.00	
Total		**0.01**	**2E-8**	**0.11**	**5E-8**

[a] EPA 1989.

[b] 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 = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

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.

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 24).

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.

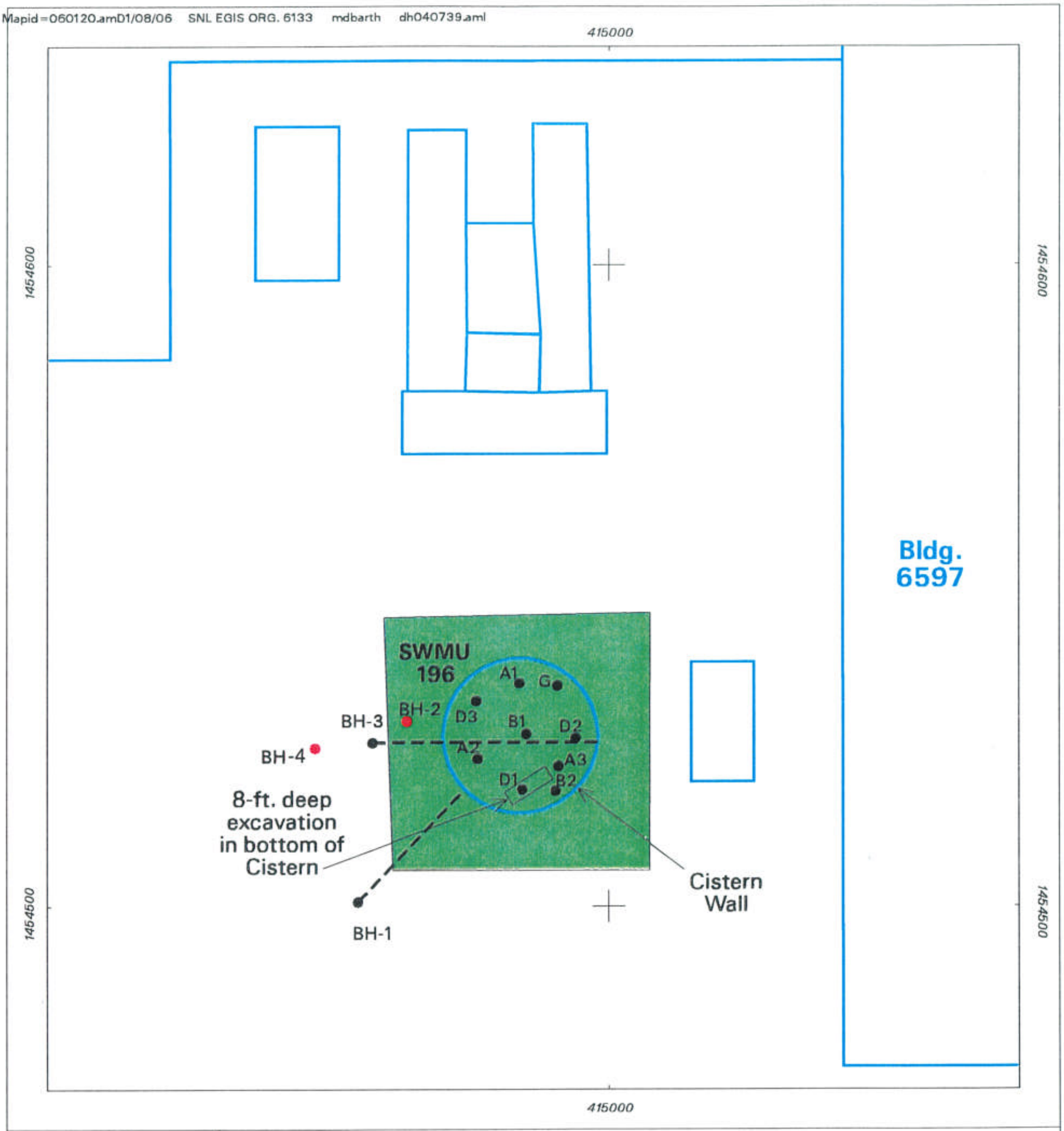
In March 1996, an 8-ft deep trench was excavated in the bottom of the Cistern and 12 soil samples plus one duplicate were collected using a hand auger from one location within the trench and two locations outside the trench to a maximum depth of 13 ft below the bottom of the Cistern. The samples were 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 trichlorethene) 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 18). 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.



Legend

●- - -	1999 Approximate Borehole Location with Trace of Angled Borehole
●	Approximate Verticle Borehole Location (BH-2, 1999; BH-4, 2003)
●	1994-1996 Sample Locations G = Grab A = Metals Profile B = Radionuclides D = TPH/VOC Profile
▭	Building/Structure
🟩	SWMU 196

Figure 24
SWMU 196
Location of Boreholes and Soil Samples

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

For the radiological COCs (tritium, uranuim-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.

Table 18
Risk Assessment Values for SWMU 196 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
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	
Organic					
2-Butanone	0.5[b]	0.00		0.01	
Carbon disulfide	0.0043 J	0.00		0.00	
Chloromethane	0.5[b]	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[b]	0.00	3E-7	0.01	7E-7
1,1-Dichloroethene	0.25[b]	0.00	2E-7	0.00	4E-7
Diethylphthalate	0.39	0.00		0.00	
Ethyl benzene	0.25[b]	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[b]	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[b]	0.00		0.00	
Tetrachloroethene	0.25[b]	0.00	7E-8	0.00	2E-7
Toluene	0.25[b]	0.00		0.00	
Trichloroethene	0.25[b]	0.00	2E-6	0.02	5E-6
Xylene	0.25[b]	0.00		0.00	
Total		**0.03**	**3E-6**	**0.27**	**6E-6**

[a] EPA 1989.

[b] 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 = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

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).

SWMU 233, Storm Drain System Outfall

Site Location

SWMU 233, the Storm Drain System Outfall, is located about 30 ft southeast of TA-IV on land owned by KAFB and leased to the DOE. It covers approximately 0.03 acres of unpaved ground along the steep northern rim of Tijeras Arroyo. The outfall consists of a 175-ft long site with two storm-water discharge points (Figure 25). The first discharge point is located next to the unpaved TA-IV perimeter road at the end of the TA-IV outfall pipe. Storm water flows across bare ground at the first discharge point and then into a storm-water grate that is connected to a 75-ft long segment of buried piping. This piping terminates at a concrete drop structure from which the storm water discharges, for a second time, into an earthen ditch.

Operational History

The outfall was built in the early 1980s for the purpose of reducing the amount of soil erosion caused by storm water. SWMU 233 is one of five storm-water outfalls that have been connected to TA-IV; the other four are SWMUs 230, 231, 232 and 234. The TA-IV storm-water outfalls are managed under two separate regulatory programs (the ER Project for RCRA Corrective Action, and the Storm Water Program annual reporting for National Pollutant Discharge Elimination System compliance). The outfalls were added to the SWMU list in 1993, even though no chemical releases had been reported for the catchment areas. Similarly, no stained soil was identified at SWMU 233 during inspections conducted between 1993 and 2002.

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

Evaluation of Relevant Information

Site inspections were conducted between 1993 and 2002; no stained soil was observed.

In June 1994, the ground surface at SWMU 233 was surveyed for UXO / HE and radioactive materials; no anomalies were detected.

In September 1994, shallow soil samples were collected at the locations most likely to be contaminated. Eight samples were collected, including two samples at the first discharge point, four at the second discharge point, and two at the furthest extent of visible erosion and scour. The maximum sampling depth of the eight samples was three ft bgs. The soil samples were analyzed for TCLP metals, TPH, VOCs, SVOCs, tritium and gamma-emitting radionuclides. No VOCs were detected in the soil samples. Twelve SVOCs were detected at low concentrations. The maximum TPH concentration was 140 mg/kg. Of the metals, only cadmium exceeded the background value at several locations. The maximum cadmium concentration was 2.3 mg/kg, which exceeded the background value of 0.9 mg/kg. No radionuclides were detected above background activities; however, while uranium-235 and uranium-238 were not detected, the MDAs exceeded the background activities.

In September 2000, historical aerial photographs and TA-IV engineering drawings were used to confirm the discharge locations.

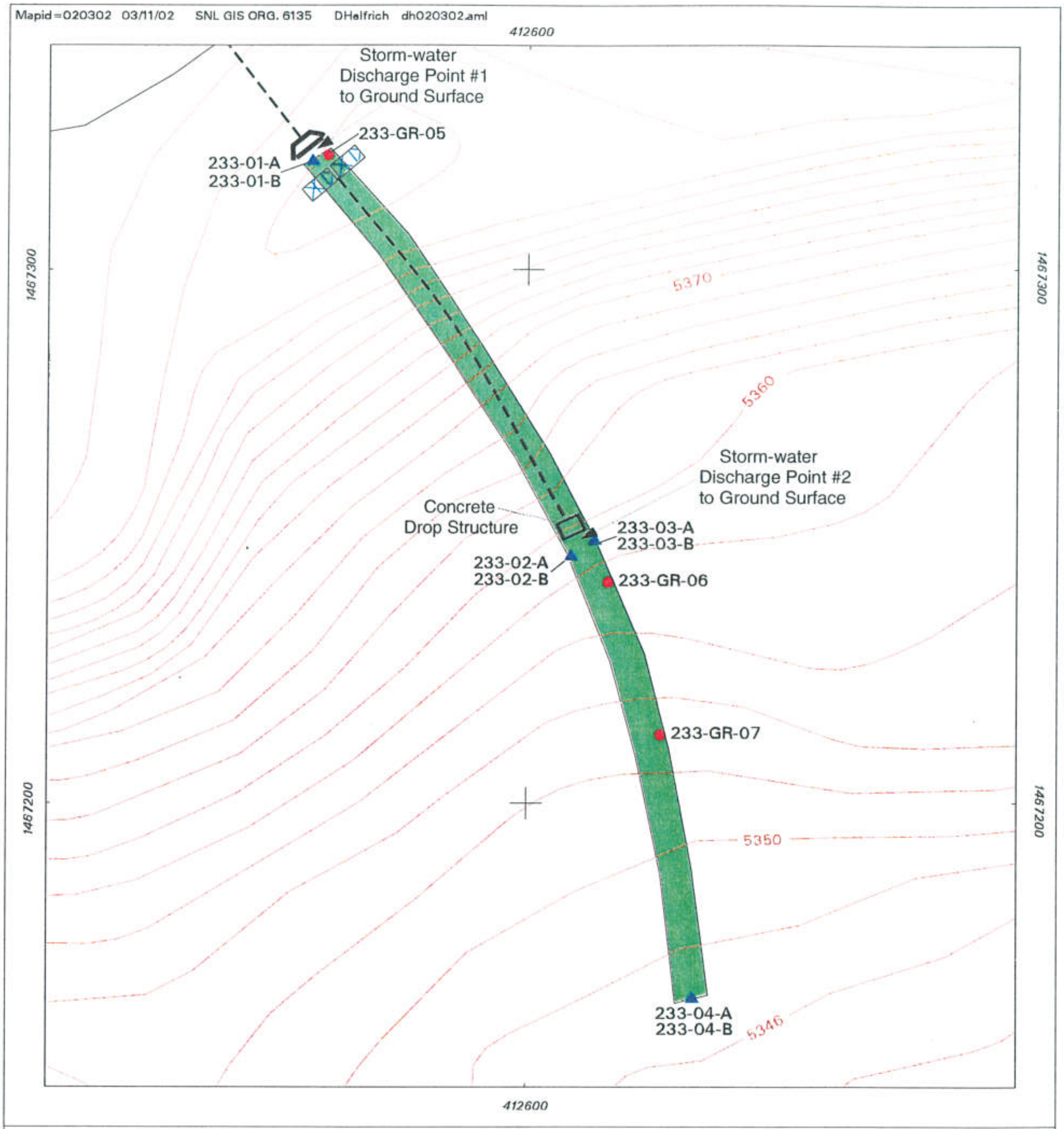
In June 2001, soil samples were collected at the first discharge point and at two locations below the second discharge point. Five soil samples plus one duplicate were collected at depths ranging from 0 to 5 ft bgs. All six samples were analyzed for VOCs, SVOCs, TPH, metals, chromium-VI, gamma-emitting radionuclides, gross alpha/beta and tritium. No VOCs were detected in the samples. Seventeen SVOCs were detected. The maximum TPH concentration was 36.2 mg/kg. Chromium-VI was detected in one sample at a concentration of 0.143 mg/kg J. No metals or radionuclides were reported above the background values.

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 risk are acceptable; for the residential land-use scenario, the total HI was acceptable while the total estimated excess cancer risk was not (Table 19).

However, using the UCL of the mean concentrations for the main contributors to risk [arsenic, benzo(a)pyrene, and benzo(g,h,i)perylene], the total HI and estimated excess cancer risk were reduced to 0.10 and 9E-6, respectively. Both the total human health HI and estimated excess cancer risk were acceptable for the residential land-use scenario under these conditions.

For the radiological COCs (uranuim-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 5.2E-2 millirem (mrem)/year (yr). The estimated excess cancer risk is 3.4E-7.

Ecological risks associated with SWMU 233 were estimated through a screening assessment that incorporated site-specific information when available. Overall, risks to ecological receptors are



Legend

▲ Soil Sample Location (1994)
● Soil Sample Location (2001)
⏢ Headwall with Outfall Pipe
⊠ Metal Grate
— — — Buried Pipe from TA-IV
2-foot Contour
Unpaved Road
🟩 SWMU 233

Figure 25
Soil Sampling Locations for SWMU 233

0 15 30
Scale In Feet

0 3.6 7.2
Scale in Meters

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Table 19
Risk Assessment Values for SWMU 233 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	5.1	0.02/**Below Background**[b]	3E-6/**Below Background**[b]	0.24/ **Below Background**[b]	1E-5/ **Below Background**[b]
Barium	210	0.00		0.04	
Cadmium	2.3	0.00	8E-10	0.06	2E-9
Chromium VI	0.143 J	0.00	3E-10	0.00	7E-10
Organic					
Anthracene	0.044 J	0.00		0.00	
Acenaphthene	0.033 J	0.00		0.00	
Benzo(a)anthracene	0.236	0.00	6E-8	0.00	4E-7
Benzo(a)pyrene	0.282/**0.185**	0.00/**0.00**	7E-7/**4E-7**	0.00/**0.00**	5E-6/**3E-6**
Benzo(b)fluoranthene	0.291	0.00	8E-8	0.00	5E-7
Benzo(ghi)perylene	0.237/**0.178**	0.00/**0.00**	6E-7/**5E-7**	0.00/**0.00**	4E-6/**3E-6**
Benzo(k)fluoranthene	0.251	0.00	6E-9	0.00	4E-8
2-Butanone	0.006 J	0.00		0.00	
Carbazole	0.0126 J	0.00	9E-11	0.00	4E-10
2-Chlorophenol	0.00766 J	0.00		0.00	
Chrysene	0.316	0.00	9E-10	0.00	5E-9
Di-n-butyl phthalate	0.21	0.00		0.00	
Dibenz[a,h]anthracene	0.121	0.00	3E-7	0.00	2E-6
Dibenzofuran	0.00494 J	0.00		0.00	
bis(2-Ethylhexyl) phthalate	1.0	0.00	5E-9	0.00	2E-8
Fluoranthene	0.345	0.00		0.00	
Fluorene	0.00732 J	0.00		0.00	
Indeno(1,2,3-c,d) pyrene	0.206	0.00	5E-8	0.00	3E-7
2-Methylnaphthalene	0.0053 J	0.00		0.00	
Naphthalene	0.086 J	0.00		0.00	
Phenanthrene	0.110	0.00		0.00	
Pyrene	0.418	0.00		0.00	
Total		0.02/**0.00**	5E-6/**1E-6**	0.34/**0.10**	2E-5/**9E-6**

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

[a] EPA 1989.

[b] UCL concentration was below background screening level. Therefore risk was not calculated.

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

expected to be low because predicted risks associated with exposure to COPECs are based upon calculations using maximum detected values. The mean concentrations of the metals of concern (arsenic and barium) were found to be within background range. The mean concentrations of organics of concern [benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and chrysene] did not result in HQs greater than unity. For bis(2-ethylhexyl)phthalate, the application of a more realistic area use factor to the exposure estimation for the burrowing owl is sufficient to reduce all HQs to values less than unity. Based upon this final analysis, ecological risks associated with SWMU 233 are acceptable.

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

Basis for Determination

SWMU 233 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 234, Storm Drain System Outfall

Site Location

SWMU 234, the Storm Drain System Outfall, is located about 145 ft south of TA-IV on land that is owned by KAFB and leased to the DOE. SWMU 234 covers approximately 0.15 acres of unpaved ground along the steep northern rim of Tijeras Arroyo. The Outfall consists of a 270-ft long earthen ditch (Figure 26). No piping or outfall components are currently present. Before removal in the early 1990s, the outfall consisted of a steel pipe that discharged onto the ground surface. When the outfall pipe was removed, the storm water was re-directed through a buried pipe to the nearby SWMU 233 outfall.

Operational History

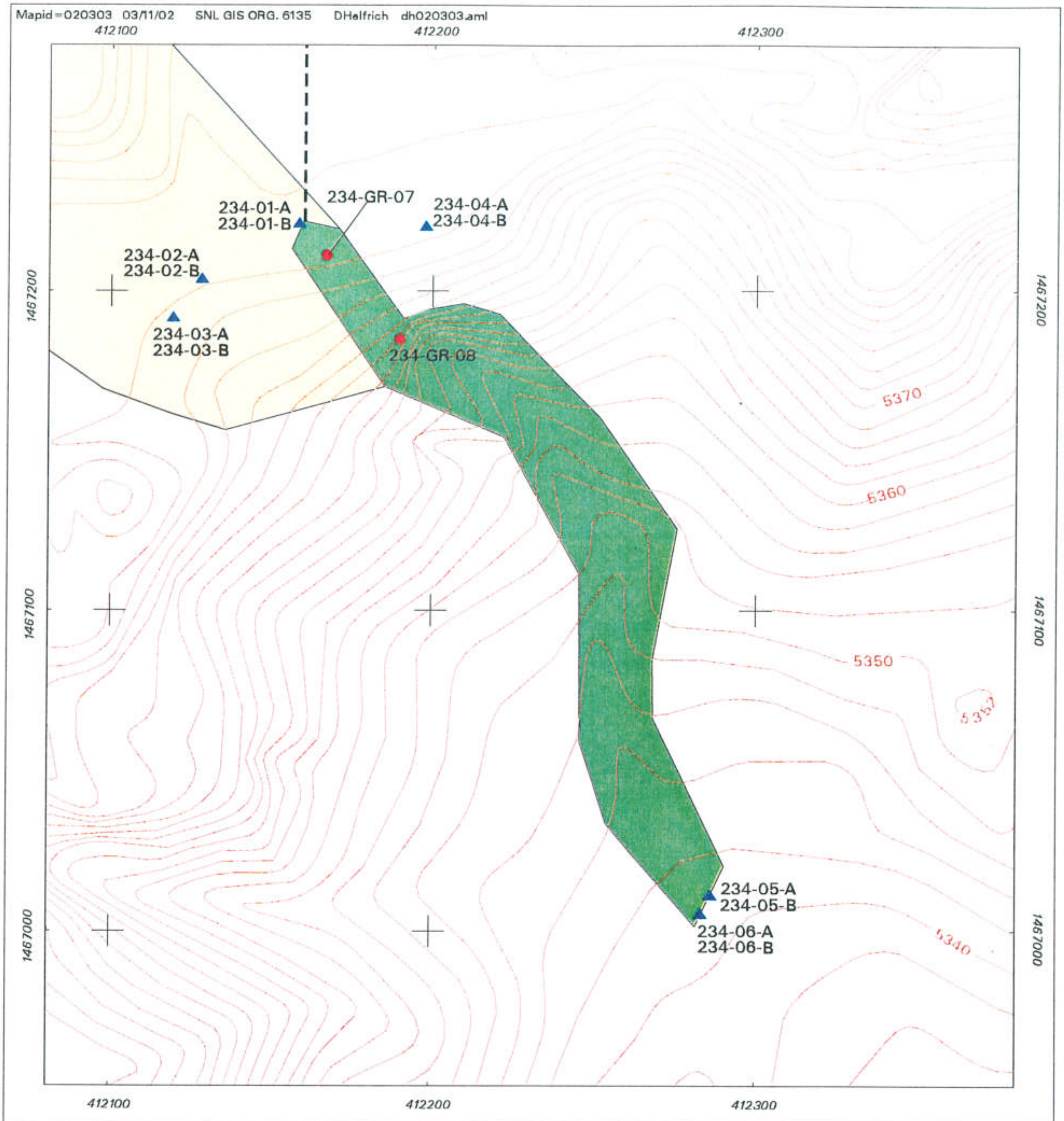
SWMU 234 is one of five storm-water outfalls that have been connected to TA-IV; the other four are SWMUs 230, 231, 232 and 233. The TA-IV storm-water outfalls are managed under two separate regulatory programs (the ER Project for RCRA Corrective Action, and the Storm Water Program annual reporting for NPDES compliance). The outfalls were added to the SWMU list in 1993, even though no chemical releases had been reported for the catchment areas. Similarly, no stained soil was identified at SWMU 234 during inspections conducted between 1993 and 2002.

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

Evaluation of Relevant Information

In June 1994, the ground surface at SWMU 234 was surveyed for UXO/HE and radioactive materials; no anomalies were detected.

In September 1994, twelve shallow-soil samples were collected at six locations that were all considered to be within the SWMU boundary at the time; later investigation (see below) revealed that six samples from three locations were outside the SWMU boundaries. The maximum sampling depth of the six original locations was three ft bgs. All the soil samples were analyzed for TCLP metals, chromium VI and TPH. No TPH was detected in the soil samples.



Legend

▲ Soil Sample Location (1994)

● Soil Sample Location (2001)

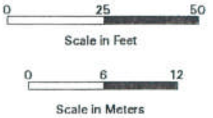
— 2-foot Contour

– – – – Previous location of buried TA-IV Outfall Pipe

🟩 SWMU 234

☐ SWMU 46

Figure 26
Sampling Locations for
SWMU 234



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Selected samples were also analyzed for VOCs, SVOCs, tritium and gamma-emitting radionuclides. One VOC (acetone) was detected in one of the soil samples. Four SVOCs were detected. Thorium-232, uranium-238, and tritium were detected above background values.

In September 2000, historical aerial photographs and TA-IV engineering drawings were used to determine the correct location for the outfall pipe. The boundary for SWMU 234 was revised after this evaluation.

In June 2001, three soil samples plus one duplicate were collected with a backhoe from two locations along the centerline of the ditch. The soil samples were collected at depths ranging from 0 to 5 ft bgs. All the soil samples were analyzed for VOCs, SVOCs, TPH, RCRA metals, chromium VI, gamma-emitting radionuclides, gross alpha/beta and tritium. No VOCs were detected in the samples. Seventeen SVOCs were detected. The maximum TPH concentration was 5.23 mg/kg. Chromium VI was detected in one sample at a concentration of 2.08 mg/kg. One sample had a silver concentration of 1 mg/kg which is near the background value. No radionuclides were detected above the background values; however, the MDA for uranium-235 exceeded the background value in several samples.

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 human health HI and estimated excess cancer risk are acceptable; for the residential land-use scenario, the total human health HI was acceptable while the estimated excess cancer risk was not (Table 20).

Using the UCL of the mean concentrations for the main contributors to risk [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene benzo(ghi)perylene and arsenic], the total HI and estimated excess cancer risk for the residential land-use scenario were reduced to 0.35 and 2E-5, respectively. The estimated cancer risk is not acceptable for the residential-land use scenario.

For the radiological COCs (thorium-232, tritium, uranuim-235 and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 13 millirem (mrem)/year (yr). The estimated excess cancer risk is 1.9E-4 which is not acceptable.

Ecological risks associated with SWMU 234 were estimated through a screening 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 COPECs are based upon calculations using maximum detected values. The mean concentrations of the metals of concern (arsenic, barium and total chromium) were found to be within background range. The mean concentrations of organics of concern [benzo(a)pyrene, benzo(b)fluoranthene, chrysene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene] and chromium VI did not result in HQs greater than unity. Based upon this final analysis, ecological risks associated with SWMU 234 are predicted to be low.

Table 20
Risk Assessment Values for SWMU 234 Nonradiological COCs

COC	Maximum Concentration /**UCL Concentration** (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	7/**4.60**	0.02/**0.02**	4E-6/**3E-6**	0.32/**0.21**	2E-5/**1E-5**
Barium	240	0.00		0.05	
Cadmium	2.9	0.01	1E-9	0.07	2E-9
Chromium, total	17.7	0.00		0.00	
Chromium VI	2.08	0.00	5E-9	0.01	1E-8
Organic					
Acenaphthene	0.00626 J	0.00		0.00	
Acetone	0.015	0.00		0.00	
Anthracene	0.0212 J	0.00		0.00	
Benzo(a)anthracene	0.258/**0.242**	0.00/**0.00**	7E-8/**7E-8**	0.00/**0.00**	4E-7/**4E-7**
Benzo(a)pyrene	0.435/**0.234**	0.00/**0.00**	1E-6/**6E-7**	0.00/**0.00**	7E-6/**4E-6**
Benzo(b)fluoranthene	0.506/**0.375**	0.00/**0.00**	1E-7/**7E-8**	0.00/**0.00**	8E-7/**6E-7**
Benzo(ghi)perylene	0.309/**0.267**	0.00/**0.00**	8E-7/**7E-7**	0.00/**0.00**	5E-6/**4E-6**
Benzo(k)fluoranthene	0.471	0.00	1E-8	0.00	8E-8
Carbazole	0.0182 J	0.00	1E-10	0.00	6E-10
Chrysene	0.435	0.00	1E-9	0.00	7E-9
Di-n-butyl phthalate	0.0207 J	0.00		0.00	
Di-n-octyl phthalate	0.0102 J	0.00		0.00	
bis(2-Ethylhexyl) phthalate	0.28 JB	0.00	1E-9	0.00	6E-9
Fluoranthene	0.450	0.00		0.00	
Fluorene	0.00666 J	0.00		0.00	
Indeno(1,2,3-c,d) pyrene	0.345 J	0.00	9E-8	0.00	6E-7
Phenanthrene	0.139	0.00		0.00	
Pyrene	0.603	0.00		0.00	
Total		0.03/**0.03**	6E-6/**4E-6**	0.46/**0.35**	3E-5/**2E-5**

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

[a]EPA 1989.

B = Analyte detected in method blank.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

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

Basis for Determination

SWMU 234 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.

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 27). 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

Mapid=060201 05/16/06 SNL EGIS ORG. 6146 DHelfrich dh060201.aml

Legend

- ● Soil Boring Location
- ▬ Septic Tank / Distribution Box
- - - - - Drain Line
- ▬ Building / Structure
- o—o—o—o Fence
- Paved Road

Figure 27
Site Map of Drain and Septic Systems (DSS) AOC 1090, Bldg. 6721 Septic System, TA-III

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

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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 27. 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 27). 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 21).

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 (uranuim-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 conservatisms 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.

Table 21
Risk Assessment Values for AOC 1090 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
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	
Organic					
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	
Total		**0.02**	**1E-5**	**0.28**	**4E-5**

[a]EPA 1989.

AOC = Area of Concern.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Concentration was qualified as an estimated value.
mg/kg = Milligram(s) per kilogram.

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.

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 28). 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.

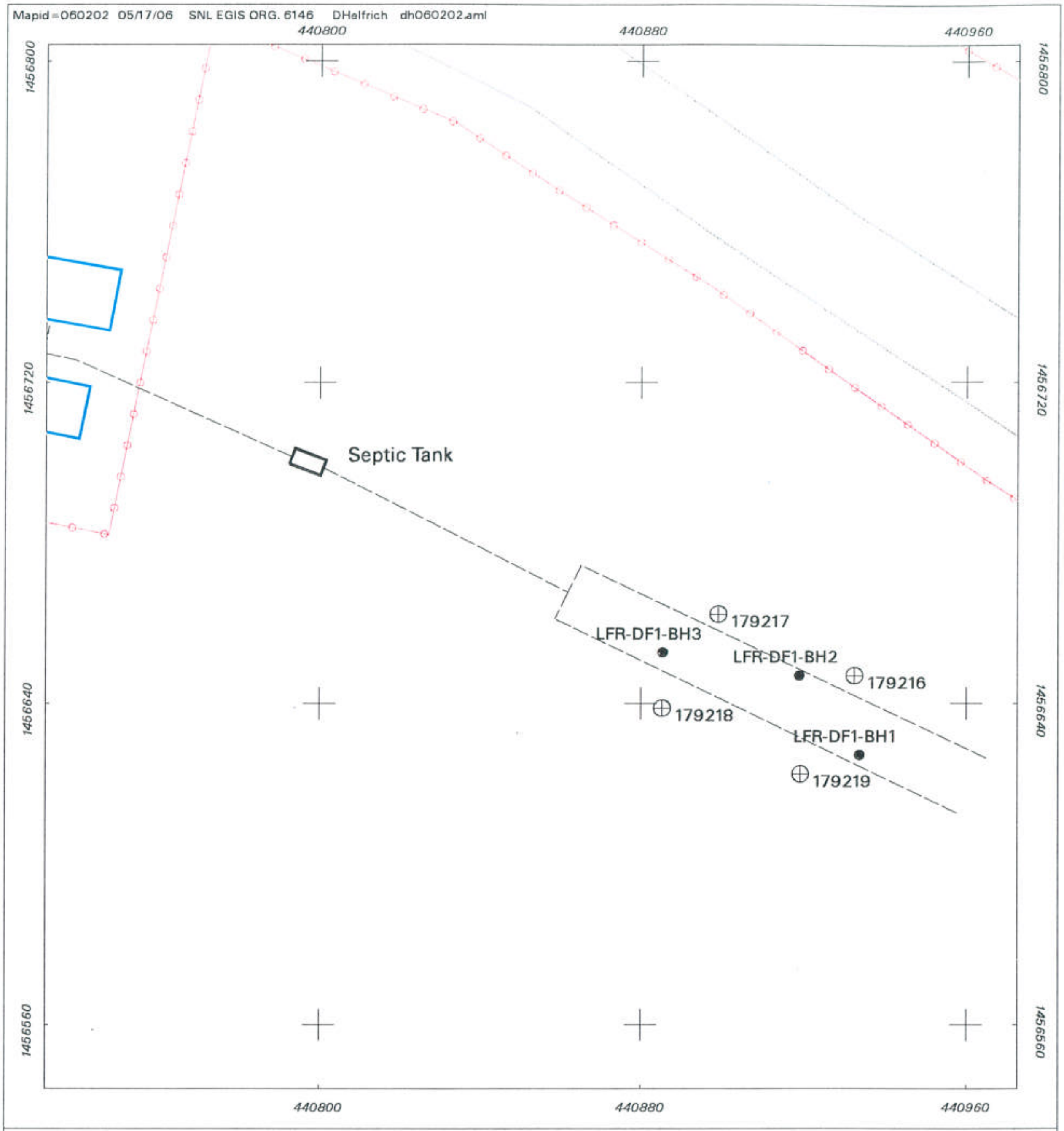
Investigation 1—Backhoe Excavation

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



Legend

●	Soil Boring Location
⊕	Gore-Sorber™ Sample Location
▭	Septic Tank
o · o · o · o	Fence
┈	Unpaved Road
―	Building / Structure
— — —	Sewerline, Drain Line

Figure 28
Site Map of Drain and Septic Systems (DSS) AOC 1094, Live Fire Range East Septic System, Lurance Canyon

0 20 40
Scale in Feet

0 4.8 9.6
Scale in Meters

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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 28). Only toluene was detected in the April 2005 samples at a maximum concentration of 6.63 μg/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 22).

For the radiological COC (uranuim-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.

Table 22
Risk Assessment Values for AOC 1094 Nonradiological COCs

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

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

AOC = Area of Concern.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.

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.

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 29).

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 29). 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.

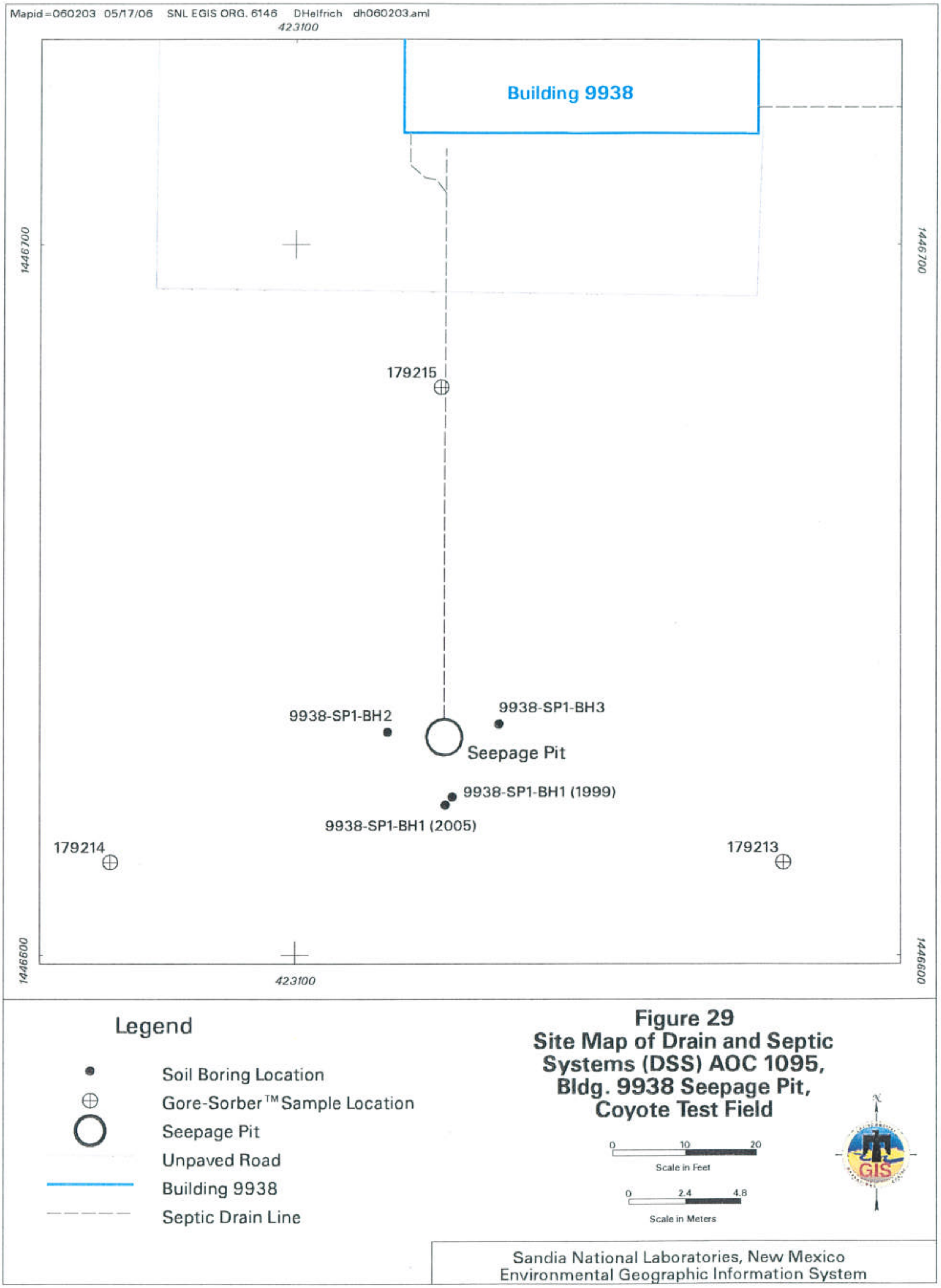

Figure 29
Site Map of Drain and Septic Systems (DSS) AOC 1095, Bldg. 9938 Seepage Pit, Coyote Test Field

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 23).

Table 23
Risk Assessment Values for AOC 1095 Nonradiological COCs

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

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

AOC = Area of Concern.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.

For the radiological COC (uranuim-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.

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 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 30).

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 24).

For the radiological COC (uranuim-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.

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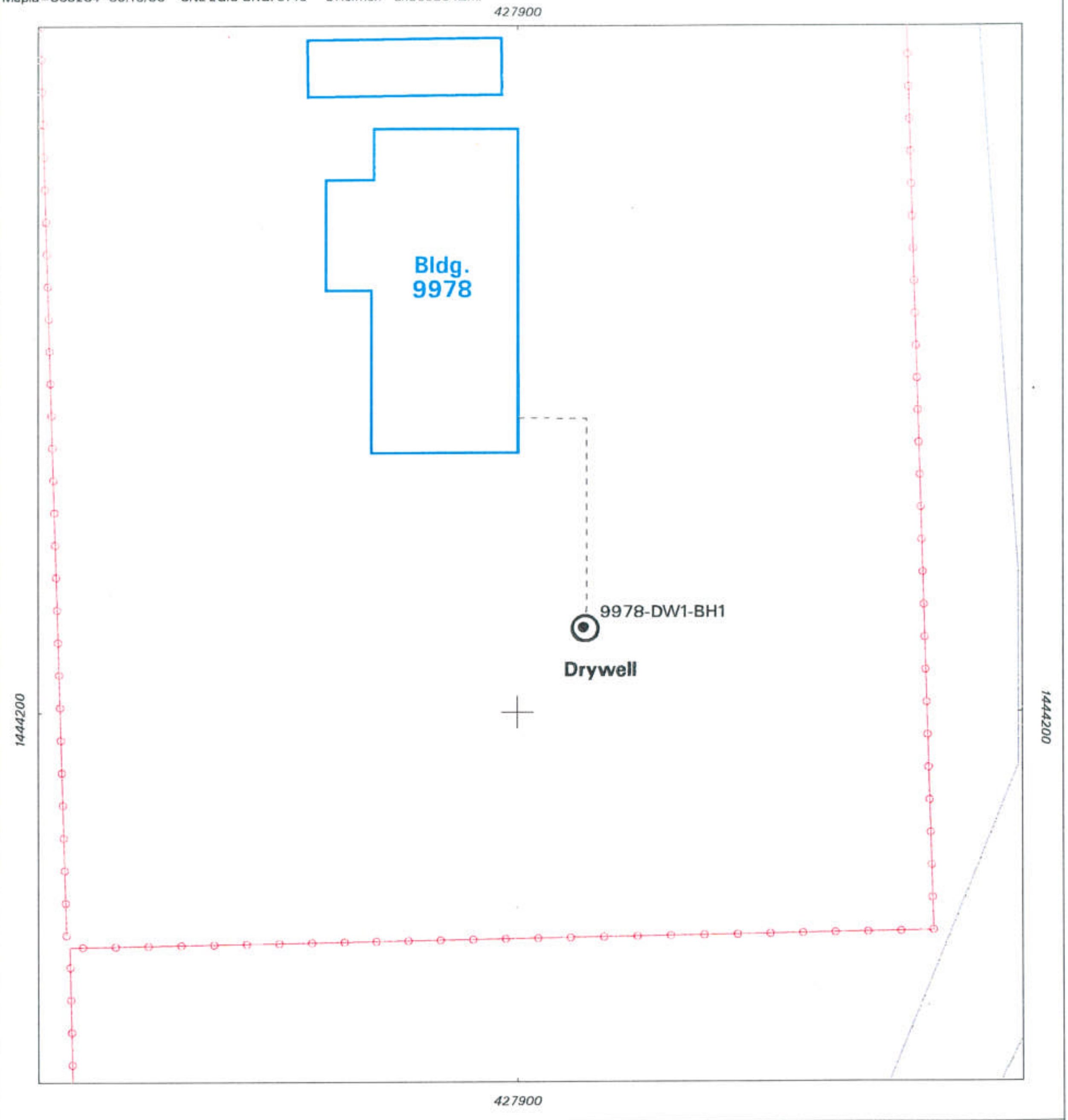


Legend

- ● Borehole Location
- ○ Drywell
- - - - - Drain Line
- ─ Building / Structure
- Unpaved Road
- o-o-o Fence

Figure 30
Site Map of Drain and Septic Systems (DSS) AOC 1114, Bldg. 9978 Drywell, Coyote Test Field

0 10 20
Scale in Feet

0 2.4 4.8
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Table 24
Risk Assessment Values for AOC 1114 Nonradiological COCs

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

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

AOC = Area of Concern.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
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 1115, Former Offices Septic System

Site Location

AOC 1115 is located at the former headquarters for the Solar Tower Complex on federal land controlled by KAFB and permitted to the DOE. The site is located approximately 1,400 ft northwest of the solar tower. The abandoned septic system consisted of a 1,500-gallon septic tank that emptied to a herringbone-shaped drainfield with seven branching laterals, each about 50 ft long (Figure 31). Construction details are based upon engineering drawings, site inspections and backhoe excavations of the system. The system received discharges from three mobile office trailers that were located approximately 170 ft to the east.

Operational History

Available information indicates that mobile office trailers used as the temporary headquarters for the Solar Tower Complex were placed on site around 1976 and it is assumed the septic system was constructed at the same time. The mobile offices were relocated to TA-I in June 1979. At some point after the relocation, the septic tank was pumped out. The tank was inspected by the Department in July 2005, and was found to be empty and dry and a closure form was signed. The empty tank was caved in and backfilled with clean soil 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 have been conducted at this site. In August 1999, a backhoe was used to locate the buried drainfield drain lines (Investigation 1). In August 1999 and April 2005, subsurface soil samples were collected from three borings in the drainfield (Investigation 2).

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 seven branching laterals, as shown in Figure 31, with an average drain line trench depth of 5 ft bgs. 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

Once the system drain lines were located, soil sampling was conducted. In August 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 5 feet below the top of the upper sample interval.

In April 2005, additional soil samples for VOC analysis only were collected from the same three 1999 borehole locations. AOC 1115 was one of five shallow groundwater DSS sites that had 2-butanone concentrations above the 10 ppb 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. After meeting with the Department, it was decided to resample AOC 1115 and the other four sites for VOCs only. At AOC 1115, it was agreed that additional VOC samples would be collected at the original 1999 sample locations and depths, and additional samples would be collected at 5 and 10 feet below the original sample depths, as specified by the Department. The VOC resampling was conducted in April 2005. Only toluene was detected in the April 2005 samples at a maximum concentration of 4.25 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.

The soil boring location for the 12 soil samples and 1 duplicate collected for VOCs in April 2005 is shown on (Figure 31). Low concentrations of toluene were detected in all but the duplicate sample collected. In addition, toluene was not detected in either the EB or TB associated with these samples. A trace of acetone was detected only in the TB associated with these samples.

The remaining results are from six soil samples collected in August 1999. A low concentration of the SVOC, di-n-butyl phthalate, was detected in the 5-ft-bgs sample from borehole BH2. A trace amount of the PCB, aroclor-1242, was detected in the 5-ft-bgs sample from borehole BH1.

No HE compounds were detected in any of the soil samples collected. One RCRA metal (lead) was detected at concentrations above Department-approved background levels in the 10-ft-bgs sample from borehole BH1 and in the 5-ft-bgs sample from borehole BH3. Hexavalent chromium was detected. All other metal concentrations were below background levels. Low concentrations of cyanide were detected in each of the 5-ft bgs samples from all three boreholes. For radionuclides, uranium-238 activity was detected slightly above the Department-approved background level in the 10-ft bgs samples from boreholes BH2 and BH3. However, although not detected, the MDAs for two of the uranium-235 analyses exceeded the background activity. 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 in 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 25).

For the radiological COCs (uranuim-235and uranium-238) a total effective dose equivalent (TEDE) was calculated that results in a TEDE of 3.3E-2 millirem (mrem)/year (yr). The estimated excess cancer risk is 3.3E-7.

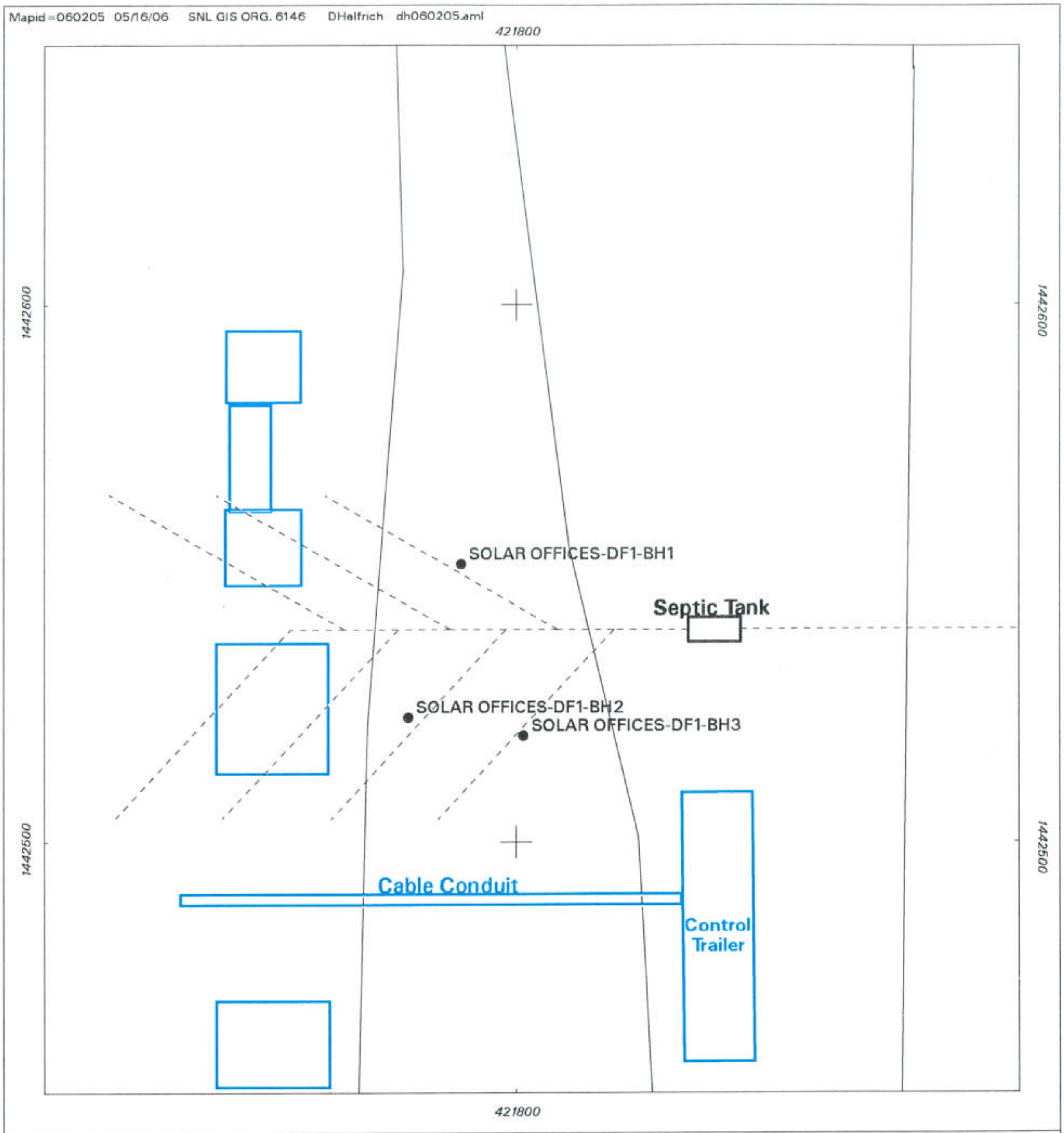
Table 25
Risk Assessment Values for AOC 1115 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Chromium VI	0.151 J	0.00	3E-10	0.00	7E-10
Cyanide	0.285[b]	0.00		0.00	
Organic					
Di-n-butyl phthalate	0.21 J	0.00		0.00	
Toluene	0.0042	0.00		0.00	
Total		**0.00**	**3E-10**	**0.00**	**7E-10**

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

AOC = Area of Concern.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.



Legend

● Soil Boring Location
- - - - - - Sewerline / Drain Line
——— Building / Structure
——— Road
▭ Septic Tank

Figure 31
Site Map of Drain and Septic Systems (DSS) AOC 1115, Former Offices Septic System, Solar Tower Complex

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

The exposure pathway analysis established that no complete ecological exposure pathway exists for exposure of ecological species to contaminants at AOC 1115. All COCs are located at depths of 5 ft bgs or greater. 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 1115 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 32). 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.

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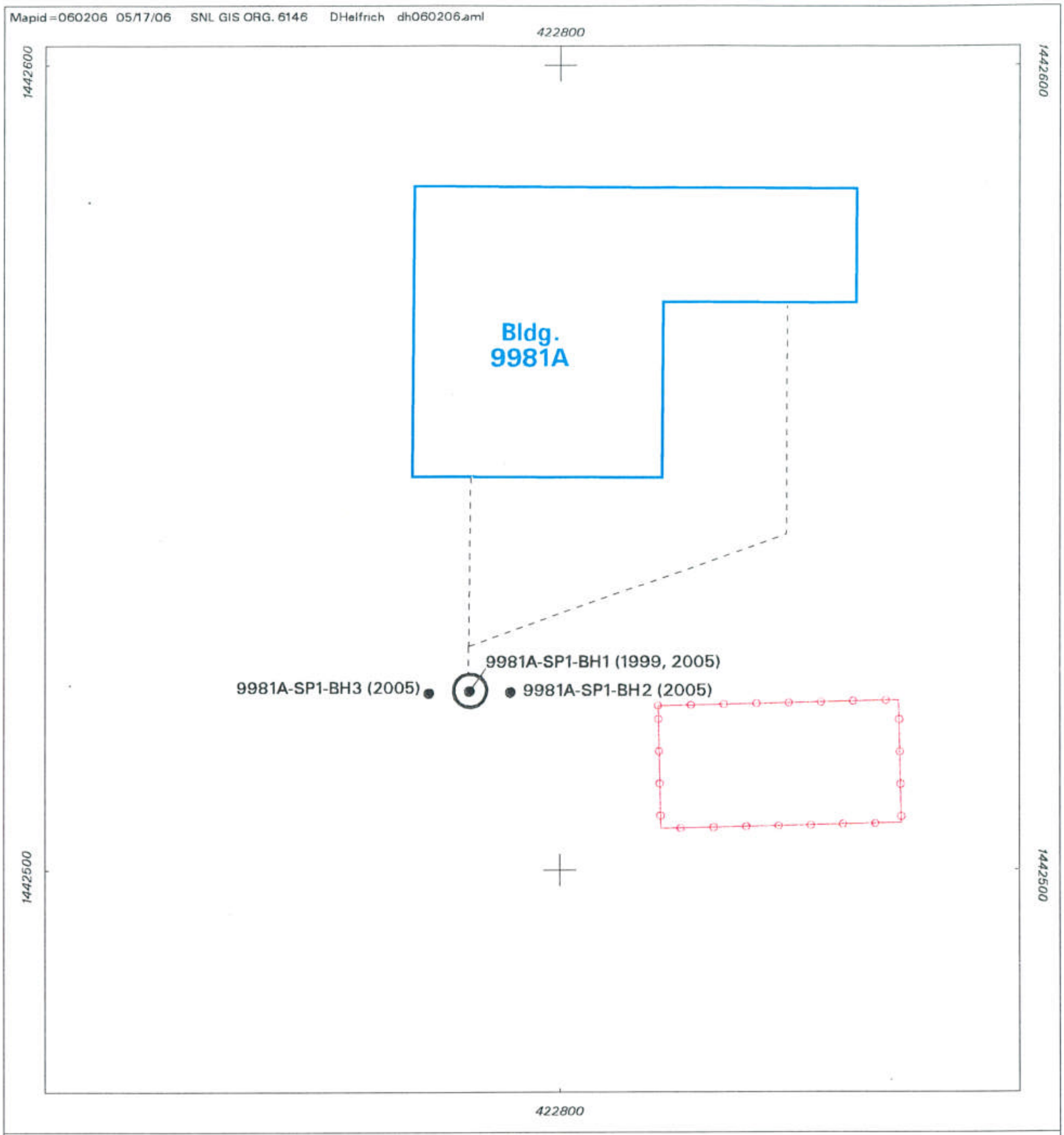


Legend

●	Soil Boring Location
○	Seepage Pit
- - - - - - -	Sewerline / Drain Line
○—○—○—○	Fence
—	Building / Structure

Figure 32
Site Map of Drain and Septic Systems (DSS) AOC 1116, Bldg. 9981A Seepage Pit, Solar Tower Complex

0 10 20
Scale in Feet

0 2.4 4.8
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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 32). 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 26).

For the radiological COCs (thorium-232 and uranuim-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.

Table 26
Risk Assessment Values for AOC 1116 Nonradiological COCs

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

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

AOC = Area of Concern.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.

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.

AOC 1117, Building 9982 Drywell, Solar Tower Complex

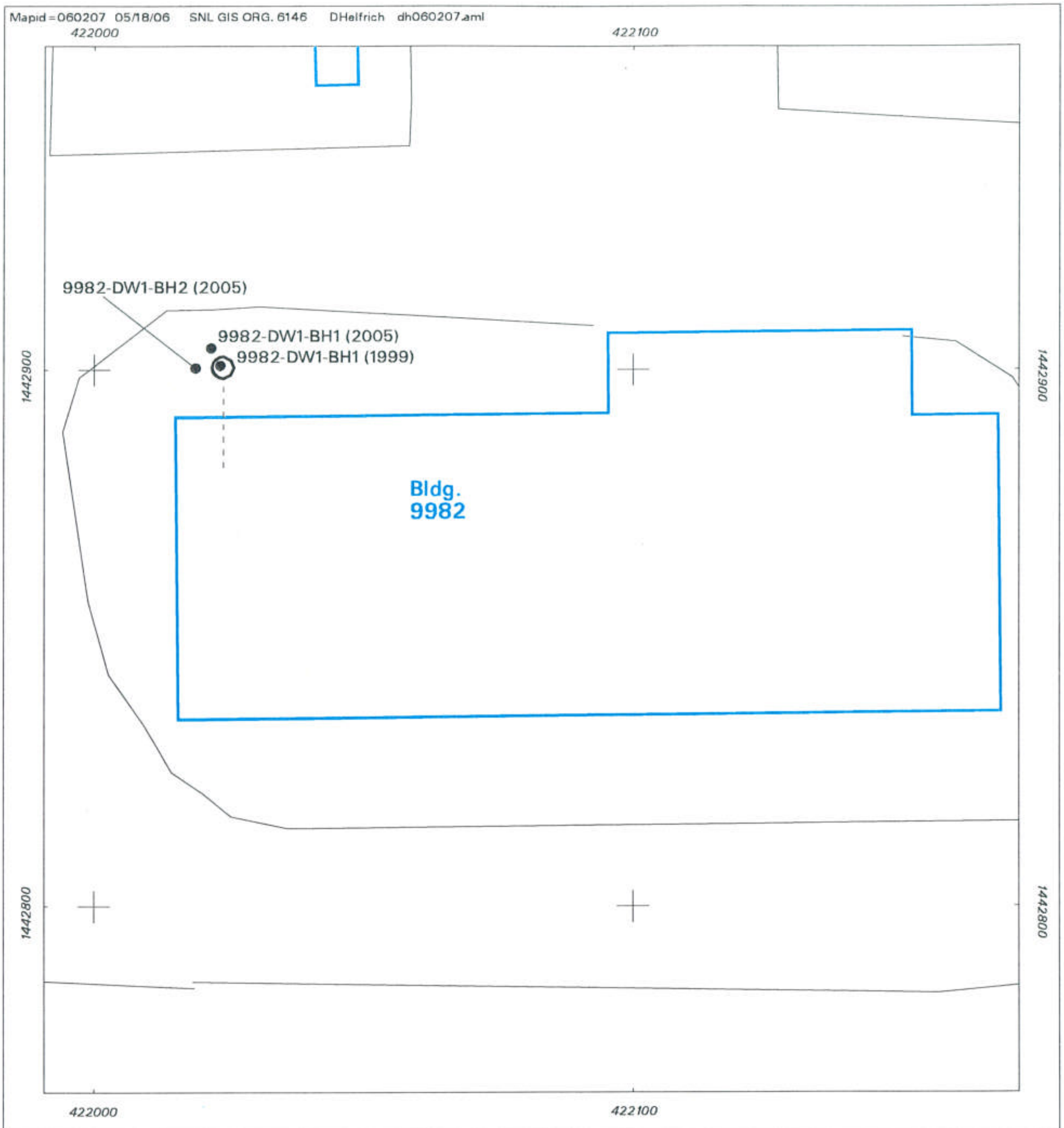
Site Location

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 33). 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.



Legend

- ● Soil Boring Location
- ○ Drywell
- - - - Drain Line
- — Edge of Pavement
- ▭ Building 9982

Figure 33
Site Map of Drain and Septic Systems (DSS) AOC 1117, Bldg. 9982 Drywell, Solar Tower Complex

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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 33 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 27).

For the radiological COC (uranuim-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 27
Risk Assessment Values for AOC 1117 Nonradiological COCs

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

[a] EPA 1989.

[b] Nondetected concentration (concentration listed is one-half of the maximum detection limit, used for a conservative risk assessment).

AOC = Area of Concern.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.

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.

J. References

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