

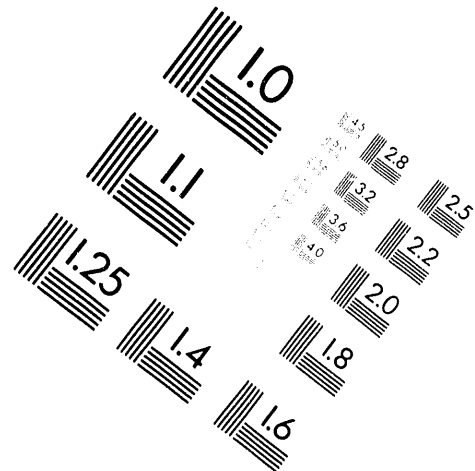
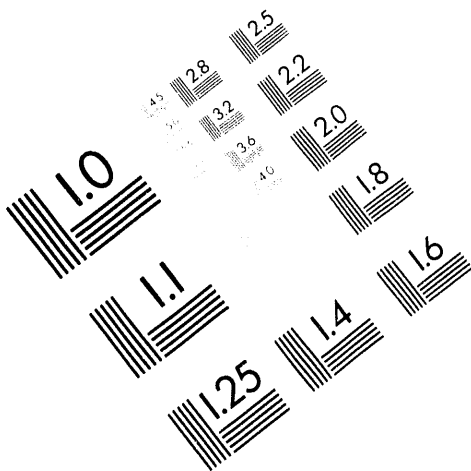


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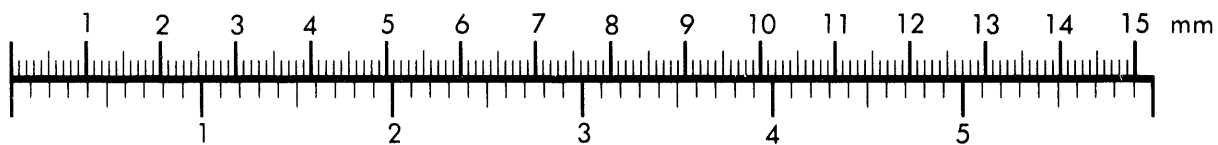
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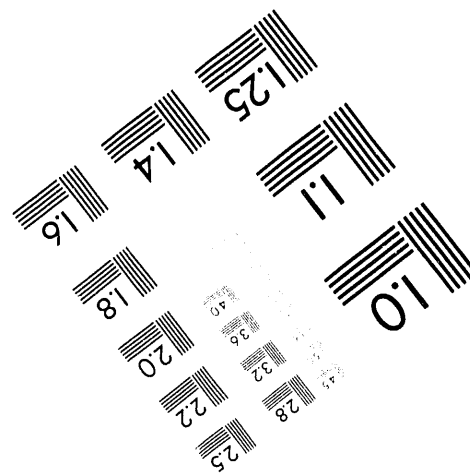
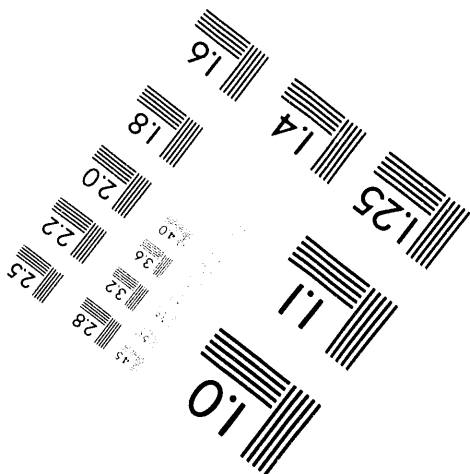
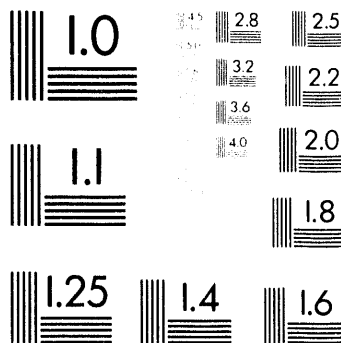
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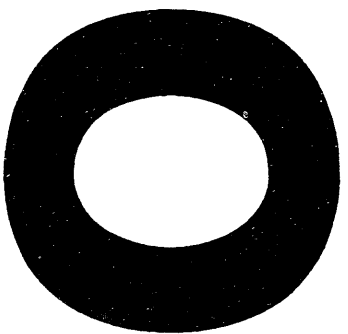
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5. Proj./Prog./Dept./Div.: SIS-ISS/ERHP/HP/ESQ	6. Cog. Engr.: M. A. Wendling	7. Purchase Order No.: N/A
8. Originator Remarks: Supporting Document for approval and release		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: N/A
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date:

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Impact Level	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	WHC-SD-EN-RPT-010 ^{2/26} 009		0	200-UP-2 Operable Unit Radiological Surveys	N/A	3	1	

16. KEY		
Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
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1	1	Cog. Eng. M. A. Wendling		N1-06	EPIC (2)		H6-08	3	
1	1	Cog. Mgr. C. D. Wade		N1-06	IRA (2)		H4-17	3	
		QA			Central Files (2)		L8-04	3	
		Safety			R. A. Carlson		H6-03	3	
		Env.			M. J. Galgoul		H6-04	3	
3		G. C. Henckel		H6-04	R. M. Mitchell		H6-01	3	
3		C. A. Rowley		H6-01	G. G. Kelty		H6-06	3	
3		H. D. Downey		H6-27					

18. M. A. Wendling Signature of EDT Originator	19. C. D. Wade Authorized Representative for Receiving Organization	20. C. D. Wade Cognizant/Project Engineer's Manager	21. DOE APPROVAL (if required) Ltr. No. [] Approved [] Approved w/comments [] Disapproved w/comments
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Title: 200-UP-2 Operable Unit Radiological Surveys Unclassified Category: UC- Impact Level: N/A

New or novel (patentable) subject matter? No Yes
 If "Yes", has disclosure been submitted by WHC or other company?
 No Yes Disclosure No(s).
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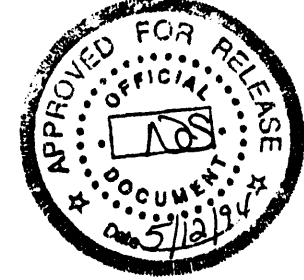
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			Name (printed)	Signature
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WHC Program/Project	<input checked="" type="checkbox"/>	<input type="checkbox"/>	H. D. Downey	<i>per telecon serv. not req'd. HTH</i> 5/12/94
Communications	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
RL Program/Project	<input checked="" type="checkbox"/>	<input type="checkbox"/>	P. M. Pak	<i>Review not req'd. HTH</i> 5/10/94
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References Available to Intended Audience	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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SUPPORTING DOCUMENT		1. Total Pages 44
2. Title 200-UP-2 Operable Unit Radiological Surveys	3. Number WHC-SD-EN-RPT-009	4. Rev No. 0
5. Key Words radiological surveys, MSCM-II, USRADS APPROVED FOR PUBLIC RELEASE <i>5/12/94 D. Dolis</i>	6. Author Name: M. A. Wendling <i>[Signature]</i> Signature Organization/Charge Code 33534/PT2CD	
7. Abstract Wade, C. D. and M. A. Wendling, 1994, <i>200-UP-2 Operable Unit Radiological Surveys</i> , WHC-SD-EN-RPT-009, Rev. 0, Westinghouse Hanford Company, Richland, Washington.		
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9. Impact Level N/A		

WHC-SD-EN-RPT-009
Rev. 0

200-UP-2 OPERABLE UNIT RADIOLOGICAL SURVEYS

AUTHOR

MARC WENDLING

**Plant Engineer
WHC\ERHP\Site Investigative Surveys**

REVIEWED BY

C.D. WADE

**Manager
WHC\ERHP\Site Investigative Surveys**

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200-UP-2 OPERABLE UNIT RADIOLOGICAL SURVEYS

Scope

This report summarizes and documents the results of the radiological surveys conducted from Aug. 17 through Dec. 16, 1993 over a partial area of the 200-UP-2 Operable Unit, 200-W Area, Hanford Site, Richland, Washington (Fig 1). In addition, this report explains the survey methodology of the Mobile Surface Contamination Monitor II (MSCM-II) and the Ultra Sonic Ranging And Data System (USRADS).

The radiological survey of the 200-UP-2 Operable Unit was conducted by the Site Investigative Surveys/Environmental Restoration Health Physics Organization of the Westinghouse Hanford Company. The survey methodology for the majority of area was based on utilization of the MSCM-II or the USRADS for automated recording of the gross beta/gamma radiation levels at or near six (6) inches from the surface soil.

Purpose

The purpose was to perform an initial radiological survey of the area, providing data to assist in the development of a Remedial Action Work Plan.

Procedure

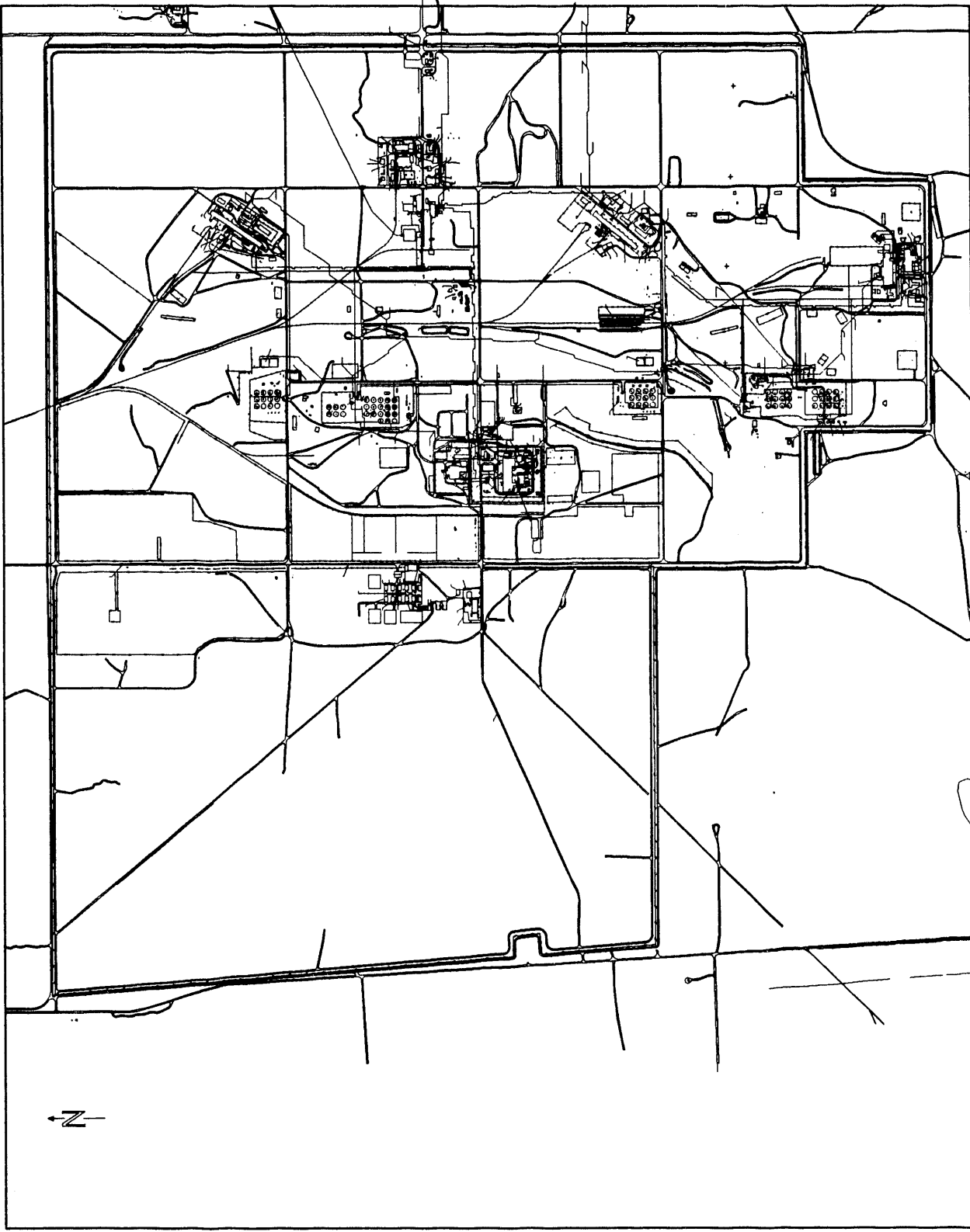
The radiological surveys were conducted following the procedures contained in the Environmental Restoration Health Physics Radiological Protection Procedures Manual, (RPP); in particular; Section 6.7.1, USRADS-Connecting The System; Section 6.7.2, USRADS- Setup; Section 6.7.3, USRADS Calibration; Section 6.7.4, USRADS- Surveys; Section 6.6.1, Operation of the Mobile Surface Contamination Monitor II and WHC-IP-0718; Section 3.3.1, Air Sampling.

Hand Held Instrumentation

- Ludlum Model 2221 Count Rate Meter, Serial No. 5581
w/Ludlum 44-10 NaI Detector
- Ludlum Model 4 Count Rate Meter, Serial No. 81518
w/Ludlum 44-10 NaI Detector
- Ludlum Model 4 Count Rate Meter, Serial No. 81500
w/Ludlum 44-10 NaI Detector
- Ludlum Model 19 uR Dose Rate Meter, Serial No. 5028
- Eberline EGM Count Rate Meter, Serial No. 1445
w/Eberline HP-211 GM Probe No. 1502
- Eberline EGM Count Rate Meter, Serial No. 937
w/Eberline HP-211 GM Probe No. 333
- Eberline EGM Count Rate Meter, Serial No. 1474
w/Eberline HP-211 GM Probe No. 135
- Eberline EGM Count Rate Meter, Serial No. 1518
w/Eberline HP-211 GM Probe No. 286
- Eberline EGM Count Rate Meter, Serial No. 1378
w/Eberline HP-211 GM Probe No. 1262
- Eberline EGM Count Rate Meter, Serial No. 1445
w/Eberline HP-211 GM Probe No. 371

RADIOLOGICAL SURVEY OF 200-UP-2 HANFORD SITE, 200 WEST AREA

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RADIOLOGICAL SURVEY
WHC-SD-EN-RPT-009

FIGURE 1

WHC-SD-EN-RPT-009

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Eberline EGM Count Rate Meter, Serial No. 1413
w/Eberline HP-211 GM Probe No. 1502
Eberline EGM Count Rate Meter, Serial No. 1879
w/Eberline HP-211 GM Probe No. 380
Eberline Portable Alpha Meter, Serial No. 2424
Eberline Portable Alpha Meter, Serial No. 2034

These instruments are maintained and calibrated by Pacific Northwest Laboratory.

Instrumentation Response Verification

The MSCM-II radiation detection system, the radiological instrumentation interfaced with the USRADS, and hand held radiation survey instruments were checked at the beginning of each day for the proper instrument response(s). This was accomplished by placing a radioactive check source next to the detector(s) and observing the instrument's response to the source. Local background gamma radiation readings were also recorded in the vicinity of all contaminated areas found.

Introduction

Nine individual sites within the 200-UP-2 Operable Unit were surveyed. The 216-U-10 pond area, 216-U-11 trench area, 216-U-14 stabilized ditch area, and the Z-ditch area (216-Z-10, -11, -19) surveys were conducted using the MSCM-II (Ref. Appendix A). The tile field area (216-U-1, -2 cribs and the 2607-W-5), the 216-U-8 crib/pipeline area, and the 207-U Retention Basin area were surveyed with the USRADS (Ref. Appendix B). Follow up surveys of areas surveyed with the USRADS or MSCM-II that showed indications of radioactive contamination as well as the 216-U-4 Area (216-U-4 and 216-U-4A) and the 216-U-9 Trench Area were conducted utilizing hand held count rate meters outfitted with Geiger Meuller contamination detectors.

Location

All the sites surveyed are located within or near 200-West area of the Hanford Site. Figure 2 shows the location of each individual site.

Field Activities

Four primary field activities were conducted to perform the 200-UP-2 Operable Unit Radiological Survey; MSCM-II surveys, grab air sampling and analysis, USRADS surveys, and manual surveys.

200-UP-2 RADIOLOGICAL SURVEY- LOCATION OF SPECIFIC AREAS

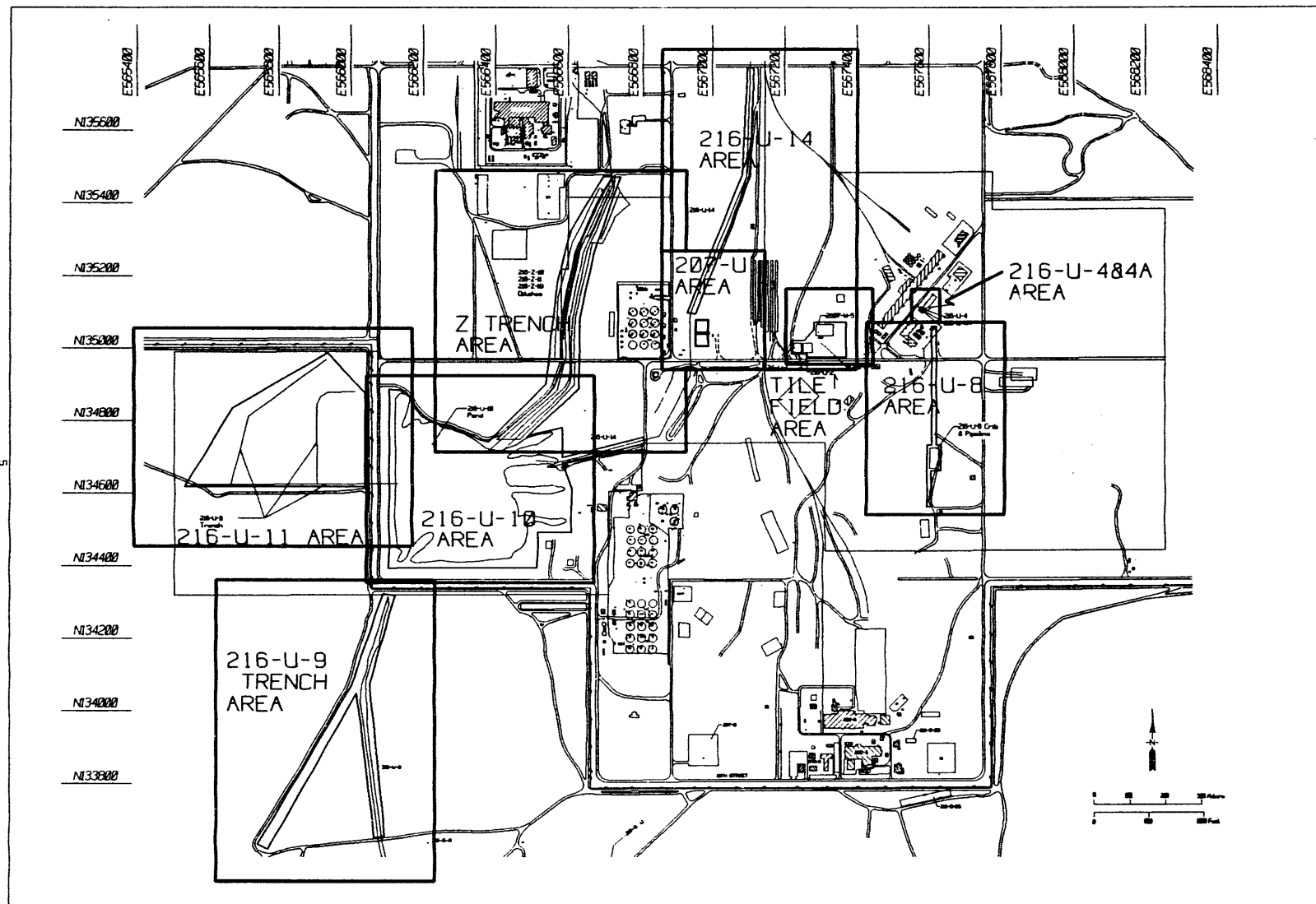


FIGURE 2

MSCM-II SURVEYS

Radiological information was obtained from large area plastic scintillation detectors interfaced with a National Nuclear Sys-10 controller recording background reference detector counts per second (CPS), counting detector CPS and calculated radioactive activity in pico-curies (pCi). This calculated activity is normalized for Cs-137 utilizing the detector efficiency determined during system calibration.

Approximately 323,247 square meters of the 200-UP-2 Operable Unit was surveyed with the MSCM-II.

MSCM-II Methodology

The MSCM-II collects data points once per second. These data points represent the radiological information from the Sys-10 controller along with the physical coordinates of the readings. The MSCM-II records these data points on electronic files in the on-board computer system. This allows down loading of these files into a Geographic Information System (GIS) for generating maps of the surveyed area and creation of a data base relevant to the positions and radiological readings.

Each days survey efforts entailed initializing the Global Positioning System (GPS) differential correction base station, initializing the on-board GPS receiver, powering up the radiation detection controller system and computer, source checking detection instrumentation to insure proper response, and performing the survey. The purpose of the initialization sequence is to allow the GPS receivers to locate and establish a radio reception lock on at least four individual NAVSTAR Global Positioning Satellites to insure valid positional information.

Every attempt was made to traverse the survey area on parallel passes insuring 100% coverage of the area, however, due to the roughness of the terrain this was not always possible. Speed of survey was approximately 2 miles/hr. The MSCM-II detectors were maintained as near as practical to six inches from the soil surface by operation of the tractors hydraulic front end loader assembly. In this manner detector geometry remained relatively constant throughout the entire survey.

MSCM-II Survey Results

216-U-10 Pond

MSCM-II surveys of the 216-U-10 Pond area were conducted from Aug. 17 through Aug. 24, 1993.

50,975 data points were collected within the ~181,393 sq. meter area surveyed.

2,035 of these data points showed indications of elevated radiation/contamination levels. Spot checks with hand held Health Physics (HP) instrumentation showed no evidence of surface contamination, leading to the conclusion that the elevations were due to sub-surface radioactive materials. Figure 3 is a composite survey track map that shows the locations of these suspect areas and Figs. 4 and 5 are graphical interpretations of the radiological data collected.

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216-U-11 Trench Area

MSCM-II surveys of the 216-U-11 Trench area were conducted from Aug. 25 through Aug. 30, 1993.

26,543 data points were collected within the ~80,847 sq. meter site.

1640 of these data points showed indications of elevated radiation/contamination levels. As before, spot checks with hand held Health Physics (HP) instrumentation showed no evidence of surface contamination, leading to the conclusion that the elevations were due to sub-surface radioactive materials. Figure 6 is a composite survey track map that shows the locations of these suspect areas and Figs. 7 and 8 are graphical interpretations of the radiological data collected.

216-Z Trenches (216-Z-10, -11, -19)

MSCM-II surveys of the 216-Z Trench area were conducted on Aug. 23 and Aug. 24, 1993.

12,673 data points were collected within the ~44,836 sq. meter site.

156 of these data points showed indications of elevated radiation/contamination levels. As before, there was no evidence of surface contamination. Figure 9 is a composite survey track map that shows the locations of these suspect areas and Figs. 10 and 11 are graphical interpretations of the radiological data collected.

216-U-14 Stabilized Ditch

The MSCM-II survey of the 216-U-14 Stabilized Ditch area was conducted on Sept. 1, 1993.

5,079 data points were collected within the ~16,171 sq. meter site.

435 of these data points showed indications of elevated radiation/contamination levels with no evidence of surface contamination. Figure 12 is a composite survey track map that shows the locations of these suspect areas and Figs. 13 and 14 are graphical interpretations of the radiological data collected.

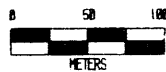
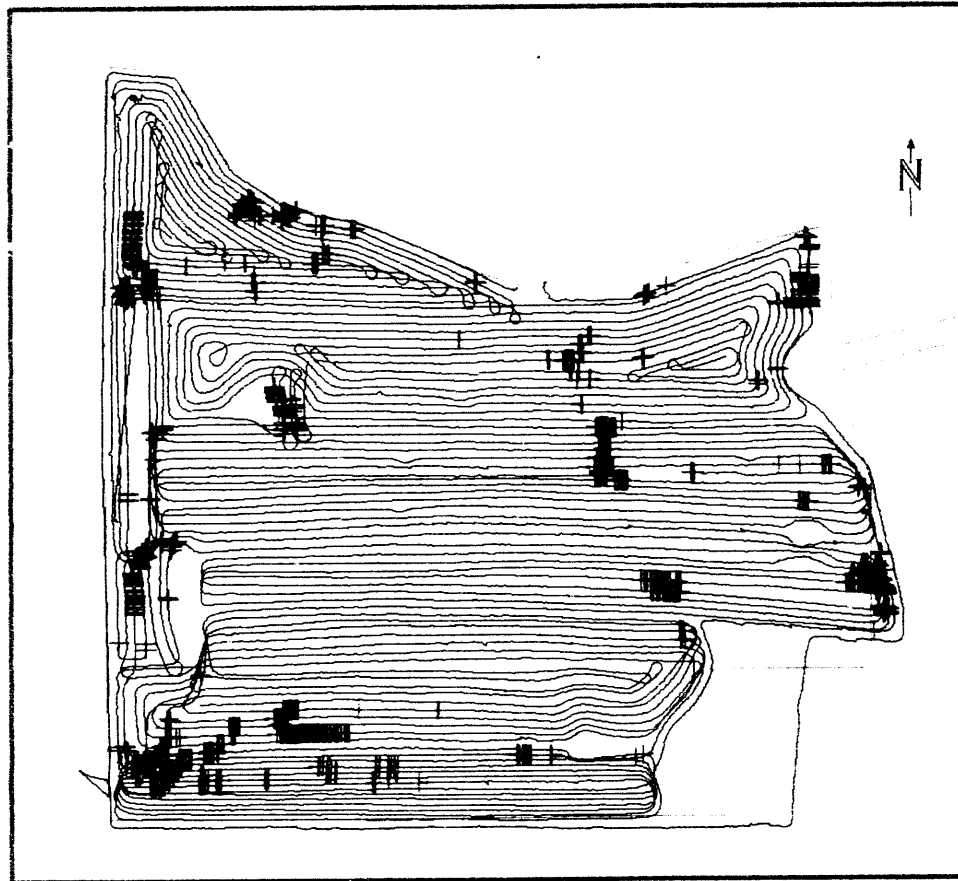
AIR SAMPLING

Particulate air sampling was performed while the MSCM-II was being utilized. Air samples were taken at the downwind perimeter of the site(s) being surveyed. Two samples were drawn each day, one in the morning and one in the afternoon. A calibrated Hi-Q high volume sampler equipped with Gelman Versapor AN-3000 filter media was used to pull samples of 120 ft.³. Air sample volumes were maintained uniformly by running at 2 ft³/min. for 60 minutes per sample.

All samples collected were allowed to decay for 72 hours in order to eliminate interference from short lived Radon-Thoron daughter products.

All samples were screened with the portable instrumentation listed above and recorded as having no detectable radiological activity.

200-UP-2 MSCM-11 SURVEY COMPOSITE TRACK MAP OF U10 POND AREA



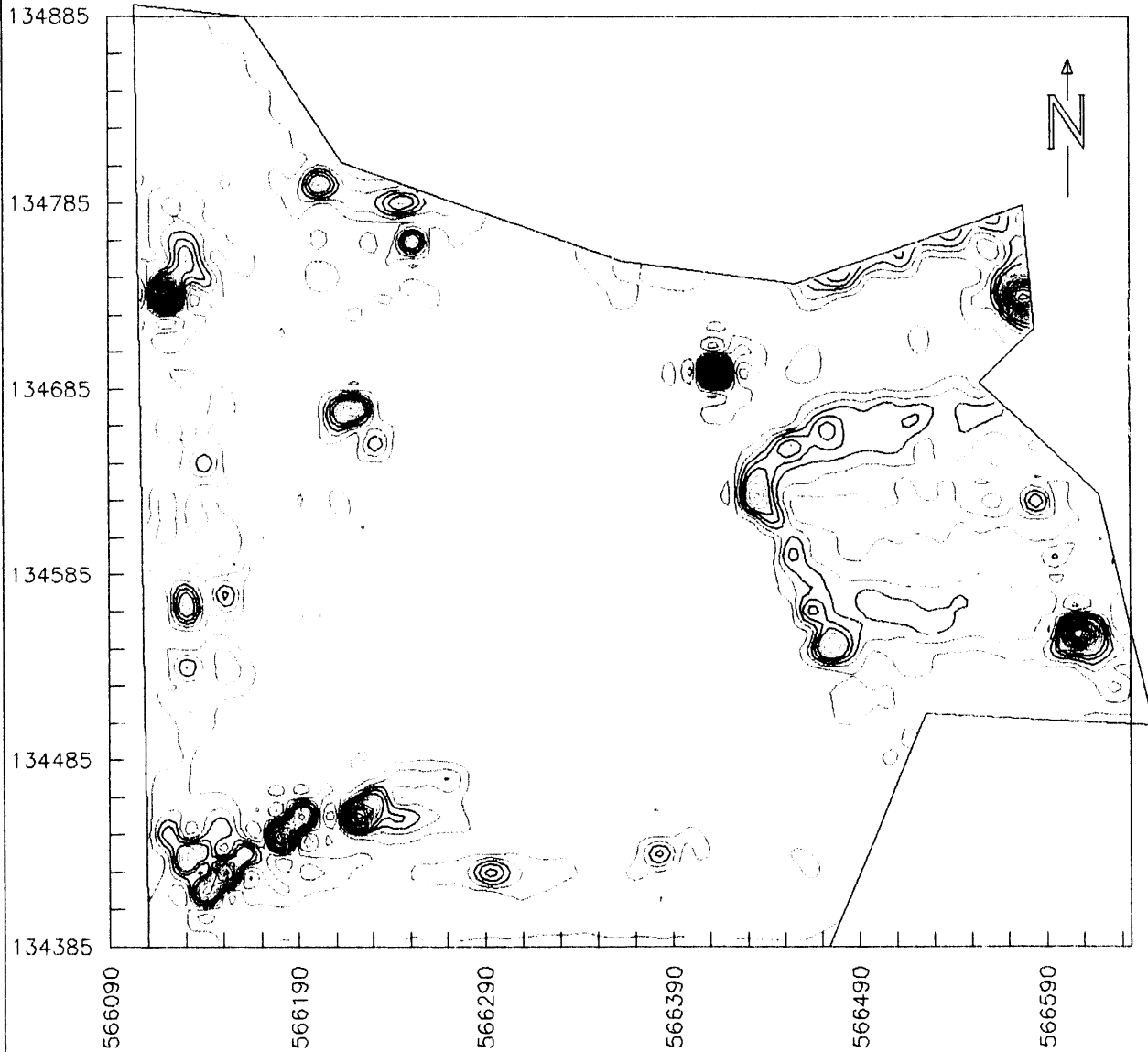
MSCM-11 SURVEYS

EM/ Site Investigative Surveys

FIGURE 3

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Page 2

200-UP-2 MSCM-11 RADIOLOGICAL SURVEY RADIOLOGICAL CONTOUR OF 216-U-10 AREA



COUNT RATE KEY

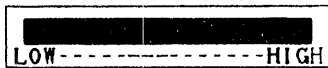
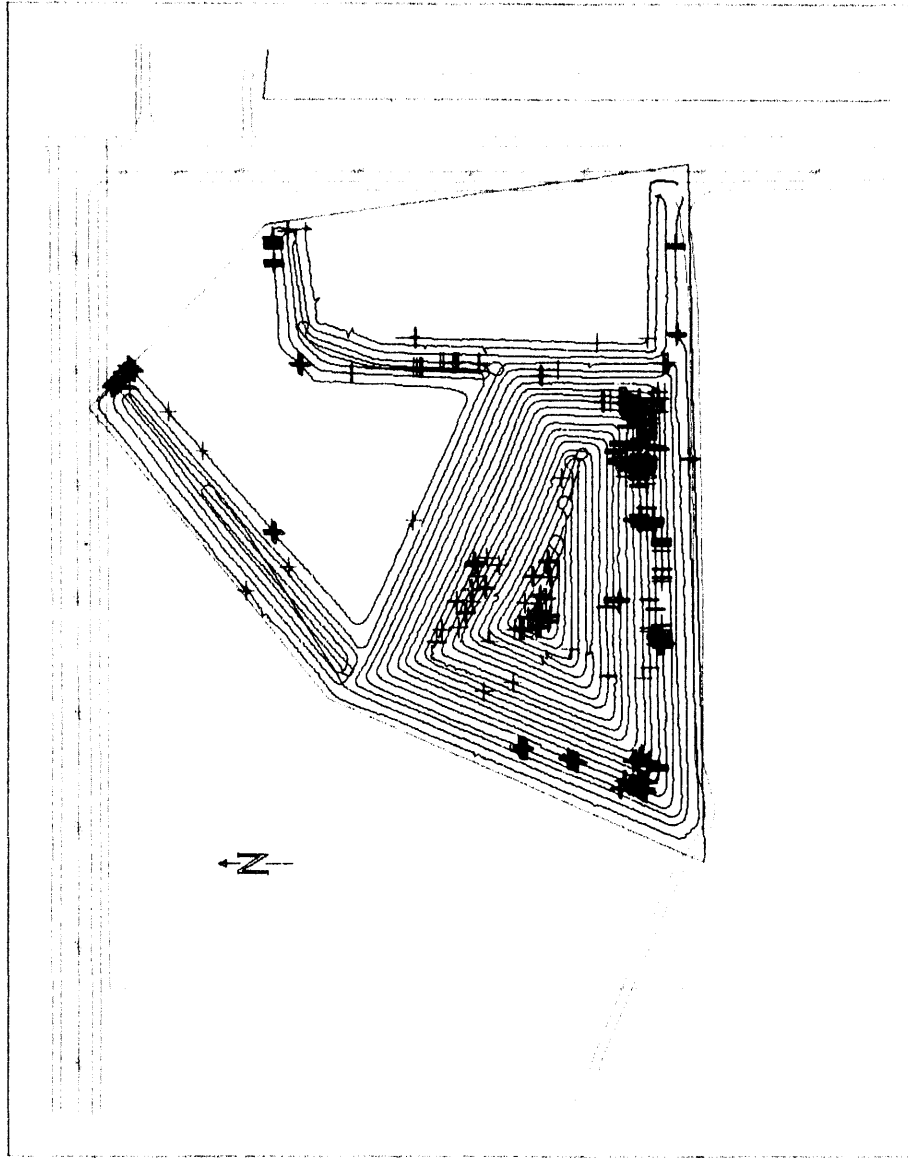


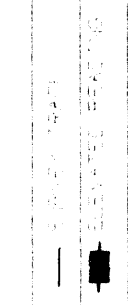
FIGURE 4

MSCM-11 SURVEYS
EAB/Date Investigative Surveys

200-UP-2 MSCM-II SURVEY
COMPOSITE TRACK MAP OF U11 TRENCH AREA



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MSCM-II SURVEYS
200-UP-2 Site Investigation Surveys

FIGURE 6

200-UP-2 MSCM-II RADIOLOGICAL SURVEY RADIOLOGICAL CONTOUR OF 216-U-11 AREA

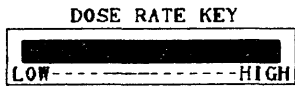
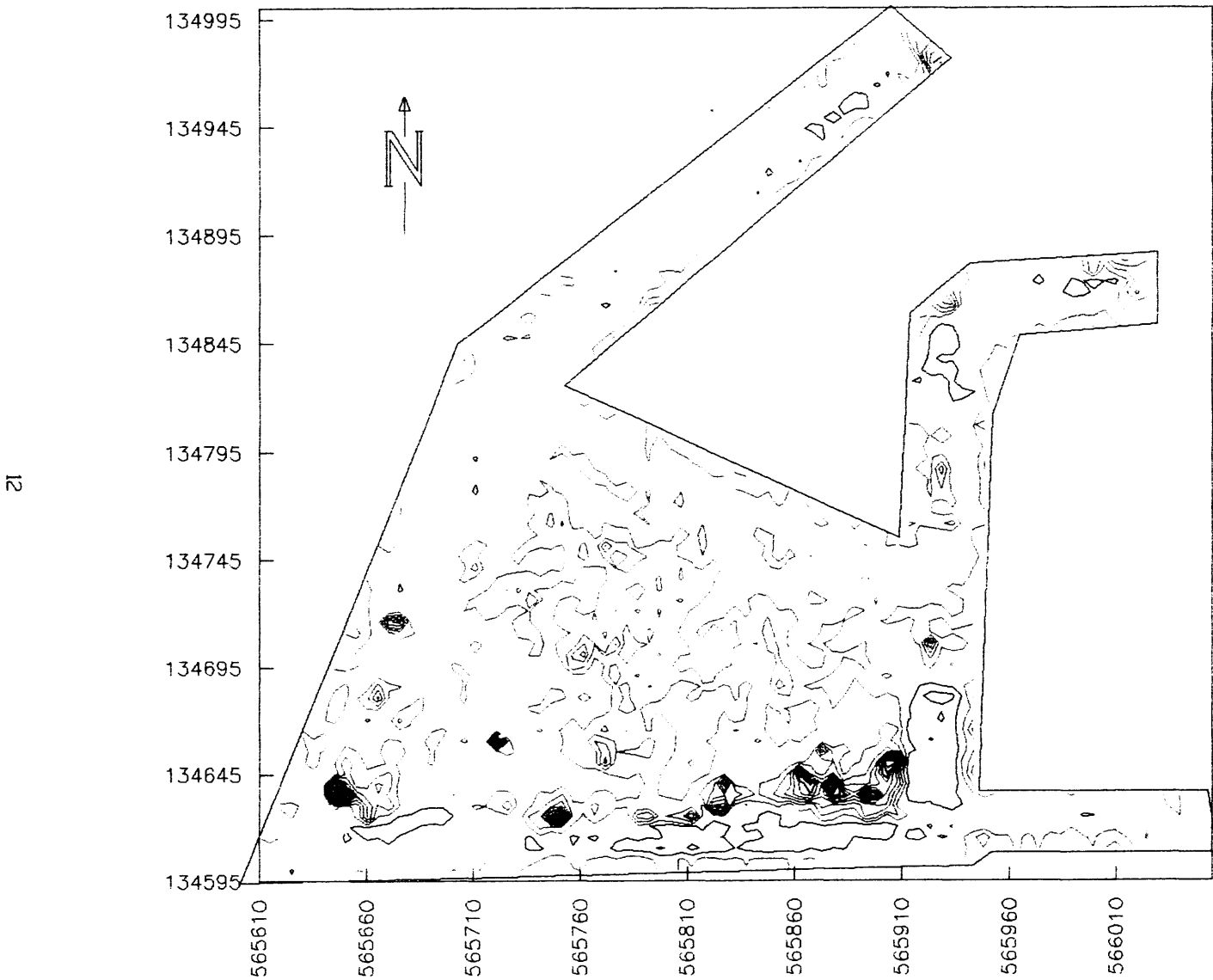


FIGURE 7

MSCM-II SURVEYS
EMF/ELC Investigative Services

WHC-SD-EN-RPT-009
Paul D

Rev. 0

200-UP-2 MSCM-11 SURVEY COMPOSITE TRACK MAP OF 216-10.11.&19 DITCHES

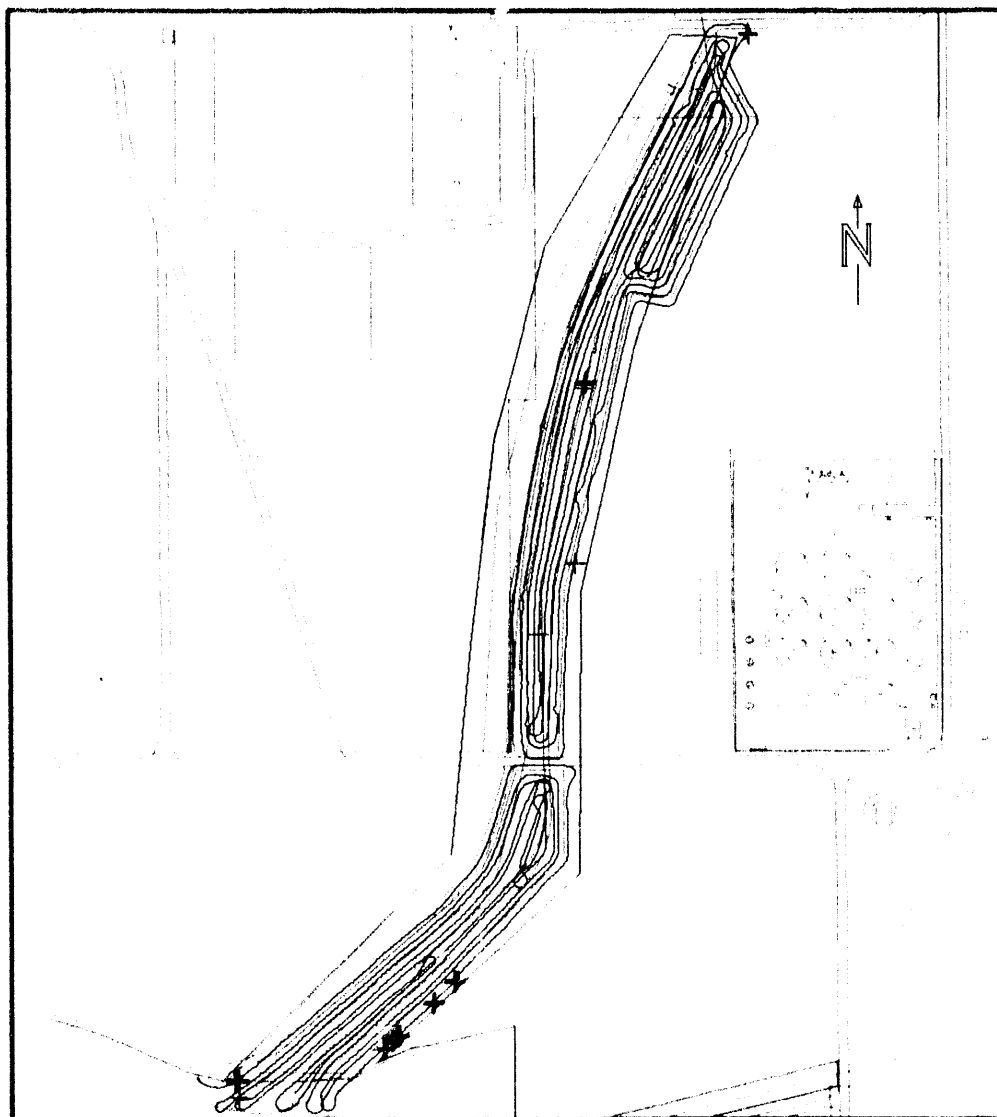
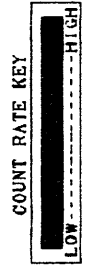
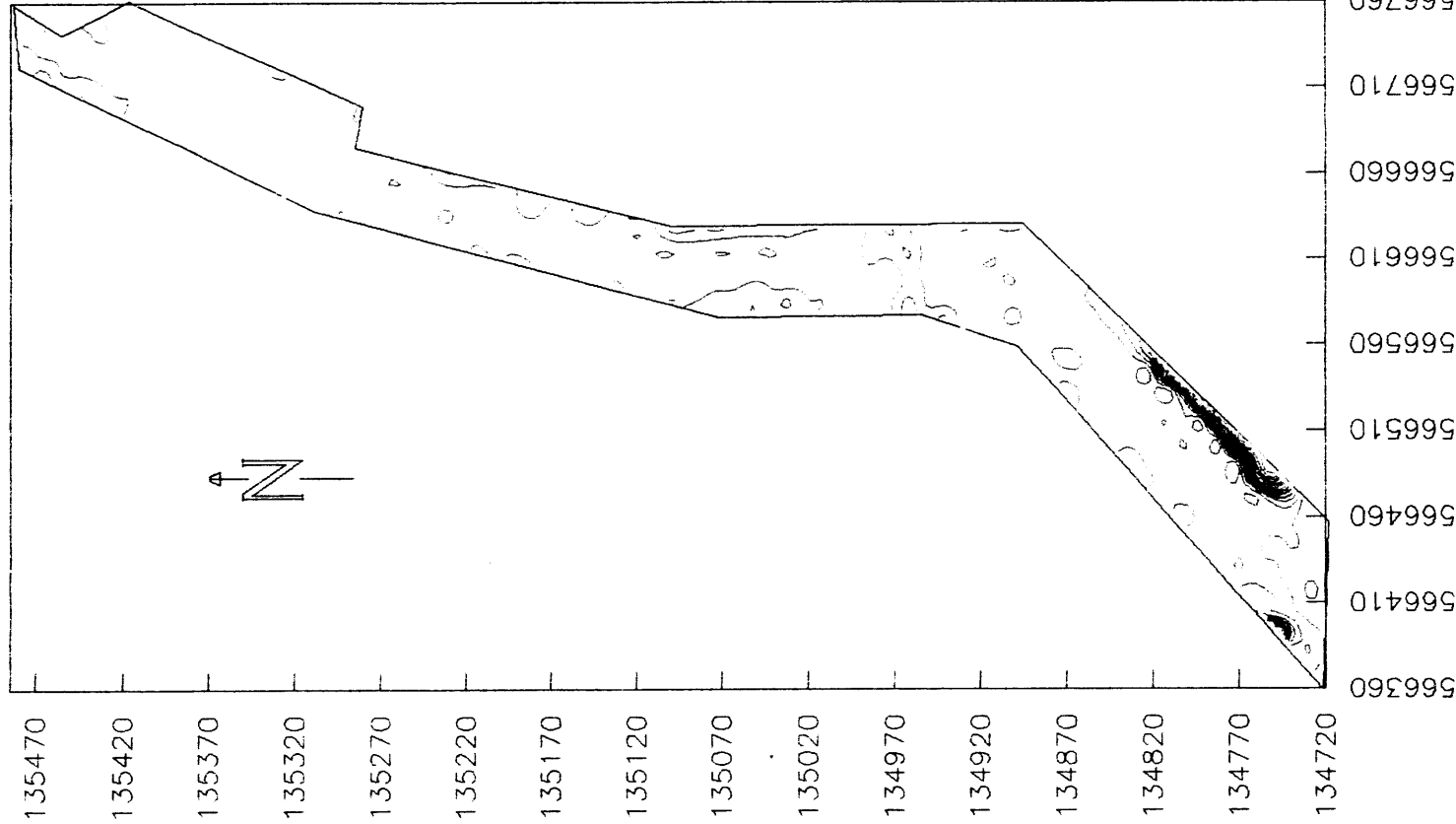


FIGURE 9

WMC-SD-EN-RPT-008 Rev. 1.0

200-UP-2 MSCM-11 RADIOLOGICAL SURVEYS RADIOLOGICAL CONTOUR OF Z TRENCH AREA



MSCM-11 SURVEYS
EMP/Site Investigative Surveys

FIGURE 10
15

200-UP-2 MSCM-II RADIOLOGICAL SURVEY
 RADIOLOGICAL PROFILE OF Z TRENCH AREA
 VIEWED FROM THE NORTHWEST

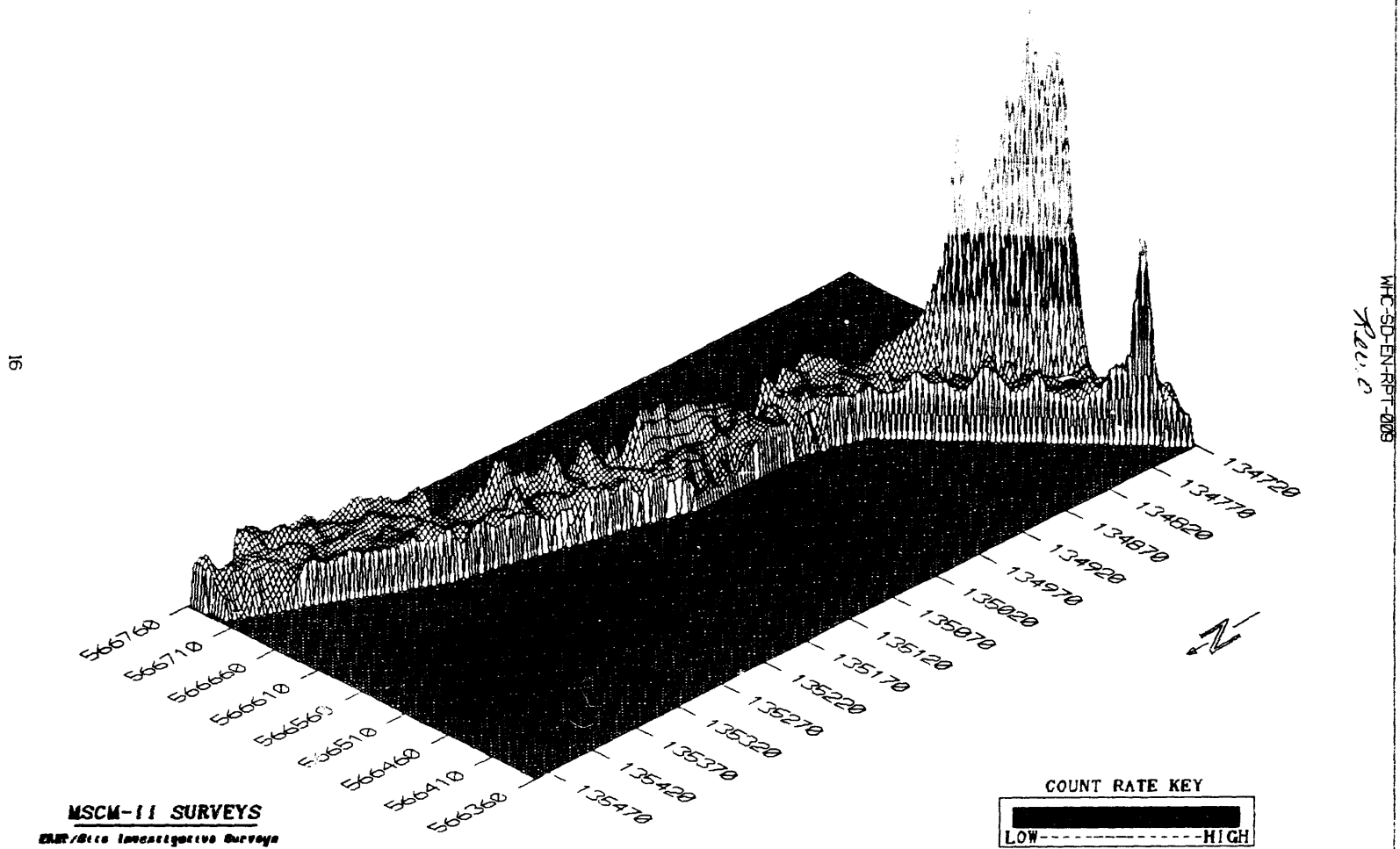
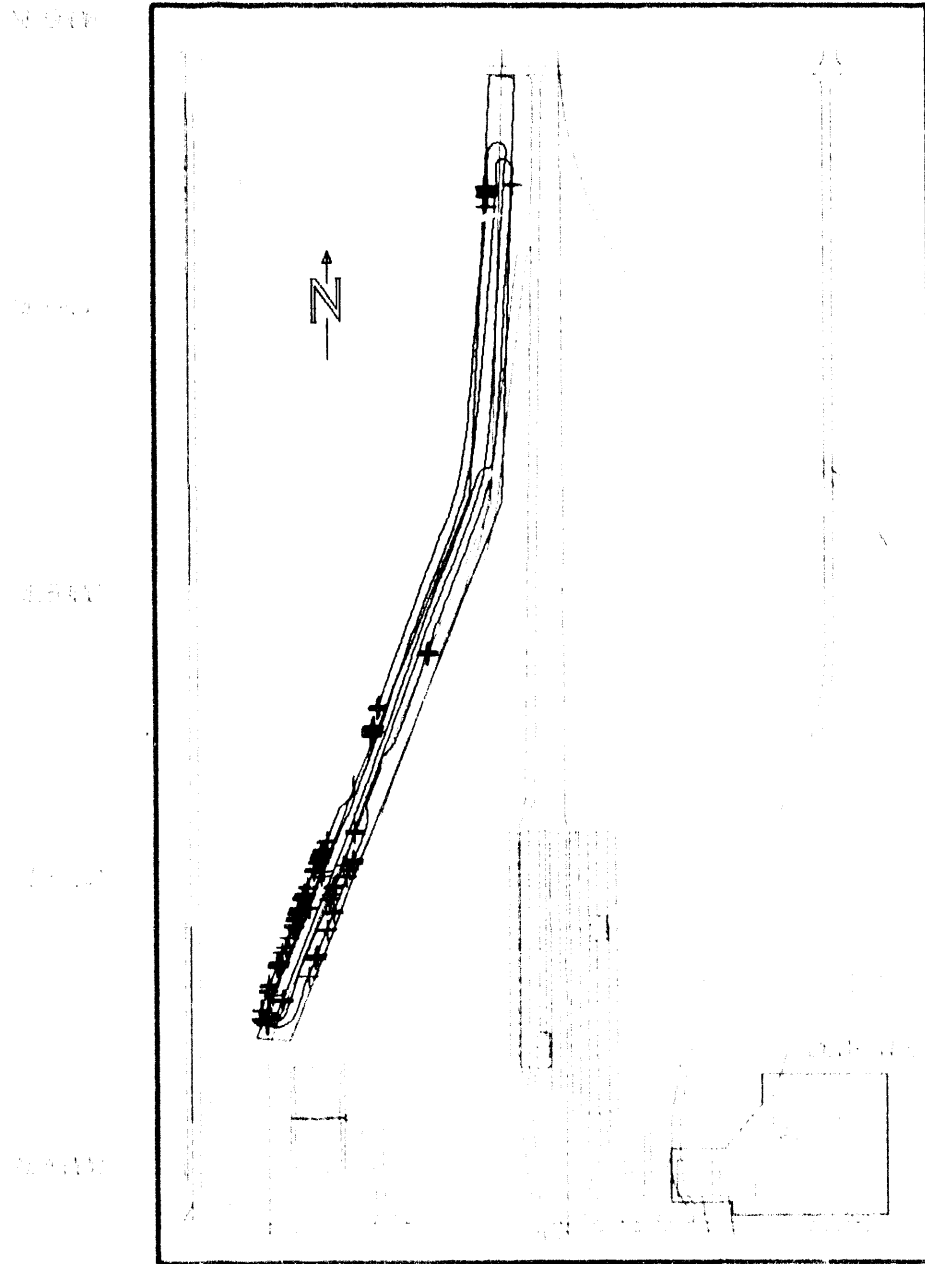


FIGURE 11

200-UP-2 MSCM-II SURVEY COMPOSITE TRACK MAP OF U14 DITCH AREA



— 200-UP-2
■ 200-UP-2

0 50 100
FEET

FIGURE 12

MSCM-II SURVEYS
ERMP/Site Investigative Surveys

200-UP-2 MSCM-II RADIOLOGICAL SURVEY RADIOLOGICAL CONTOUR OF U14 TRENCH

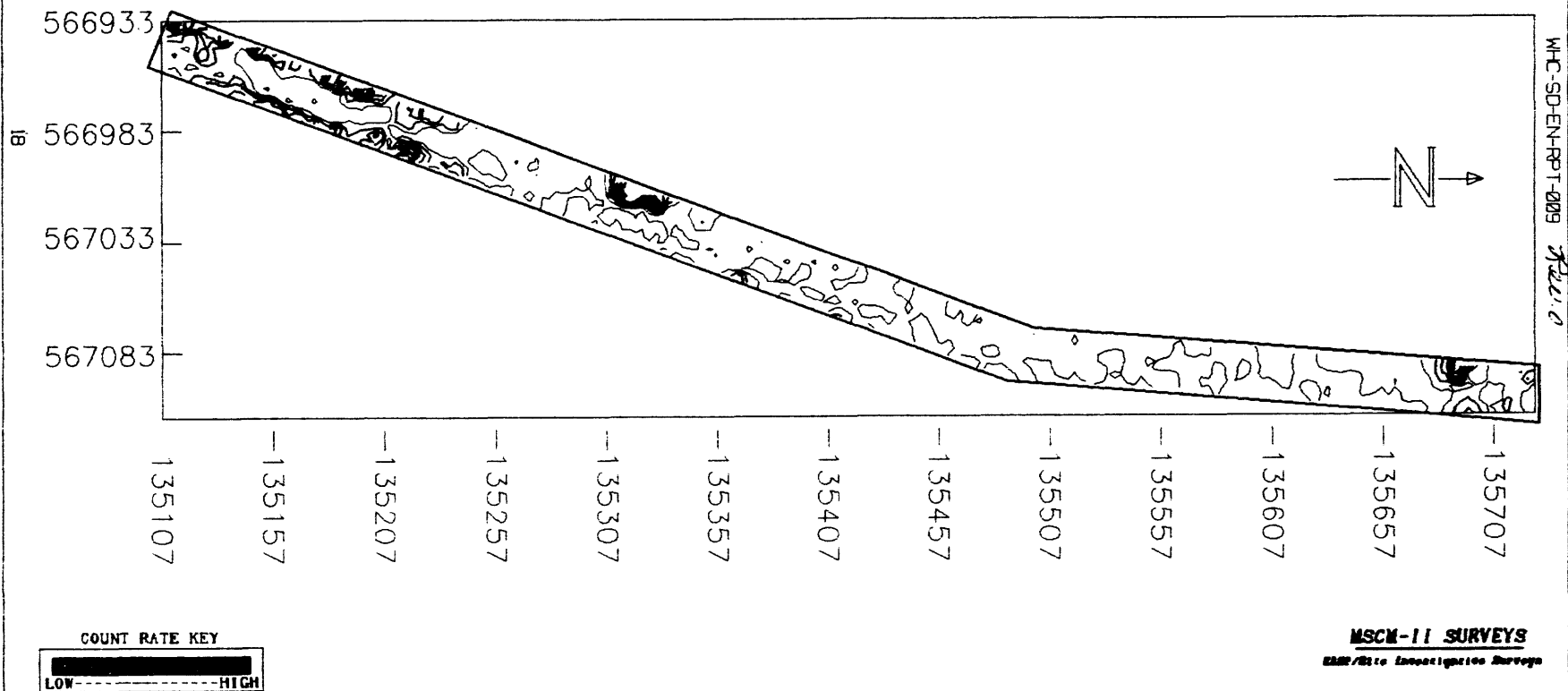
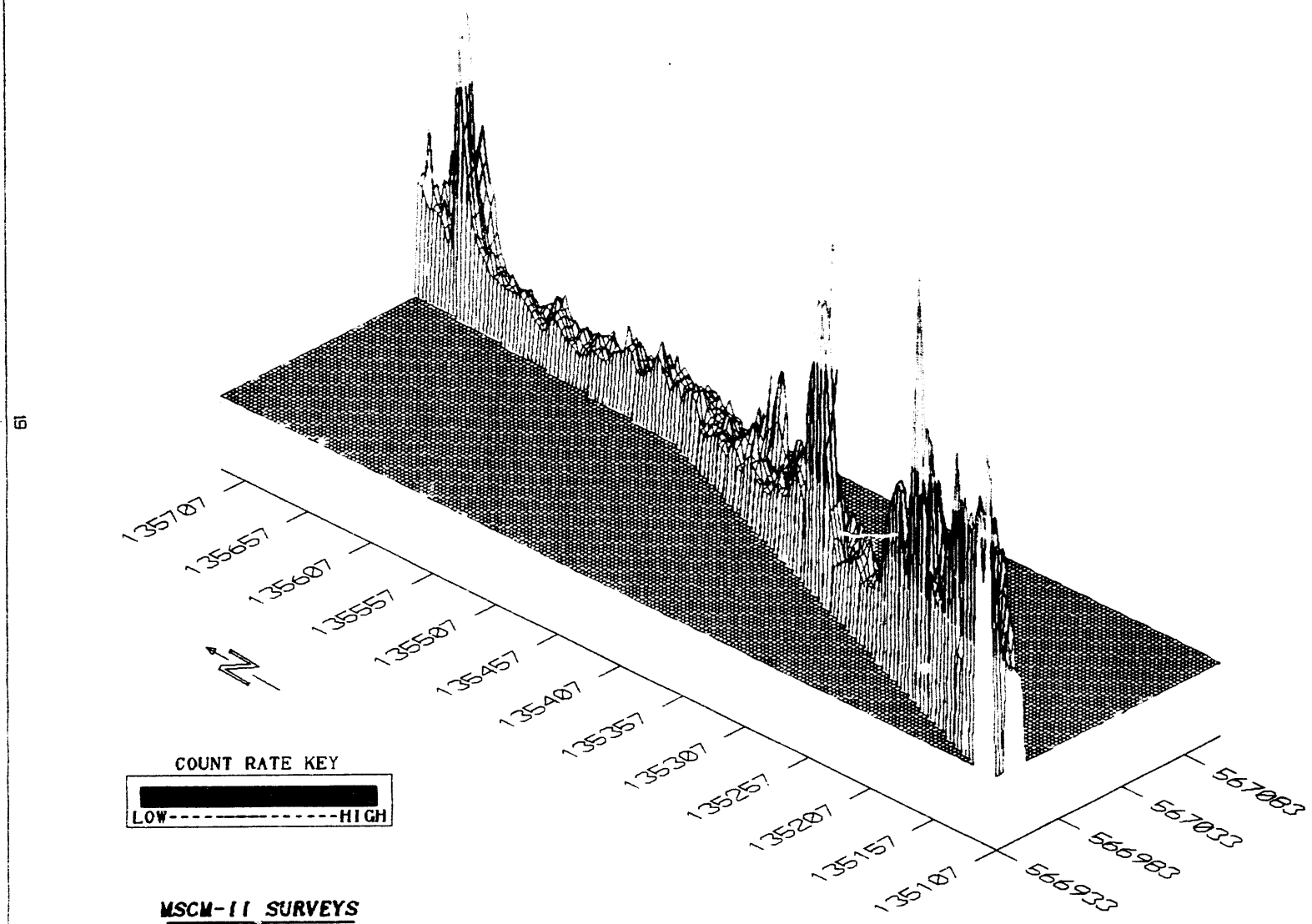


FIGURE 13

200-UP-2 MSCM-II RADIOLOGICAL SURVEY RADIOLOGICAL PROFILE OF U14 TRENCH



MSCM-II SURVEYS
ERMP/Size Investigative Surveys

FIGURE 14

WEC-SD-EN-RPT-009
 Rev. 1

USRADS SURVEYS

The radiological surveys were conducted using both a digital count rate meter with a sodium iodide detector reporting in counts per minute (CPM) and a dose rate meter reporting micro Roentgen per hour (uR). The count rate meter was set for gross counting, i.e., window "out". The window setting allows detection of low, intermediate and high energy photons.

These instruments were connected to a CHEMRAD Tennessee Corp. Series 2000 USRADS. The USRADS equipment is used to record the detector readings versus the location of the readings, generate a map of the survey area and save the data on computer storage media.

Each survey entailed setting up the USRADS equipment in a grid block; connecting the radiation survey meters to the USRADS Data Pack; calibrating the USRADS equipment and performing the survey. Calibration of the USRADS is performed prior to starting a survey. The purpose of the calibration sequence is to reestablish the positioning instrumentation after the equipment is moved to a new location.

Every attempt was made to traverse each grid block of the Tile Field Area on an approximately 10 foot cross hatched pattern and both the 207-U and the 216-U-8 Crib/Pipeline areas on 10 foot transects, however, due to the roughness of the terrain and varying vegetation growth this was not always possible. Speed of survey was approximately 2 feet/sec. The gamma detector was maintained about six inches from the soil surface by suspending the detector from a boom attached to the surveyors backpack. The dose rate meter was mounted to this boom three feet from the soil surface. In this manner detector geometry remained relatively constant throughout the entire survey.

Approximately 62,757 sq. meters of the 200-UP-2 Operable Unit were surveyed with the USRADS.

USRADS Location

Prior to initiating the USRADS radiological surveys of the 200-UP-2 Operable Unit, a grid system was established so that the individual surveys could be controlled and tied together. Using 16th St. as a baseline for the Tile Field Area and the 207-U Area, and the Surface Contamination Area (SCA) boundary of the 216-U-8 area as a baseline, Site Investigative Surveys placed stakes in a grid within the areas proper. Each grid block was given a unique designator.

USRADS Survey Results

Tile Field Area

~24,767 sq. meters of the Tile Field Area was surveyed with the USRADS. Due to well drilling activities in the area near the 216-U-1 and 216-U-2 cribs, not all of the area commissioned to be surveyed was completed.

Statistically elevated radiation/contamination readings were observed in every survey of each grid block. These elevated readings may be due to either radiation emitting from the cribs located in the area, radiation from sub-surface radioactive material, surface contamination, or a combination of all three. Out of 25,521 data points collected during the entire survey, 13,423 were greater than the minimum detectable count rate (MDC). USRADS Survey statistics of this area are summarized in Table 1.

Rev. 0

Figure 15 shows the survey grid layout used. Figure 16 is a composite survey track map of the entire area surveyed. Figure 17 and 18 are graphical interpretations of the CPM data collected.

Table 1
 USRADS survey statistics of the Tile Field Area

FILE	DATE	GRID	DATA PTS	MAX CPM	MEAN CPM	SIGMA	MAX uR	MEAN uR	SIGMA
2EPTILEB	09/14/93	2EUP	2460	39240	12018.98	3726.05	28.52	11.96	3.29
SCA1	09/17/93	SCA1	682	141960	19406.74	19885.43	59.12	17.83	8.4
TILE1A	09/15/93	1	3554	24660	12278	2437.47	25.52	13.16	2.91
TILE2A	09/15/93	2	1850	15720	11846.63	1203.8	22.22	13.56	2.36
TILE3A	09/16/93	3	3552	39780	14728.23	3533.22	34.52	15.77	3.66
TILE5A	09/16/93	5	4422	51420	12773.45	2499.7	36.92	13.72	2.75
TILE6A	09/17/93	6	3718	34800	14801.64	2759.49	33.02	15.93	3.19
TILE8A	09/20/93	8	5283	33120	9962.88	2548.04	35.12	10.61	2.9

216-U-8 Crib/Pipeline Area

~20,152 sq. meters of the 216-U-8 Crib/Pipeline SCA was surveyed utilizing the USRADS.

Statistically elevated radiation/contamination readings were observed in every survey of each grid block. These elevated readings may be due to either radiation emitting from the buried pipeline and crib located in the area, radiation emitting from sub-surface radioactive material, surface contamination, or a combination of all three. Out of 9,365 data points collected during the entire survey, 414 were greater than the MDC. USRADS Survey statistics of this area are summarized in Table 2.

Figure 19 shows the survey grid layout used. Figure 20 is a composite survey track map of the entire area surveyed. Figure 21 and 22 are graphical interpretations of the CPM data collected.

Table 2
 USRADS survey statistics of the 216-U-8 Crib/Pipeline Area

FILE	DATE	GRID	DATA PTS	MAX CPM	MEAN CPM	SIGMA	MAX uR	MEAN uR	SIGMA
U8-1A	09/21/93	1	1312	20940	10768.77	1215.68	17.42	11.21	2.04
U8-2A	09/21/93	2	1737	44160	10250.05	2252.02	16.82	10.29	1.92
U8-3A	09/23/93	3	1893	26580	10071.16	1270.08	17.42	10.85	2
U8-4A	09/23/93	4	1837	22740	9350.1	2392.51	20.72	10.09	2.09
U8-5A	09/24/93	5	1410	12240	9167.62	869.46	15.02	9.62	1.8
U8-6A	09/23/93	6	1176	23220	8861.94	1597.41	14.72	8.98	1.78

200-UP-2 USRADS RADIOLOGICAL SURVEY GRID LAYOUT OF TILE AREA



FIGURE 15
22

200-UP-2 USRADS RADIOLOGICAL SURVEY COMPOSITE TRACK MAP OF TILE FIELD AREA

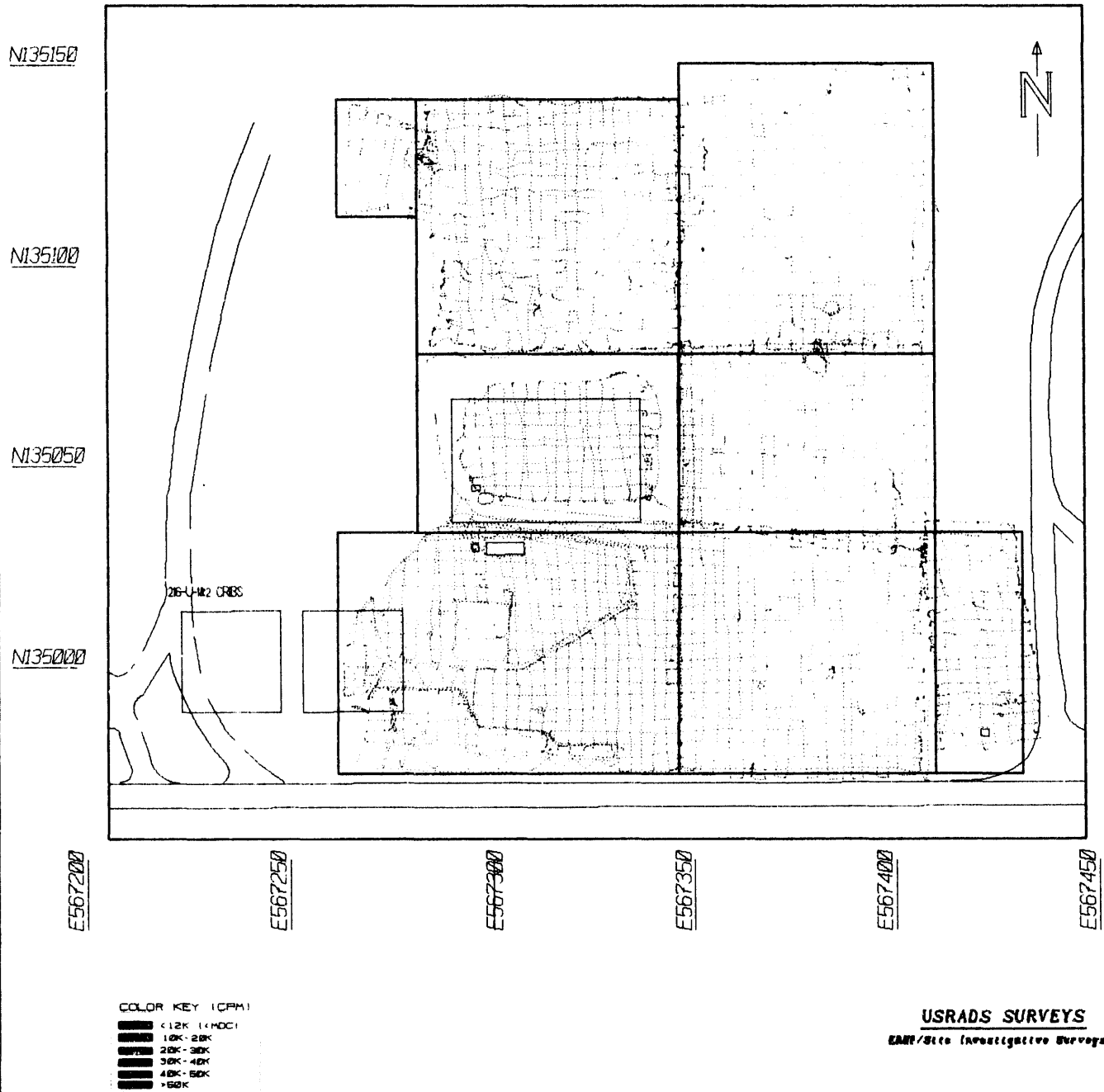
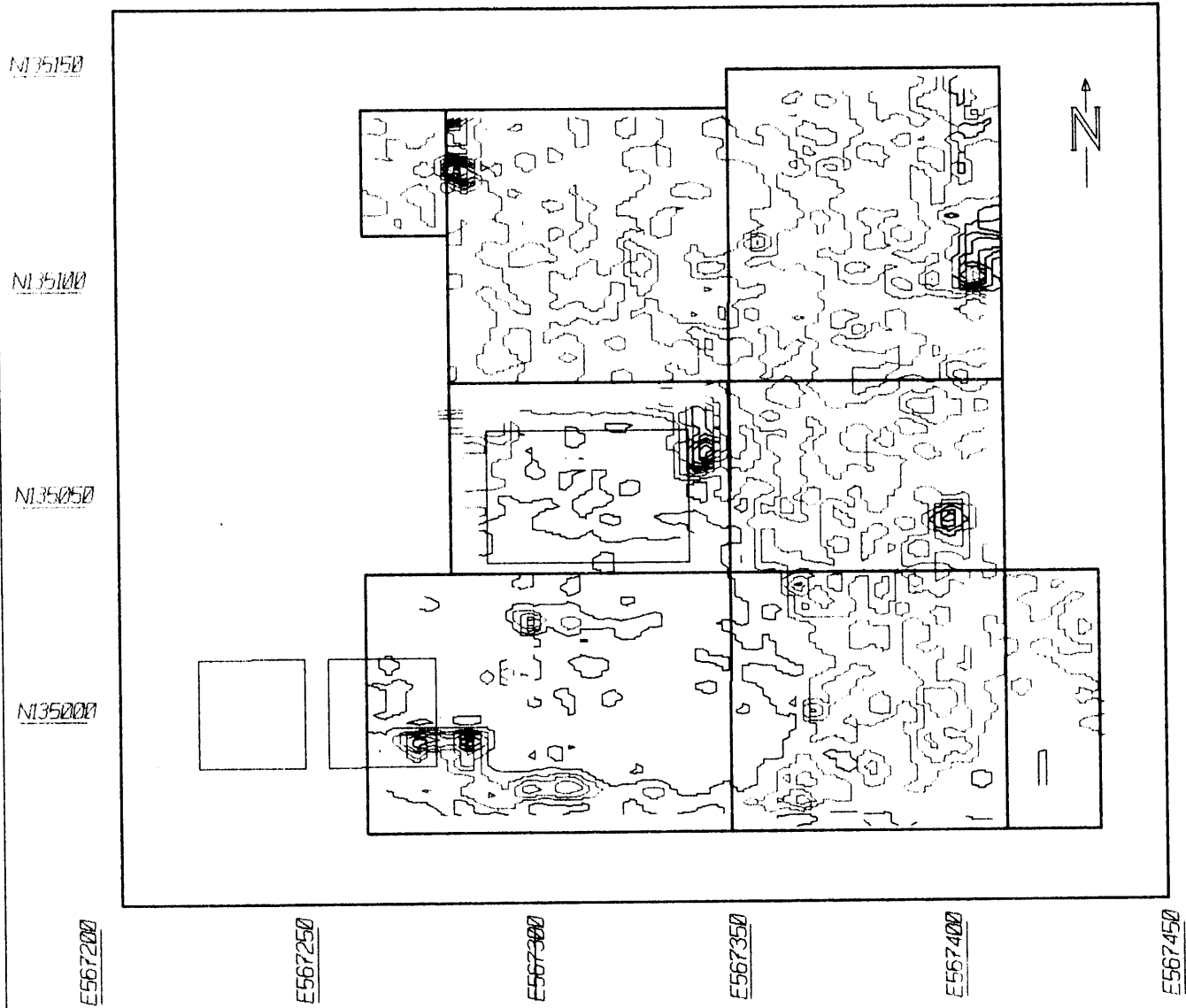


FIGURE 16

200-UP-2 USRADS RADIOLOGICAL SURVEY RADIOLOGICAL CONTOUR OF TILE AREA

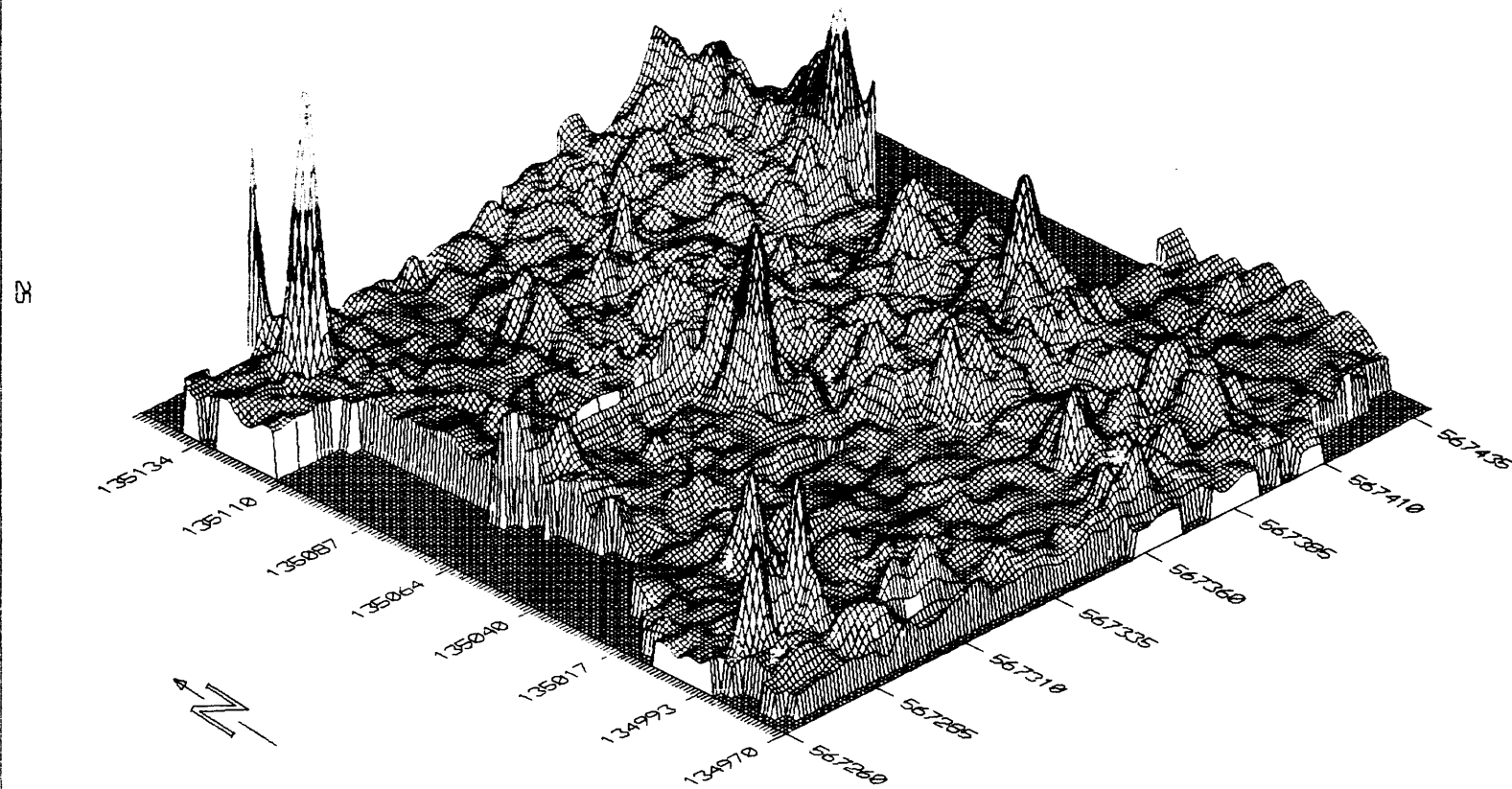


USRADS SURVEYS

ENR/Health Investigation Surveys

FIGURE 17
24

200-UP-2 USRADS RADIOLOGICAL SURVEY
RADIOLOGICAL PROFILE OF TILE FIELD AREA
VIEWED FROM THE SOUTHWEST



25

MFC-SD-ENRPT-009
Rev. 0

COUNT RATE KEY
LOW-----HIGH

FIGURE 18

USRADS SURVEYS
EMF/Site Investigative Surveys

Rev. 0

200-UP-2 USRADS RADIOLOGICAL SURVEY GRID LAYOUT FOR 216-U-8 CRIB/PIPELINE

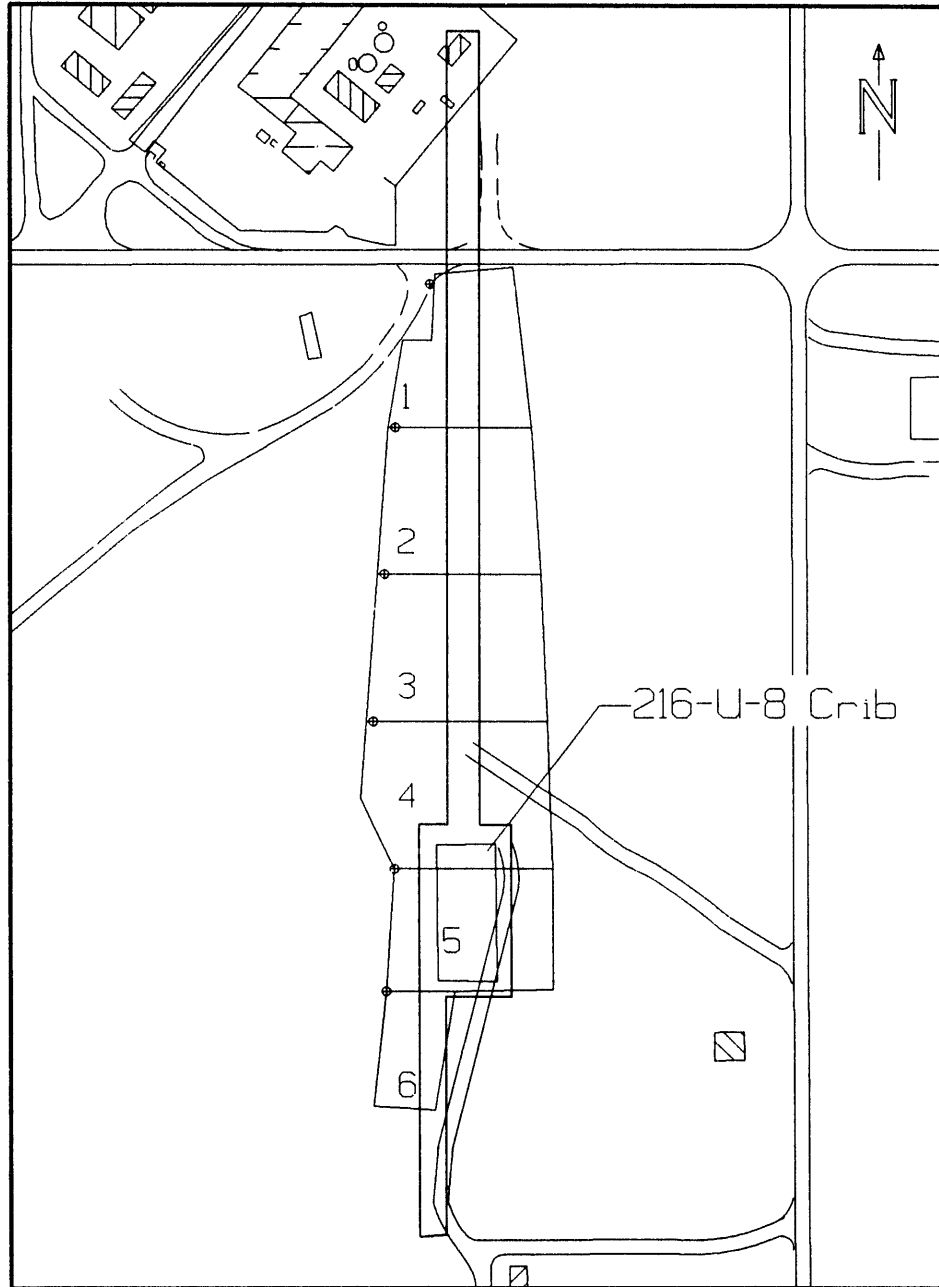
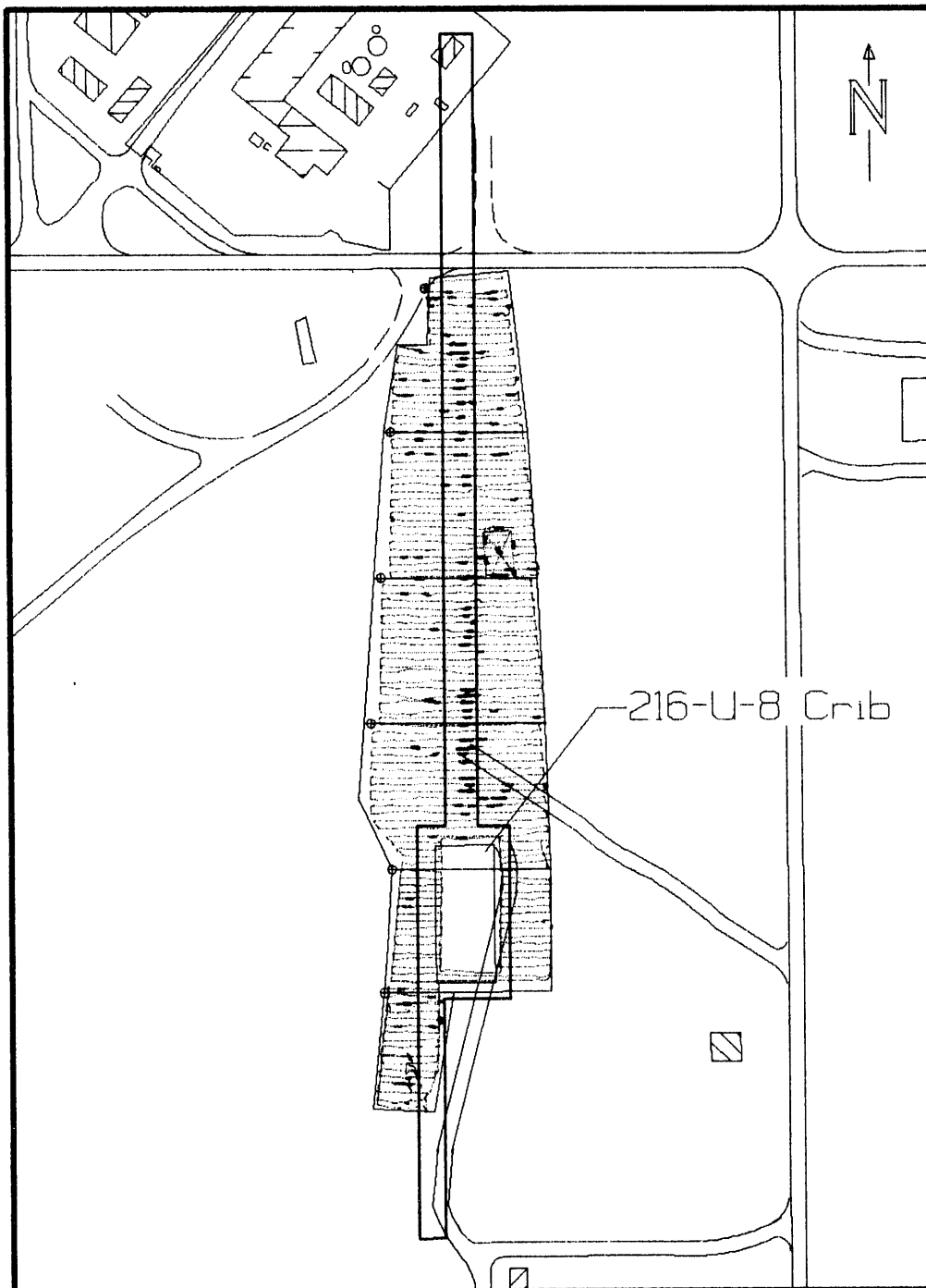


FIGURE 19

Rev. 0

200-UP-2 USRADS RADIOLOGICAL SURVEY COMPOSITE TRACK MAP OF 216-U-8



COLOR KEY (CPM)

█	< 12K (<MDC)
█	18K-20K
█	20K-30K
█	30K-40K
█	40K-50K
█	>50K

FIGURE 20

200-UP-2 USRADS SURVEY

RADIOLOGICAL CONTOUR OF U8 CRIB & PIPELINE

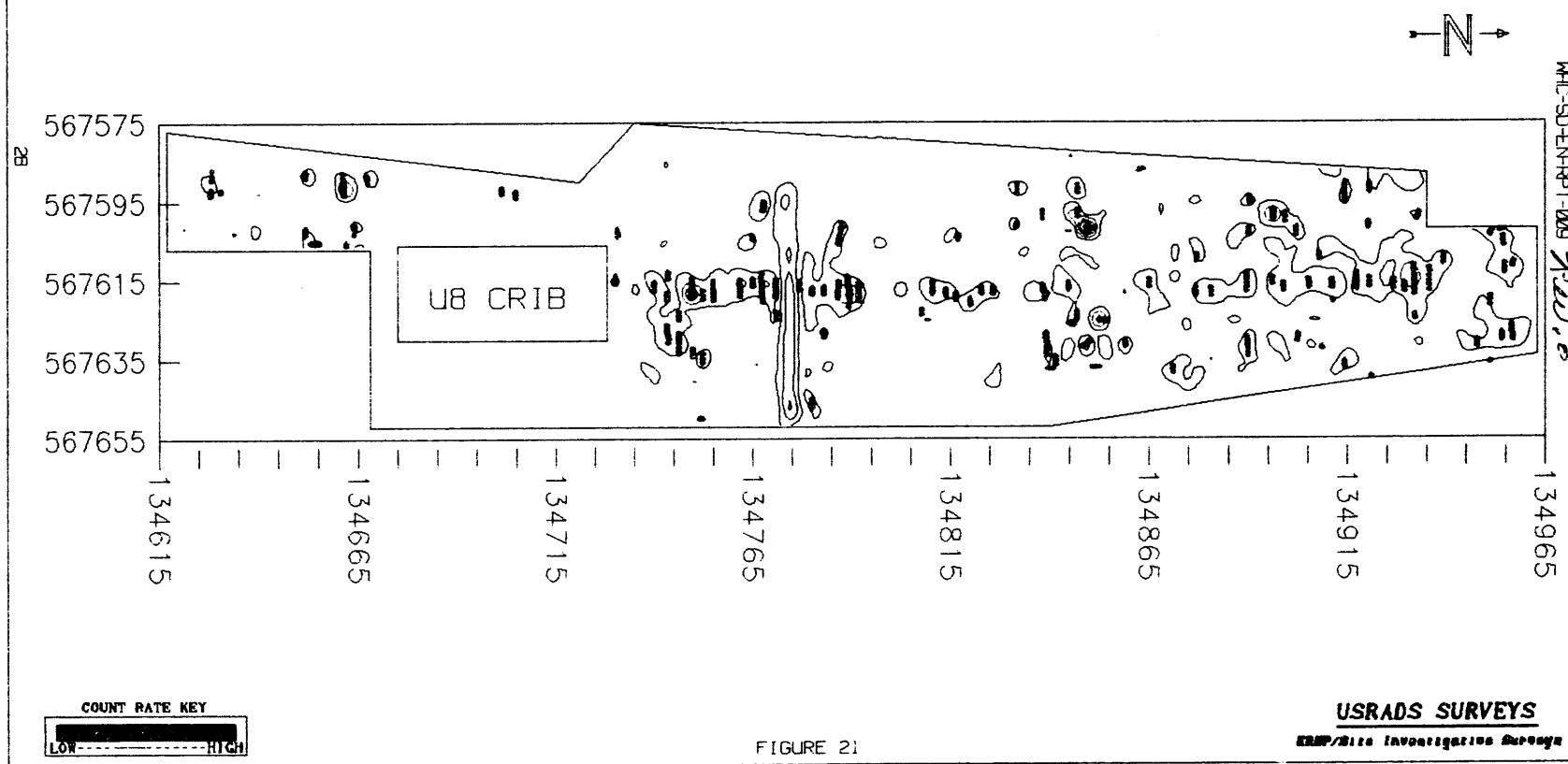
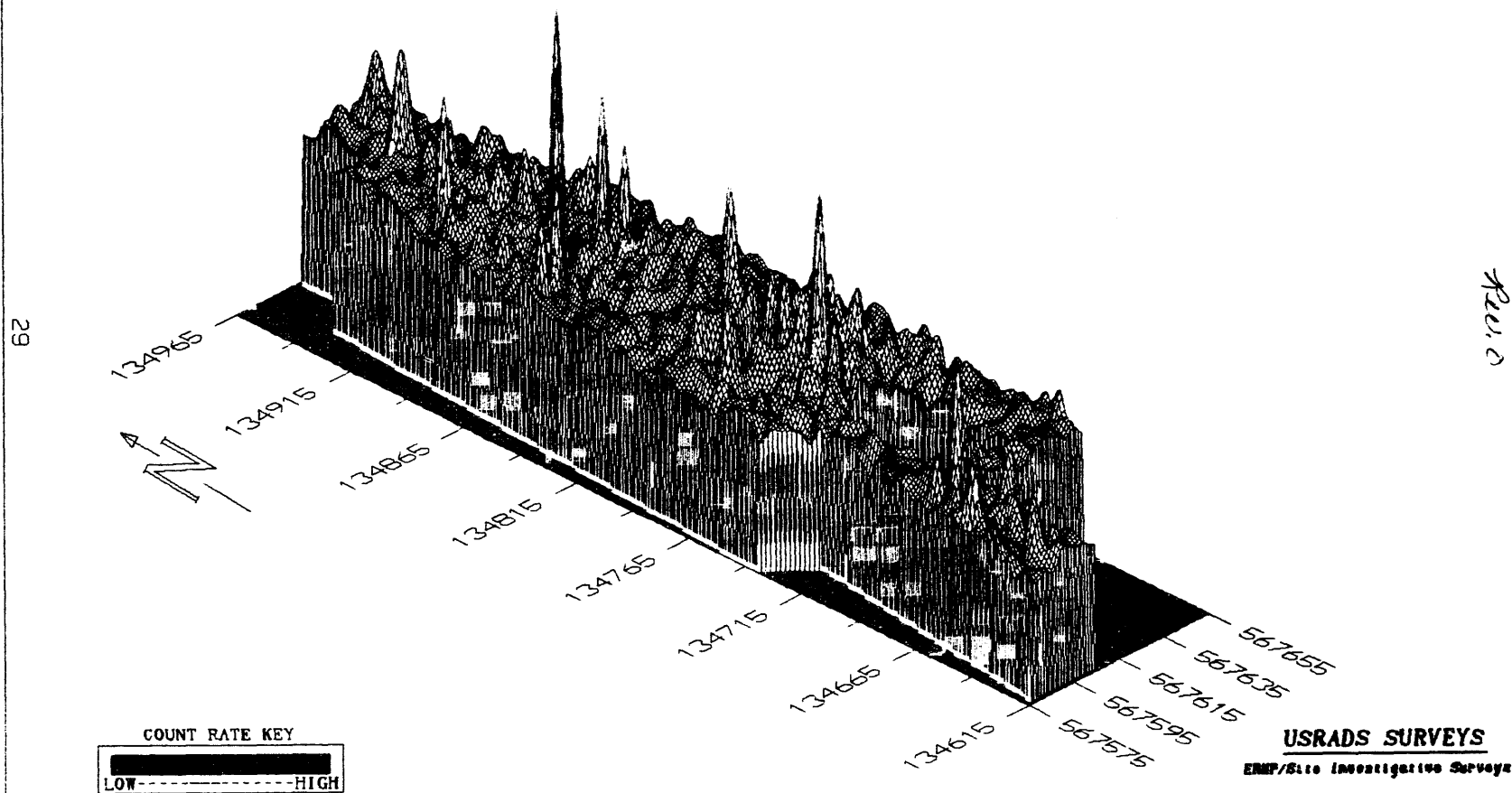


FIGURE 21

200-UP-2 USRADS RADIOLOGICAL SURVEY RADIOLOGICAL PROFILE OF U8 CRIB AND PIPELINE



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Rev. 2

FIGURE 22

Rev. 0

207-U SCA Area

~17,838 sq. meters of the 207-U SCA, which encompassed the area around the retention basins and none of the U-14 Trench, was surveyed with the USRADS.

Statistically elevated radiation/contamination readings were observed in every survey of each grid block. These elevated readings may be due to either radiation emitting from the cribs located in the area, radiation from sub-surface radioactive material, surface contamination, or a combination of all three. Out of 10,444 data points collected during the entire survey, 10,375 were greater than the minimum detectable count rate (MDC). USRADS Survey statistics of this area are summarized in Table 3.

Figure 23 shows the survey grid layout used. Figure 24 is a composite survey track map of the entire area surveyed. Figures 25 and 26 are graphical interpretations of the CPM data collected.

Table 3
USRADS survey statistics of the 207-U Area

SURVEY	DATE	GRID	DATA PTS	MAX CPM	MEAN CPM	SIGMA	MAX uR	MEAN uR	SIGMA
207U1A	12/15/93	1	2545	340200	48520.83	42172.66	326.12	52.35	41.77
207U2A	12/15/93	2	1954	202680	46178.75	28543.53	192.32	49.96	27.91
207U3A	12/16/93	3	1921	123600	25387.59	12169.31	93.62	27.39	10.25
207U4A	12/16/93	4	2104	128820	30985.12	17007.26	108.02	33.06	14.92
207U6A	12/16/93	6	1920	40620	18932.38	3994.73	40.82	20.6	4.29

MANUAL SURVEYS

Due to the roughness of the terrain in the 216-U-9 Trench Area and the relative small size of the 216-U-4 Area (216-U-4 and 216-U-4A), these areas were surveyed by WHC Health Physics Technicians using traditional survey methodology.

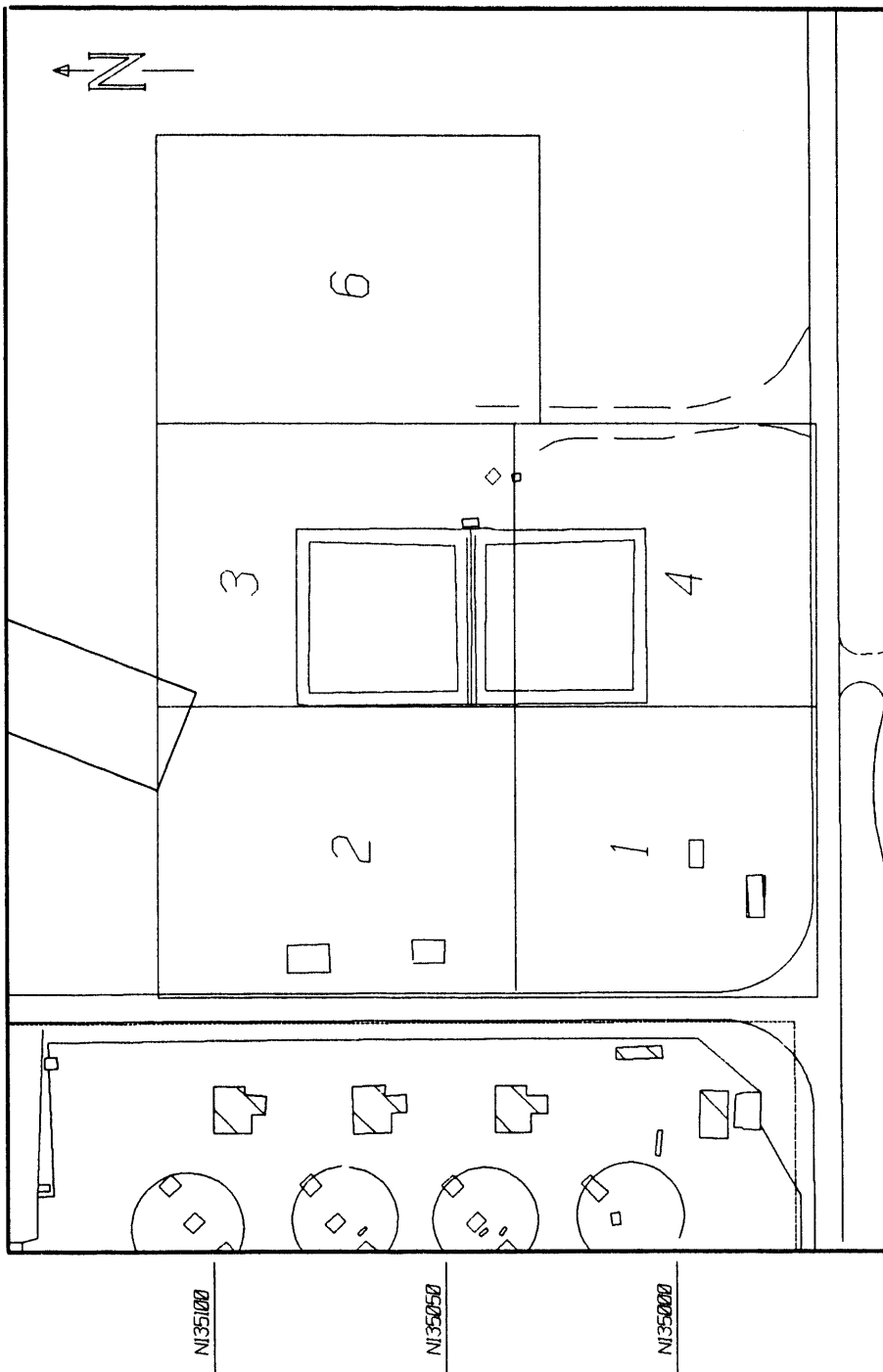
216-U-9 Trench Area

Survey was conducted on 12/20/93. No indications of elevated levels were recorded. Results of this survey can be referenced on WHC Radiation Survey Report # 146173 (copy attached).

216-U-4 Area

This survey was conducted on 11/30/93. Elevated beta/gamma and alpha readings, both fixed and smearable, were recorded. Results may be referenced on WHC Radiation Survey Report # 146149 (copy attached).

200-UP-2 USRADS RADIOLOGICAL SURVEY GRID LAYOUT FOR 207-U AREA



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E567100

E567050

E567000

E566950

E566900

E566850

N1351000

N1350500

N1350000

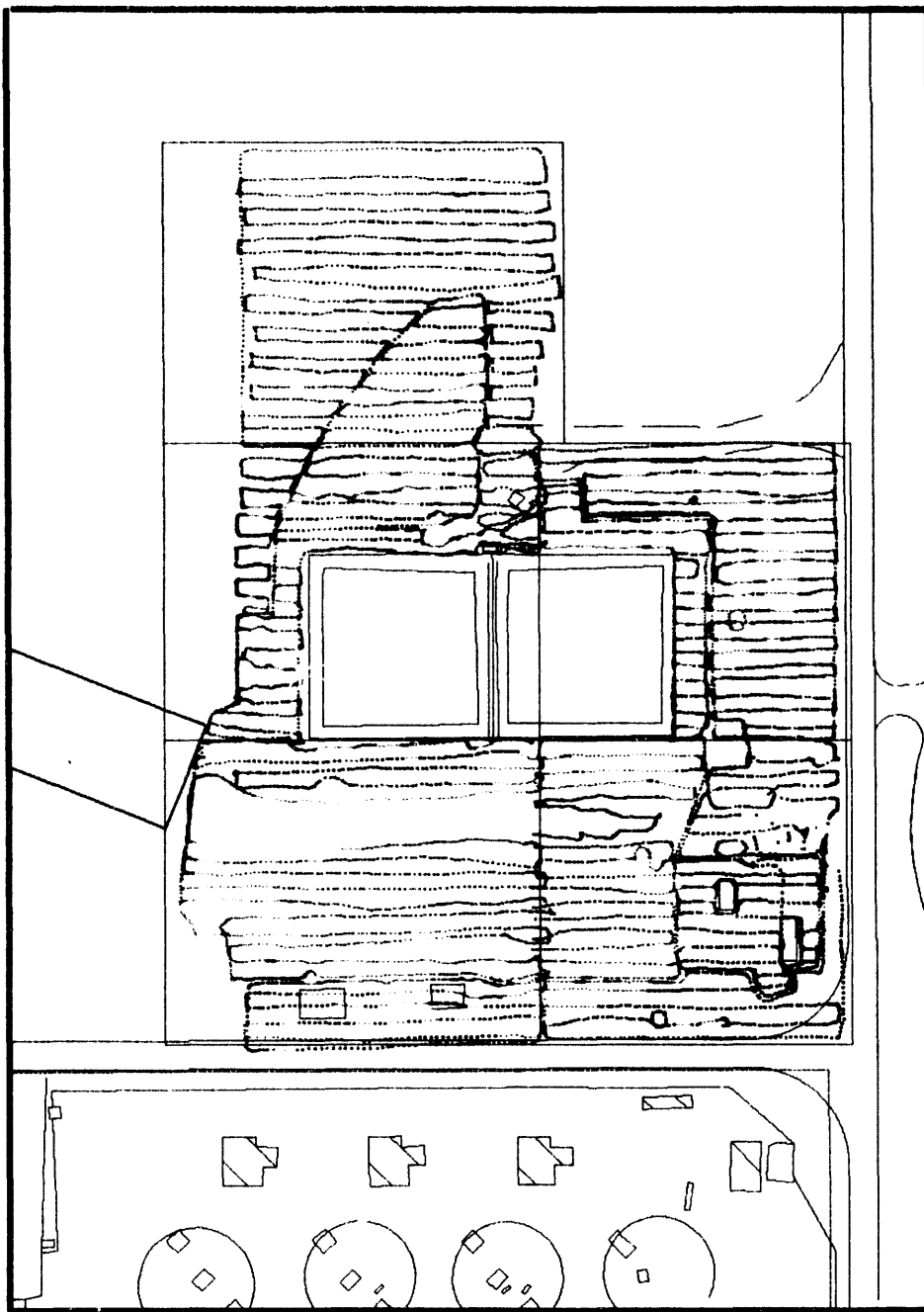
N1349500

USRADS SURVEYS
Health, Safety & Environment Division

FIGURE 23

REV. 0

200-UP-2 USRADS RADIOLOGICAL SURVEY COMPOSITE TRACK MAP OF 207-U AREA



NI351000

NI350750

NI350000

NI349500

COLOR KEY (CPM)

- < 1.2K (< 100)
- 10K - 20K
- 20K - 30K
- 30K - 40K
- 40K - 50K
- > 50K

E566850

E566900

E566950

E567000

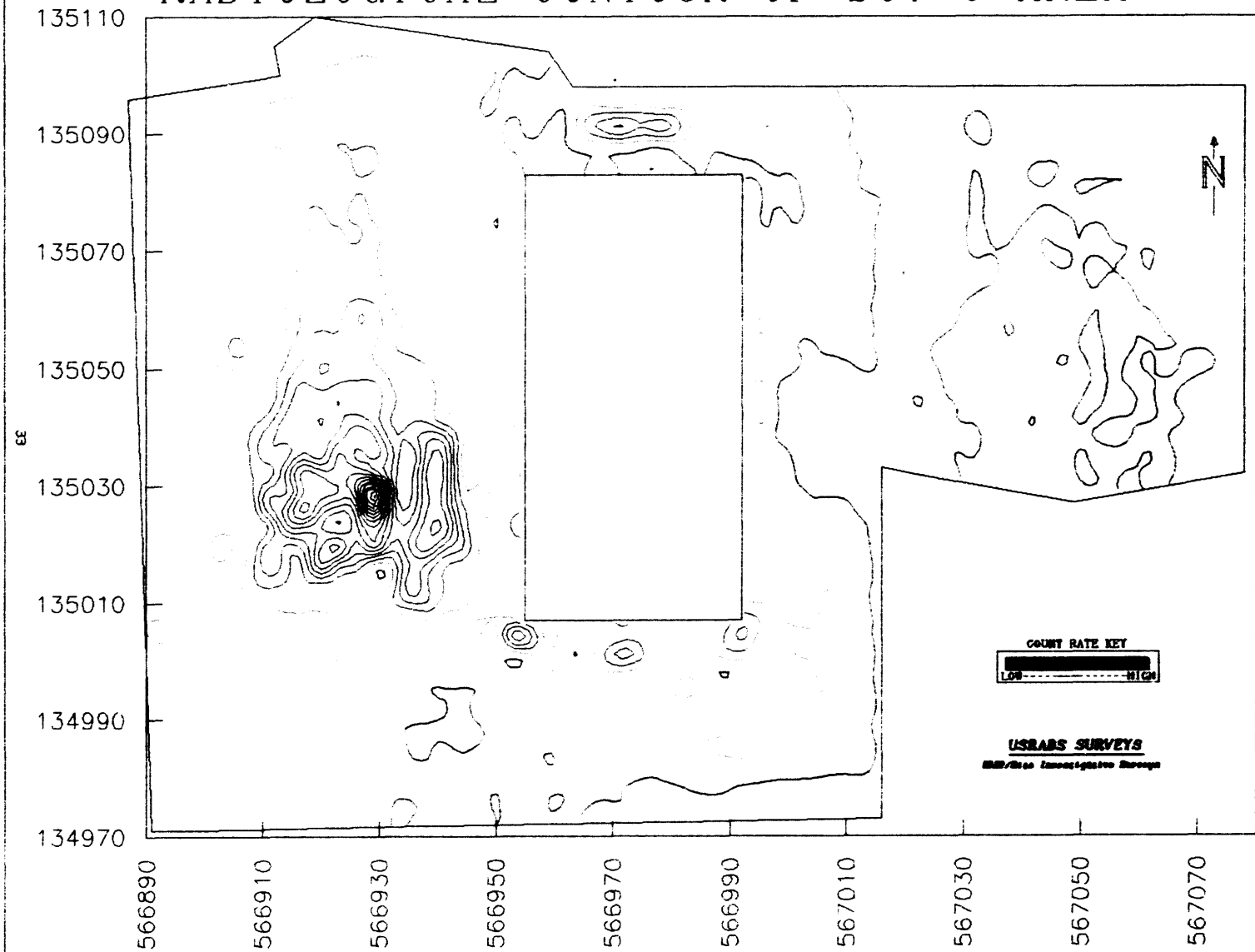
E567050

E567100

USRAID SERVICES
Environmental Investigation Services

FIGURE 24

200-UP-2 USRADS SURVEY RADIOLOGICAL CONTOUR OF 207-U AREA



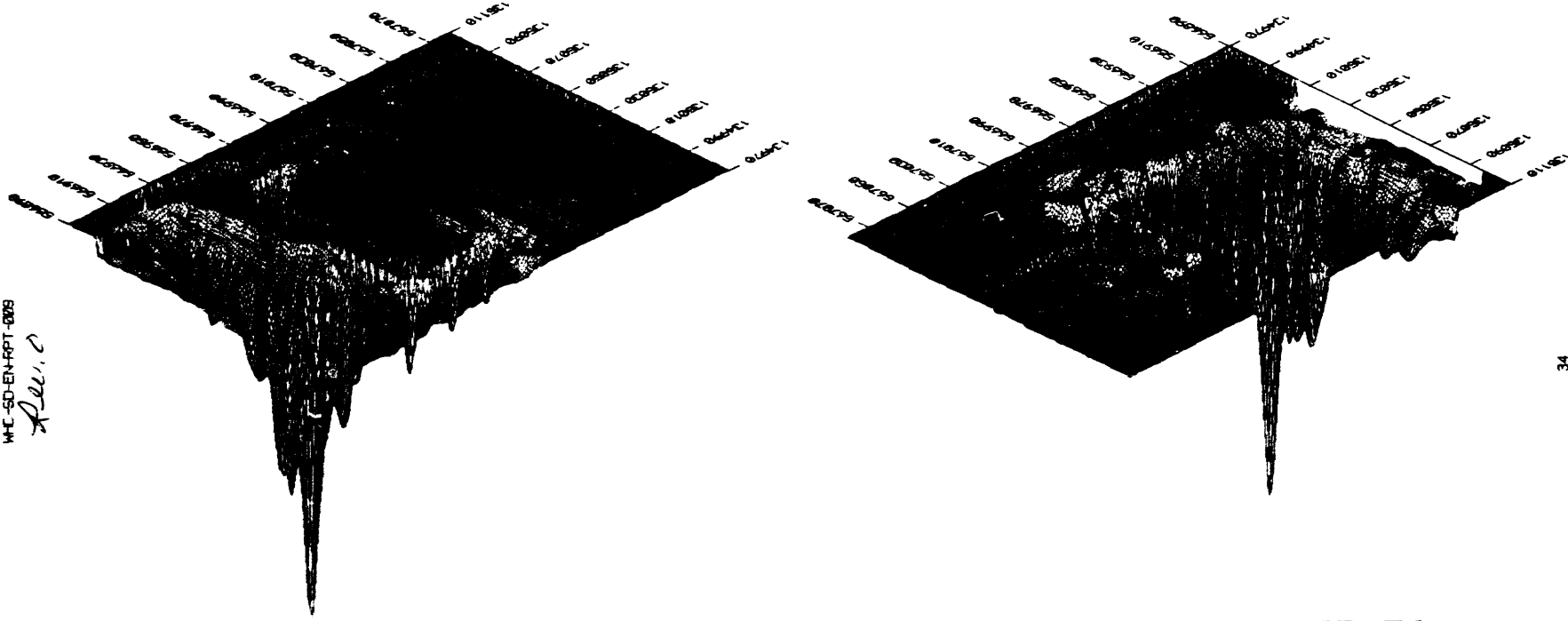
MC-50-ENRPT-003
Rev. 1

FIGURE 25

200-UP-2 USRADS SURVEYS
 RADIOLOGICAL PROFILES OF 207-U AREA

VIEWED FROM NORTHEAST

VIEWED FROM SOUTHWEST



COUNT RATE KEY
 LOW-----HIGH

USRADS SURVEYS
 EMP/GRS Investigation Group

FIGURE 26

WAC-SD-EN-RPT-009
 Rev. C



Westinghouse
Hanford Company

RADIATION SURVEY REPORT

Date
12-20-93

Time
From 0800 To 1500

Survey Number
No 146173

FC
SI

Page 1 of 2

Blog
N/A

Area
600

Room
N/A

Description of Job

SEMI ANNUAL ROUTINE SURVEY OF 216-U-9 DITCH G-M/PANCAKE
SURVEYS PERFORMED INSIDE THE ENTIRE LENGTH OF THE DITCH.
100% COVERAGE WAS NOT ATTAINED. ALL READINGS <D.

RWP No 51-008

Location 216-U-9 DITCH

Check if appropriate. When checked do not place unrelated information on this record

- Personnel Contamination
- CAM Radiation Alarm
- Establish Dose Rates
- Radiation Contamination Incident
- High Radiation Level Work
- "Special Survey"
- Property Release
- RAM Shipment

Item No	PER (1)	Description of Work Performed, Radiation Controls, and Measurements	Meter Deflection		Dist	CF	DOSE RATE			CONTAMINATION LEVELS				
			W/O	W/C			beta (non pen) mrad/hr	gamma (pen) mR/hr	neutron mrem/hr	Direct (dpm)		Smear 100 cm ²		
										beta	alpha	beta (d'm)	alpha (d'm)	mrad hr
1	N/A	216-U-9 DITCH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<D	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

1 Check for personnel dose rate Continued on supplemental report form

Instrument(s) Used	<input type="checkbox"/> CP	<input checked="" type="checkbox"/> G-M Pancake	<input type="checkbox"/> PAM	<input checked="" type="checkbox"/> G-M/PANCAKE	<input checked="" type="checkbox"/> G-M/PANCAKE	<input checked="" type="checkbox"/> G-M/PANCAKE
Serial No (s)	N/A	1378 1262		1145 371	1413 1502	1879 390

ESTIMATED PERSONNEL DOSE RATES

Phase of Work	Based on Measurement(s)	Average Dose Rate	Limit Applying
N/A	N/A	N/A	WBP S E
N/A	N/A	N/A	WBP AS E
N/A	N/A	N/A	WBP S E

Respiratory Protection Worn

- Supplied Air
- Filter
- Other
- None

COPY

RPT Exposure
< 1 mrem

Work Location Code
N/A

Signed *Mo D. Van Nuen*
PR No 84767

Do you increase or reduce RWP requirements for this work?
 No Yes Explain on reverse side

Did you attend a pre job meeting for this work?
 N/A No Yes

Reviewed By *[Signature]* Date 12/21/93

MHE-SD-EN-RPT-009

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RADIATION SURVEY REPORT (cont.)

Survey Number

No 146173

FC

SI

Page 2 of 2

Further Descriptions, Data, and Comment

NONE

DIAGRAMS OR SKETCHES

NONE

ADDITIONAL REPORTS COMPLETED

Radiological Problem Report

Skin Contamination Survey

Personnel Effects Contamination Report

Radiation Survey Report

Log No.

~~N/A~~

Onsite Radioactive Shipment

Offsite Radioactive Shipment

Routine Radioactive Shipment

Sample Counter Log

COPY
Log No.

~~N/A~~

MHC-SD-EN-RPT-009



Westinghouse
Hanford Company

RADIATION SURVEY REPORT

Date

11-30-93

Time

From 1330 To 1430

Survey Number

No 146149

FC

51

Page 1 of 2

Biog

N/A

Area

200E

Room

N/A

Description of Job

G-M/PANCAKE, PAM SURVEY OF GROUND UNDERNEATH VALVE PLATFORM
200-UP-2 Operable Unit -
216-U-4 Reverse Well and
216-U-4A French Drain Area

RWP No SI-002

Location VALVE PLATFORM BEHIND UO₂ PLANT

Check if appropriate When checked do not place unrelated information on this record

- Personnel Contamination
- High Radiation Level Work
- CAM Radiation Alarm
- "Special Survey"
- Establish Dose Rates
- Property Release
- Radiation Contamination Incident
- RAM Shipment

Item No	P E R (1)	Description of Work Performed, Radiation Controls, and Measurements	Meter Deflection		Dist	CF	DOSE RATE			CONTAMINATION LEVELS				
			W/O	W/C			beta (non pen) mrad/hr	gamma (pen) mR/hr	neutron mrem/hr	Direct (dpm)		Smear 100 cm ²		
										beta	alpha	beta (d'm)	alpha (d'm)	mrad hr
1	N/A	CEMENT BLOCK	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15,000	2,000	N/A	N/A	N/A
2		CEMENT BLOCK								8,000	1,000	2,000	200	
3		CEMENT BLOCK								2,000	200	N/A	N/A	
4		CEMENT BLOCK								4,000	200			
5		CEMENT BLOCK								2,000	100			
6		PERSONNEL								<D	<D			
7		AREA SURVEY (SEE BACK)								9,000	<D	N/A	N/A	
8	N/A	EQUIPMENT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<D	<D	<D	<D	N/A

1 Check for personnel dose rate Continued on supplemental report form

Instrument(s) Used	<input type="checkbox"/> CP	<input checked="" type="checkbox"/> G-M/Pancake	<input checked="" type="checkbox"/> PAM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Serial No (s)	N/A	1518 296	2034	N/A	N/A	N/A

ESTIMATED PERSONNEL DOSE RATES

Phase of Work	Based on Measurement(s)	Average Dose Rate	Limit Applying
N/A	N/A	N/A	WBP S E
			WBP _N A S E
			WBP S E

Respiratory Protection Worn

- Supplied Air
- Filter
- Other
- None

COPY

RPT Exposure
< 1 mrem

Work Location Code

N/A

Signed *W. Van Ugen*

PR No 84767

Do you increase or reduce RWP requirements for this work?

No Yes Explain on reverse side

Did you attend a pre-job meeting for this work?

N/A No Yes

Reviewed by

C. Wade

Date

12/13/93

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RADIATION SURVEY REPORT (cont.)

Survey Number

No 146149

FC

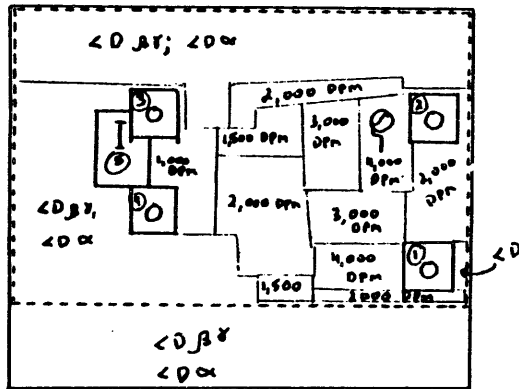
51

Page 2 of 2

Further Descriptions, Data, and Comment

SMEAR SURVEY DONE WHERE PRACTICABLE DUE TO ROUGH, DAMP CONDITIONS.

DIAGRAMS OR SKETCHES



- CONCRETE SLAB WITH PLATFORM SUPPORT POLE
- PLATFORM ACCESS LADDER
- STEAM LINE VENT/DRAIN VALVE DISCHARGE
- - POTENTIAL BOUNDARY - SCB

COPY

ADDITIONAL REPORTS COMPLETED

	Log No.
Radiological Problem Report	_____
Skin Contamination Survey	_____
Personnel Effects Contamination Report	N A
Radiation Survey Report	_____

	Log No.
Onsite Radioactive Shipment	_____
Offsite Radioactive Shipment	_____
Routine Radioactive Shipment	N A
Sample Counter Log	_____

MHC-SD-EN-RPT-009

WHC-SD-EN-RPT-009

Rev. 0

**200-UP-2 OPERABLE UNIT
MSCM-II RADIOLOGICAL SURVEYS**

APPENDIX A

THE MOBILE SURFACE CONTAMINATION MONITOR

MSCM-II

The second generation Mobile Surface Contamination Monitor was developed by Westinghouse Hanford Company for the purpose of performing radiological surveys of vast outdoor areas in order to verify the presence or absence of surface contamination and/or uncharted radiological burial grounds. The MSCM-II will also be used for verifying that contamination is removed from sites undergoing remediation and for tracking and trending stabilized burial sites in order to ensure environmental compliance regulations are being met.

The MSCM-II contains three major sub-systems: the Radiation Detection System and carrier vehicle, the Global Positioning System, and the Geographic Information System.

Radiation detection system/carrier

The MSCM II is a nine ton, four wheel drive tractor with a dual cab design equipped with a modified front end loader. This modified loader consists of a header to support three paired plastic scintillation radiation detectors and a caster wheel assembly to support the detector pairs at the proper height above the varying terrain of the Hanford Site.

The rear cab contains the radiation detection system controller, a GPS receiver, VHF radio receiver, radio modem, and a computer with monitor which is used to observe data collected and as a navigational display. The hardware is rack mounted in order to protect the equipment and allow room for the operator.

The front cab houses the driver, who in addition to driving is responsible for operating the front end header assembly with its detector array that is typically maintained at six inches above the ground and is hydraulically lifted when obstacles are encountered.

Three pairs of plastic scintillator detectors are mounted on the header. The six detectors are each 34x11x1.5 inches in size and are lead shielded. The total weight of the header assembly is about two tons. Each detector header assembly contains two detectors, a reference detector and the main detector.

Beta or gamma radiation causes light pulses in the plastic scintillant material which are detected by photomultiplier (PM) tubes mounted within the detector itself. Pulses from the PM tubes are amplified and passed via coaxial cable to the radiation controller box located within the instrument cab for amplification, counting, and processing.

The main detector views the ground being monitored through a thin titanium window and is shielded on all other sides with lead. Detector efficiencies have been established at approximately 10% using a mixed source containing Cs-137, Co-60, and Sr/Y-90. Since the detectors will ride 6 inches off the ground, the effective viewing area under the assembly is approximately 24 " long (in the direction of travel). At a traveling speed of 3 ft/sec, (2 mph) this allows a count time of 0.67 seconds. Using a sigma factor of 3.5 and a confidence level of 95%, the system can detect a minimum of 50 nCi source (point or 100 sq. cm. planar).

The detectors are bit slice counted with a slice duration of forty-seven milliseconds. The reference detectors record a counts-per-second background which is used internally to calculate the detector pair alarm levels. The main detectors record counts into a rolling register which are normalized to counts-per-second every forty-seven milliseconds and compared to the calculated detector pair alarm level. Every second, the gross counts-per-second from each detector and the results of the alarm level comparison, are transmitted via RS-232 link to an on board 386 PC.

Rev. 0

In survey mode, the operator may set the controller to alarm at any time the main detector registers a reading greater than established background, or at a pre-set detection level programmed in units of pCi. Each detector assembly is equipped with a solenoid triggered aerosol paint ejection system which will mark the ground where an elevated reading is detected. The operator will be alerted to this event by a visual and audible alarm integrated in the controller.

Global Positioning and Mapping System

The MSCM-II's positioning is achieved utilizing a real-time differentially corrected Global Positioning System (GPS). This system consists of a base unit, a Trimble 4000 SE¹ GPS receiver with reference locator and Radio Technical Commission for Maritime Services Version 1.04 (RTCM-104) options. It is known as the 400 RL unit. RTCM-104 refers to a standard for sending and receiving GPS correctional messages. These messages are used to correct a roving GPS receiver's position in the field in real time. Correction of position minimizes the effects of intentional scrambling of the GPS position information (known as Selective Availability or SA), atmospheric perturbation, and other systemic errors.

The base station is equipped with a radio modem and a VHF radio for transmission of RTCM-104 corrections from the base to the roving MSCM-II. The entire base is powered by two 100 amp/hr batteries and housed in NEMA cabinets to allow up to sixty hours of unattended operation.

The base is located at a known fixed location and the coordinates of it's location loaded into it using the keypad located on the GPS receivers front face.

Located within the instrument cab of the MSCM-II is a radio and modem for receiving the base's RTCM-104 corrections and a Trimble 4000 SE GPS receiver with differential locator (DL) options. This GPS receiver determines it's position by correcting it's own GPS position information with the information obtained from the base. This GPS receiver downloads positional information via serial link to the on-board 386 PC once each second.

Loaded on this PC is a modified version of GeoResearch's GeoLink XDS² software. This software allows a background map of the survey area to be shown on screen with the tractors path updated once each second. Counts that exceed an alarm level are highlighted with a different color and the software store all the positioning and radiation detector information into files on the PC's hard drive. This allows for an on screen representation of survey coverage and entry of other information as attributes, such as radiological boundaries, fences, well locations, etc. by the instrument operator. This data is downloaded from the on-board PC and loaded into a Hanford Radiological Geographical Informational System (GIS).

¹ Trimble is the registered company name and 4000 SE a registered trademark of Trimble Navigation, Sunnyvale, CA.

² GeoResearch is a registered servicemark and GeoLink and GeoEdit registered trademarks of GeoResearch, Inc., Billings, MT.

WHC-SD-EN-RPT-009

Rev. 0

**200-UP-2 OPERABLE UNIT
RADIOLOGICAL SURVEYS**

APPENDIX B

THE ULTRA SONIC RANGING AND DATA SYSTEM

**AMBIENT RADIATION BACKGROUND
AND
MINIMUM DETECTABLE COUNT RATE DETERMINATION**

LOW BACKGROUND SITE

Introduction

The Low Background survey was conducted to establish baseline radiological background conditions in a designated test plot known to have no history of radiological operations. The radiological data collected during this survey is considered representative of the undisturbed soil surfaces on the Hanford Site. The survey was conducted on April 1, 1993.

Location

The Low Background test plot is located in the 600 Area, between the 100-D/DR and 100-H Areas, approximately 2,000 feet from the Columbia River. The site had been previously staked on 100 foot intersects oriented along a north-south axis. The total size of the background plot is 500 by 500 feet. A 200 by 200 foot area was surveyed with USRADS for this background study.

Discussion

The survey was conducted using Ludlum Model 4 digital rate meters with a Ludlum Model 44-10, 2 by 2 inch sodium iodide detectors and a Ludlum Model 19 uR meter. The meters were coupled to the USRADS for the purpose of recording the data from the output of the individual detectors versus the location of that data within the survey area.

Two surveys were performed to cover the 40,000 square foot site twice. A total of 5940 data points were collected within this site. A summary of the survey results can be found in Table 1. The location of the Low Background Test Site, the survey grid layout, and a track map of the surveyed area is shown in Figure 1. The grid block was traversed on an approximately 10 foot cross hatched pattern.

Table 1

SURVEY	DATE	GRID	DATA PTS	MAX CPM	MEAN CPM	SIGMA	MAX uR	MEAN uR	SIGMA
LBS2A	04/01/93	1	2730	10860	8576.73	746.91	15.32	8.57	1.61
LBS2B	04/01/93	1	3210	10980	8804.15	757.5	13.52	8.51	1.66

As the surveyor traverses the survey area, the USRADS records the output data from the radiation detector versus the location of where in the survey area the data was detected - each second. Therefore, while the survey is in progress, a real-time map of the survey area is generated. When the survey is completed, the survey data set is saved on a computer disk.

The average background count rate for the Low Background Site was determined to be 8700 CPM and the average dose rate to be 8.57 uR/Hr.

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Minimum Detectable Count Rate

The minimum detectable count rate (MDC) was then calculated by employing the formula¹:

$$MDC = 60 \left(4.66 \sqrt{\frac{Rb}{60}} \right)$$

Where:

Rb = background count rate in CPM

Based on the formula above, the minimum detectable count rate is:
3366.83 CPM + 8700 CPM = 12,066.83 CPM

One of the features of the USRADS is the ability to enter a "Threshold" setting upon initiating a survey. The threshold setting is a value that when exceeded, the data point plotted on the CPU monitor is highlighted. This feature alerts the CPU operator that the CPM data has exceeded the threshold, or preset value. For the purpose of conducting surface radiation surveys, it is desirable to establish a value for the threshold where readings above the setting could be considered for further investigations. The threshold value established for USRADS survey work is 12,050 CPM. This value is practical based on the premise that too low a setting would highlight normal fluctuations above the calculated mean, and too high a setting would cut off the low end of surface radiation that might be present.

¹ Ref.: D.A. Gollnick, Basic Radiation Protection Technology, 2nd Edition.

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