Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Date: June 27, 1997
In Reply Refer To: ESH-18/WQ&H:97-0192
Mail Stop: K497
Telephone: (505) 665-2014

Ms. Barbara Hoditscheck, Environmental Specialist
Surface Water Quality Bureau
New Mexico Environment Dept.
P.O. Box 26110
Santa Fe, New Mexico 87502

SUBJECT: RESPONSE TO JUNE 19, 1997, VERBAL REQUEST FOR INFORMATION CONCERNING FLOW OBSERVED BELOW THE TA-33-93 SEPTIC TANK

Dear Ms. Hoditscheck:

This correspondence is in response to your request for information concerning the discharge observed by NMED and Laboratory personnel on May 30, 1997, below the TA-33-93 septic tank.

The following is a brief chronology of events and corrective measures taken concerning the surface flow from this septic system.

- On May 27, 1997, a Johnson Controls Inc. (JCI) fitter at TA-33-86 started the cooling system for the control and process rooms at Building 86. This cooling system is run during hot weather to cool the building.

- During a site visit on May 30, 1997, at approximately 2:30 p.m., NMED Surface Water Quality Bureau (SWQB), ESH-18 and ESA staff observed a small pool of water located at the southeast corner of the TA-33-93 septic system leach field, which serves TA-33, Building 86. The pool was clear and not flowing at the time.

- At 3:30 p.m. on May 30, 1997, ESA staff contacted personnel at the site and requested that the source of this discharge be traced to its origin.

- ESA staff determine on June 13, 1997, that water was coming from the cooling system blowdown inside of Building 86. At that time the flow to the system was reduced.

- ESA staff re-evaluated the cooling system water use on June 16, 1997, and again reduced the flow.


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- Another site visit was conducted on June 19, 1997, by ESA staff in order to verify that flow was no longer occurring. Staff verified that no flow and no standing water was present at the discharge point.

- On June 19, 1997, approximately 2:30 p.m. NMED/SWQB staff notified ESH-18 that this release should be reported as a spill under Section 1203 of the N. M. Water Quality Control Commission Regulations. ESH-18 provided NMED/SWQB staff with information regarding the discharge. NMED indicated that this telephone conversation fulfilled the 24-hour verbal notification requirement.

- On June 20, 1997, ESH-18 and ESA staff again visited the site to determine the precise location of this discharge and to determine if there was any further indication of flow. The discharge point was located and no water was evident on the surface from the previously identified discharge.

- ESH-19 notified the NMED Hazardous and Radioactive Materials Bureau (HRMB) of this release on June 20, 1997, pursuant to Resource and Conservation Recovery Act (RCRA), Module 8, Section H, requirements.

- Engineering drawings of TA-33-93 septic system indicate a 4 inch drain pipe daylighting from the leach field.

- An occurrence reporting meeting was held on June 24, 1997, pursuant to DOE Order 5003.B.

Attached is the Release Notification regarding this discharge. Please call me at 665-2014 or Mike Saladen at 665-6085 of the Laboratory's Water Quality and Hydrology Group (ESH-18) if you need any additional information.

Sincerely,

Harvey Decker
ESH-18
Water Quality and Hydrology Group

HD/rj

Attach: a/s

Cy: S. Rae, ESH-18, w/att., MS K497
M. Saladen, ESH-18, w/att., MS K497
M. Alexander, ESH-18, w/o att., MS K497
S. Yanicak, NMED DOE OB, w/att., MS J993
S. Veenis, ESH-18, w/o att., MS K497
A. Sherrard, ESA/FM, w/att., MS C924
D. Woitte, LC/Gen, w/o att., MS A187
P. Shanley, ESH-19, w/o att., MS K498
P. Bussolini, FM, FMU 75, w/att., MS E525
B. Garcia, NMED/HRMB, w/att., Santa Fe, New Mexico
WQ&H File, MS K497
CIC-10, MS A150

RELEASE / DISCHARGE NOTIFICATION

LOS ALAMOS NATIONAL LABORATORY

Permit Number: NM0028355

Year 1997

NPDES or Operational Spill/Release ☒ (Indicate by X in appropriate box)

ER Spill/Release ☐

Release ID Number: 13

Responsible Facilty/User Group: ESA/ESH

Contact Person: A. Sherrard

Pager #: NA

Phone #: 665-7226

Cell Phone #: NA

Release/Discharge Location:

TA: 33

Building: 86

This release was discovered on 5/30/97 during a site tour with the NMED. It appears that this release is of cooling water into the septic tank system to the east of building 86 at TA-33.

If the release/discharge is associated with a NPDES Outfall, Potential Release Site (PRS) or Solid Waste Management Unit (SWMU), indicate the site/unit number and its relationship to the release/discharge:

NPDES:☐ PRS:☒ SWMU:☒ PRS/SWMU Number: 33-002(a)

(Indicate by X in appropriate box)

Relationship of the Discharge to a SWMU or PRS:

This septic tank is listed as a SWMU in the May 1992, RFI Work Plan for Operable Unit 1122.

Release / Discharge Occurred: 5/30/97 2:30:00 PM (Date and Time)

Release / Discharge Discovered: 5/30/97 2:30:00 PM (Date and Time)

Release / Discharge Stopped: 6/13/97 2:00:00 PM (Date and Time)

Cleanup Started: (Date and Time)

Cleanup Finished: (Date and Time)

Material(s) Released / Discharged:

Cooling tower blowdown water. Data is included from the September 1995 RFI report for TA-33-002 (a,b,c,d,e)

Release/Discharge Mitigation Method:

Flow of water to cooling system was decreased to prevent flow from septic system to the surface.

Weather Conditions:

Warm

Duration of Release/ Discharge, in HOURS: 408

Est. Volume Released/ Discharged, in GAL. 195000

Est. Volume Recovered, in GAL. 0

Corrective Actions Taken (ie, type of BMPs, etc):

Flow from cooling tower was reduced in order to eliminate surface discharge from septic system.

Nearest Watercourse (Canyon Name) Chaquehui Canyon

If the release/discharge reached a watercourse, describe the estimated surface area affected, presence of release/discharge now in the watercourse, and the media the release/discharge was detected in:

From observation it does not appear that flow from this septic system reached a watercourse from this release. Estimated area impacted is 400 sq. ft. as determined by moist soil near discharge point.

Depth to Groundwater, in FT, if known: 600

Distance to Nearest Drinking Water Well, in FT, if known: 21120 **Well ID#** PM-2

24-HOUR RELEASE / DISCHARGE NOTIFICATIONS

Agency	Name	Phone	Fax	Date and Time
EPA:	E. Spencer			6/19/97 3:00:00 PM
NMED/SWQB:	B. Hoditscheck			6/19/97 2:30:00 PM
NMED/GWQB:	B. Swanson			6/24/97 9:00:00 AM
NMED/HRMB:	K. Hill			6/24/97 9:00:00 AM
NMED/DOE-OB:	S. Yanicak			6/24/97 9:00:00 AM
ESH-18:	H. Decker			6/19/97 3:00:00 PM
DOE:	B. Koch			6/19/97 3:00:00 PM
OTHER:	D. Woitte			

Comments: Although the septic system is listed as 33-002(a) the discharge point for this release appears to eminate near 33-002(e) which is an area that recieved discharge from roof drains from building 86. Included with this report is a brief chronology of events.

Form Completed By: H. Decker

7 DAY RELEASE / DISCHARGE NOTIFICATION

7 Day Notice ☒ **7 Day Notice Date:** 6/24/97 **7 Day Notice By:** H. Decker

(X When Complete)

Comments: Please see attached letter for additional information. Although this release occurred on 5/30/97, on 6/19/97 NMED requested this be reported as 1203.

15 DAY FOLLOW-UP NOTIFICATION

15 day Follow-up Due: 6/14/97 **15-day Follow-Up By:** H. Decker

Comments:

30 DAY RELEASE / DISCHARGE NOTIFICATION

NMED 30 Day Response Date: 7/14/97

Comments:

G. Thomas Todd, Area Manager
Los Alamos Area Office
Department of Energy
Los Alamos, New Mexico 87544
(505) 667-5105

Dennis J. Erickson, ESH Division Director
University of California
Los Alamos National Laboratory
P.O. Box 1663, MS K491
Los Alamos, New Mexico 87544
(505) 667-4218

TABLE 4-1

PRSs AT MDA K

PRS[a] ID	HSWA[b]	PRS TYPE	RECOMMENDATION
33-002(a)	1990	Septic system TA -33-93	Divert outflow; remove sludge. Phase II
33-002(a)	1990	MDA K tritium	Stabilize tritium plume. Phase II
33-002(b)	1990	Sump TA-33-134	Phase II
33-002(c)	1990	Sump TA-33-133	Phase II
33-002(d)	1994	Outfall NPDES EPA 04A147	NFA[c]
33-002(e)	1994	Roof drain from TA-33-86	NFA

[a] PRS = Potential release site.
[b] HSWA = Hazard and Solid Waste Amendment.
[c] NFA = No further action.

4.1 SWMU 33-002(a) TA-33-86 Septic System and MDA K Surface Tritium

SWMU 33-002(a) is listed as the MDA K septic system. In this discussion the SWMU has been expanded to include the surface component of MDA K. SWMU 33-002(a) is discussed in the RFI Work Plan for OU 1122 Subsections 3.2.2.1, 4.1.4, and 4.2.3.1. Based on sampling data collected in May and June and August through November 1993, a tritium plume is proposed for long-term stabilization; the septic tank is proposed for expedited cleanup (EC). A Phase II plan is proposed for the subsurface on Appendix B. The MDA will be posted for radioactivity in accordance with the LANL RADCON manual (LANL 1994, 1235).

SWMU 33-002(a) is the septic system established when tritium facility TA-33-86 was built in 1954. The system consists of 1 860-gal. tank TA-33-93 and a tiled drain field approximately 50 ft x 100 ft. The system serves three floor drains, three sinks, and two bathrooms—both with toilet, sink, and shower facilities. The building was removed from service in 1990. No personnel are stationed in the building and all equipment has been removed. Because building TA-33-86 has a water supply, the septic system is considered active.

The tank is located about 100 ft east of the tritium facility (Fig. 4-1). The drain field is east and downslope of the tank. The ground level slopes gently east about 350 ft to a drainage channel. The soil is a sandy loam with inclusions of pumice. The eastern end has sections of exposed bedrock. The surface of the drain field supported a thick, almost impenetrable, growth of chamisa, now showing signs of stress due to lack of water. The lower section of the drain field has been disturbed by drilling activities. The remainder of the site is typical pinyon-juniper woodland.

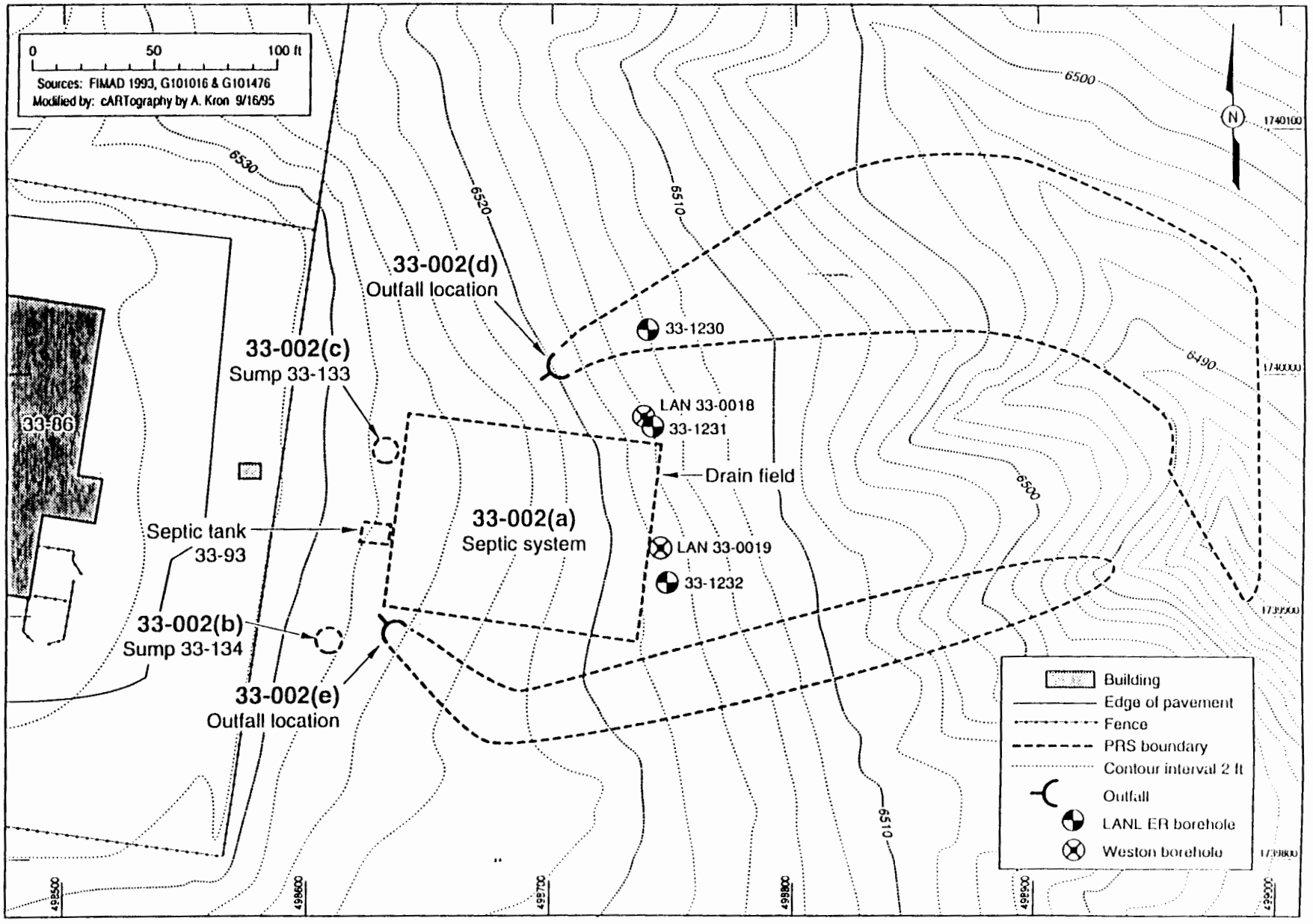

Fig. 4-1. PRS locations at MDA K.

4.1.1 Previous Investigation

Surface monitoring conducted by the LANL Environmental Surveillance Program in 1986 is discussed in detail in Subsection 3.2.4 of the work plan (LANL 1992, 0784). Elevated levels of tritium were detected at MDA K. Figure 4-2 shows the 1986 distribution of surface tritium.

In 1989 personnel from Weston sampled at MDA K. Samples were collected from surface locations, sumps, and three boreholes drilled at the lower boundary of the drain field. Weston data are discussed in conjunction with LANL ER activities in the following assessments, as appropriate. In Subsection 4.1.3.2.1, Weston borehole analytical results are compared to LANL ER borehole results in 1993.

4.1.2 Field Investigation

As specified in the sampling and analysis field plan for SWMU 33-002(a) one liquid sample and one sludge sample were taken from the tank. Duplicates of the fluid/sludge samples were not taken. Four samples, including one duplicate, were taken from a borehole adjacent to the tank. Two boreholes were drilled into the drain field with samples taken at 5 and 10 ft in each location. Two surface samples, one in duplicate and one in triplicate, were also taken in the drain field.

All samples were analyzed for uranium, tritium, plutonium, gamma emitters, inorganics, and SVOCs. Nine subsurface samples were analyzed for VOCs. The surface sample and its duplicate from the borehole adjacent to the tank were analyzed for pesticides and herbicides.

In autumn of 1993, three deep boreholes were drilled in an attempt to further characterize a tritium plume discovered by the Weston investigation in 1989 (LANL 1992, 0784). The northernmost borehole was drilled in the cattail bed formed when the cooling water outfall was active. The middle borehole was drilled near the Weston borehole at the northeast corner of the drain field where geophysical studies indicated that a subsurface anomaly existed. The third borehole was drilled at the southeast corner of the drain field (Fig. 4-3). Samples were taken at approximately 5-ft intervals along the length of each borehole and all samples were analyzed for tritium. In the first 30 ft of each borhole all samples were also analyzed for inorganics and SVOCs. Subsurface samples were analyzed for VOCs. Six additional samples in the three boreholes were analyzed for inorganics, SVOCs, and VOCs.

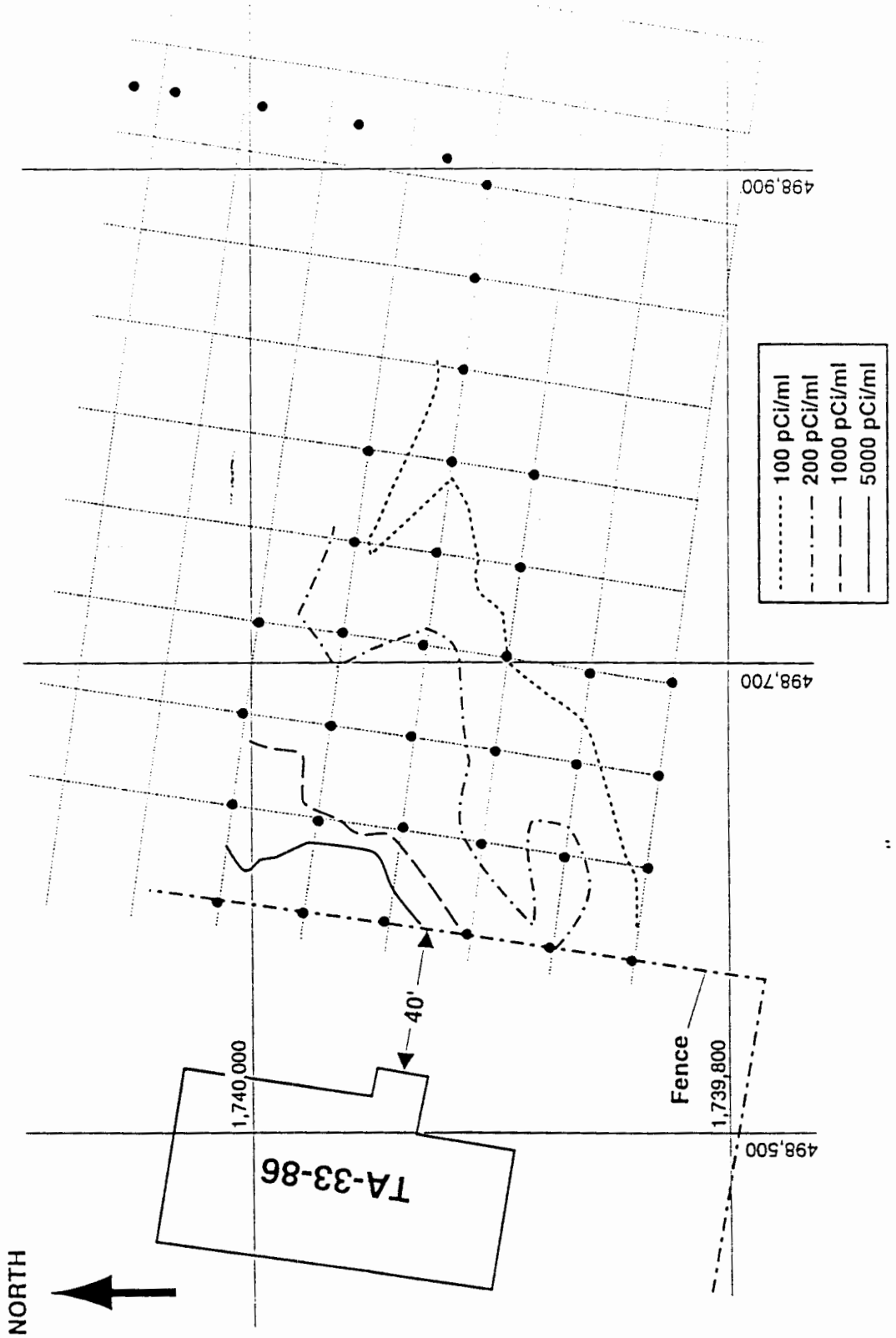

Fig. 4-2. Tritium in surface soil moisture at MDA K (1986 survey).

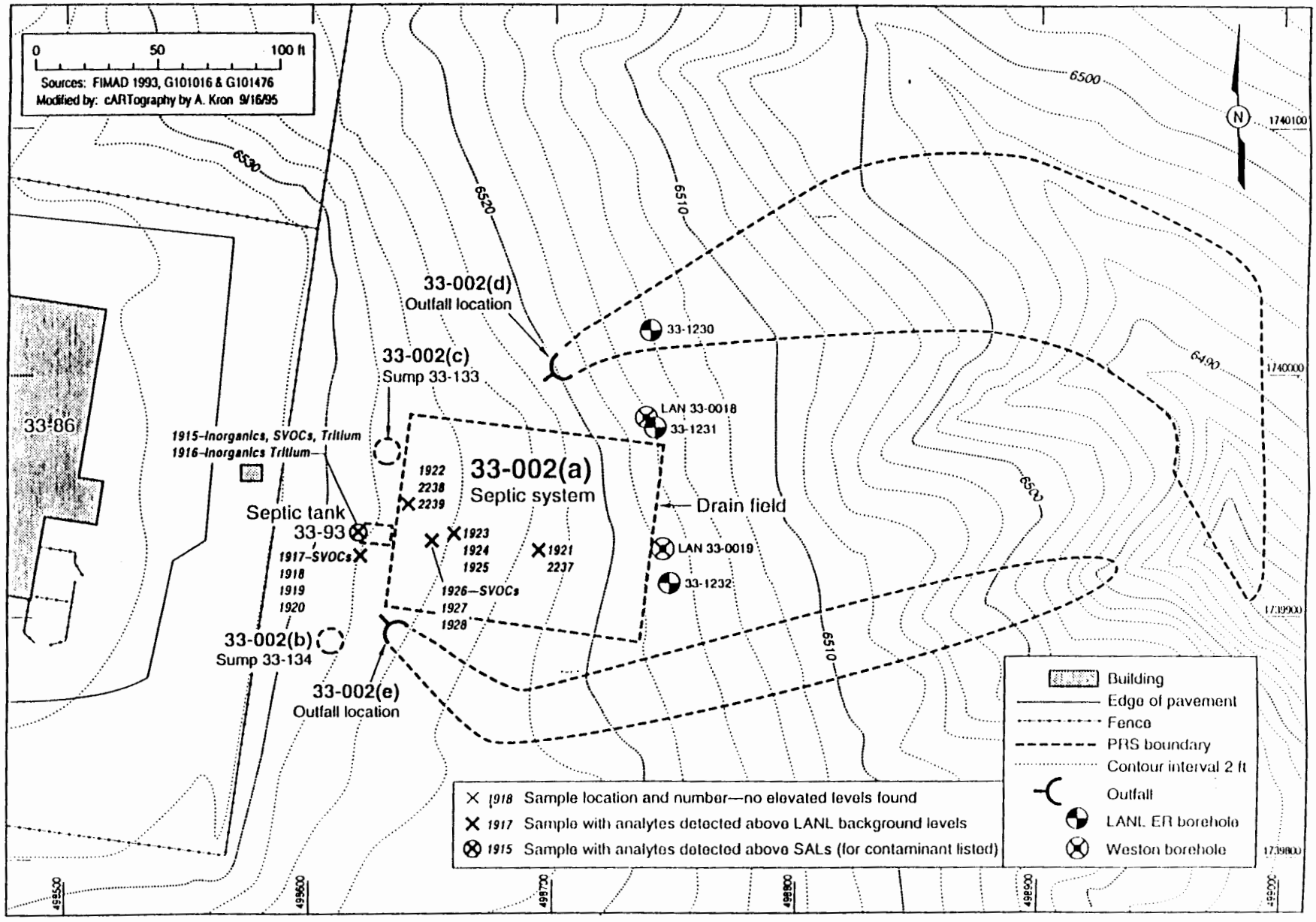

Fig. 4-3. SWMU 33-002(a) septic systems and boreholes locations.

4.1.2.1 Results of Field Surveys

All sampling points were surveyed.

The 1993 electromagnetic survey method used at MDA K detected anomalies that were interpreted to represent structures and drain lines associated with the septic system and drain field. These anomalies coincide with the locations of drain field structures on existing as-built construction maps of MDA K. Sample locations were selected within these areas.

Data from the resistivity survey were compared with data from a geophysical investigation conducted at the lower edge of the drain field by Weston personnel in 1989. These two studies were similar in that anomalous low-resistivity zones occurred in the same region. The resistivity geophysical survey identified another zone of low resistivity approximately 40 ft south of Weston borehole LAN 33-0018. Models created from soundings near the Weston borehole indicated layers with generally low resistivities. These low resistivities may indicate the presence of water or conductive materials such as clay. The borehole log from the Weston drilling indicated strata composed mainly of tuff with clay-lined fractures.

Results of the ER resistivity geophysical survey were used to select the deep borehole biased sample locations at MDA K. The middle borehole, site ID 1231, was positioned at the point of greatest resistivity change. This point was near Weston borehole LAN 33-0018. The south borehole, site ID 1232, was positioned at a location where the subsurface material exhibited high resistivity, indicating unaltered or unsaturated conditions. The north borehole, site ID 1230, was positioned in the surface drainage of the cooling water outfall, SWMU 33-002(d) (Fig. 4-3).

4.1.2.2 Results of Field Screening

SWMU 33-002(a) was included in the grid radiation surveys conducted at Main Site in the spring of 1992. No radiation was detected during the grid survey or during routine field screening. During drilling, tritium "sniffers" were set up in work areas; no tritium was detected (ICF Kaiser 1994, 02-095).

4.1.3 Screening Assessment

4.1.3.1 Comparison to Background/SALs

4.1.3.1.1 Septic Tank and Shallow Borehole Results

Table 4-2 lists inorganic and radionuclide analytes found above LANL and TA-33 background UTLs at SWMU 33-002(a). No screening parameters for liquid or sludge from septic tanks have been developed. Drinking water and soil background UTLs and SALs are listed here merely as reference. Sampling points were shown in Fig. 4-3.

TABLE 4-2

INORGANIC AND RADIONUCLIDE ANALYTES FOUND IN THE TANK AND SHALLOW BOREHOLES AT SWMU 33-002(a) WITH CONCENTRATIONS GREATER THAN LANL OR TA-33 BACKGROUND SURFACE UTLs

ANALYTE	SAMPLE ID	RESULTS	LANL UTL[a]	TA-33 UTL	SAL[b]	DEPTH
Arsenic	AAA1916	**29.8 mg/kg**	11.6 mg/kg	4.36 mg/kg	None	Sludge[c]
Cadmium	AAA1915	**9.2 µg/L**	None	None	5 µg/L	Liquid
Lead	AAA1916	**922 mg/kg**	39 mg/kg	39 mg/kg	400 mg/kg	Sludge[c]
Plutonium-239	AAA1923	0.147 pCi/g	0.025 pCi/g	0.058 pCi/g	24 pCi/g	0-6 in.
Tritium	AAA1915	**136 210 pCi/L**	None	None	20 000 pCi/L	Liquid
	AAA1916	**35 903.5 pCi/g**	None	23.2 pCi/g	810 pCi/g	Sludge[c]
	AAA1924	37.8 pCi/g	NA	23.2 pCi/g	810 pCi/g	60 in.
Uranium	AAA1916	27.8 mg/kg	2.82 mg/kg	4.84 mg/kg	95 mg/kg	Sludge[c]

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] Soil SALs are based on a residential exposure to contaminated soils. No SALs exist for the exposure to contaminated tank sludges.

Analyses were performed for a total of 1 979 organic analytes at SWMU 33-002(a). Table 4-3 lists those concentrations of organic compounds found above their respective detection limits.

4.1.3.1.2 Surface Tritium Results

A source of surface tritium at MDA K is most likely stack releases from the tritium facility. SWMU 33-017, discussed in a separate RFI report, was intended to address stack releases. However, surface tritium contamination at the whole of Main Site is discussed in this RFI report in order to comprehensively in deal with tritium. Table 4-4 lists all sample locations at TA-33 with tritium activity above the TA-33 background UTL of 23.2 pCi/g. Figure 4-4 shows the location of each sampling point.

TABLE 4-3

ORGANIC ANALYTES FOUND ABOVE DETECTION LIMITS AT SWMU 33-002(a)

ANALYTE	SAMPLE ID	CONCENTRATION (mg/kg)	EQL[a] (mg/kg)	SAL[b] (mg/kg)	DEPTH (ft.)	MEDIUM
Acetone	AAA1916	0.51	0.01	8 000	In tank	Sludge
Benzo[a]anthracene	AAA1917	0.49	0.33	1	0-6	Soil
Benzo[a]anthracene	AAA1926	0.47	0.33	1	0-6	Soil
Benzo[a]pyrene	AAA1917	0.49	0.33	0.1	0-6	Soil
Benzo[a]pyrene	AAA1926	0.44	0.33	0.1	0-6	Soil
Benzo[b]fluoranthene	AAA1917	0.37	0.33	1	0-6	Soil
Benzo[g,h,i]perylene	AAA1917	0.38	0.33	NC[c]	0-6	Soil
Benzo[k]fluoranthene	AAA1917	0.51	0.33	1	0-6	Soil
Benzo[k]fluoranthene	AAA1926	0.4	0.33	1	0-6	Soil
Bis(2-ethylhexyl)phthalate	AAA1915	75 µg/L	0.33 µg/L	6 µg/L	In tank	Septic liquid
Bis(2-ethylhexyl)phthalate	AAA1916	4.4	0.33	50	In tank	Sludge
Butylbenzene [sec-]	AAA1916	0.32	NL[d]	NC	In tank	Sludge
Butylbenzene [tert-]	AAA1916	0.19	NL	NC	In tank	Sludge
Carbon disulfide	AAA1916	0.075	0.01	7.4	In tank	Sludge
Chlorobenzene	AAA1916	0.72	0.01	67	In tank	Sludge
Chrysene	AAA1917	0.52	0.33	96	0-6	Soil
Chrysene	AAA1926	0.48	0.33	96	0-6	Soil
Di-n-butyl phthalate	AAA1925	0.47	0.33	8 000	120	Soil
Dichlorobenzene (1,4) [p-]	AAA1916	1.4	0.33	29	In tank	Sludge
Dichloroethane [1,1-]	AAA1916	0.054	0.01	410	In tank	Sludge
Ethylbenzene	AAA1916	0.15	0.01	3 100	In tank	Sludge
Fluoranthene	AAA1917	1.4	0.33	3 200	0-6	Soil
Fluoranthene	AAA1923	0.49	0.33	3 200	120	Soil
Fluoranthene	AAA1926	1.2	0.33	3 200	0-0.5	Soil
Fluoranthene	AAA2239	0.38	0.33	3 200	0-0.5	Soil
Indeno[1,2,3-cd]pyrene	AAA1917	0.38	0.33	1	0-0.5	Soil
Isopropylbenzene	AAA1916	0.45	NL	3 200	In tank	Sludge
Isopropyltoluene [4-]	AAA1916	0.32	NL	NC	In tank	Sludge
Phenanthrene	AAA1917	1.1	0.33	NC	0-6	Soil
Phenanthrene	AAA1926	1.1	0.33	NC	0-6	Soil
Propylbenzene	AAA1916	0.59	NL	NC	In tank	Sludge
Pyrene	AAA1917	0.97	0.33	2 400	0-6	Soil
Pyrene	AAA1926	0.76	0.33	2 400	0-6	Soil
Toluene	AAA1916	0.16	0.01	910	In tank	Sludge
Trimethylbenzene [1,2,4-]	AAA1916	2.2	NL	40	In tank	Sludge
Trimethylbenzene [1,3,5-]	AAA1916	1.2	NL	32	In tank	Sludge
Xylenes (o + m + p) [mixed-]	AAA1916	0.26	0.01	160 000	In tank	Sludge

[a] EQL = Estimated quantitation limit.
[b] SAL = Screening action level.
[c] NC = Not calculated because of insufficient toxicity data.
[d] NL = Not listed.

TABLE 4-4

SURFACE TRITIUM ACTIVITIES GREATER THAN TA-33 BACKGROUND UTL

ANALYTE	SAMPLE ID	ACTIVITY (pCi/g)	LANL UTL[a]	TA-33 UTL (pCi/g)	SAL[b] (pCi/g)	DEPTH (in.)
Tritium	AAA1917	43	NA[c]	23.2	810	0-6
	AAA1921	213	NA	23.2	810	0-6
	AAA2237[d]	112	NA	23.2	810	0-6
	AAA1922	32.5	NA	23.2	810	0-6
	AAA2238[d]	67	NA	23.2	810	0-6
	AAA1924	38	NA	23.2	810	0-6
	AAA1931	540	NA	23.2	810	0-6
	AAA1934	1728	NA	23.2	810	0-6
	AAA1941	5 449	NA	23.2	810	0-6
	AAA2185	1 457	NA	23.2	810	0-6
	AAA1942	11 963	NA	23.2	810	0-6
	AAA1943	142	NA	23.2	810	0-6
	AAA1944	302.5	NA	23.2	810	0-6
	AAA2193[d]	27	NA	23.2	810	0-6
	AAA2060	28	NA	23.2	810	0-6
	AAA2063	42.5	NA	23.2	810	0-6
	AAA2086	27	NA	23.2	810	0-6
	AAA2092	44	NA	23.2	810	0-6

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] NA = Not analyzed.
[d] Duplicate of sample directly above.

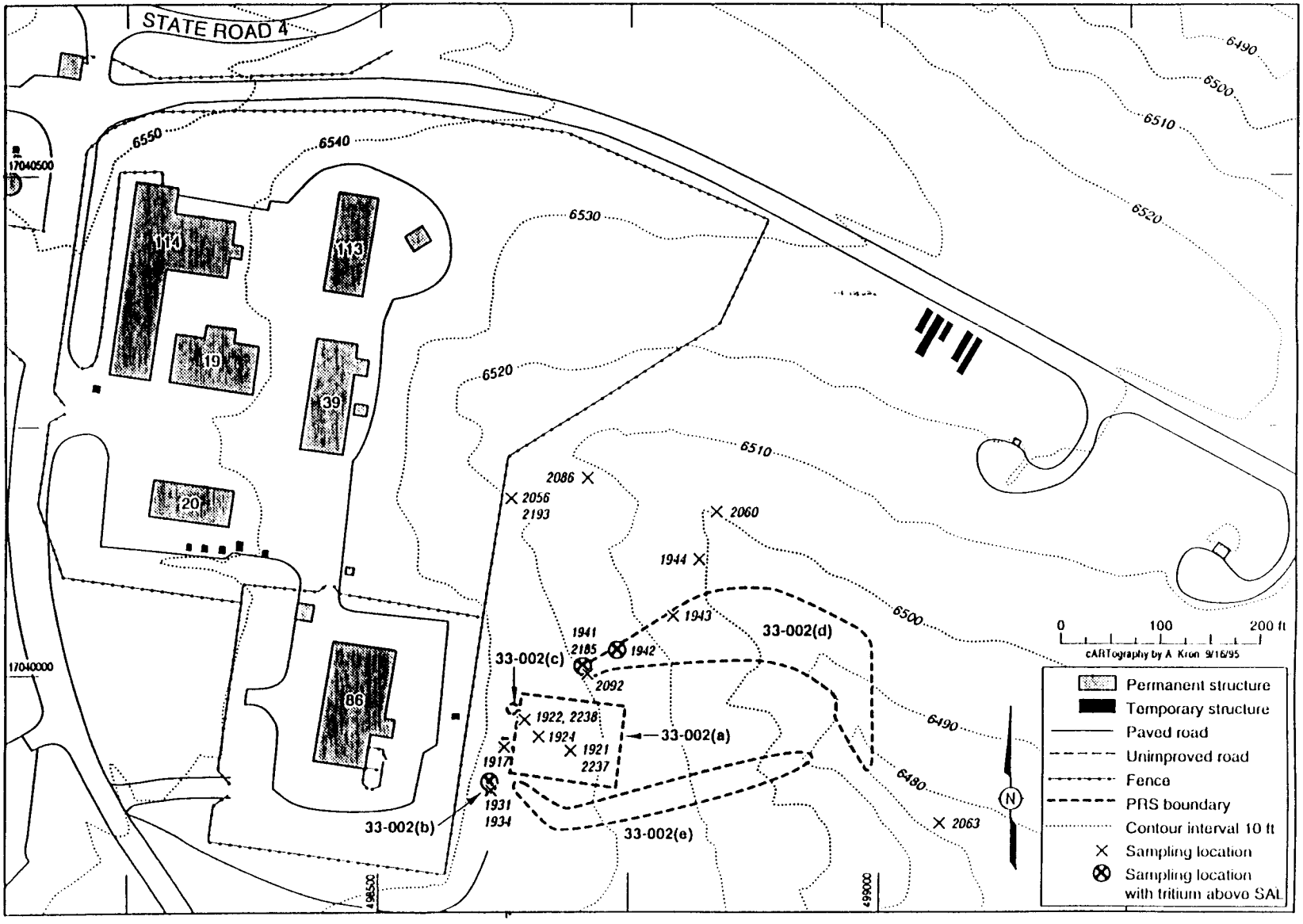

Fig. 4-4. Sampling locations with surface tritium above TA-33 background UTLs.

4.1.3.1.3 Deep Borehole Results

The following subsection discusses the deep boreholes at the lower (east) end of the drain field. Note that results were compared to surface background LANL and TA-33 background UTLs because no subsurface background UTLs are available at this time.

Table 4-5 list analytes (excluding tritium) exceeding LANL and TA-33 background UTLs at the north borehole, site ID 1230, and the middle borehole, site ID 1231. No analytes were detected above background at the south borehole, site ID 1232. No multiple constituent analysis was performed for these analytes because of the widely varying depths and disparate toxicological effects.

TABLE 4-5

ANALYTE CONCENTRATIONS ABOVE LANL AND TA-33 UTLs FOR BOREHOLES AT MDA K, EXCLUDING TRITIUM

ANALYTE	BOREHOLE ID	SAMPLE ID	CONCEN-TRATION (mg/kg)	LANL UTL[a] (mg/kg)	TA-33 UTL (mg/kg)	SAL[b] (mg/kg)	DEPTH (ft)
Antimony	33-1230	AAA3292	23	2.5	0.27	32	127
Cadmium	33-1231	AAA3321	4.2	2.7	2.7	80	314
	33-1230	AAA3884	3.6	2.7	2.7	80	0-1
Chromium	33-1230	AAA3884	57	34.2	20.7	400	0-1
Lead	33-1230	AAA3884	48	39	39	400	0-1
Nickel	33-1231	AAA3321	103	26.7	17	1 600	314
Uranium	33-1230	AAA3884	8.09	2.82	4.84	95	0-1
	33-1230	AAA3889	5.16	2.82	4.84	95	30
ANALYTE	**BOREHOLE ID**	**SAMPLE ID**	**ACTIVITY (pCi/g)**	**LANL UTL (pCi/g)**	**TA-33 UTL (pCi/g)**	**SAL (pCi/g)**	**DEPTH (ft)**
Plutonium-238	33-1230	AAA3281	0.145	0.01	0.0074	27	10
	33-1230	AAA3283	0.040	0.01	0.0074	27	10
Plutonium-239	33-1231	AAA3321	0.113	0.025	0.058	24	314

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.

Table 4-6 lists all tritium activities in the three boreholes as pCi/g of soil. Tritium activities in the north and south boreholes, 33-1230 and 33-1232, were for the most part below TA-33 surface background UTLs. Elevated tritium levels were concentrated in the middle borehole, 33-1231. Tritium is present well above SAL for several samples from 94 ft to 155 ft, indicating the presence of a subsurface tritium plume.

TABLE 4-6

SOIL TRITIUM ACTIVITIES IN BOREHOLES 33-1230, 33-1231, and 33-1232

DEPTH (ft)	BOREHOLE 33-1230 SAMPLE ID	Tritium (pCi/g) RV[a]	FL[b]	BOREHOLE 33-1231 SAMPLE ID	Tritium (pCi/g) RV	FL	BOREHOLE 33-1232 SAMPLE ID	Tritium (pCi/g) RV	FL
0	AAA3884	1 222	1.6	AAA3885	1	87	AAA3886	3.9	20.0
10	AAA3281	6.8	3.8	AAA3308	140	101	AAA3336	22	359
20	AAA3282	4.7	4.4	AAA3309	560	527	AAA3337	16	16.3
30	AAA3283	4.1	4.9	AAA3310	920	831	AAA3338	24	25.6
35							AAA4870	25	NA[c]
40				AAA4904	1 300	NA			
45							AAA4872	9.8	NA
55	AAA4940	7.5	NA	AAA4906	770	NA			
60							AAA3339	5.2	4.5
65	AAA3284	7.2	8.4	AAA3311	1 300	2 835	AAA4876	3.7	NA
70							AAA4878	2.7	NA
75	AAA4944	12	NA	AAA4910	5 400	NA			
80				AAA4912	5 000	NA			
85	AAA4946	9.2	NA						
95	AAA3286	11	10.8	AAA3312	7 900	8 006	AAA3340	2.2	2.6
100							AAA4882	1.6	NA
105	AAA4952	13	NA	AAA4916	6 900	NA	AAA4884	1.1	NA
115				AAA4918	5 700	NA			
120	AAA3289	16	NA				AAA3344	1.5	1.2
125	AAA3292	27	24.5	AAA3314	4 000	5 698	AAA3343	1.6	1.3
135	AAA4956	22	NA	AAA4922	3 616	NA	AAA4888	0.55	
145	AAA4958	22	NA	AAA4924	1 722	NA			
155	AAA4950	16	NA	AAA3317	1 452	1 698	AAA3345	1.8	0.8
160				AAA4928	550	NA	AAA4894	1.7	NA
165	AAA4962	17	NA						
170	AAA3290	12	18.4				AAA4896	0.79	NA
175				AAA4930	140	NA			
180	AAA3291	6.9	9.1						
185				AAA3318	4	5	AAA3346	1.5	2.2
190							AAA4900	2.3	NA
195	AAA4968	4.5	NA	AAA4934	1	NA			
200							AAA4902	0	NA
205				AAA4936	1	NA			
210				AAA3319	320	0.2	AAA3347	0	2.6
215	AAA3294	34	NA						
220	AAA3296	21	NA	AAA3320	1	NA	AAA5269	9	NA
225	AAA3295	23	NA	AAA4903	4	NA			
230	AAA3297	42	0.2				AAA5270	2.2	NA
235				AAA4905	5.2	NA	AAA5272	1.9	NA
245				AAA3325	9.1	6.8	AAA3350	1.3	1.2
250				AAA4911	5.6	NA			
270				AAA4915	1.6	1			
280				AAA4919	22	NA			
290				AAA4921	1.3	NA			
300				AAA4923	4.1	NA			
315				AAA3321	2.8	0.2			

[a] RV = Mobile radiation laboratory van.
[b] FL = Fixed analytical laboratory.
[c] NA = Not analyzed.
[d] SAL = 810 pCi/g.

4.1.3.2 Data Interpretation

This subsection discusses subsurface tritium results from the boreholes.

4.1.3.2.1 Borehole Observations

Tritium Profiles

Three separate efforts to measure subsurface tritium activities beneath MDA K have been conducted: drilling and sampling by Weston in 1989, drilling and sampling by the ER project in 1993, and Seamist™ sampling of ER borehole 33-1231 in 1994.

The 1989 Weston borehole sampling at borehole LAN33-0018 revealed a sharp tritium peak at a depth near 100 ft, with a maximum activity of 82 000 pCi/ml. ER samples collected from nearby 33-1231 in the fall of 1993 were analyzed by the mobile radiation laboratory van (RV). A subset of samples was analyzed by a fixed lab (FL). Considering the inherent difficulties in tritium analysis (due to its volatility and low-energy beta emissions) the two sets of results are in reasonable agreement. Compared to the Weston data, the ER results show a broader tritium peak, centered at a depth near 100 ft, with a maximum activity on the order of 70 000 pCi/ml.

An experiment was conducted to determine the suitability of Seamist™ technology to gain information on the tritium distribution in boreholes by installation of absorber pads to measure subsurface tritium activities. A 300-ft Seamist™ membrane was installed in Borehole 33-1231 in October 1994. The membrane was equipped with 60 absorber pads spaced at 5 ft intervals. After two months, the membrane was removed from the borehole and the pads analyzed for moisture content and tritium activity in the sorbed water. The resulting profile revealed an even broader tritium peak centered at a depths between 80 ft and 100 ft. Maximum tritium activities were on the order of 50 000 pCi/ml.

Comparison of the four sets of tritium activities in contaminated borehole 33-1231/LAN33-0018 is shown in Fig. 4-5. The 1993 ER results clearly show the vertical extent of the tritium plume. In addition, the results are in agreement with results from the earlier Weston study and the experimental Seamist™ study.

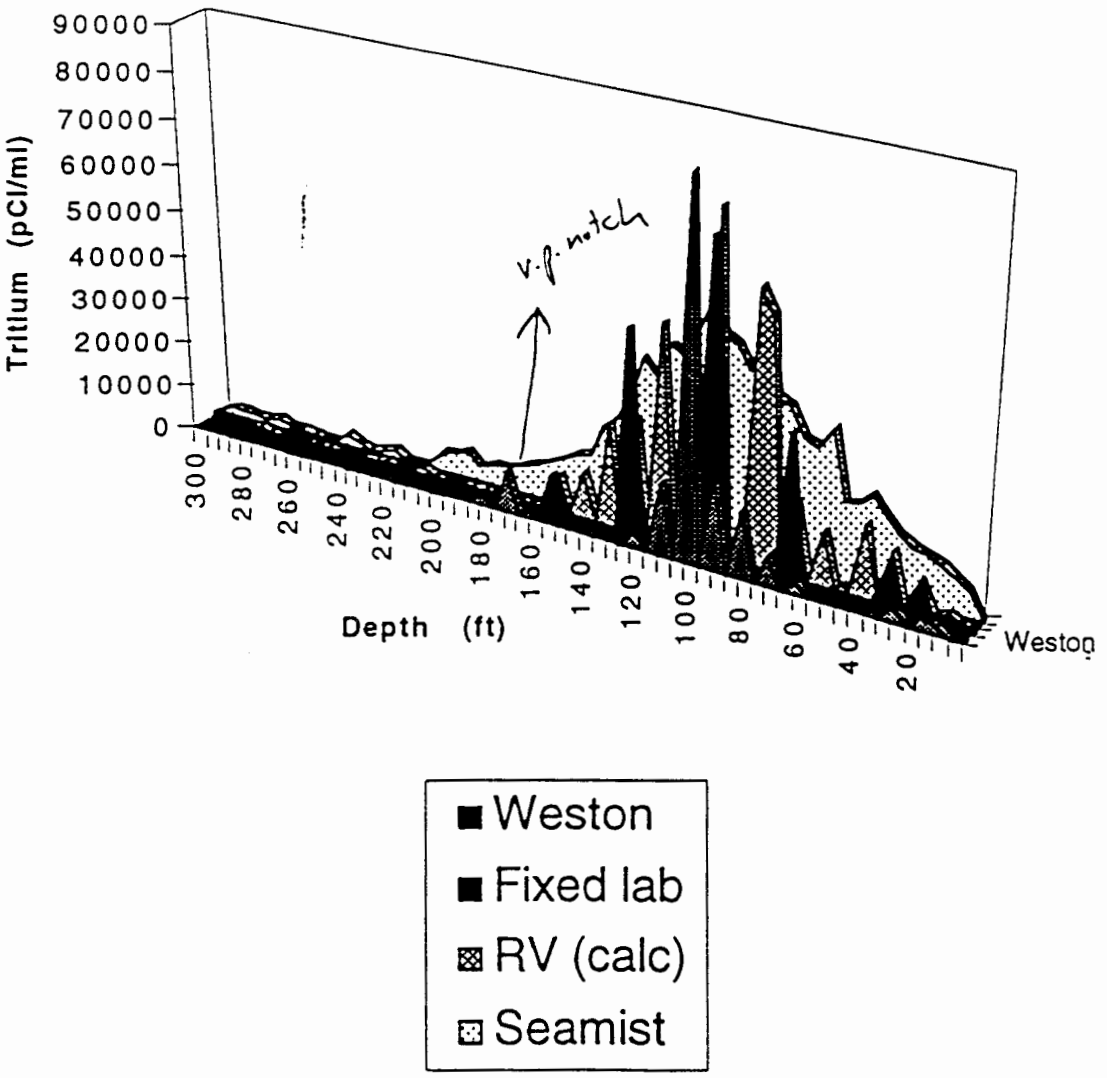

Fig. 4-5. Borehole 33-1231 tritium comparisons.