40-7604

RADIOLOGICAL SURVEY OF THE VISTRON CHEMICAL FACILITY

AUGUST 1985

ject Application 5436	Copy No	Assigned To

APPROVALS

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REV NO	PREPARED BY C. J. Marino	Project Manager	Dept. Manager		
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FORM # NES 206 2/80

TABLE OF CONTENTS

1. INTRODUCTION

1.1 HISTORY OF SOHIO/VISTRON FACILITY

The Vistron Chemical Facility area consists of 227 acres of property located on the boundaries of Fort Amanda and Adgate Roads in Lima, Ohio. The site contains numerous manmade ponds,storage tanks, and plant facilities, as noted in Figure 1.

From 1963 to 1971, Vistron produced,used, and marketed a catalyst which contained small amounts of depleted uranium.
Physically, the area is composed of heavy clay soils overlaid with industrial gravel and paved roadways.

In July of 1982, Oak Ridge Associated Universities conducted a radiological survey of selected areas at the facility at the behest of the Nuclear Regulatory Commission (NRC).This survey was in response to the intent of Vistron to terminate its radioactive materials possesion license. Results of the Oak Ridge study indicate amounts of radioactive materials onsite which are in excess of those allowed in areas for unrestricted use.

1.2 SCOPE OF WORK

A full site survey has been contracted by SOHIO/Vistron through Nuclear Energy Services to quantify the type,locations, and amounts of radioactive materials remaining onsite. This information will be used to perform decontamination of the site to levels acceptable by the NRC for unrestricted use and license termination.

The scope of the survey undertaken in July of 1985 is outlined below:

1. Survey of buildings and pathways throughout the Vistron site for alpha,beta, or gamma radiation.

2. Soil sampling at selected locations and depths throughout the site.

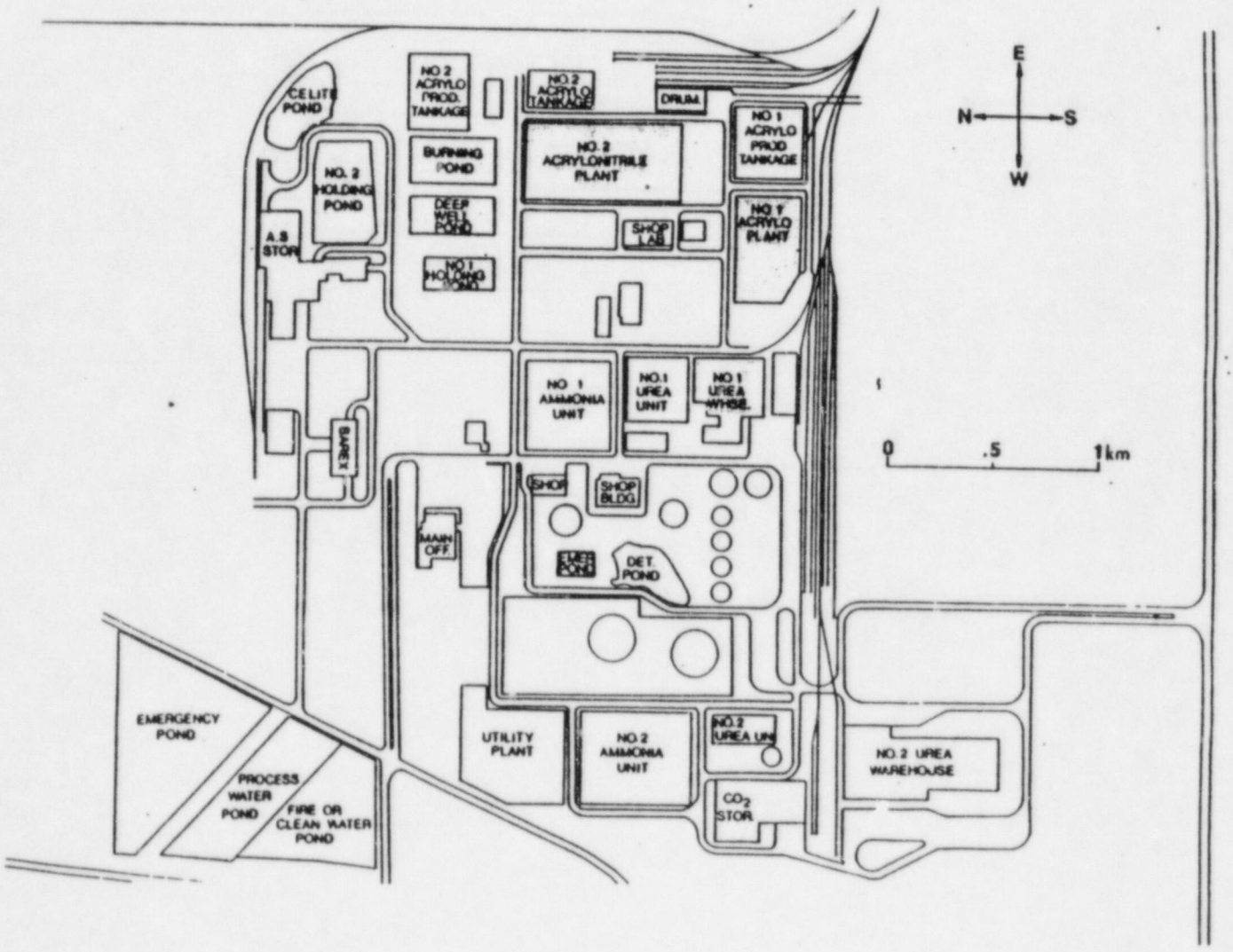
3. Removable contamination swipes inside all plant structures.

4. Sediment and water sampling of all open ponds and selected enclosed storage tanks,sumps, and drainage pits.

5. A review of data from the Oak Ridge study to ensure a comprehensive investigation of the site radiological condition is achieved.

FIGURE 1

GENERAL LAYOUT OF THE VISTRON SITE



2. METHODOLOGY

2.1 PERFORMANCE OF RADIATION SURVEYS

Survey techniques were based on standard NES procedures and accepted industry standard methods. As indicated on the data sheets of Section 3,the following general site data was recorded:

- beta and gamma radiation scans at 2 cm (on contact) from floor surfaces and the site grounds.
- beta/gamma and alpha surveys on contact with selected surfaces, components, and equipment.
- removable contamination measurements of 100 cmsq. area at selected locations

An initial equipment check was performed which included voltage readings for the particular probes to be used as well as verification of instrument calibration within the past (6) months. Source checks of the instruments were performed daily using certified calibration standards traceable to the National Bureau of Standards.

In addition, airborne radioactive materials measurements were performed in all enclosed work areas in which elevated (greater than backround) levels of radiation were found.

Note that throughout this document, all measurements refer to beta/gamma radiation except where alpha radiation is specifically noted.As described in the referenced Oak Ridge report, heavy dust accumulation, rust, and grease inhibit efficient detection of low levels of direct alpha radiation. Specific alpha surveys were therefore conducted at selected targets based on the results of beta/gamma surveys for daughters of alpha emitters.

2.2 PERFORMANCE OF SOIL SAMPLING

After the above building,structures,and site grounds surveys were obtained,soil samples were taken. Samples were taken in areas where surveys indicated elevated radiation levels. Elevated levels are taken as those indicating greater than 100 counts per minute (1000 DPM), including backround radiation.
Two methods were employed to collect soil samples:

1) Surface soil samples were procured by clearing loose debris from the point to be sampled. An approximately 2.5" diameter core was taken using a metal cylinder and digging instrument.This method was employed for 0-2" and 2-6" sample depths.
2) Samples taken at depths greater than 6" were performed using a combination of manual labor and the motorized cathead drilling equipment. The drilling equipment in question consisted of a tripod arrangement which mechanically drove a variety of cutting heads though unwanted strata until the desired depth was reached. At that point, 10" long by 1.5" diameter cores were obtained,using a standard split tube device.

All soil samples were sealed in plastic containers, identified with individual sequential serial numbers. Background samples from the surrounding community were taken in such a manner that they did not appear differentiable from genuine site samples by laboratory personnel. This quality control measure was performed both for comparison with site results and to ensure legitimate analytical laboratory results. Each sample consisted of 250 gms. Sample locations are shown on the maps in Section 3.

2.3 PERFORMANCE OF WATER AND SEDIMENT SAMPLING

A hand-operated dredging device was used to collect sediment samples from each pond and from selected tanks and sumps. Sediment and water samples were taken at the same locations in each pond. All samples were sealed and identified with individual sequential serial numbers. Each water sample consisted of 500 ml. (minimum) of fluid and each sediment sample of approx. 250 gms. Sample locations are shown on the maps in Section 3.

It should be noted that the water samples were heavily contaminated with oils and chemicals to the point that it is doubtful that the main constituent of the liquid samples could in all cases be considered water. The potential chemical toxicity of the samples was noted to laboratory personnel prior to their analysis.

2.4 FIELD AND LABORATORY DATA

All data collected is presented in Appendix B. Part B-1 contains onsite radiation and contamination surveys of grounds and buildings, noted in the text as NES field survey maps #1 - #39. Air, soil, water, and sediment sample measurements are summarized in Parts B-2,B-3,B-4, and B-5, respectively. A summary of radiation levels is given in Part B-6 and a listing of the results of environmental dosimetry measurements at the site are presented in Part B-7. A table of unrestricted release criteria is shown in Part B-8.

3. RESULTS

3.1 CATALYST PLANT AND ASSOCIATED STRUCTURES

NES performed a detailed contact radiation survey as well as transferable contamination surveys in the Catalyst plant and associated structures. The Catalyst Plant was found to have high levels of fixed contamination on floor surfaces and equipment.The highest levels of fixed contamination on the first floor were located surrounding the concrete bases of the four (4) tanks in the area. The maximum level at these tanks was 900,000 DPM (10.7 mRad/hr). The balance of equipment and floor areas ranged from 1500 - 15000 DPM (0.018 - 0.18 mRad/hr).Results are shown on NES field survey map #1. Removable surface contamination was also detected in some areas on the first floor. See field survey map #2.

Fixed and removable contamination on the second and third floors was found to be of the same magnitude as that found on floor one. Locations were more discreet, centering about specific equipment and valving as noted on field survey map #3. The west end of the second floor had levels of fixed materials ranging from 10,000 to 500,000 DPM (0.12 - 6.0 mRad) with hot spots of 1.2 million DPM (14.3 mRad/hr) near the uranium hopper and 700,000 DPM (8.3 mRad/hr) near a tank adjacent to the north side of the west office. Third floor fixed and removable contamination was restricted to the northwest corner at the base of machinery and in the northeast corner between the deck gratings.See field survey maps #4 & #5.

A warehouse is connected to the catalyst plant which was used for storage of 55-gal. drums. Isolated areas of fixed contamination were found throughout the warehouse with hot spots of 30,000 DPM (0.36 mRad/hr) and 40,000 DPM (0.48 mRad/hr). See field survey maps #6 & #7. Connected to the above warehouse is an supplemental A-frame storage structure. Contact radiation surveys and removable contamination swipes revealed elevated levels of radioactive contamination (up to 1 million DPM [11.9 mRad/hr]). See field survey map #8.
In addition,detectable radiation of 22,000 DPM (0.262 mRad/hr) was found to the south of the catalyst plant, near an adjacent pumping station. Results for the grounds immediately surrounding the catalyst plant are shown on field survey maps #9 and #10.

Soil sampling was performed at selected areas surrounding the catalyst plant. Results of laboratory gamma isotopic analysis and specific uranium analysis showed as much as 19.82 pCi/gm uranium to be present, the majority of which was identified as U-238. Locations are indicated on sampling map 37.

3.2 UREA WAREHOUSE

The former urea warehouse, currently known as the central stores building, was found to be contaminated with both fixed and removable radioactive contamination. Maximum levels were located along the gas cylinder racks on the west wall. Values were up to 60,000 DPM fixed (0.71 mRad/hr) to 7,000 DPM removable (0.08 mRad/hr). A wooden pallet was found in the northern bay section of the building, reading 200,000 DPM (2.38 mRad/hr). See field survey maps #11 - #13 for contact radiation and removable contamination levels.

Alpha levels were found to be 400 DPM (0.005 mRad/hr).

A "soil" sample was taken within the urea warehouse consisting of the dirt and dry material found at the gas cylinder racks. Results of

laboratory analysis indicated 6.27 pCi/gm uranium, the majority of which was U-238. The location is indicated on sampling map #30.

3.3 AREA-A

The contaminated areas of Area-A predominantly consisted of Acrylonitrile plant #1. Elevated levels of fixed and removable contamination were found spread throughout the structure,grounds, and upon a variety of valves and equipment. The cement slab beneath the four reactors was found to have from several thousand to 100,000 DPM (1.19 mRad/hr). Valves and valve stems connected to the reactors varied in degree of contamination, as noted on the data sheets. See field survey maps #14 and #15.

A catalyst settling tank was sampled for sediment,liquid content, and the surrounding area measured for radiation. Readings indicate contact radiation levels ranging from 3,000 to 1.0 million DPM (0.036-11.9 mRad/hr) around the tank and below an adjacent derick. Laboratory analysis of samples indicated no more than 2.34 E-6 uCi/ml of gamma emitting nuclides are present. Direct survey results are shown in field survey map #16.

The extent of the spread of contamination is indicated by the discovery of 160,000 DPM (1.9 mRad/hr) at the corner of 18th and 3rd street, the western-most boundary of Area-A. Direct survey data is shown on field survey maps #17 - #29.

The yard area was completely covered with loose gravel. Beneath the gravel, soil samples were procured. Results of laboratory analysis of the soil indicated as much as 230.4 pCi/gm uranium, of which the majority is U-238. At the three sample points which exceeded 35 pCi/gm of uranium, isotopic analysis revealed the presence of Niobium-95, Cerium-144, and Cadmium-109 . Gamma isotopic analysis indicated these isotopes were present in quantities less than those specified in 10CFR20 for unrestricted release.

In addition, liquid samples were procured in several manhole sewers and sumps. Results of lab analysis on the associated sediment samples indicated as much as 3.38 E-7 uCi/ml of gamma emitting nuclides. Locations of Area-A sampling points are noted on sampling maps #30 and #31.

3.4 REMAINING SITE STRUCTURES

A radiation survey of the facility grounds and remaining buildings indicated several other locations were elevated levels of radioactive materials were detected. These areas included the following:

- brown gravel, piled throughout the southern half of the site, adjacent to the urea warehouses (5,000 - 10,000 DPM [0.059-0.12 mRad/hr]).
- inside the enclosed dock at the southern storage building ; south of central stores (> 5,000 DPM [0.059 mRad/hr]).
- northern open field, east of the emergency pond (1,000 - 3,000 DPM [0.012-0.036 mRad/hr]).
- plant 2, including two reactors (0 - 30,000 dpm [0-0.354 mRad/hr]).
- several of the ponds and/or their surrounding grounds in the northeast quadrant of the site.
  (3,000-15,000 DPM [0.036-0.178 mRad/hr] at Celite pond)
  (5,000 DPM [0.059 mRad/hr] between the deep well & holding pond)
  (450,000 DPM [5.36 mRad/hr] at the burning pond)

Soil samples were taken throughout the site to provide a profile of the extent of contamination and to serve as a basis for future decontamination efforts. The results of soil samples indicated at least 5.4 pCi/gm uranium near the burning pond and measurable amounts at the deep well,outfall,and celite ponds. Measurable amounts were also located at the truck loading bay and along the north side of the west urea warehouse.
Liquid and sediment samples were also taken throughout the site, and indicate the ponds contain as much as 2.33 E-7 uCi/ml(deep well pond) of gamma emitters and that the sediment associated with the ponds contains as much as 6.9 pCi/gm (celite pond) of uranium. Locations of these samples are shown on sampling maps #33-#38.

No detectable alpha measurements were made outside the areas described in Section 3-1, 3-2, and 3-3 above.

4. DISCUSSION OF RESULTS

4.1 COMPARATIVE SURVEY AND SAMPLING DATA

Backround measurements for radioactive materials were made in the surrounding countryside. These measurements included water, soil, sediment,and ambient radiation levels. These measurements were taken using the same equipment and analysis techniques as those used for onsite surveys at Vistron. The results of these measurements compared to those for the site are shown in Appendix B. Results clearly show elevated levels of radioactive materials onsite in radiologically unrestricted areas. The magnitude of these levels is such that comparison to backround and to levels which are generally accepted for unrestricted areas show a substantial and potentially harmful quantity of radioactive materials. A further discussion of unrestricted release levels is found below in Section 4.2 .

A previous site survey was performed by Oak Ridge Associated Universities in 1983. This survey was conducted to ascertain direct radiation levels, levels of radioactive materials in soil,contamination levels on equipment and structural surfaces, and radionuclide concentrations in liquid waste collection ponds. The results of this survey were to be compared with NRC guidelines for releasing licensed facilities for unrestricted use. The survey determined that the levels were elevated to a degree which would not justify termination of the facility license. The numerical results were confirmed by the present NES survey.

The NES survey consisted on 98 soil samples, 54 water samples, 45 sediment, 499 removable contamination swipes, and a continuous sweep of the site grounds and selected equipment for elevated radiation levels. In addition, fifteen (15) environmental dosimeters were placed at locations throughout the site.Results presented in Appendix B show the area radiation levels.

Air sampling was conducted by drawing the ambient air through standard filter paper at several locations. Each filter paper sample was counted immediately and re-counted at 30 minute intervals for several hours. First count results within the catalyst plant were clearly above the level allowed for unrestricted areas per 10 CFR 20. The rate of decay noted for the samples and the final low or negligable levels found indicate that the activity was largely due to Radon, which has a relatively short half-life.

4.2 UNRESTRICTED RELEASE CRITERIA

The levels of radiation allowed in areas of unrestricted use by Title 10, Code of Federal Regulations , Part 20 may be used for comparison to site results. In addition, The NRC has published guidelines for concentrations of uranium and thorium in soil which would limit the

amount of radiation received by the public. A further guideline for various radionuclides has been presented in Regulatory Guide 1.86, for both alpha and beta/gamma emitters.

Comparison to sample levels for unrestricted release are shown in the summary of release levels in Appendix B. This listing is based on 10 CFR 20 for direct radiation and airborne levels and upon Reg.Guide 1.86 for levels of contamination.

4.3 ANTICIPATED DECONTAMINATION EFFORT

In order to achieve levels of radioactive materials onsite which are below the limits set by the NRC, decontamination must be performed. The anticipated decontamination process is summarized below based on the results of this survey.

The catalyst plant and urea warehouse contain excessive amounts of fixed and loose contamination.Scabbling of contaminated concrete and removal of equipment will suffice for the fixed contamination. Manual cleaning techniques, including HEPA filtered vacuuming, must then be performed to remove loose contamination and debris. Installation of a ventilation system is recommended , both to lower existing levels of radon gas and to prevent worker inhalation of airborne materials generated during the indoor work effort.

Area-A contains both contaminated equipment and contaminated soil. The extent of soil contamination was determined to be between 6" and 20" in depth in the west reactor yard and in spotted areas elswhere in the vicinity of Area-A. The total amount of soil to be removed is estimated to be greater than 1000 ft3. This includes soil outside Area-A discovered during this and the previous Oak Ridge survey. The actual amount will be a function of surveys taken as the soil is removed with heavy equipment and loaded into transport containers. Stripping of the surface in 4"-6" increments will provide a rapid method which minimizes removal of clean gravel and soil.

Bodies of liquids found to be contaminated above levels for unrestricted release will have to be drained. The liquid must be solidified prior to shipping in accordance with U.S.Department of Transportation regulations. Solidification of water may be performed using portland cement. Heavy oils will require other methods dependant upon chemical content and site recommendations.

The sediment underlying the contaminated ponds was found to contain radioactive materials and would have to be re-surveyed and analyzed once the overlying water is removed. This survey will determine the necessity and quantity of sediment removal.

Areas of the plant containing greater than unrestricted levels of either radiation or radioactive materials will have to be resurvey and sampled,along with their adjoining areas, to ensure the cleanup effort was sucessful and did not result in contamination of previously clean areas.

Continuous health physics monitoring and controls during all phases of the cleanup operation would be required. In addition, the decontamination of the reactor array in Area-A poses and additional health concern due to asbestos which must be fully addressed prior to the commencement of decontamination in that area.

The discovery of radioactive tan gravel near the railroad tracks of the west urea warehouse requires separate consideration. Vistron data available at the time of the survey indicates the material was not part of Vistron operations, but had been deposited at the site without Vistrons knowledge during routine flushing of incoming railcars. The disposition and accountability of this material will be a mater for discussion with the NRC.

APPENDIX A

REFERENCES

1.) "Radiological Survey of Vistron Corporation, Lima,Ohio", Oak Ridge Associated Universities,B.P.Rocco; January 1983.

2.) Title 10, Code of Federal Regulations, Part 20; as revised.

3.) 83A8001, "NES Radiological Protection Manual", Nuclear Energy Services; Rev.1, 1985.

4.) Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors", US-NRC; as revised.

APPENDIX B

FIELD AND LABORATORY DATA

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B-1 FIELD SURVEY MAPS

MAP #1 thru MAP #39

Pages 1-56

FIELD SURVEY MAP

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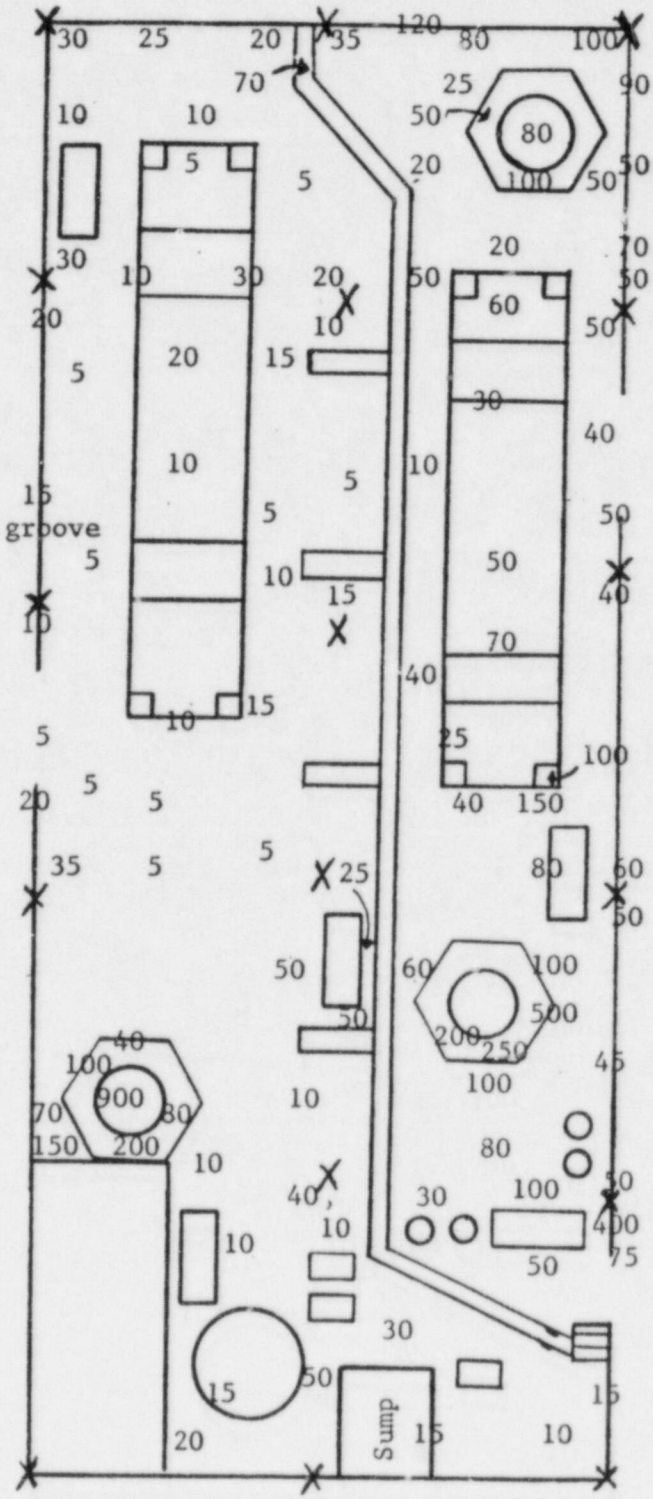
MAP NO 1
LOCATION Catalyst Plant 1st Floor
DATED 8/5/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
× Support Beams
*



Remarks: High levels of fixed contamination detected where tanks, pumps and calciners are secured to concrete bases. Also high levels of fixed contamination detected where the bases meet concrete floor. High levels of fixed contamination detected at outside walls. Entire area has gross fixed contamination within concrete floor.

Notes: All readings are in (K) thousand dpm/probe area. All readings taken using RM-20 with HP-210 probe.

ORIGINATOR

FIELD SURVEY MAP

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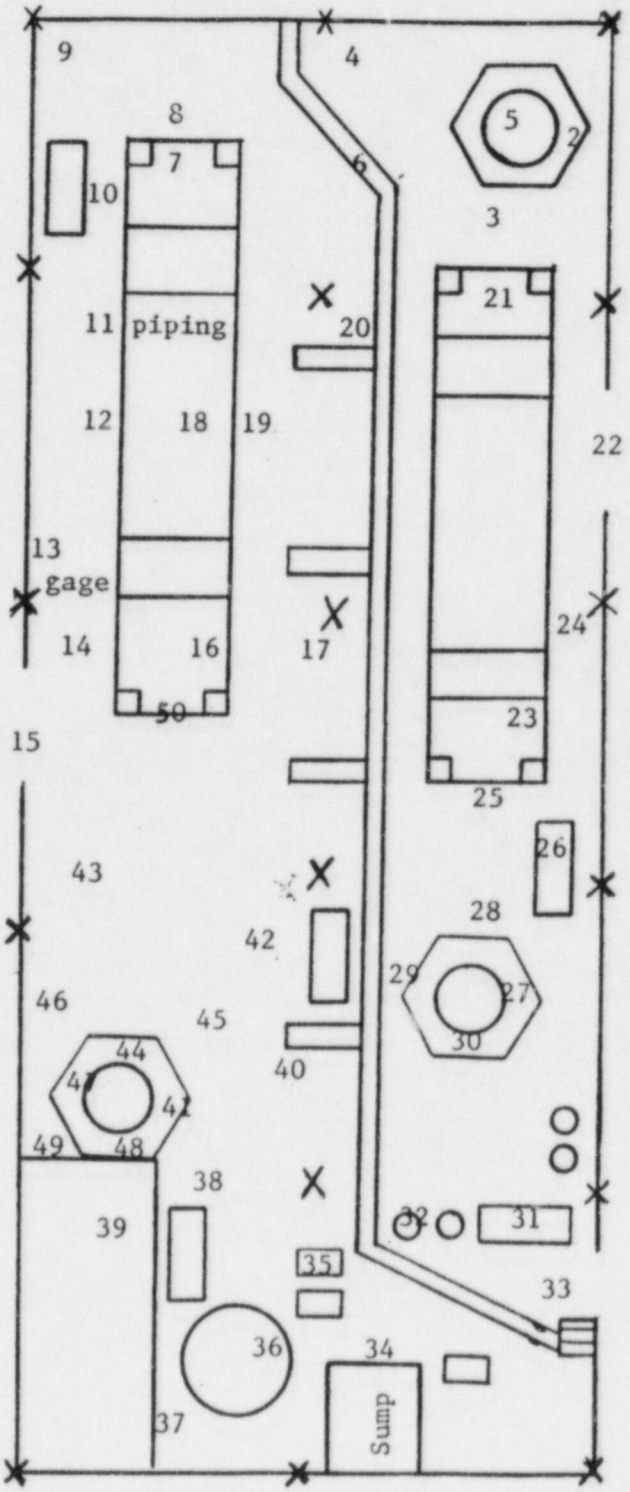
MAP NO 2
LOCATION Catalyst Plant 1st Floor
DATED 8/6/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
× Support Beams
*



ORIGINATOR

FIELD SURVEY DATA SHEET 2 DATE: 8/6/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20 / PRS-2
SERIAL NO: #999 / #549
PROBE: HP-210 / AC-3-7
EFFICIENCY: 10% / 30%

RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:

PROJECT NO. 5436
LOCATION cat.plant floor 1
TECHNICIAN Keithley
SIGNATURE

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
1.					< 1000.	< 200.
30.					< 1000.	< 200.
31.					< 1000.	< 200.
32.					< 1000.	
36.					< 1000.	
37.					< 1000.	
38.					< 1000.	
39.					< 1000.	
43.					< 1000.	
44.					1500.	
45.					< 1000.	
46.					< 1000.	
47.					< 1000.	
48.					2500.	
49.					2000.	
50.					< 1000.	< 200.

FIELD SURVEY MAP

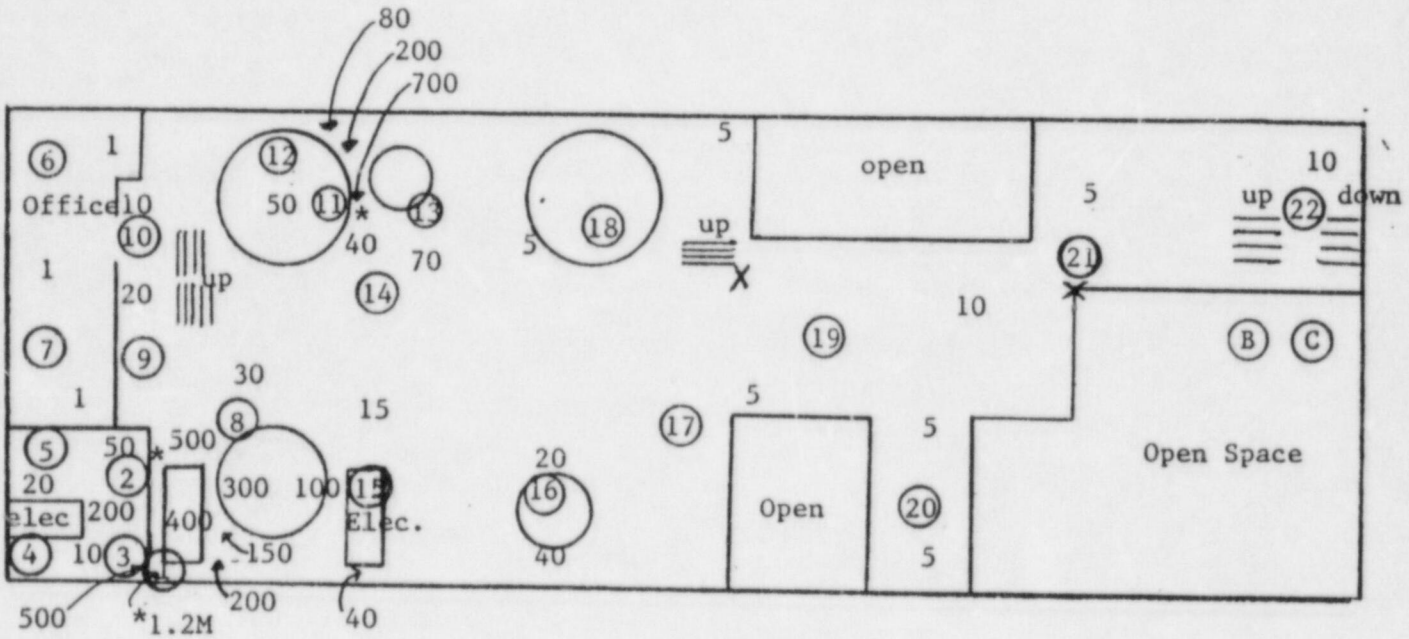
nes

P. 1 of 2

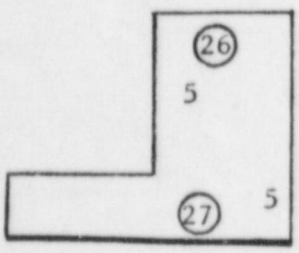
MAP NO 3
LOCATION Catalyst Plant 2nd Floor
DATED 8/13/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
(#) Swipes
Δ
X Support Beam
* Hot spot
Stairs

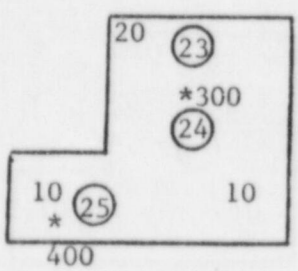
All other readings on contact and are in (K) thousand dpm/probe area.

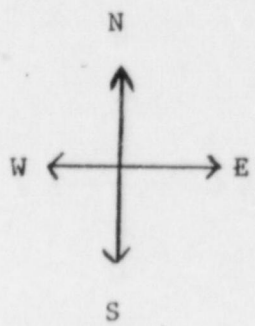


(B) Area (up)



(C) Area (down)





ORIGINATOR

FIELD SURVEY DATA SHEET 3 DATE: 8/13/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: 999
PROBE: HP-210
EFFICIENCY: 10%

RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:

PROJECT NO. 5436
LOCATION cat.plant second floor
TECHNICIAN Keithley
SIGNATURE

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
1.					4000.	300.
2.					< 1000.	< 200.
3.					3000.	300.
4.					< 1000.	< 200.
5.						
6.						
7.						
8.						
9.					< 1000.	< 200.
10.					1500.	< 200.
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
27.					< 1000.	< 200.

Remarks: Area highly contaminated, especially near electrical breaker room. Floor comprised of steel grating and beams. Beams have contamination ranging from 5K to 1.2 million DPM/probe area. Loose contamination is negligable compared to fixed levels. A few hot spots are located on the second floor (see sheet #1). Contamination is extensive throughout second floor.

note: readings above taken with RM-20 & HP-210 probe.

nes

FIELD SURVEY DATA SHEET 4 DATE: 8/5/85 PAGE: 2 of 2

PROJECT NO. 5436-200
LOCATION cat.plant floor 3
TECHNICIAN R.R.Ruschak
SIGNATURE

RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:
EFFICIENCY:

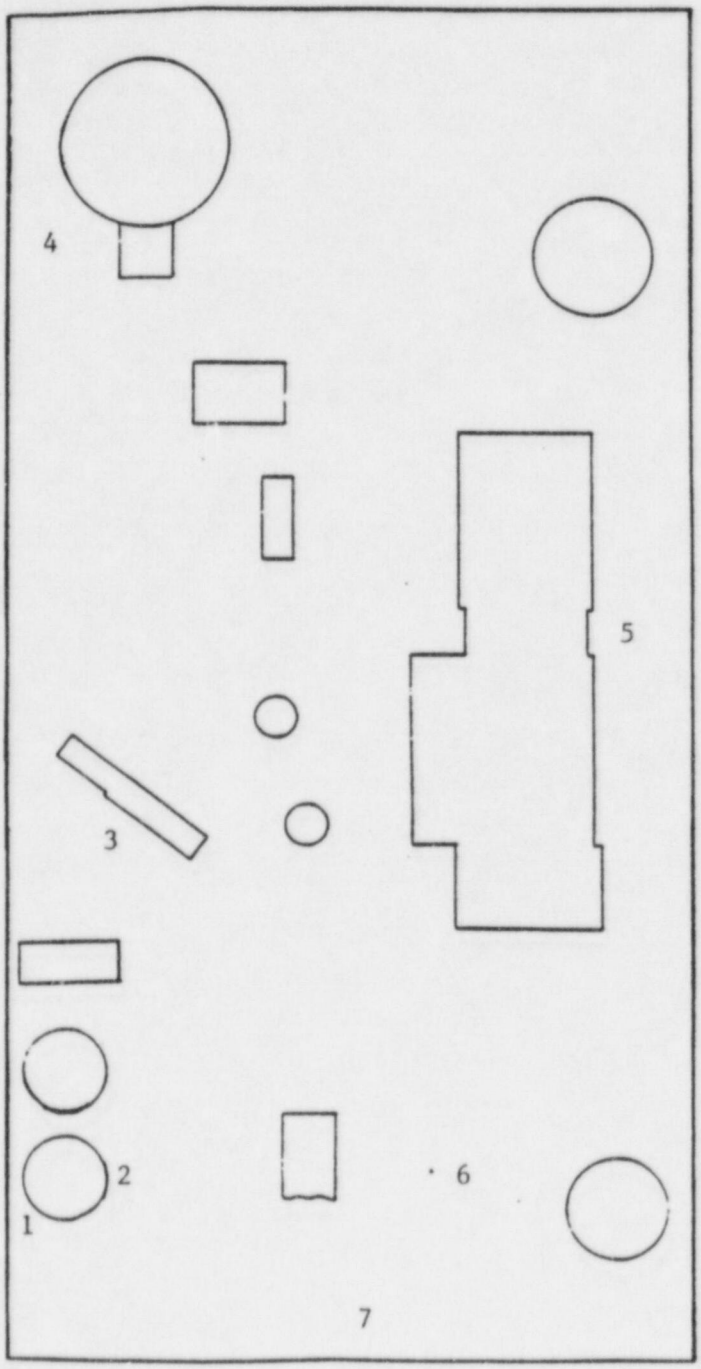
CONTAMINATION INSTRUMENTATION
MODEL: RM-20 / PRS-2
SERIAL NO: #999 / #549
PROBE: HP-210 / AC-3-7
EFFICIENCY: 10%/30%

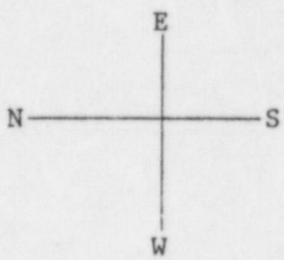
POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
1.					5000.	320.
2.					7000.	280.
3.					<1000.	<200.
4.						
5.						
6.						
7.					<1000.	<200.
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						

FIELD SURVEY MAP

MAP NO 4
LOCATION Catalyst Plant 3rd Floor
DATED 8/5/85
ORIGINATOR R.R. Ruschak
PROJECT 5436-200

TERRAIN
LEGEND:
0
Δ
×
*



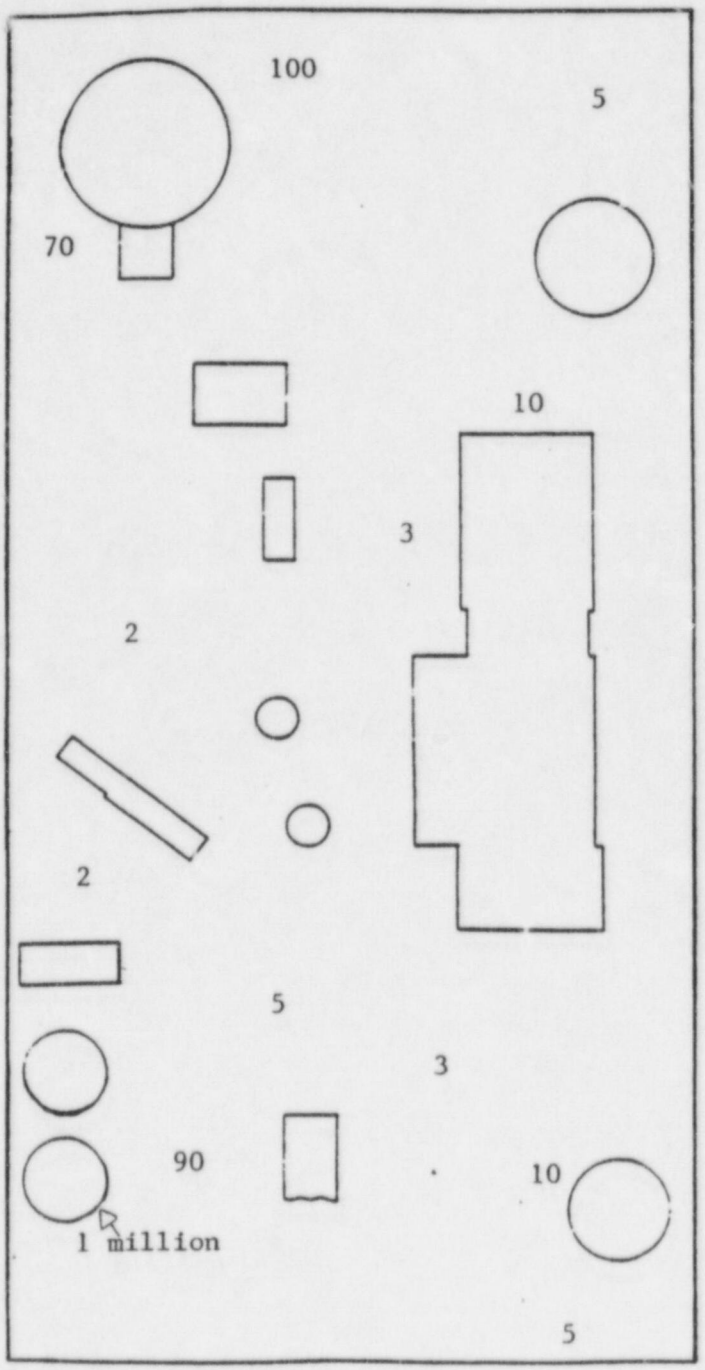


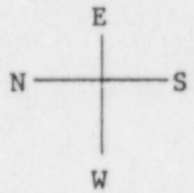
ORIGINATOR

FIELD SURVEY MAP

MAP NO 5
LOCATION Catalyst Plant 3rd Floor
DATED 8/5/85
ORIGINATOR R.R. Ruschak
PROJECT 5436-200

TERRAIN
LEGEND:
0
Δ
×
*





NOTE: All readings are on contact and are in thousands (K) dpm/probe area unless otherwise noted

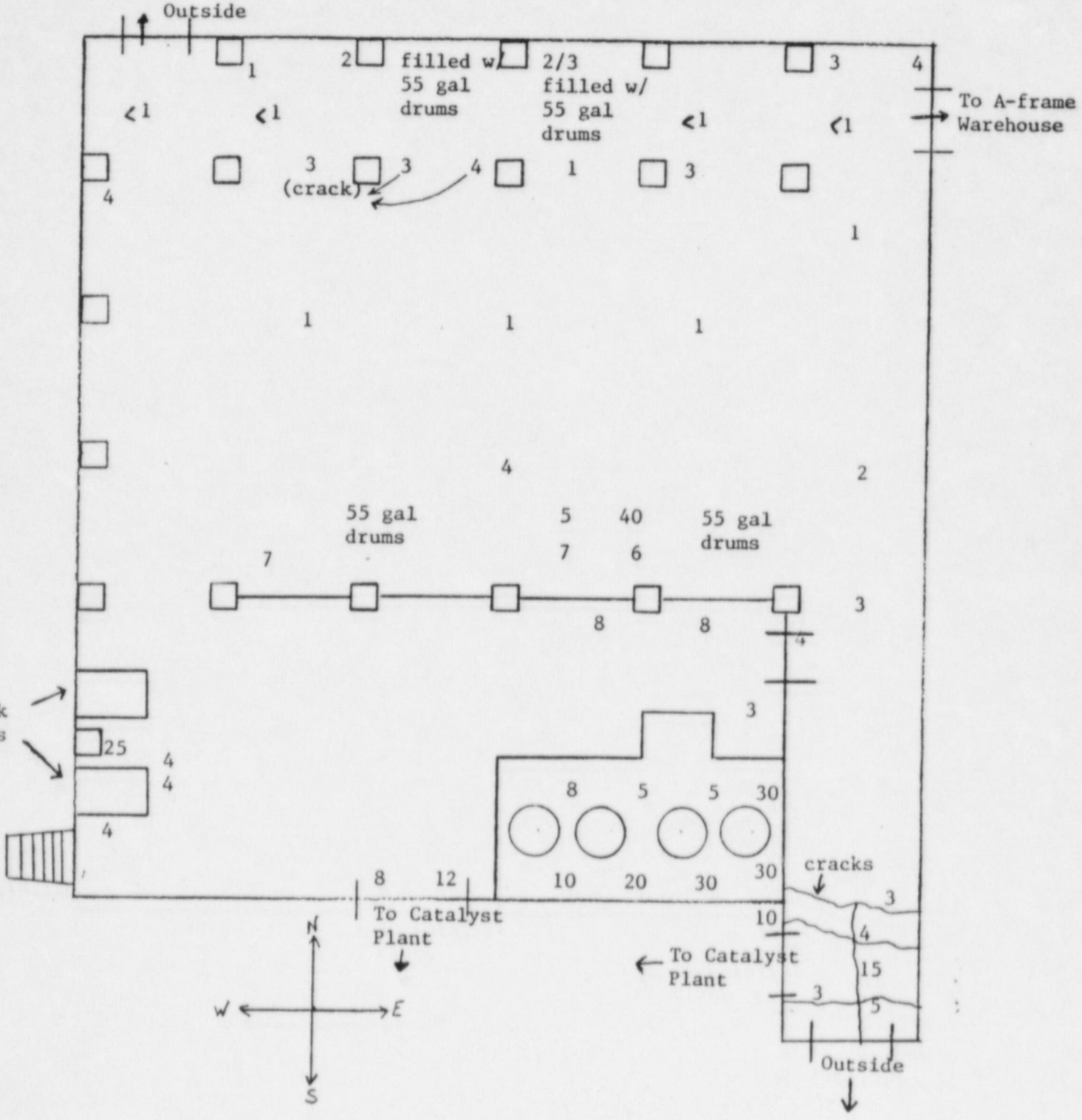
ORIGINATOR

FIELD SURVEY MAP

MAP NO 6
LOCATION Warehouse Adjacent to Cat. Plant
DATED 8/5/85
ORIGINATOR R. R. Ruschak
PROJECT 5436

TERRAIN Cement Floor
LEGEND:
0
Δ
X Floor
*
☐ Steel "I" beams

NOTE: All readings are in (K) thousand dpm/probe area. All readings taken with PRS-2 and HP-210 probe. All readings taken on contact with floor.



ORIGINATOR

FIELD SURVEY MAP

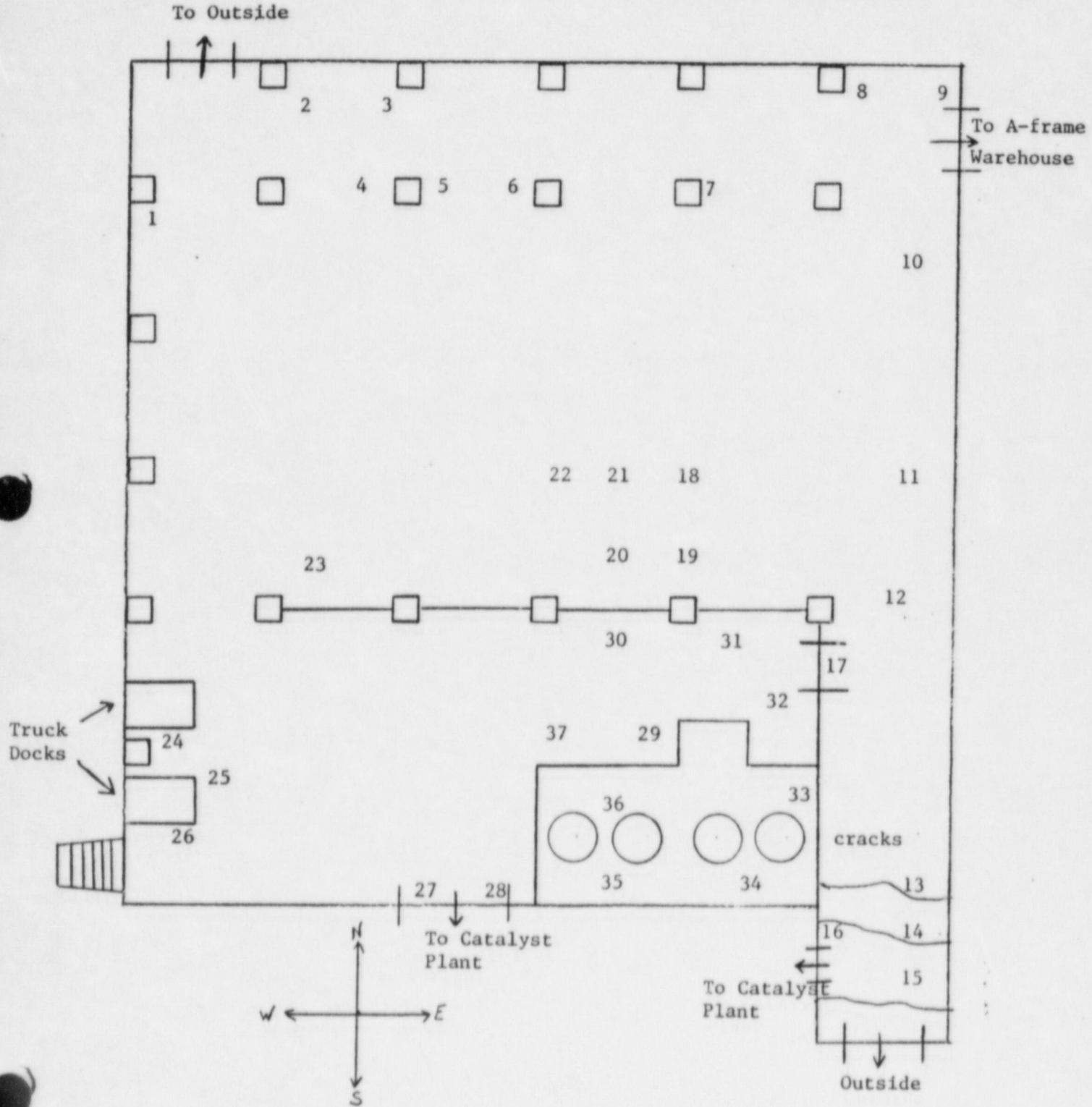
nes

P. 1 of 2

MAP NO 7
LOCATION Warehouse Adjacent to Cat. Plant
DATED 8/5/85
ORIGINATOR R. R. Ruschak
PROJECT 5436

All #s are swipe locations. See Page 2 of 2

TERRAIN Cement Floor
LEGEND:
0
Δ
X Floor
*
□ Steel "I" beams



ORIGINATOR

FIELD SURVEY DATA SHEET 7 DATE: 8/5/85 PAGE: 2 of 2

		RADIATION INSTRUMENTATION		CONTAMINATION INSTRUMENTATION	
PROJECT NO.	5436-200	MODEL:	N/A	MODEL:	RM-20 / PRS-2
LOCATION	cat.plant warehouse	SERIAL NO:		SERIAL NO:	#999 / #549
TECHNICIAN	R.R.Ruschak	PROBE:		PROBE:	HP-210 / AC-3-7
SIGNATURE				EFFICIENCY:	10% / 30%

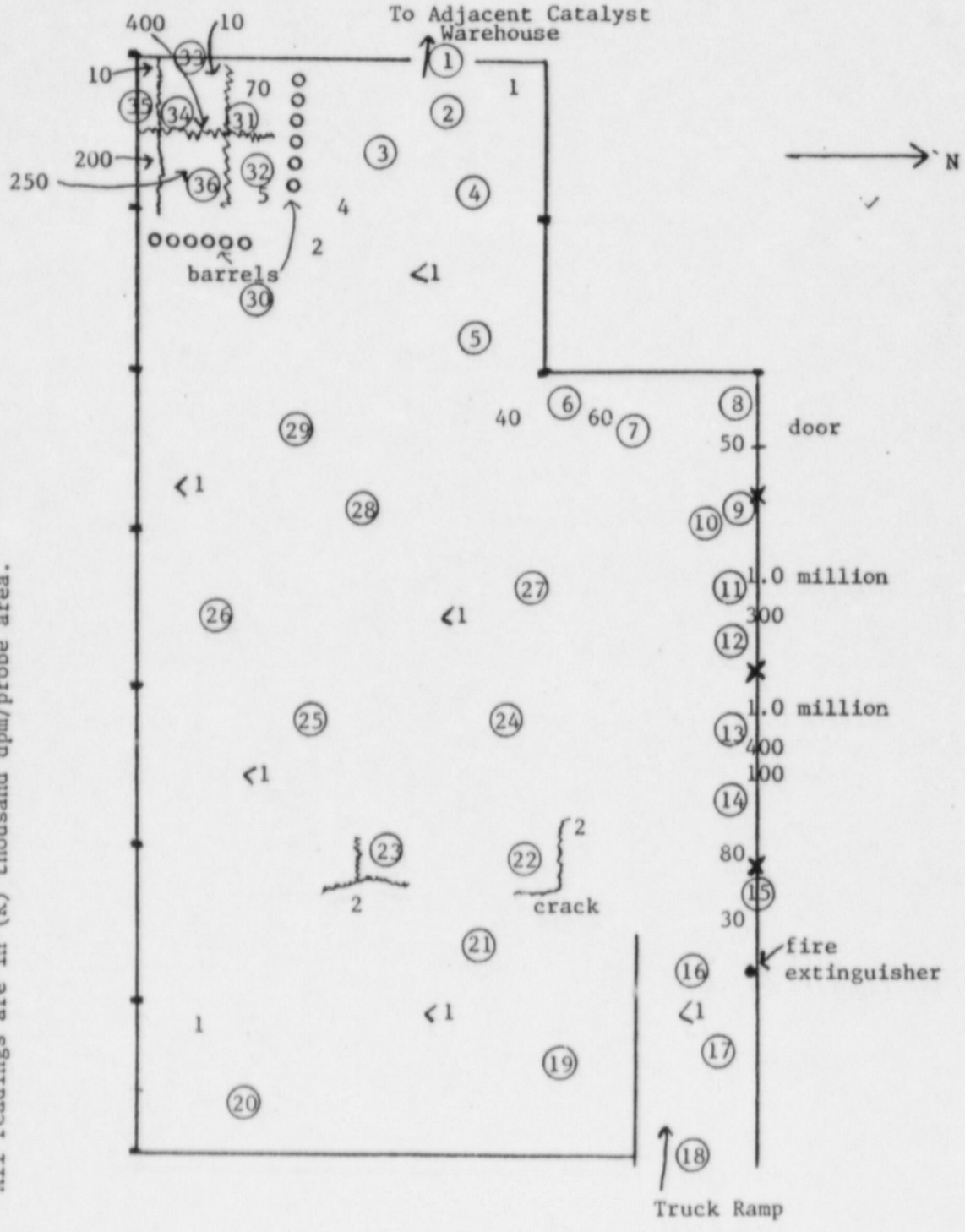
POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
1.					<1000.	<200.
32.					<1000.	<200.
33.					<1000.	<200.
37.					<1000.	<200.

FIELD SURVEY MAP

nes

MAP NO 8
LOCATION Catalyst "A" Frame Warehouse
DATED 8/15/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
(#) Swipes
Δ
× Wood Beams
▬ Support Beams



Remarks: Highly contaminated area discovered when pallets removed from SW corner and north wall of warehouse. Contamiation on north wall is concentrated along 2'x4' beams of outside wall. Does not extend into building more than 3 ft. Contamination in corner is concentrated mostly in the pavement floor cracks. Low levels detected in floor cracks. Half the area is filled with stacks of barrels on pallets, thus difficult to survey entire building.
All readings are in (K) thousand dpm/probe area.

ORIGINATOR

FIELD SURVEY DATA SHEET 8 DATE: 8/15/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: #999
PROBE: HP-210
EFFICIENCY:

RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:

PROJECT NO. 5436
LOCATION A-frame whse.
TECHNICIAN Keithley
SIGNATURE

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DFM / 100 cm^2
1.					< 1000.	< 200.
2.					↓	↓
3.						
4.					< 1000.	< 200.
5.					3000.	< 200.
6.					< 1000.	< 200.
7.					26000.	500.
8.					< 1000.	< 200.
9.					< 1000.	< 200.
10.					↓	↓
11.						
12.						
13.						
14.						
15.						
32.					< 1000.	< 200.
33.					< 1000.	< 200.
34.					2500.	< 200.
35.					1500.	< 200.
36.					< 1000.	200.

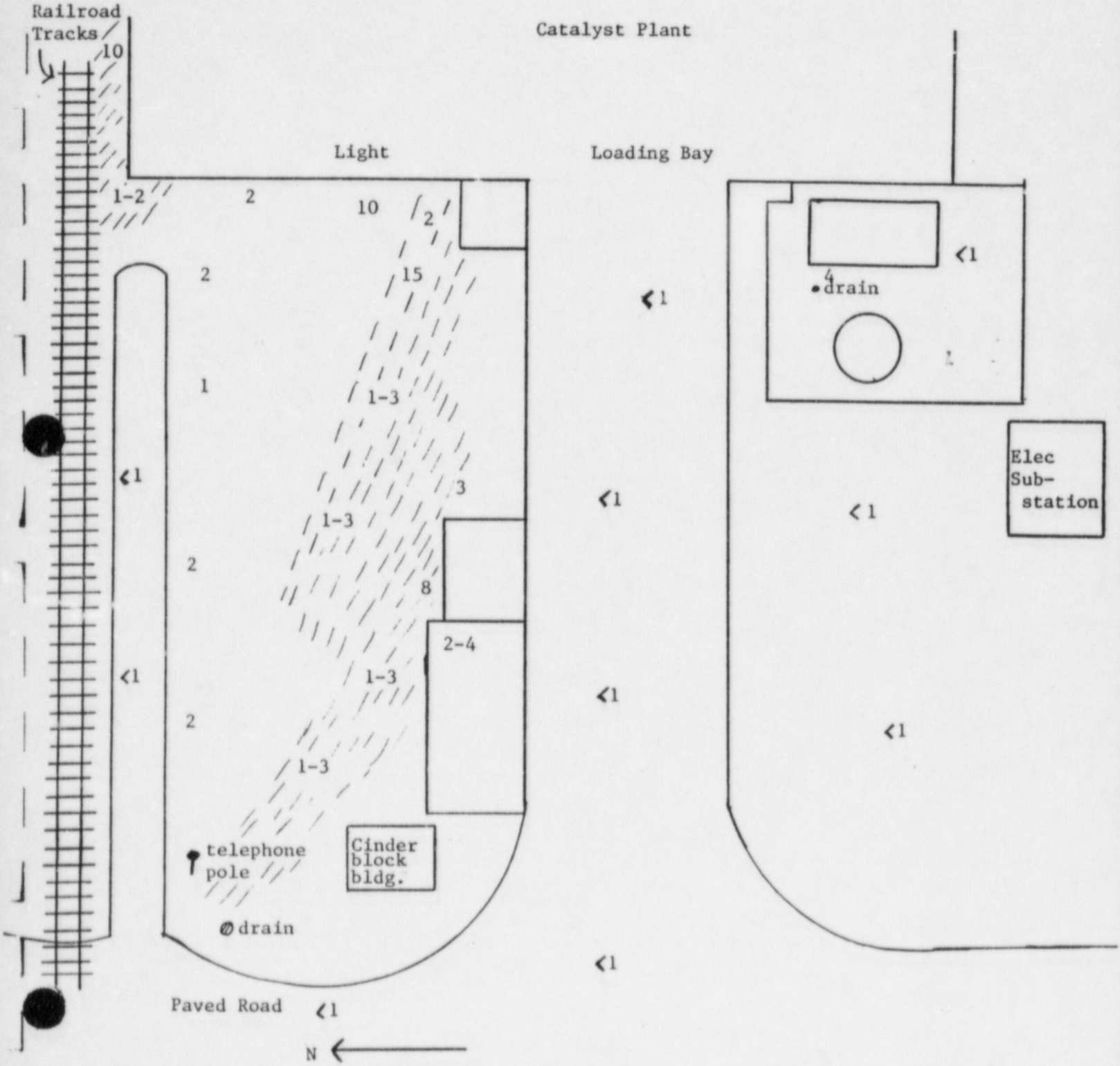
Remarks: Low levels of loose contamination were detected in southwest corner and along north wall when compared to levels found using RM-20. Areas not posted because no traffic through the area.

FIELD SURVEY MAP

MAP NO 9
LOCATION Catalyst Outside Storage Area
DATED 8/14/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
×
*

All readings are in (K) thousand dpm/probe area.



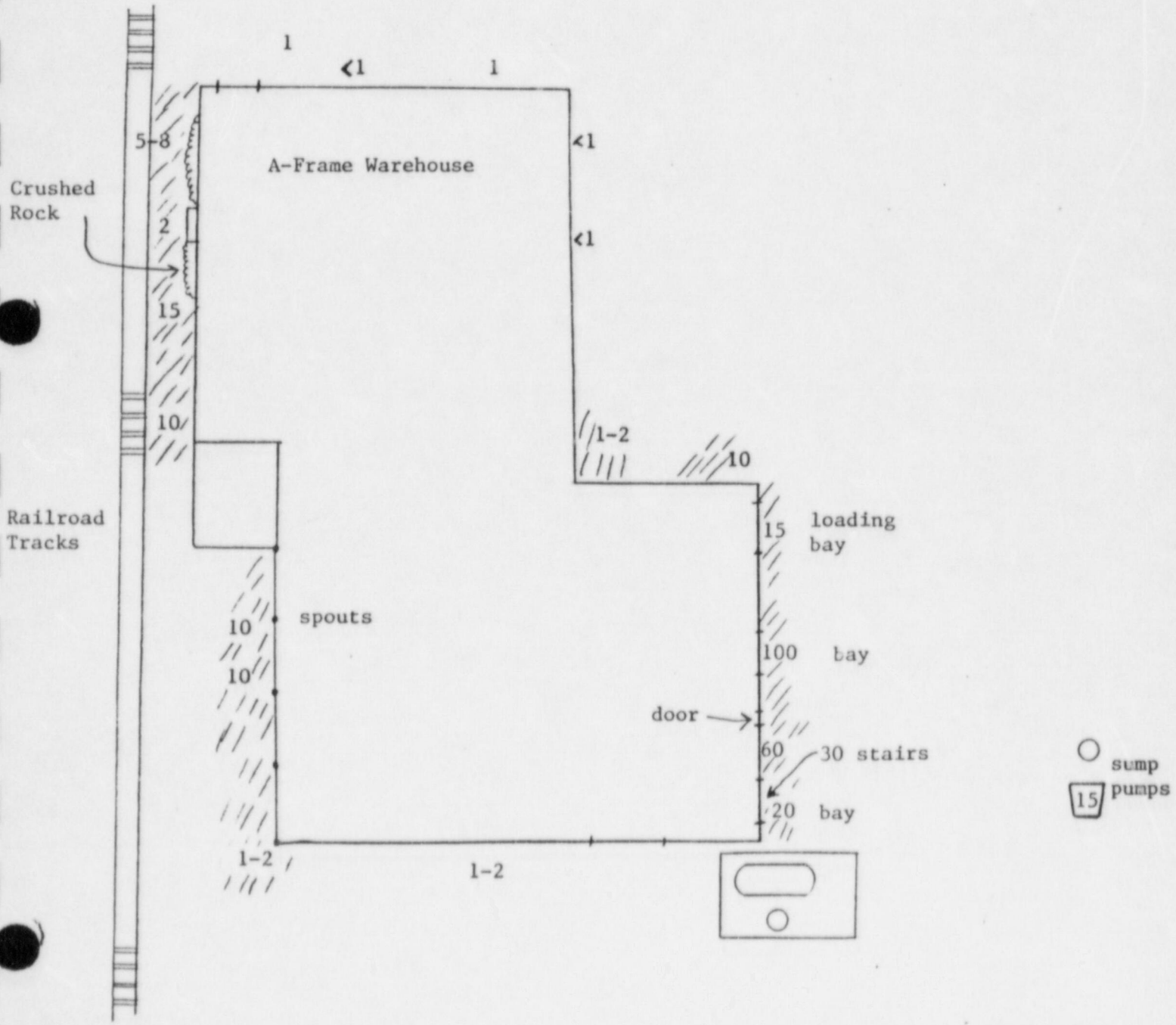
ORIGINATOR

FIELD SURVEY MAP

MAP NO 10
LOCATION Catalyst Plant
DATED 8/12/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
×
● Spouts

All readings are in (K) thousand dpm/probe area.



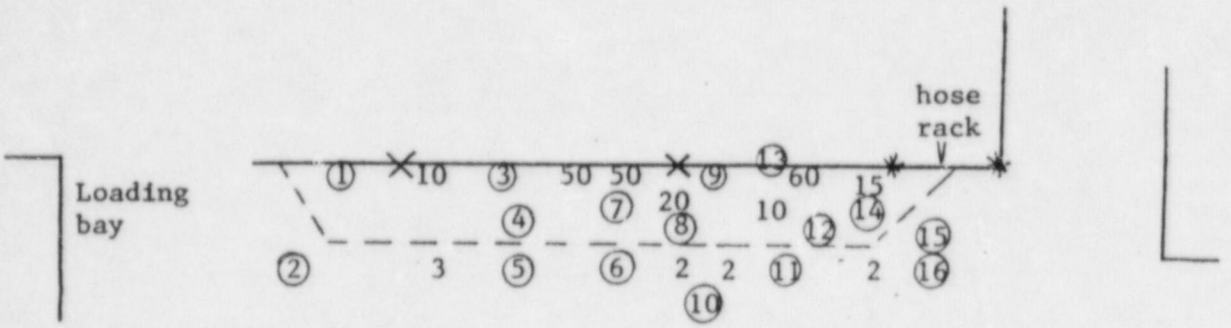
ORIGINATOR

FIELD SURVEY MAP

nes

MAP NO 11
LOCATION West Wall Urea Warehouse
DATED 8/7/85
ORIGINATOR F. Scott Keithley
PROJECT SOHIO

TERRAIN
LEGEND:
(#) Swipes
Δ
× Steel Support Beam
* Sliding door beams



REMARKS: Urea Warehouse West Wall where gas tanks were stored. Area posted as radioactive materials area. All gas tanks and equipment removed from area, all items <1,000 dpm β & γ & <200 dpm alpha. Only smear # (13) contained loose contamination (see page 2)

NOTE: Survey taken with Eberline RM-20 and HP-210 detector

ORIGINATOR

FIELD SURVEY DATA SHEET 11 DATE: 8/7/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: # 999
PROBE: HP-210
EFFICIENCY: 10%

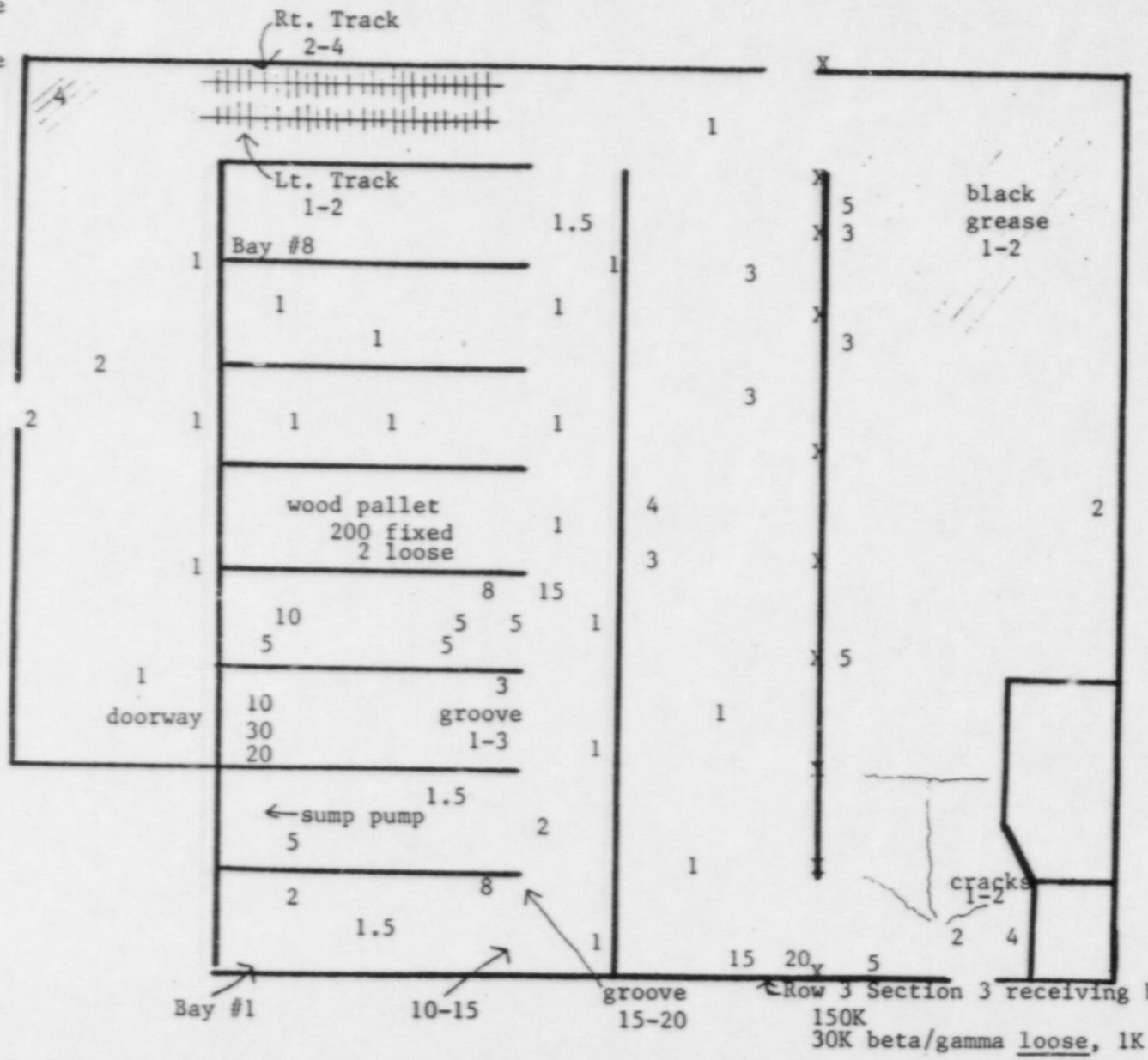
RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:

PROJECT NO. 5436
LOCATION urea warehouse
TECHNICIAN S.Keithley
SIGNATURE

POINT NO.	3 ft.	2 cr.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
1.					< 1000.	< 200.
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.					< 1000.	< 200.
13.					7000.	400.
14.					< 1000.	< 200.
15.					< 1000.	< 200.
16.					< 1000.	< 200.
17.						
18.						
19.						
20.						

NOTE: All readings taken with Eberline RM-20 using HP-210 probe.

NOTE: All readings are on contact and are in thousands (K) dpm/probe area unless otherwise noted.



REMARKS: Highly contaminated wooden pallet found in Bay #5 (200K fixed; 2K loose - beta/gamma). Posted as radioactive material. Area near gas tanks highly contam., loose contam. detected. Posted area as radioactive materials area - no gas tanks & pipe to be removed from area. East end of warehouse has black grease with fixed contam. (1-2K). Fixed contam. usually fourn within concrete floor grooves & cracks.

ORIGINATOR

FIELD SURVEY MAP

MAP NO 12
LOCATION Sohio/Vistron Urea Whse. #1
DATED 8/7/85
ORIGINATOR F. Scott Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
× Steel Support Beams
*

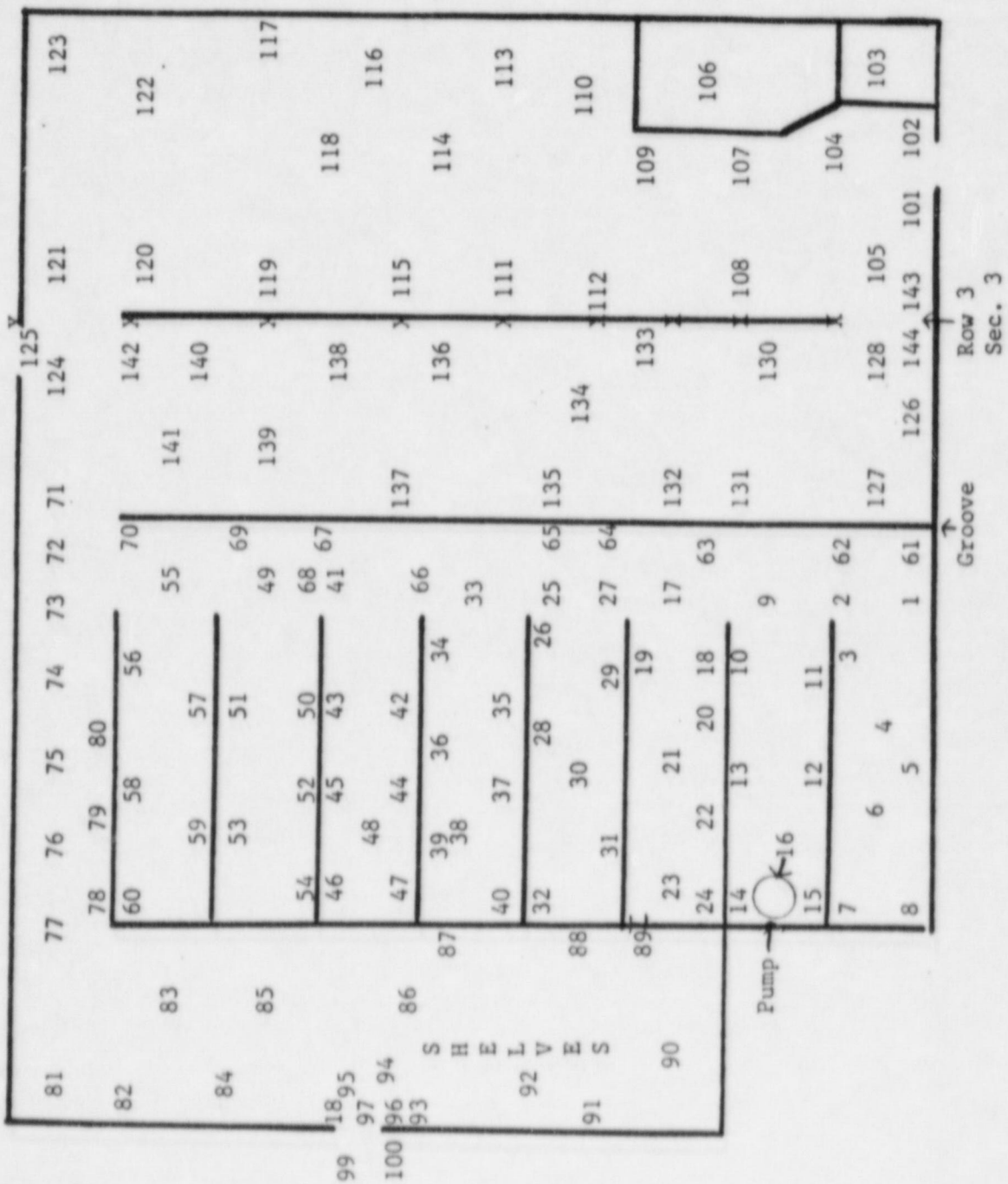
NES

FIELD SURVEY MAP

nes

MAP NO 13
LOCATION Sohio/Vistron Urea Whse. #I
DATED 8/7/85
ORIGINATOR R. Ruschak
PROJECT 5436

TERRAIN LEGEND:
0
Δ
X
*



ORIGINATOR

FIELD SURVEY DATA SHEET 13 DATE: 8/7/85 PAGE: 2 of 3

CONTAMINATION INSTRUMENTATION
MODEL: RM-20 / PRS-2
SERIAL NO: # 9991 / #549
PROBE: HP-210 / AC-3-7
EFFICIENCY: 10% / 30%

RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:

PROJECT NO. 5436-200
LOCATION urea warehouse #1
TECHNICIAN R.R.Ruschak
SIGNATURE

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
					<1000.	<200.
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
↓						
75.						

nes

FIELD SURVEY DATA SHEET 13 DATE: 8/7/85 PAGE: 3 of 3

PROJECT NO. 5436-200
LOCATION urea warehouse #1
TECHNICIAN R.R.Ruschak
SIGNATURE

RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:

CONTAMINATION INSTRUMENTATION
MODEL: RM-20 / PRS-2
SERIAL NO: 9991 / 549
PROBE: HP-210 / AC-3-7
EFFICIENCY: 10% / 30%

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
76.					<1000.	<200.
↓					↓	↓
142.						
143.					30000.	900.
144.					2000.	200.

Project 5436-200 Page 4

Date 2/27/75

Technician [illegible]

NES AIR SAMPLE SHEET

AIR SAMPLE # 3	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	750	3.4×10^{-9}	71	1.3×10^{-10}	"	
2nd count	350	1.6×10^{-9}	60	1.1×10^{-10}	"	
3rd count	200	9.2×10^{-10}	25	4.4×10^{-11}	"	
4th count	100	5.0×10^{-10}	20	3.5×10^{-11}	"	
5th count	50	5.0×10^{-10}	8	1.4×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES

P. 1 of 2

FIELD SURVEY MAP

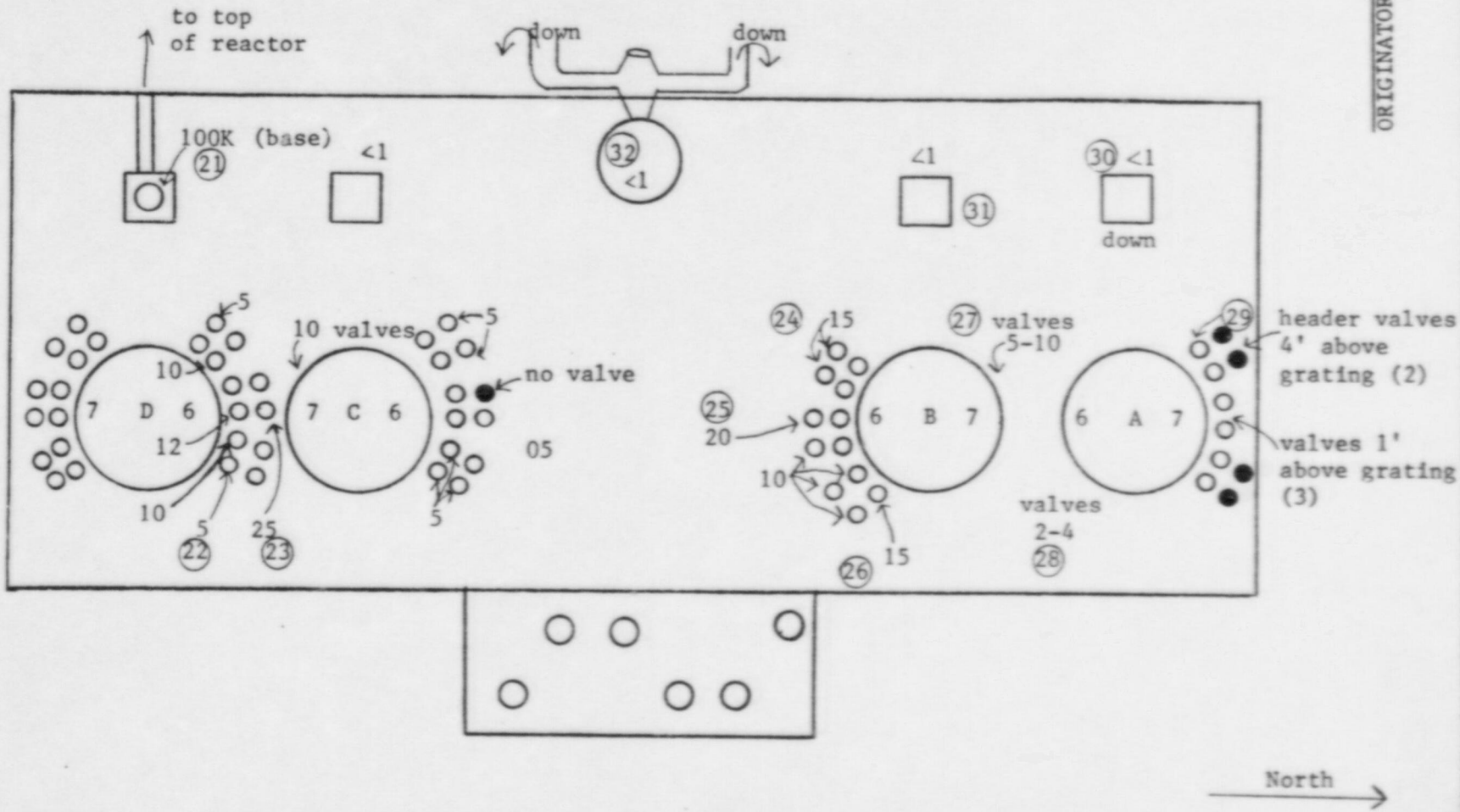
TERRAIN
LEGEND: (#) Swipes
Δ
X
*

MAP NO 14
LOCATION Reactor 3rd Floor Level
DATED 8/23/85
ORIGINATOR F.S. Keithley
PROJECT SOHIO

ORIGINATOR

NOTES: Sides of reactors which contain (7) headers have only 5 valves
Sides of reactors which contain (6) headers have 11 valves

All readings are in thousand (K) dpm/probe area unless otherwise noted.



FIELD SURVEY DATA SHEET 14 DATE: 8/23/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: #999
PROBE: HP-210
EFFICIENCY: 10%

RADIATION INSTRUMENTATION
N/A
MODEL:
SERIAL NO:
PROBE:

PROJECT NO. 5436
LOCATION Reactor 3rd floor
TECHNICIAN Keithley
SIGNATURE

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
21.					<1000.	<200.
22.					<1000.	
23.					<1000.	
24.					2000.	
25.					<1000.	
26.					<1000.	
27.					<1000.	
28.					<1000.	
29.						
30.						
31.						
32.					<1000.	<200.

Remarks: Low levels of contamination found where black grease is found on valve stems.

note: all readings and direct frisks taken with RM-20 and HP-210 probe.

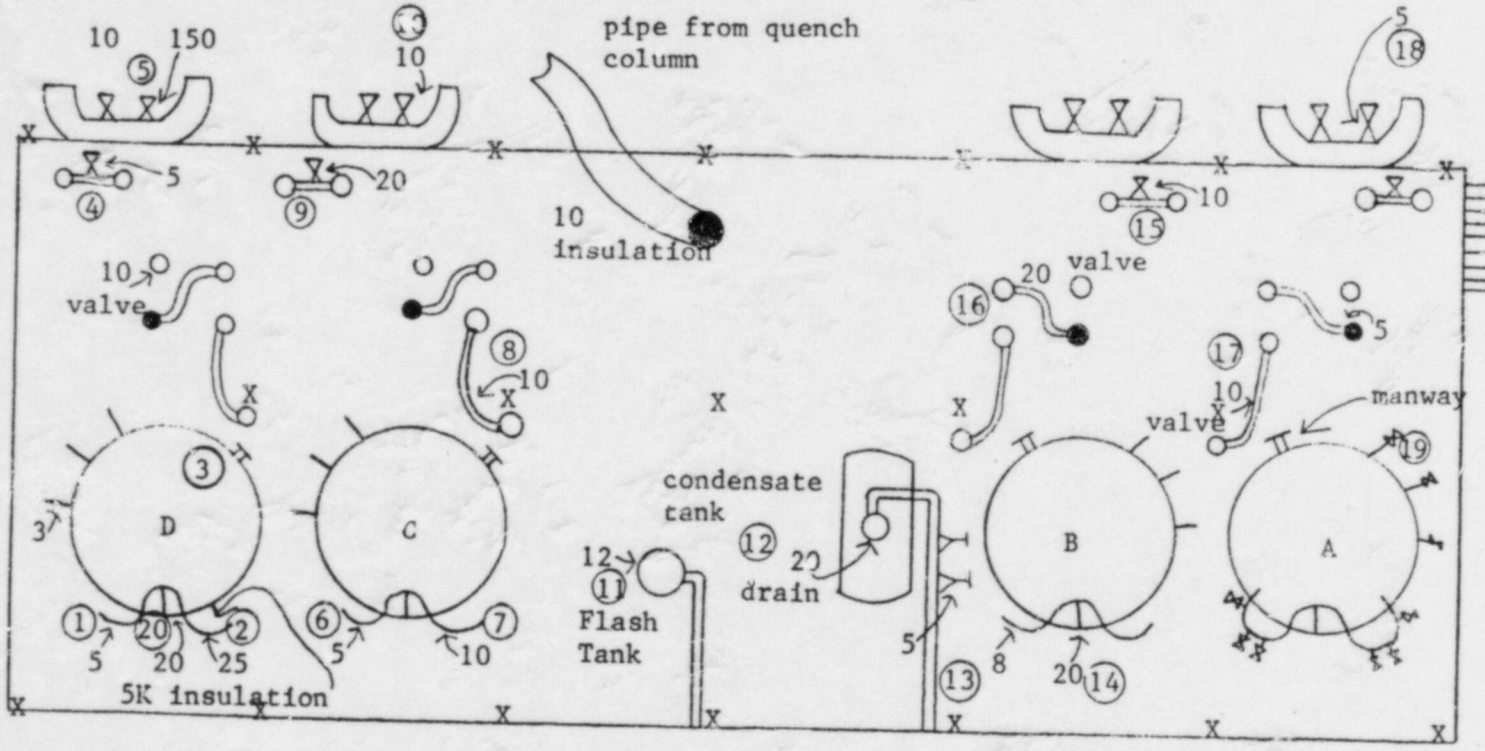
FIELD SURVEY MAP

P. 1 of 2

MAP NO 15
LOCATION Reactors 2nd Floor level
DATED 8/23/85
ORIGINATOR Keithley/Marino
PROJECT SOHIO

TERRAIN

LEGEND:
(#) swipes
● pipe going to 3rd level
X support beams
* valve



NOTE: All smears and direct frisk readings taken on valves and piping unless noted otherwise

All readings are on contact and are in thousands (K) dpm/probe area unless otherwise noted

North

nes

FIELD SURVEY DATA SHEET 15 DATE: 8/23/85 PAGE: 2 of 2

PROJECT NO. 5436
LOCATION Reactor 2nd Floor
TECHNICIAN F. S. Keithley
SIGNATURE

RADIATION INSTRUMENTATION
MODEL:
SERIAL NO:
PROBE:

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: #999
PROBE: HP-210
EFFICIENCY:

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	b-g DPM/ 100 CM^2	alpha DPM / 100 cm^2
1.					<1000	<200
2.					<1000	<200
3.					<1000	<200
4.					<1000	<200
5.					8000	<200
6.					<1000	<200
7.					<1000	<200
8.					<1000	<200
9.					5000	<200
10.					<1000	<200
11.					<1000	<200
12.					3000	<200
13.					<1000	<200
14.					1500	<200
15.					<1000	<200
16.					3000	<200
17.					<1000	<200
18.					<1000	<200
19.					<1000	<200
20.					<1000	<200

Remarks: Low levels of loose contamination found mostly on valve stems and some piping. Where "black grease" is found on valves contamination is detected, levels ranging from 1K - 20K, generally.

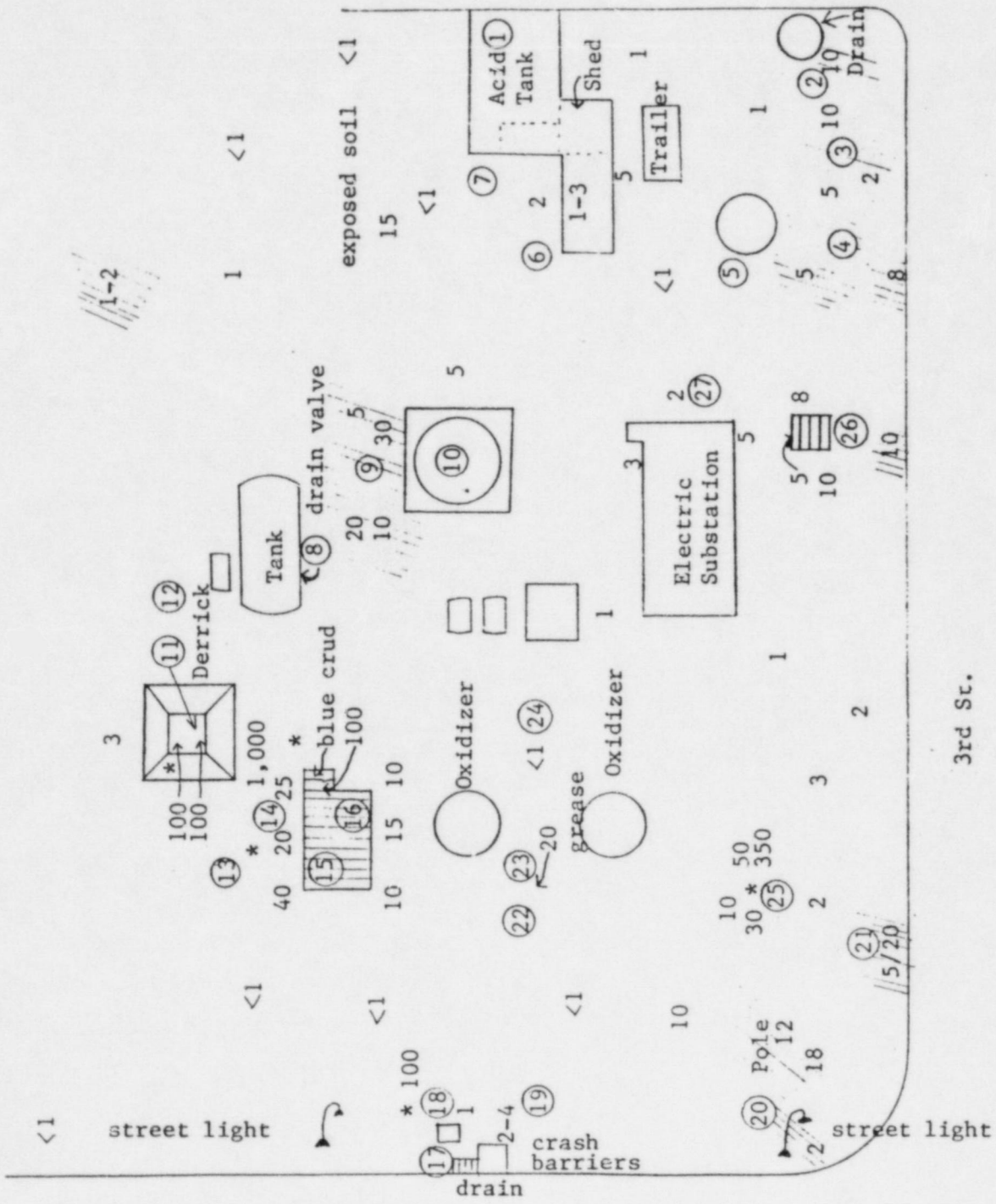
NOTE: All reading taken with RM-20 and HP-210 Probe.

FIELD SURVEY MAP

nes

MAP NO 16
LOCATION Sohio/Vistron Area-A Oxidizers
DATED 8/8/85
ORIGINATOR F. Scott Keithley
PROJECT 5436

TERRAIN Gravel
LEGEND:
(#) Swipes
Δ
× Concrete Pillars
* Hot Spots



NOTE: All readings are on contact and are in thousands (K) dpm/probe area unless otherwise noted

ORIGINATOR

FIELD SURVEY DATA SHEET 16 DATE: 8/8/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: #999
PROBE: HP-210
EFFICIENCY: _____

RADIATION INSTRUMENTATION
MODEL: _____
SERIAL NO: _____
PROBE: _____

PROJECT NO. 5436
LOCATION Area "A" Oxidizers
TECHNICIAN F. S. Keithley
SIGNATURE _____

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	CPM/ 100 CM^2	SAMPLE TYPE
1.					1,000	200
↓					↓	↓
10.					1,000	200
11.					4,000	200
12.					3,000	200
13.					1,000	200
14.					8,000	500
15.					1,000	200
16.					1,000	200
17.					3,000	200
18.					1,000	200
↓					↓	↓
24.					1,000	200
25.					20,000	700
26.					1,000	200
27.					1,000	200

Remarks: Highly contaminated areas found beneath derrick, catalyst settling tank, and a few spots within the oxidizer area. The crushed rocks provide "shielding" when trying to detect contamination in the soil. Some loose contamination was detected in the highly contaminated areas, but low levels compared to fixed contamination detected. The loose contamination is difficult to smear because it won't stick to smear pad.

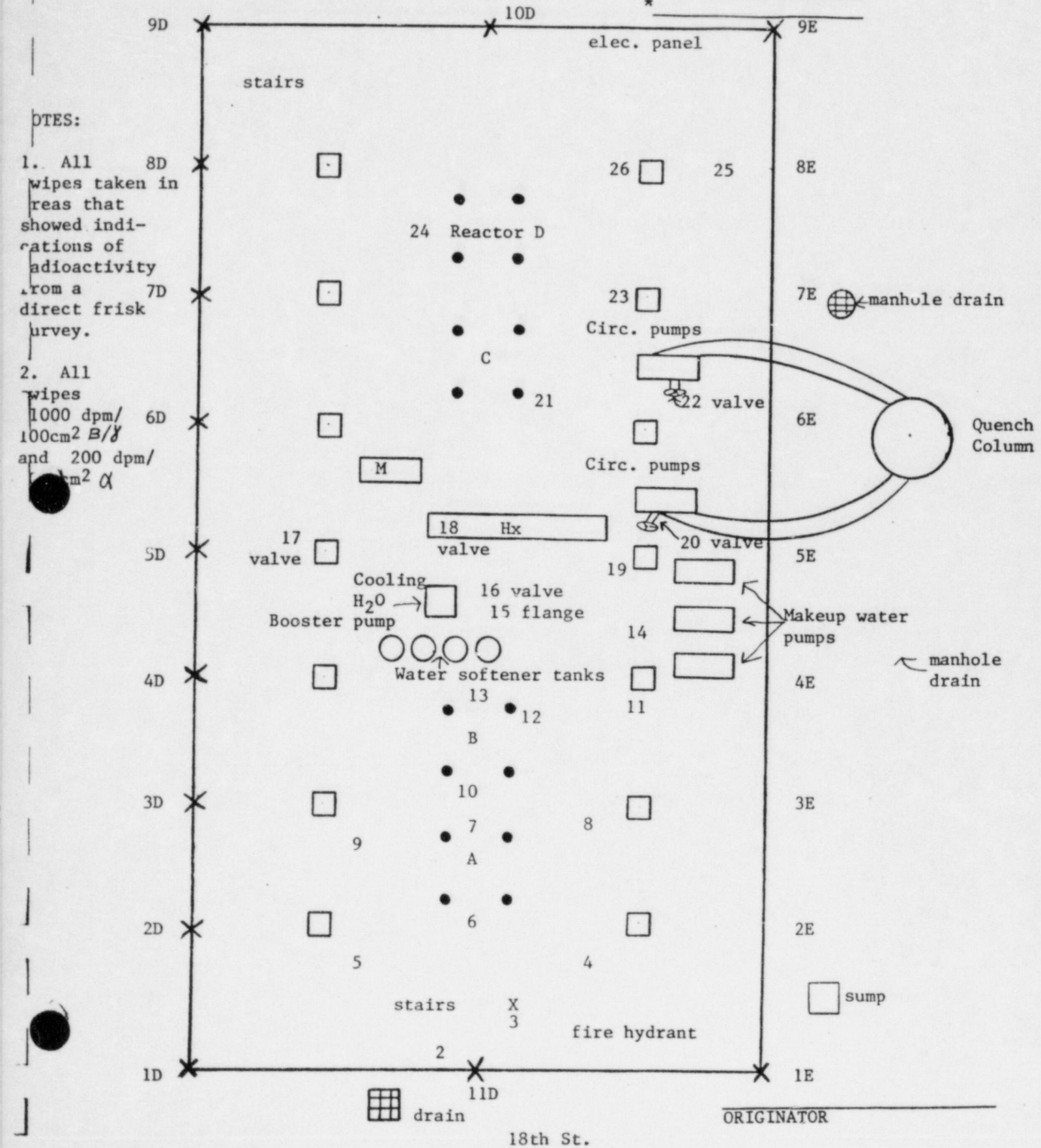
Note: All readings taken with Eberline RM-20 using HP-210 probe.

FIELD SURVEY MAP

nes

MAP NO 17
LOCATION Cement Slab beneath Reactor Structure
DATED 8/1/85
ORIGINATOR R. Ruschak
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
×
*



NOTES:

1. All wipes taken in areas that showed indications of radioactivity from a direct frisk survey.

2. All wipes 1000 dpm/100cm² β/γ and 200 dpm/100cm² α

FIELD SURVEY DATA SHEET 17 DATE: 8/1/85 PAGE: 2of 2

PROJECT NO. 5436

LOCATION Cement slab under Rx, A, B, C, D

TECHNICIAN R. R. Ruschak

SIGNATURE

RADIATION INSTRUMENTATION

MODEL: N/A

SERIAL NO:

PROBE:

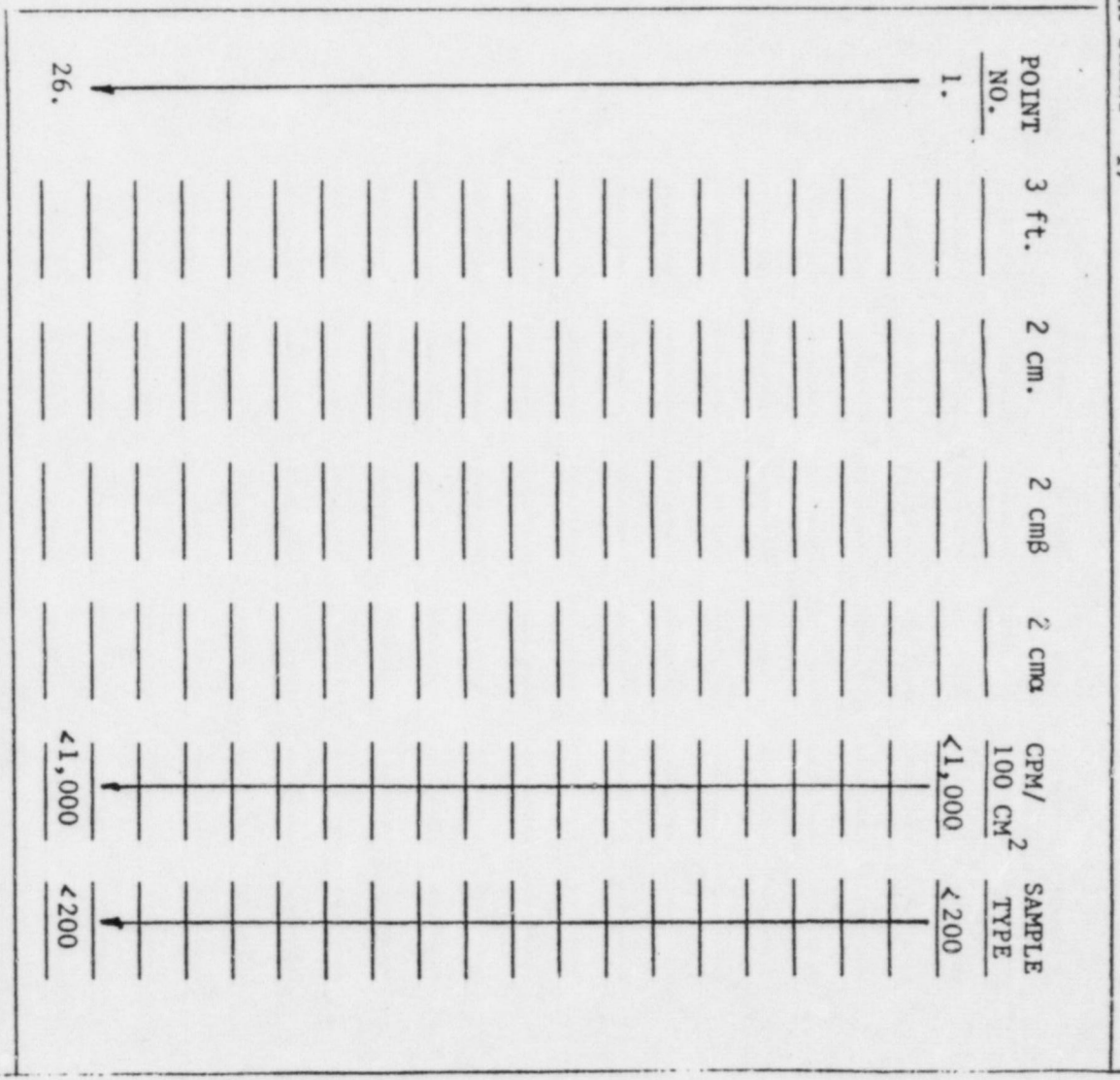
CONTAMINATION INSTRUMENTATION

MODEL: PRS-2/RM-20

SERIAL NO: #549/#999

PROBE: AC-3-7/HP-210

EFFICIENCY: 30%/10%



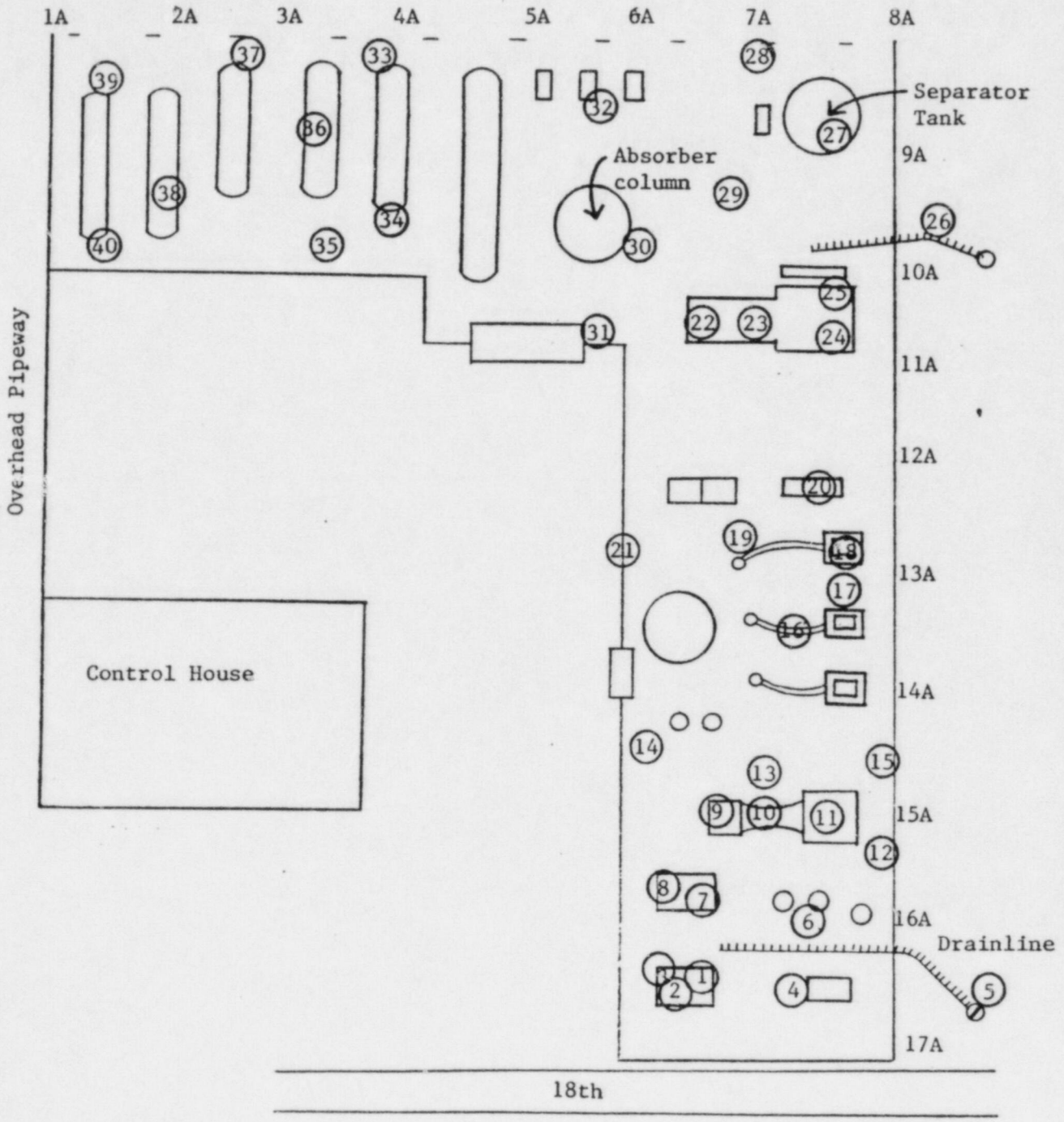
1125

FIELD SURVEY MAP

MAP NO 18
LOCATION Area A
DATED 7/30/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
(#) Swipes
Δ
X
*

1A through 17A are cement pillars



ORIGINATOR

nes

FIELD SURVEY DATA SHEET 18 DATE: 8/12/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: #999
PROBE: HP-210
EFFICIENCY: 10%

RADIATION INSTRUMENTATION
MODEL: _____
SERIAL NO: _____
PROBE: _____

PROJECT NO. 5436
LOCATION Area A
TECHNICIAN F. S. Keithley
SIGNATURE _____

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	beta/gamma DPM 100 CM^2	alpha DPM/100 cm^2
1.					<1000	<200
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
40.					<1000	<200

Remarks: No loose contamination detected within this area, but extremely difficult for any soil, hardened rease, etc. to adhere to smear.

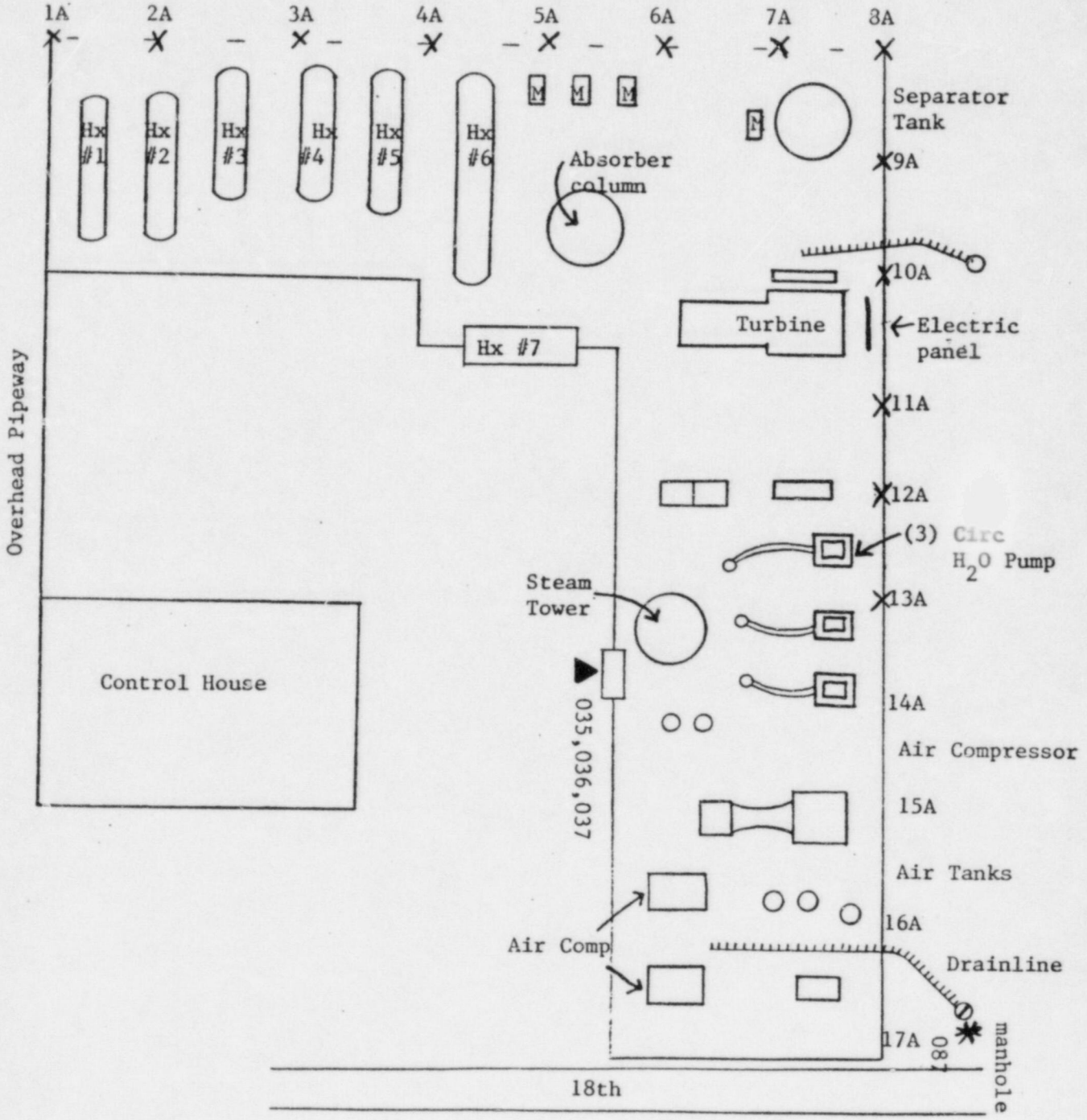
Notes: All smears counted using RM-20 with HP-210 probe for beaf/gamma and PRS-2 with AC-3-7 probe for alpha.

FIELD SURVEY MAP

MAP NO 19
LOCATION SOHIO/Vistron Area-A
DATED 8/2/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ Soil Sample
×
* Sediment

1A through 17A are cement pillars

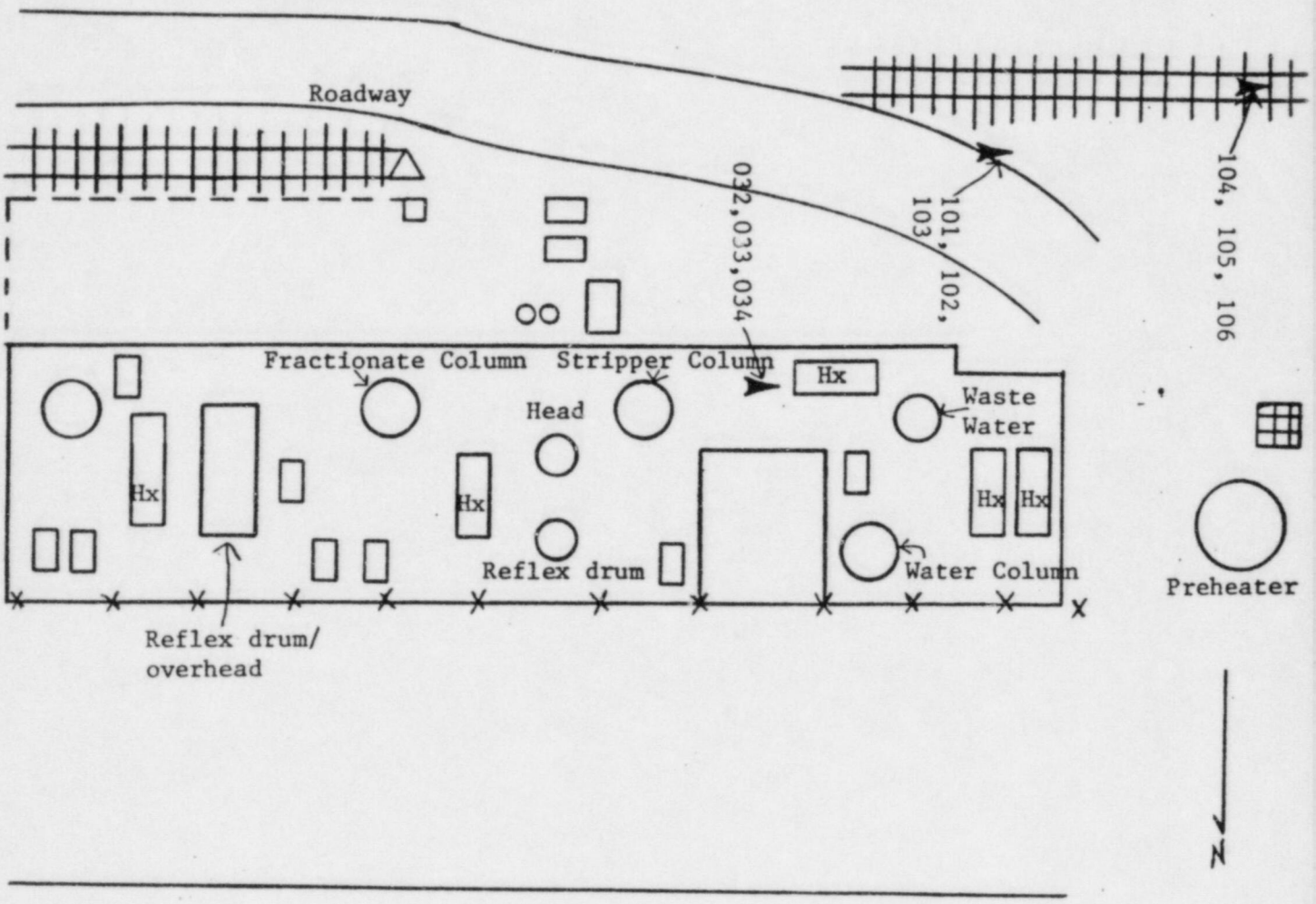


ORIGINATOR

FIELD SURVEY MAP

MAP NO 20
LOCATION Sohio/Vistron Area-A
DATED 8/14/85
ORIGINATOR F. Scott Keithley
PROJECT 5436

TERRAIN Gravel & Concrete
LEGEND:
0
▲ Three Soil Samples
X
*



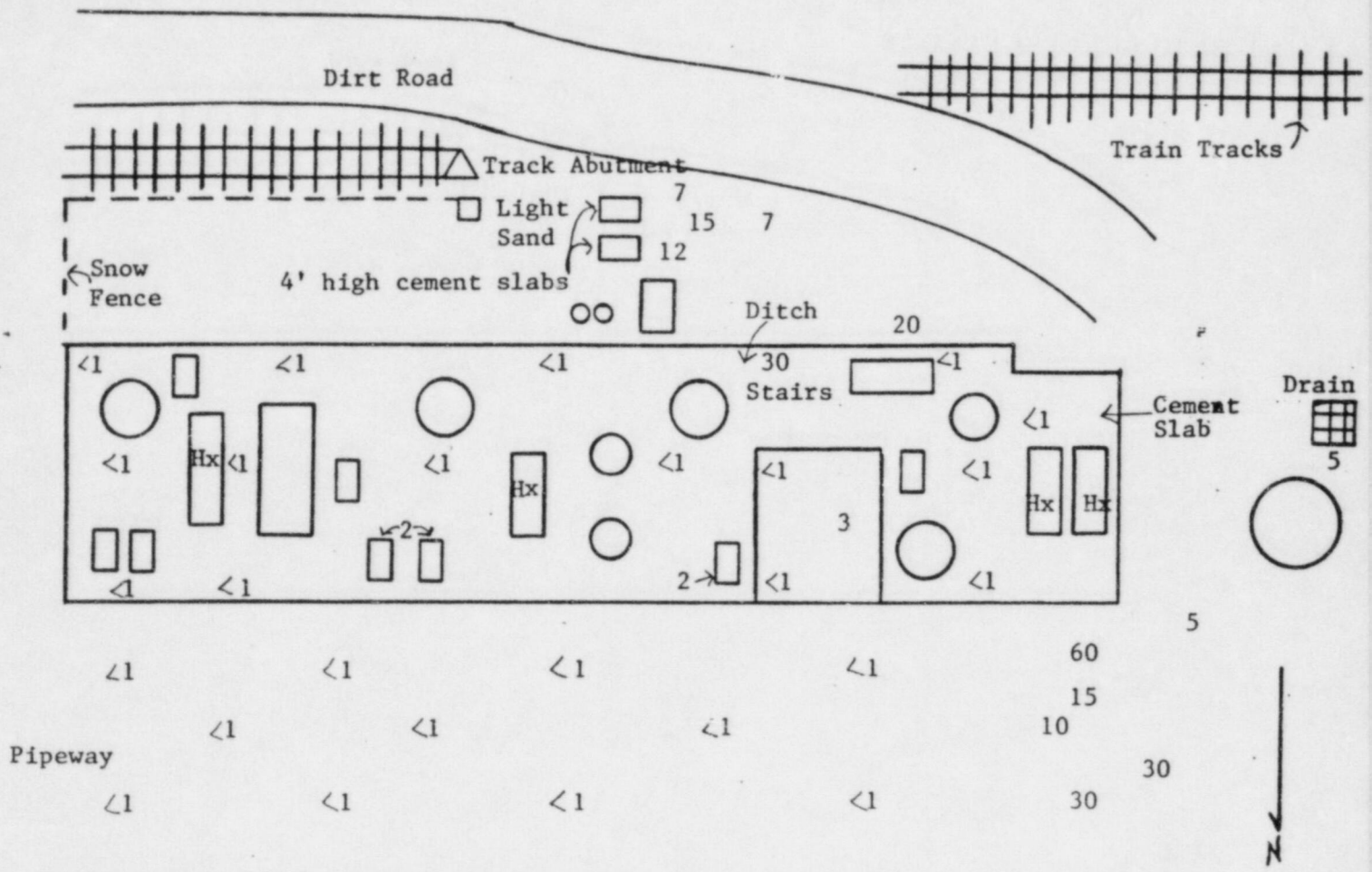
ORIGINATOR

FIELD SURVEY MAP

nes

MAP NO 21
LOCATION Area A
DATED 8/8/85
ORIGINATOR R.R. Ruschak
PROJECT Vistron/Sohio 5436-200

TERRAIN LEGEND:
0
Δ
X
★



NOTE: All readings are on contact and are in thousands (K) dpm/probe area unless otherwise noted

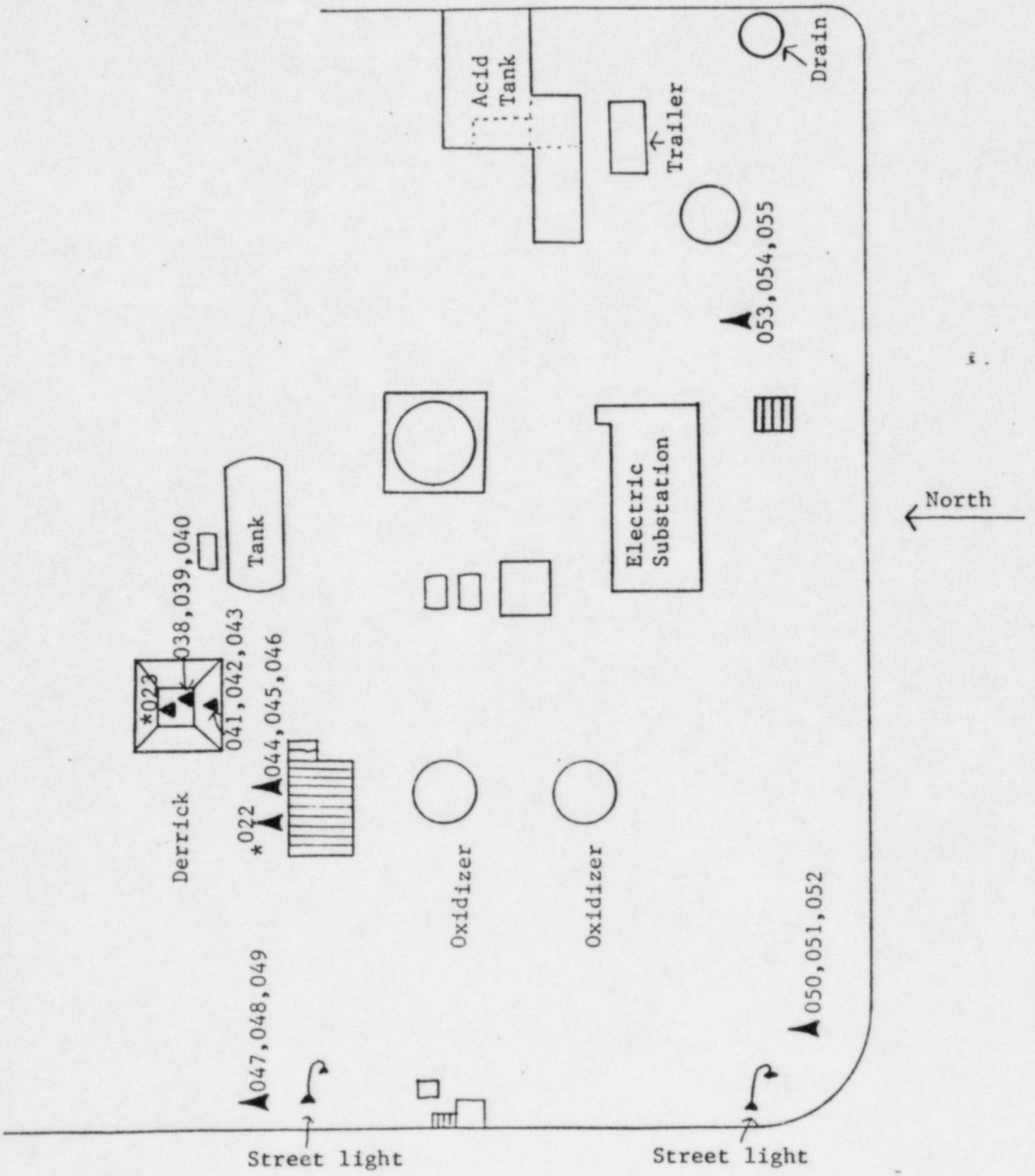
ORIGINATOR

FIELD SURVEY MAP

nes

MAP NO 22
LOCATION Sohio/Vistron Derrick Area
DATED 8/14/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
▲ 3 Soil Samples
X
★ Surface Soil Sample

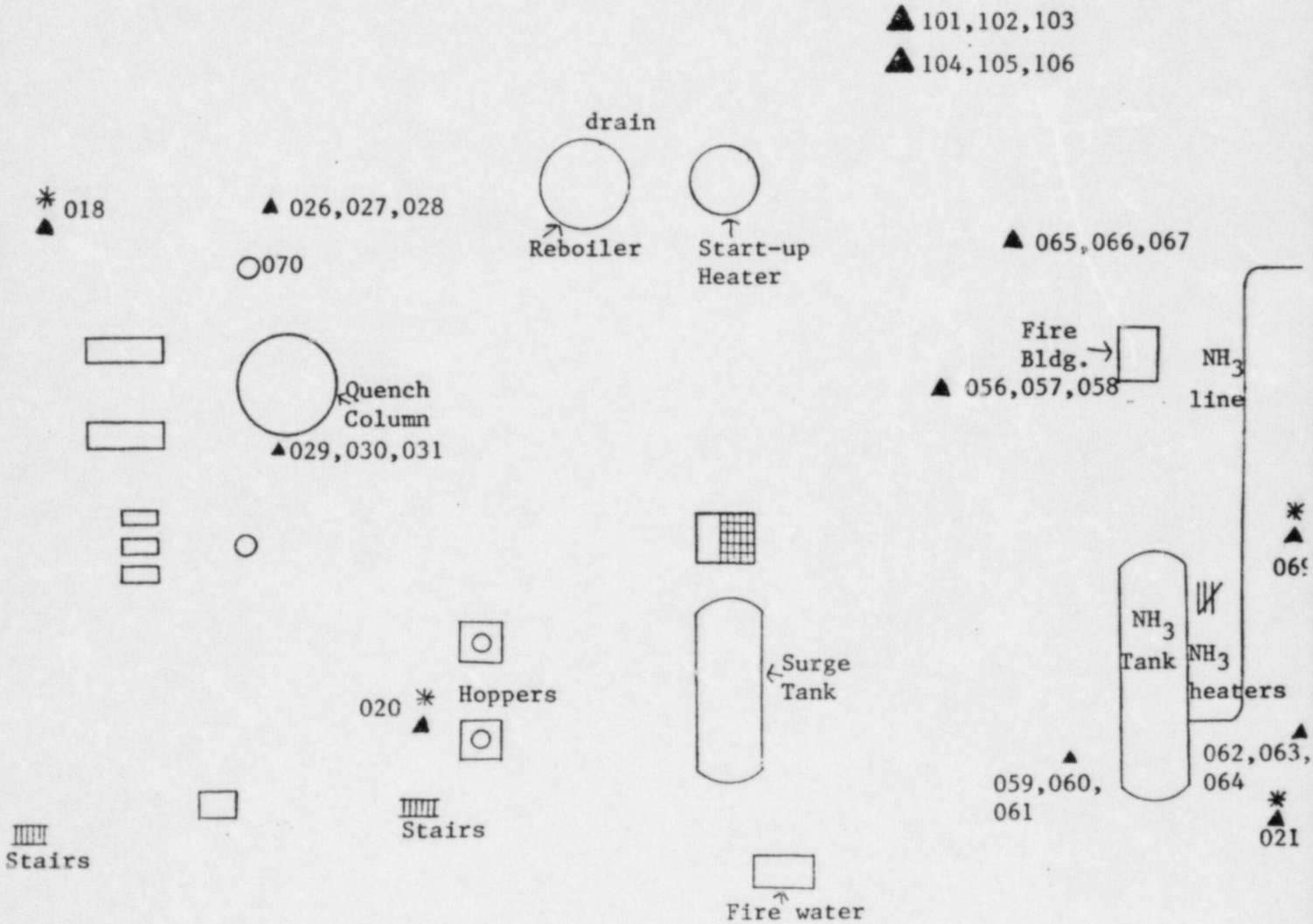


ORIGINATOR

FIELD SURVEY MAP

MAP NO 23
LOCATION Sohio/Vistron Area A
DATED 8/2/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ Soil Samples
X
* Sediment/Surface Soil



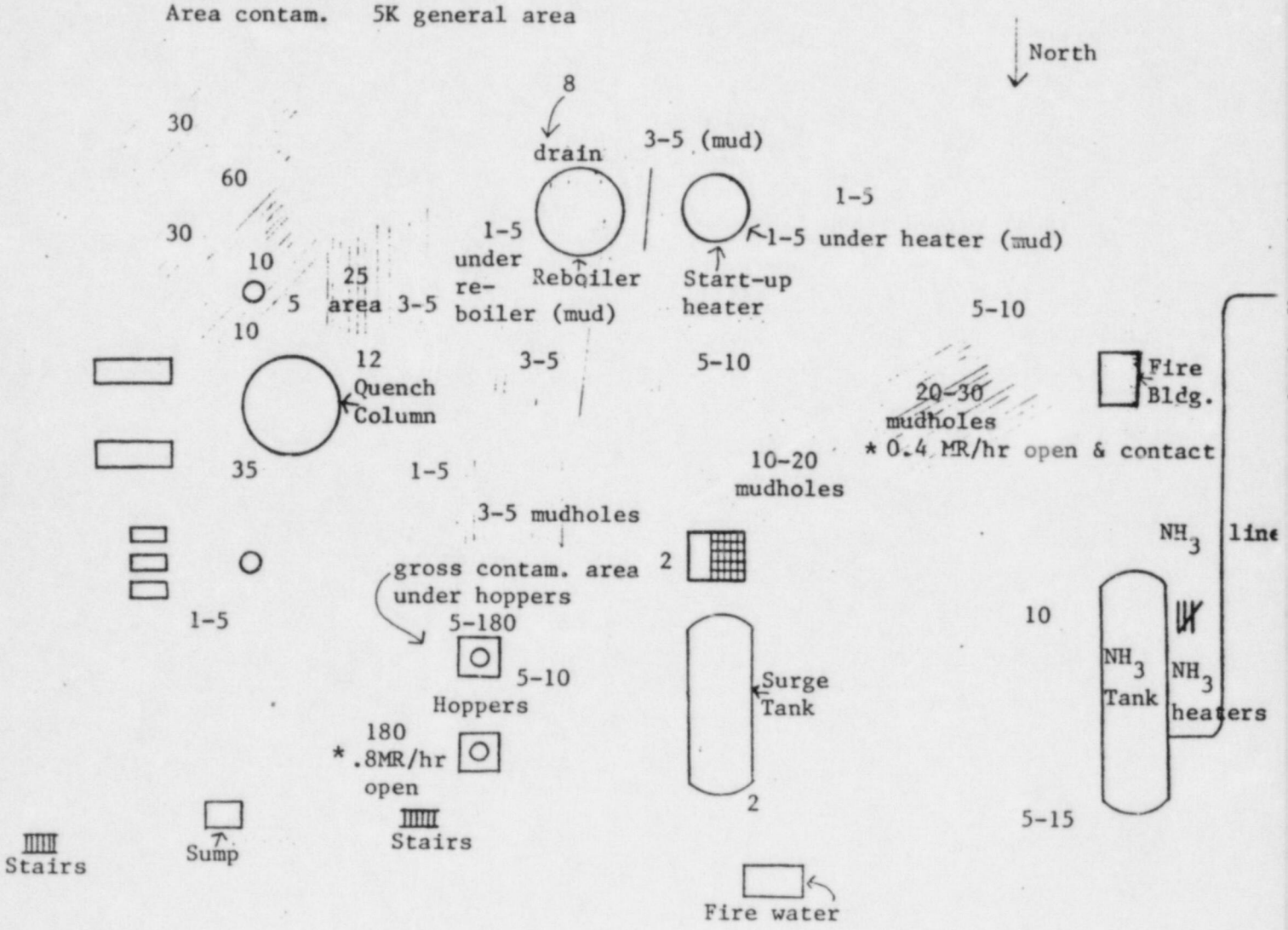
ORIGINATOR

FIELD SURVEY MAP

nes

MAP NO 24
LOCATION Sohio/Vistron Area A
DATED 8/2/85
ORIGINATOR F. Scott Keithley
PROJECT 5436

TERRAIN LEGEND:
0
Δ
X
*



NOTE: All readings taken with RM-20/HP210 probe and are in thousands (K) dpm/probe area unless otherwise noted.

* Contact reading taken with PRS2/HP270

NOTE: Mudholes within area usually have fixed contamination

ORIGINATOR

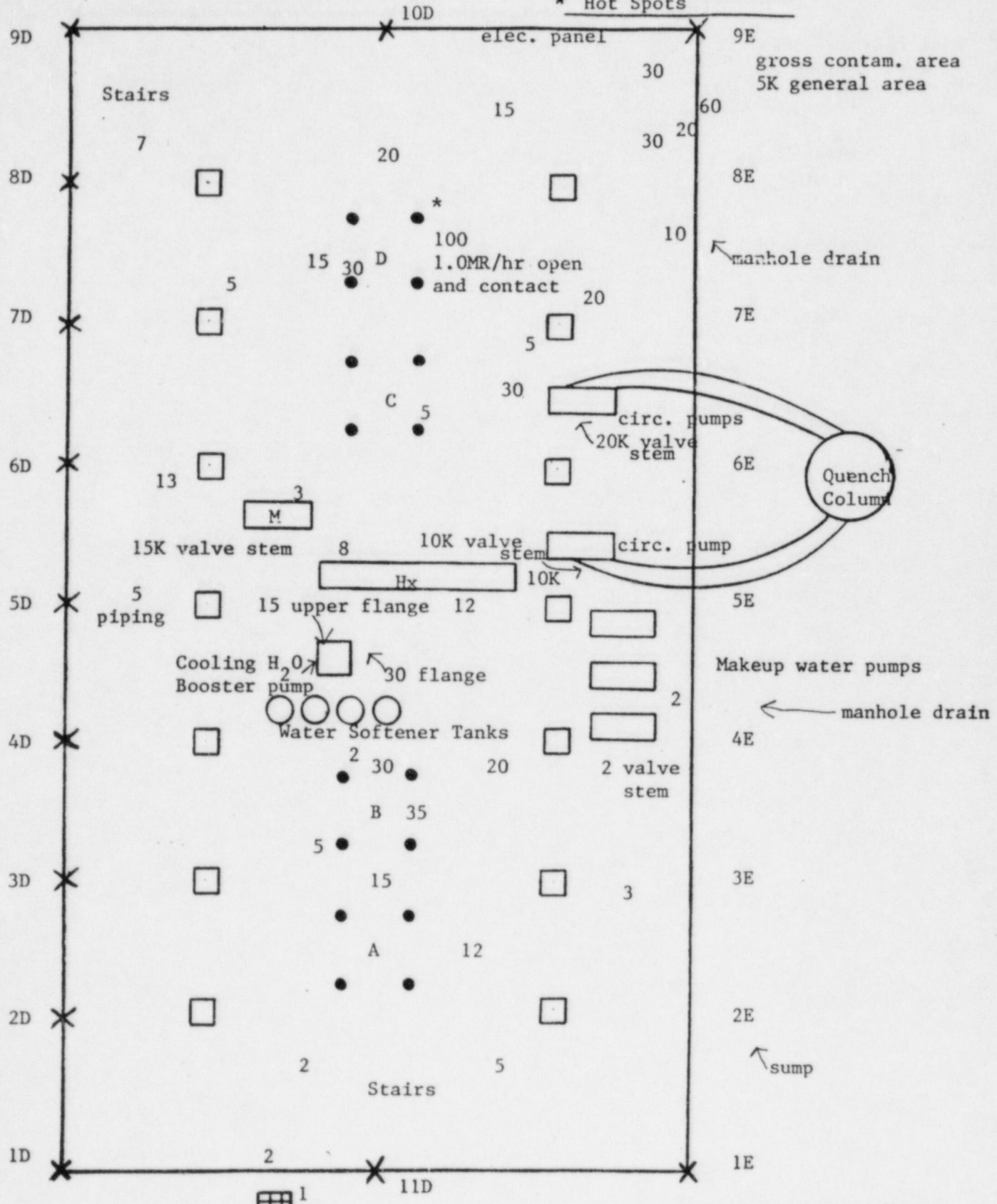
FIELD SURVEY MAP

nes

P. 1 of 2

MAP NO 25
LOCATION Sohio/Vistron Area A
DATED 8/1/85
ORIGINATOR F. Scott Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
× Steel Beams
* Hot Spots



NOTES: see attached

ORIGINATOR

18th St.

FIELD SURVEY MAP

nes

P. 2 of 2

MAP NO 25
LOCATION Sohio/Vistron Area A
DATED 8/1/85
ORIGINATOR F. Scott Keithley
PROJECT 5436

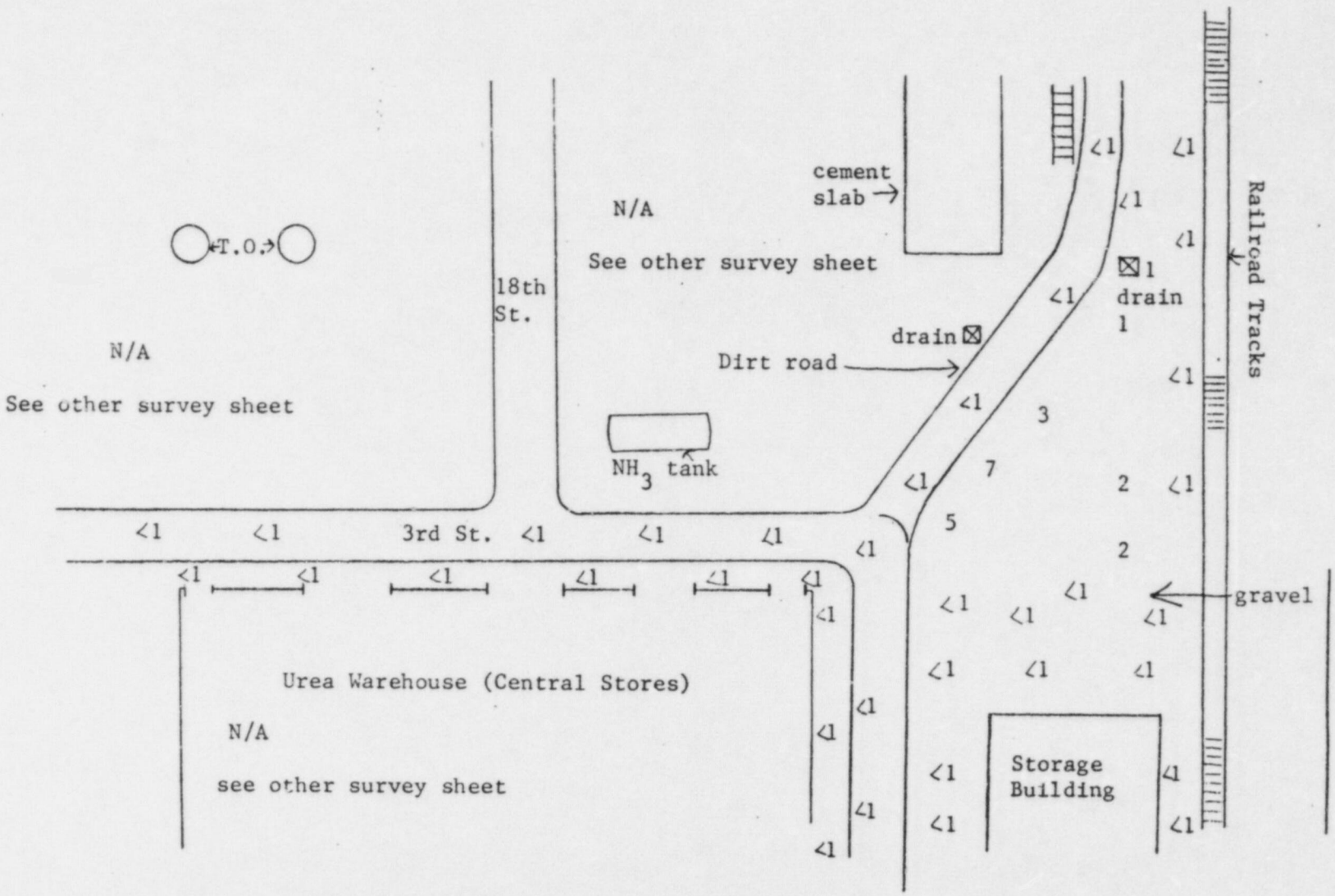
TERRAIN
LEGEND:
0
Δ
x Steel Beams
* Hot Spots

NOTE: All readings taken with Eberline RM-20 and HP-210 AL probe. Contact reading at Reactor D enclosure taken with PRS-2 and HP-270 probe.

REMARKS: Fixed contamination detected in reactor concrete floor usually concentrated at reactor drains. Numerous valve stems and piping flange connectors are contaminated. Spotty contamination located throughout reactor area (located within concrete grooves, bumps, low spots). * Highly radioactive loose contamination found within Reactor D enclosure (100,000 dpm/probe area). Sample taken for analysis and area posted as radioactive materials area.

NOTE: All readings are on contact and are in thousands (K) dpm/probe area unless otherwise noted.

NOTE: All readings are direct measurements at ground level and are in thousands (K) dpm/probe area unless otherwise noted.



MAP NO 26
LOCATION Sohio/Vistron Area A
DATED 8/11/85
ORIGINATOR R. Ruschak
PROJECT 5436

TERRAIN
LEGEND: 0 Δ × *

FIELD SURVEY MAP

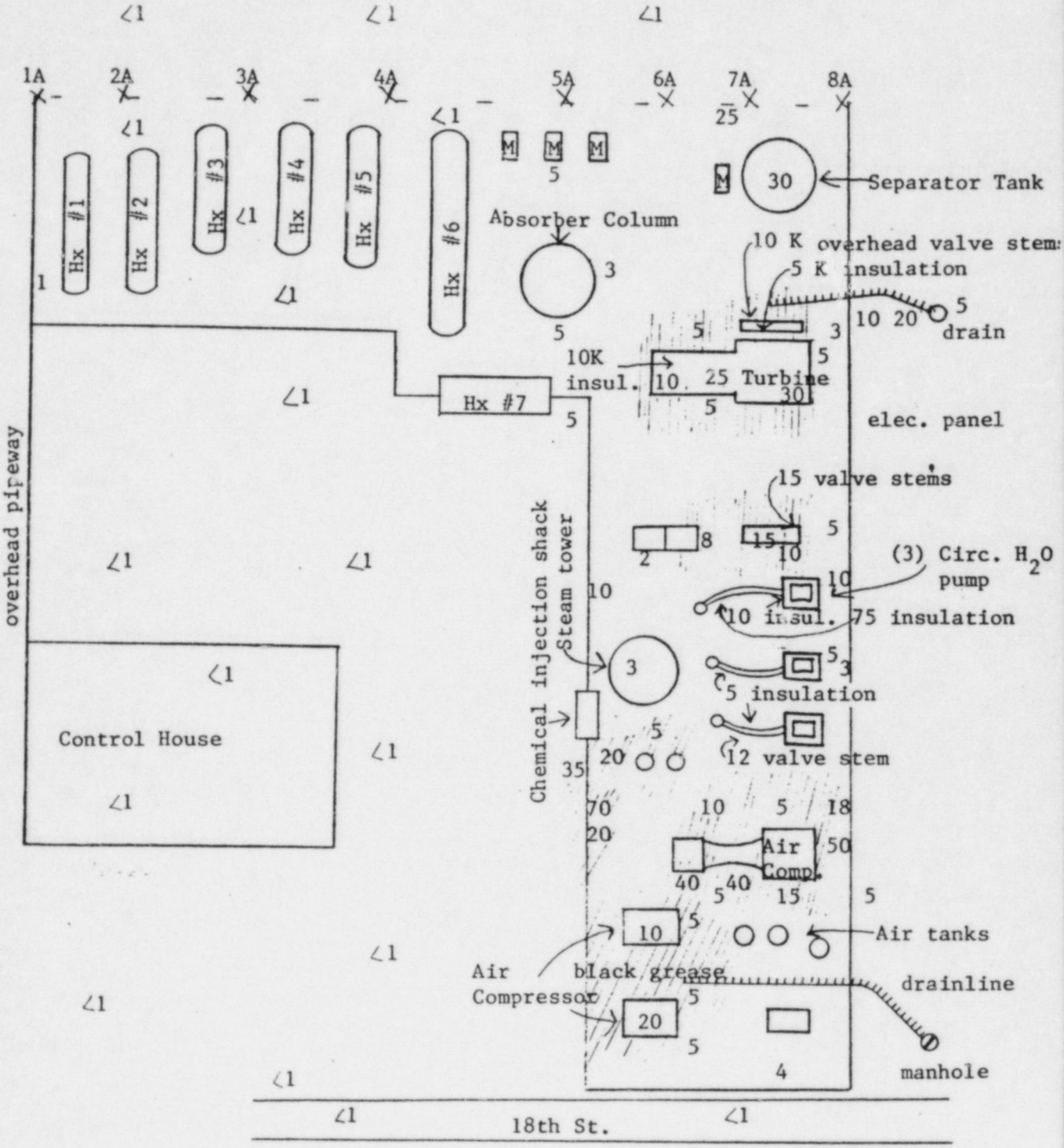
ORIGINATOR

1125

FIELD SURVEY MAP

MAP NO 27
LOCATION Sohio/Vistron Area A Operations
DATED 8/2/85
ORIGINATOR F. Scott Keithley
PROJECT 5436

TERRAIN Gravel & Concrete
LEGEND:
0
Δ
X Support beams
*



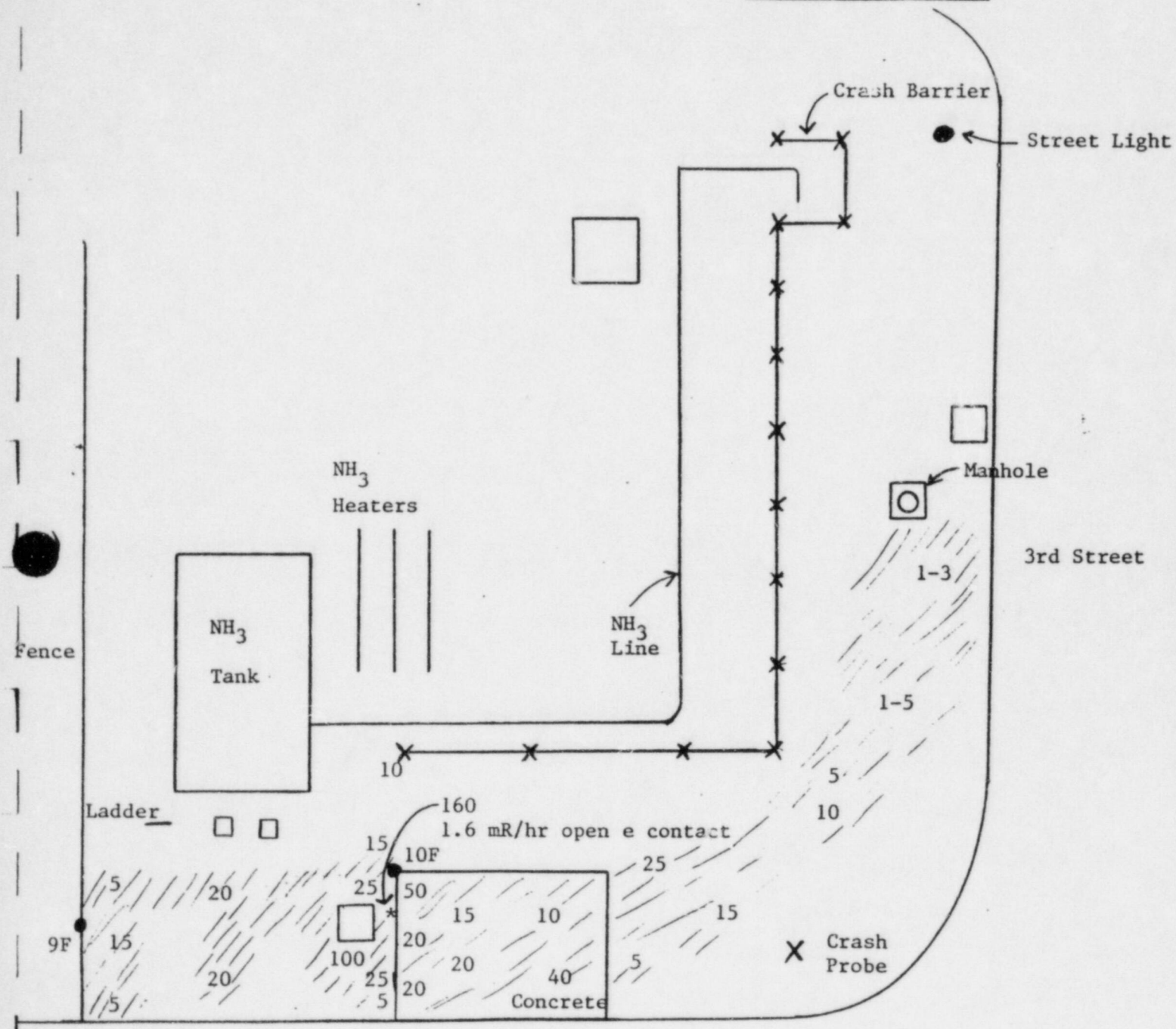
NOTES: Substantial levels of fixed contamination were detected throughout this area on various types of machinery (turbine, compressors, pumps, piping). Wherever black grease was found on machinery, contam. was detected. Valve stems and insulation near valves was also contam. Low levels on concrete floor, higher levels on machinery seems to indicate leaking of lubricating grease and/or water from machinery as cause of contam. Hx area including asbestos on piping very clean on surfaces.

ORIGINATOR

FIELD SURVEY MAP

MAP NO 28
LOCATION NH-3 Tank Area
DATED 8/2/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
0
Δ
× Crash Barrier
* Contact with Ground



Remarks: *Highly contaminated area (160,000 dpm/probe area) found at former catalyst loading area (concrete area). Contamination levels drop off as you move outward from this area. The contamination seems to have drained off towards manhole. Area by NH_3 heaters has a few spotty low level contamination, but area usually clean.

Note: All readings taken with RM-20 and HP-210 AL probe. Contact reading taken with PRS-2 and HP-270 probe. All readings are in (K) thousand dpm/probe area.

ORIGINATOR

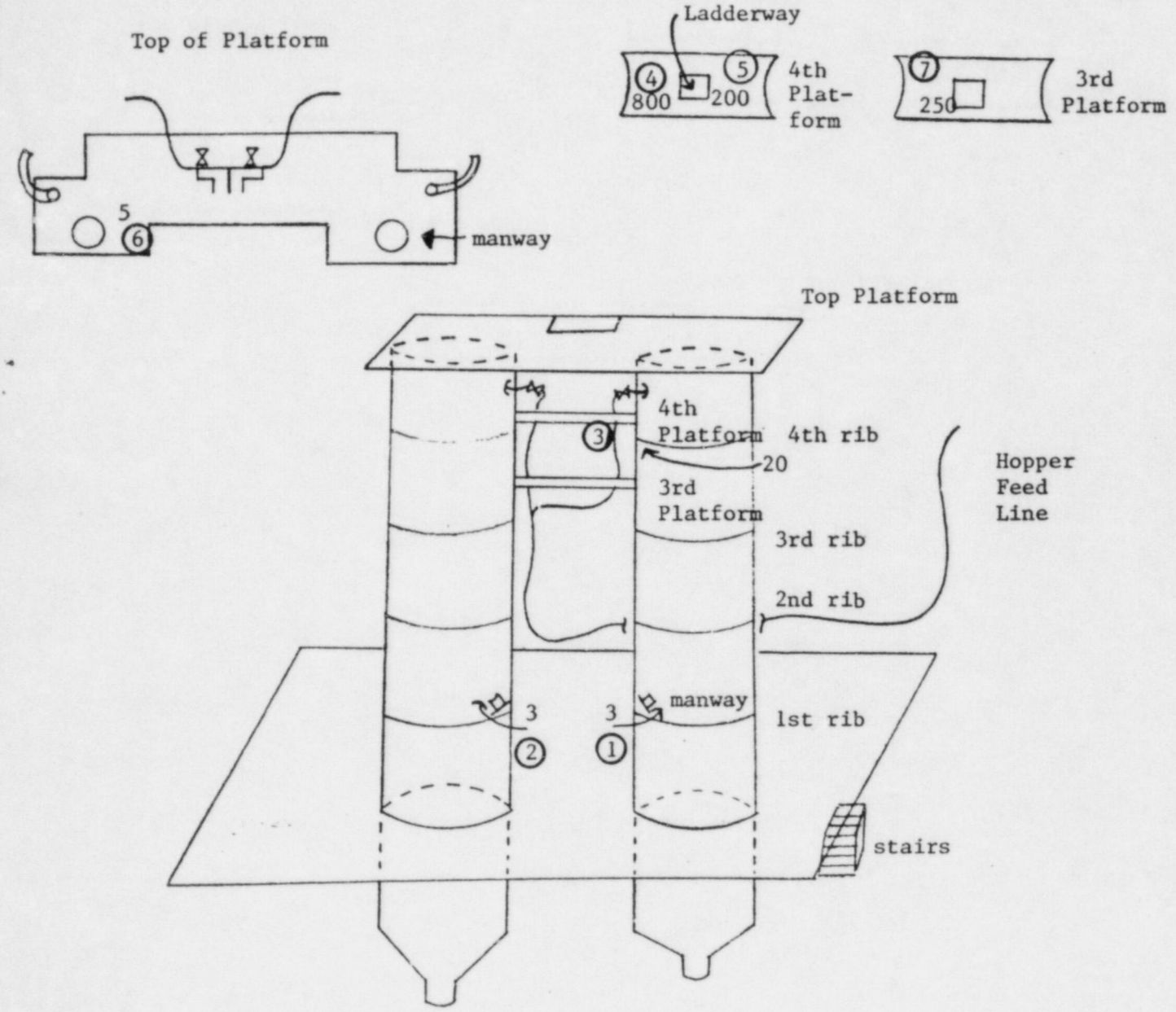
FIELD SURVEY MAP

nes

P. 1 of 2

MAP NO 29
LOCATION Catalyst Hoppers; Area A
DATED 8/23/85
ORIGINATOR R. R. Ruschak
PROJECT 5436

TERRAIN Cement/Iron Deck
LEGEND:
(#) Swipes-See attached sheets
Δ Sheet Metal Lagging
× Floor
*



Remarks: All readings are in (K) thousand dpm/probe area.

ORIGINATOR

nes

FIELD SURVEY DATA SHEET 29 DATE: 8/23/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20/RPS-2
SERIAL NO: 985/549
PROBE: HP-210/AC-3-7
EFFICIENCY: 10%/30%

RADIATION INSTRUMENTATION
MODEL: N/A
SERIAL NO:
PROBE:

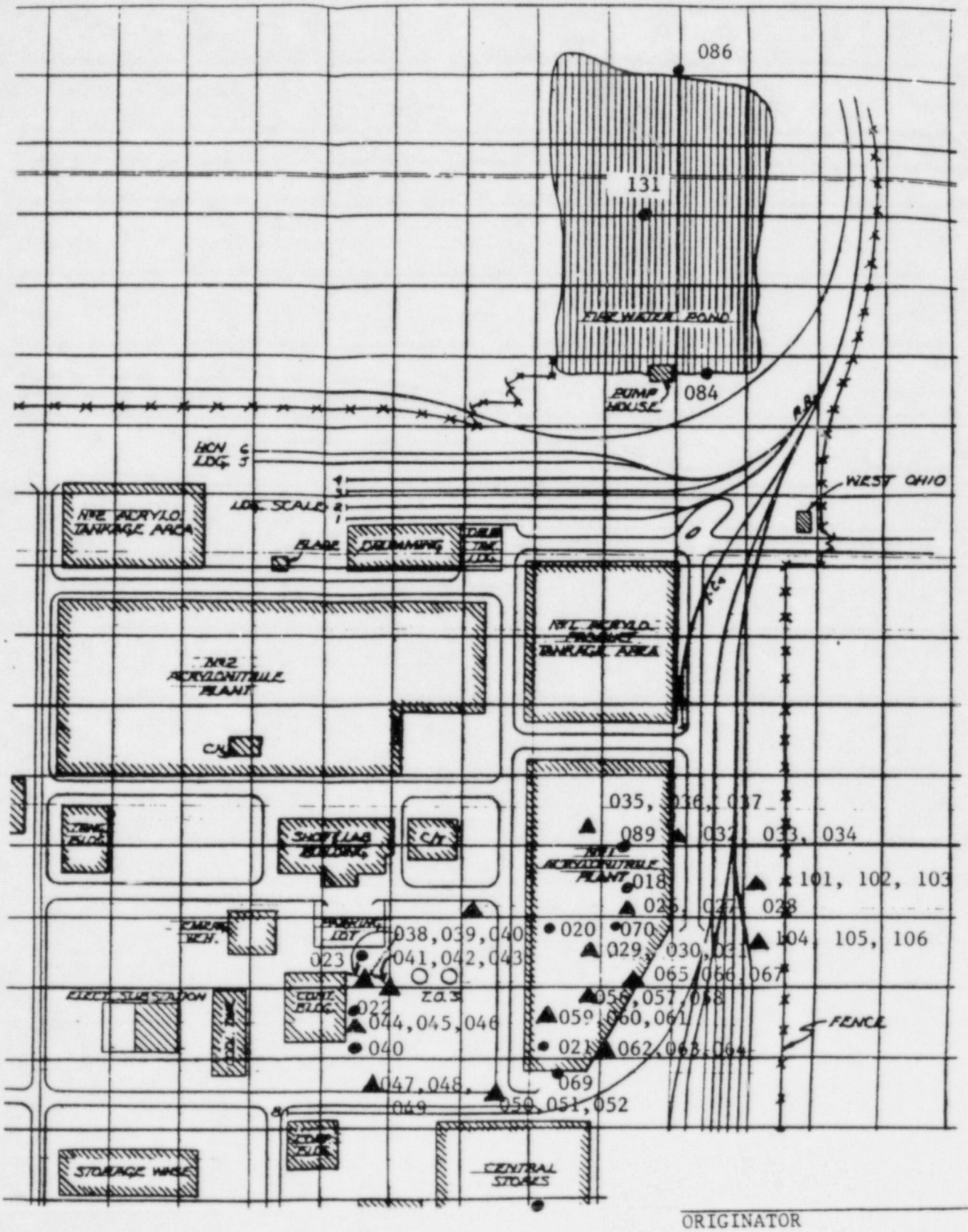
PROJECT NO. 5436-200
LOCATION Catalyst Hoppers
TECHNICIAN R. R. Ruschak
SIGNATURE

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	CPM/ 100 CM^2	SAMPLE TYPE
					<1000	<200
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						

FIELD SURVEY MAP

MAP NO 30
LOCATION Sohio/Vistron Area-A
DATED 8/15/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (13)
▲ Soil Samples (16x3)
X
*

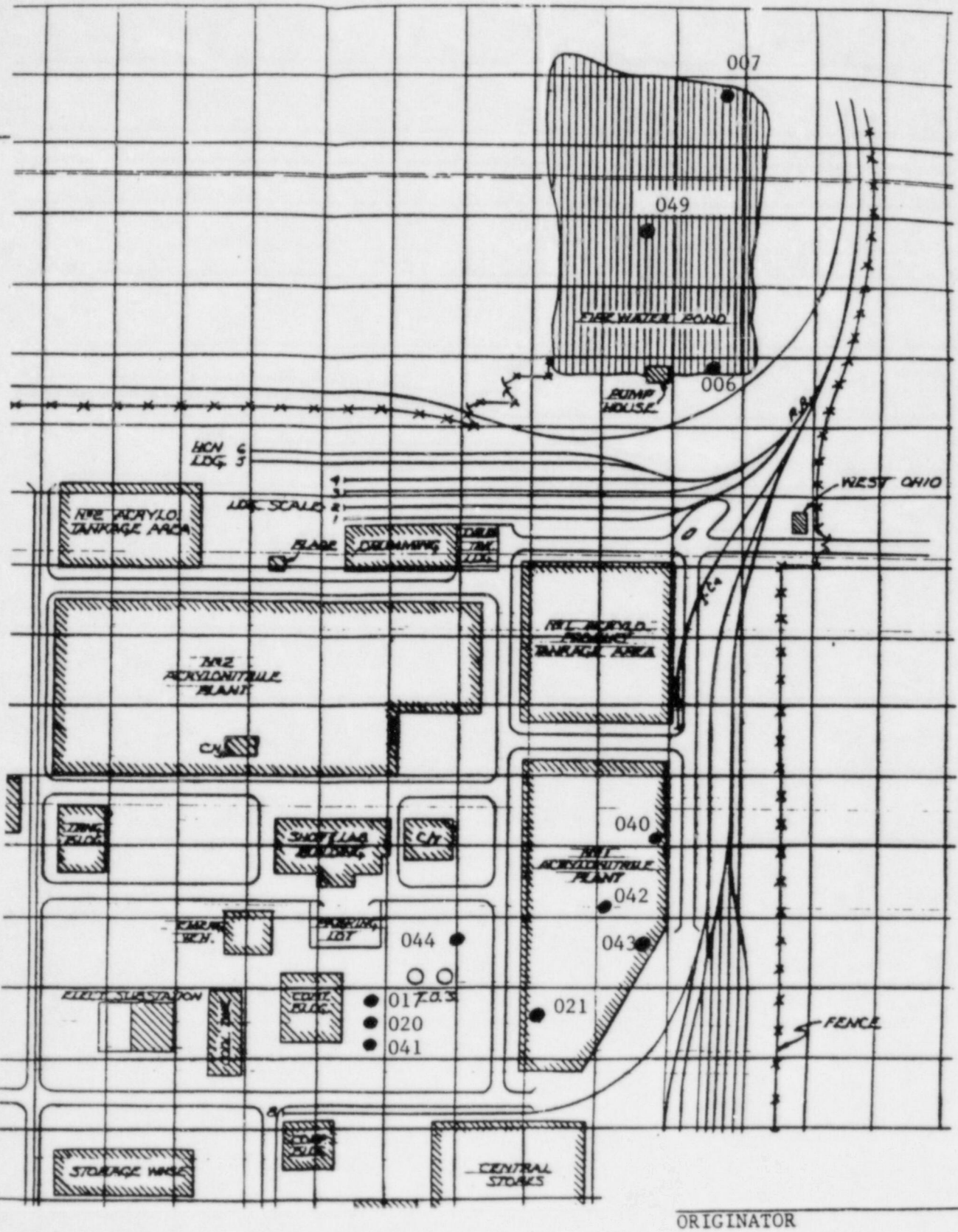


ORIGINATOR

FIELD SURVEY MAP

MAP NO 31
LOCATION SOHIO-Vistron Area-A
DATED 8/25/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (11)
Δ
×
★



ORIGINATOR

FIELD SURVEY MAP

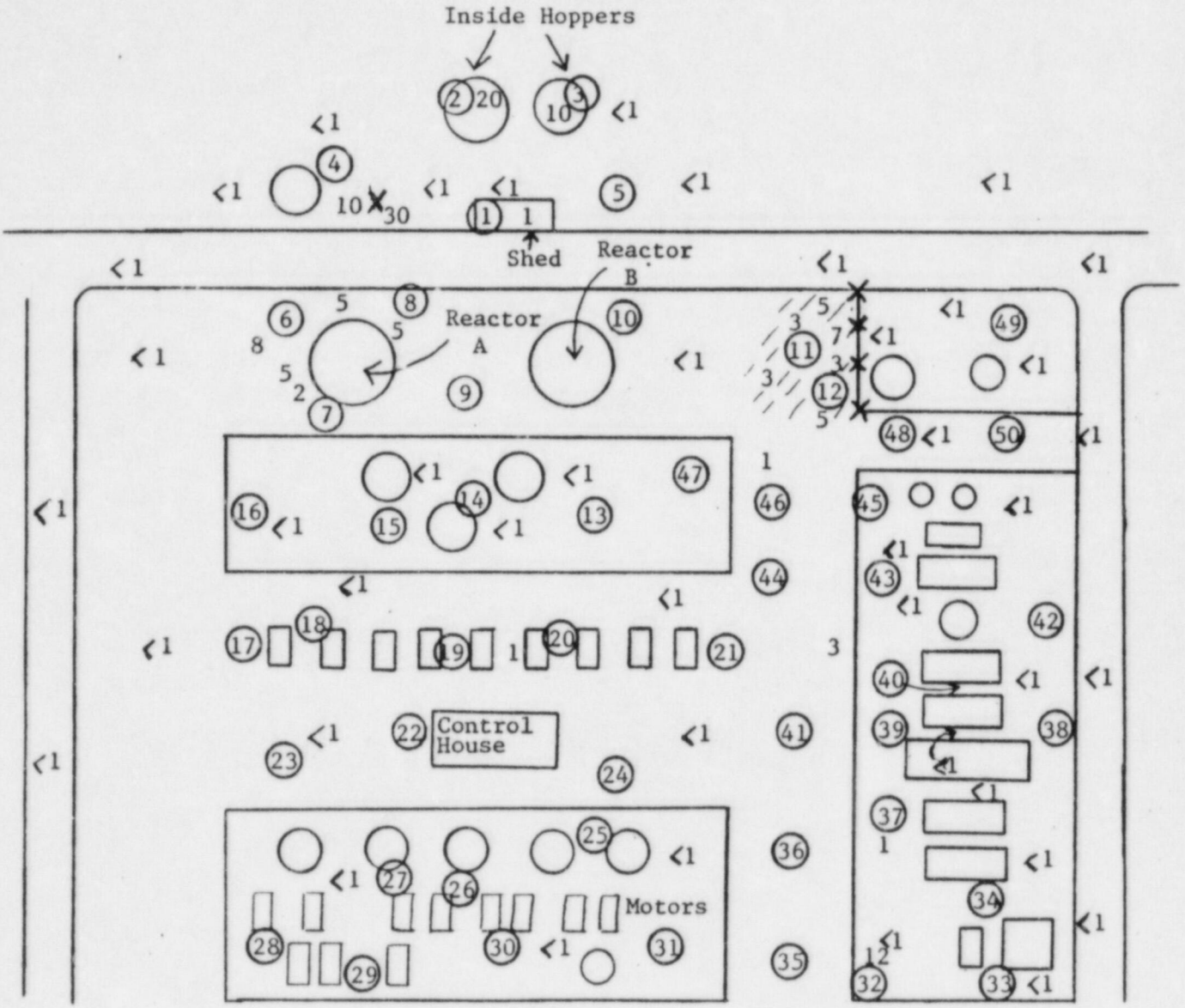
nes

P. 1 of 2

MAP NO 32
LOCATION Sohio/Vistron Plant #2
DATED 8/9/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
(#) Swipes
Δ
× Beam
★

Reddish Colored Soil



ORIGINATOR

1125

FIELD SURVEY DATA SHEET 32 DATE: 8/9/85 PAGE: 2 of 2

CONTAMINATION INSTRUMENTATION
MODEL: RM-20
SERIAL NO: #999
PROBE: HP-210
EFFICIENCY:

RADIATION INSTRUMENTATION
N/A
MODEL:
SERIAL NO:
PROBE:

PROJECT NO. 5436
LOCATION Plant #2
TECHNICIAN F. S. Keithley
SIGNATURE

POINT NO.	3 ft.	2 cm.	2 cmβ	2 cmα	beta/gamma DPM/100 CM^2	alpha DPM/100 cm^2
1.					<1000	<200
2.					↓	↓
3.						
4.					<1000	<200
5.					↓	↓
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
↓					↓	↓
50.					<1000	<200

Remarks: Only fixed contamination detected within Plant #2 area. Spotty fixed contamination found near Reactor A (red colored soil); near shed & hoppers across the road from reactors; and a few areas along overhead pipe tunnel. Area inside hoppers has elevated levels of fixed contamination in concrete floors.

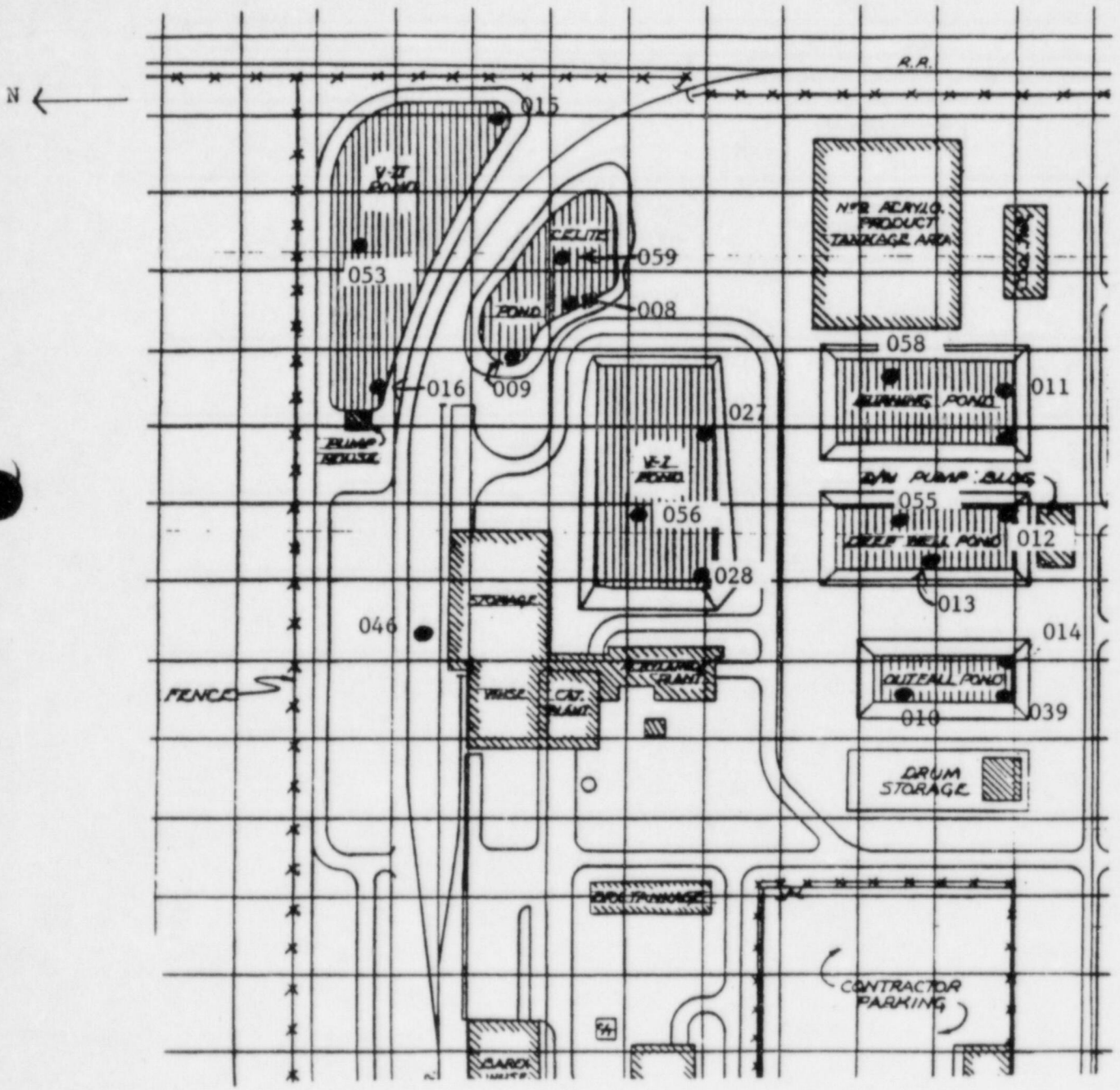
Notes: All readings taken with Eberline RM-20 and HP-210 probe.

FIELD SURVEY MAP

nes

MAP NO 33
LOCATION Sohio/Vistron NES Ponds
DATED 8/25/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (19)
Δ
X
★



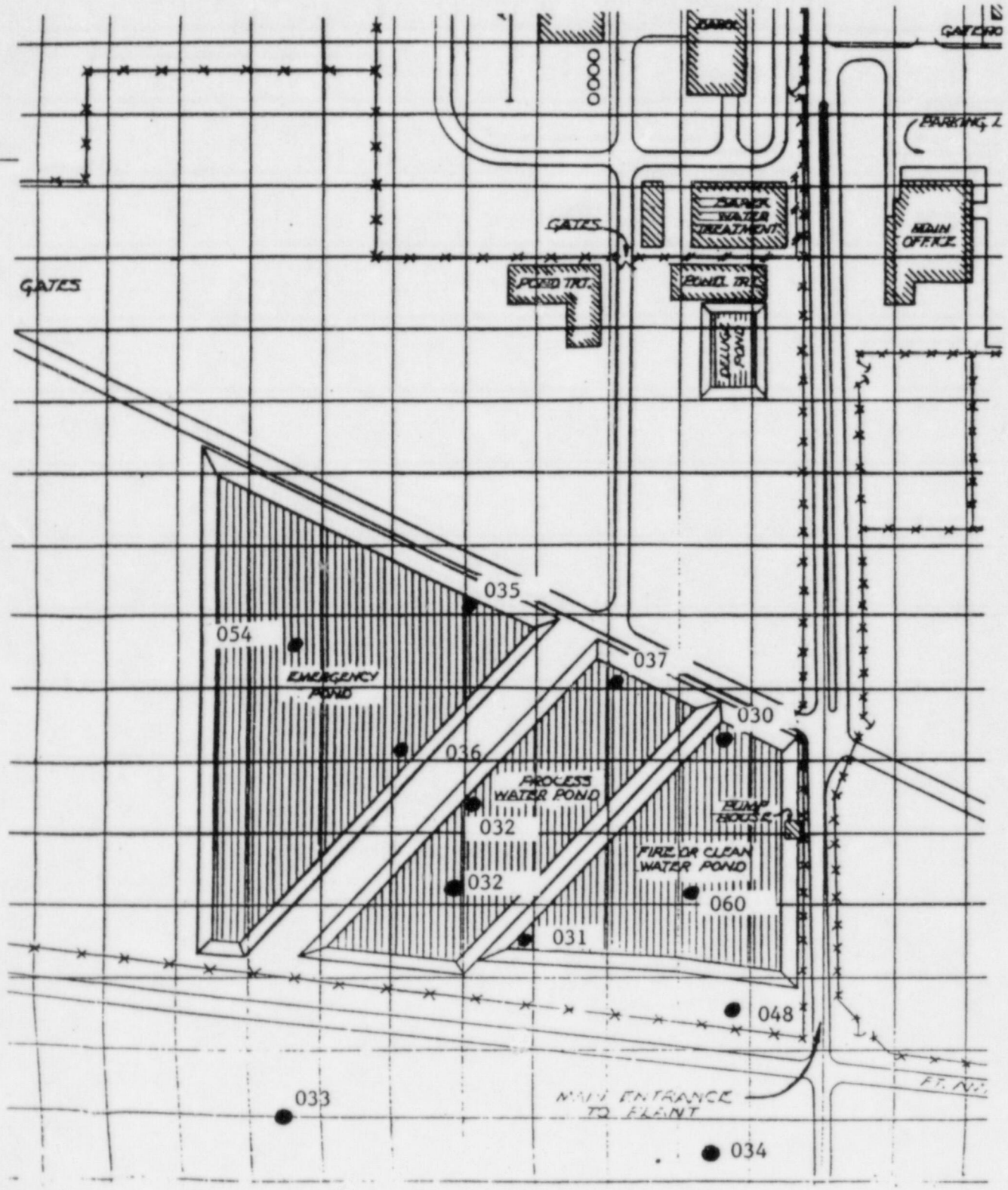
ORIGINATOR

FIELD SURVEY MAP

nes

MAP NO 34
LOCATION Sohio/Vistron NW Ponds
DATED 8/25/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (12)
Δ
×
*



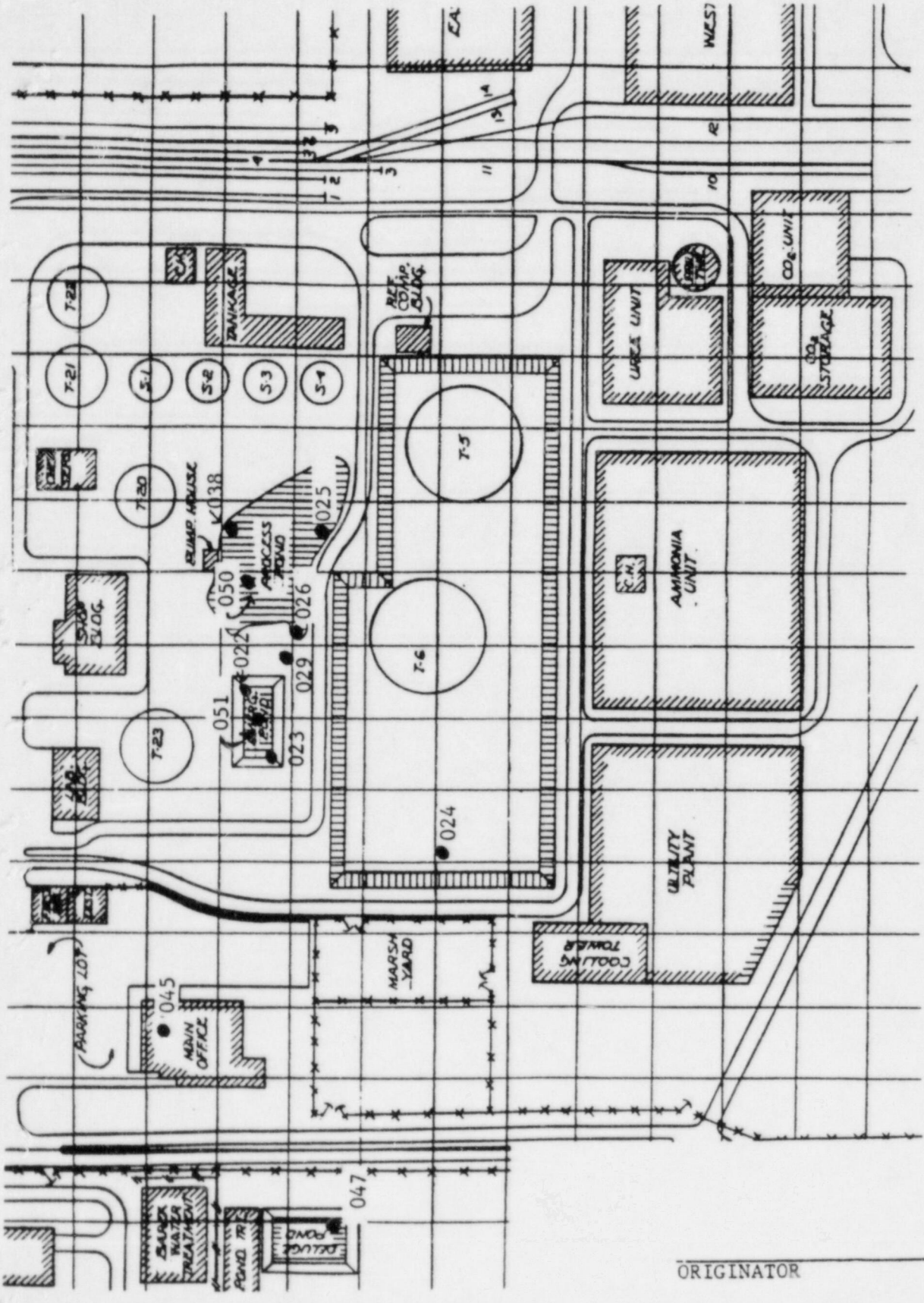
ORIGINATOR

FIELD SURVEY MAP

nes

MAP NO 35
LOCATION Sohio/Vistron
DATED 8/25/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (10)
Δ
×
*



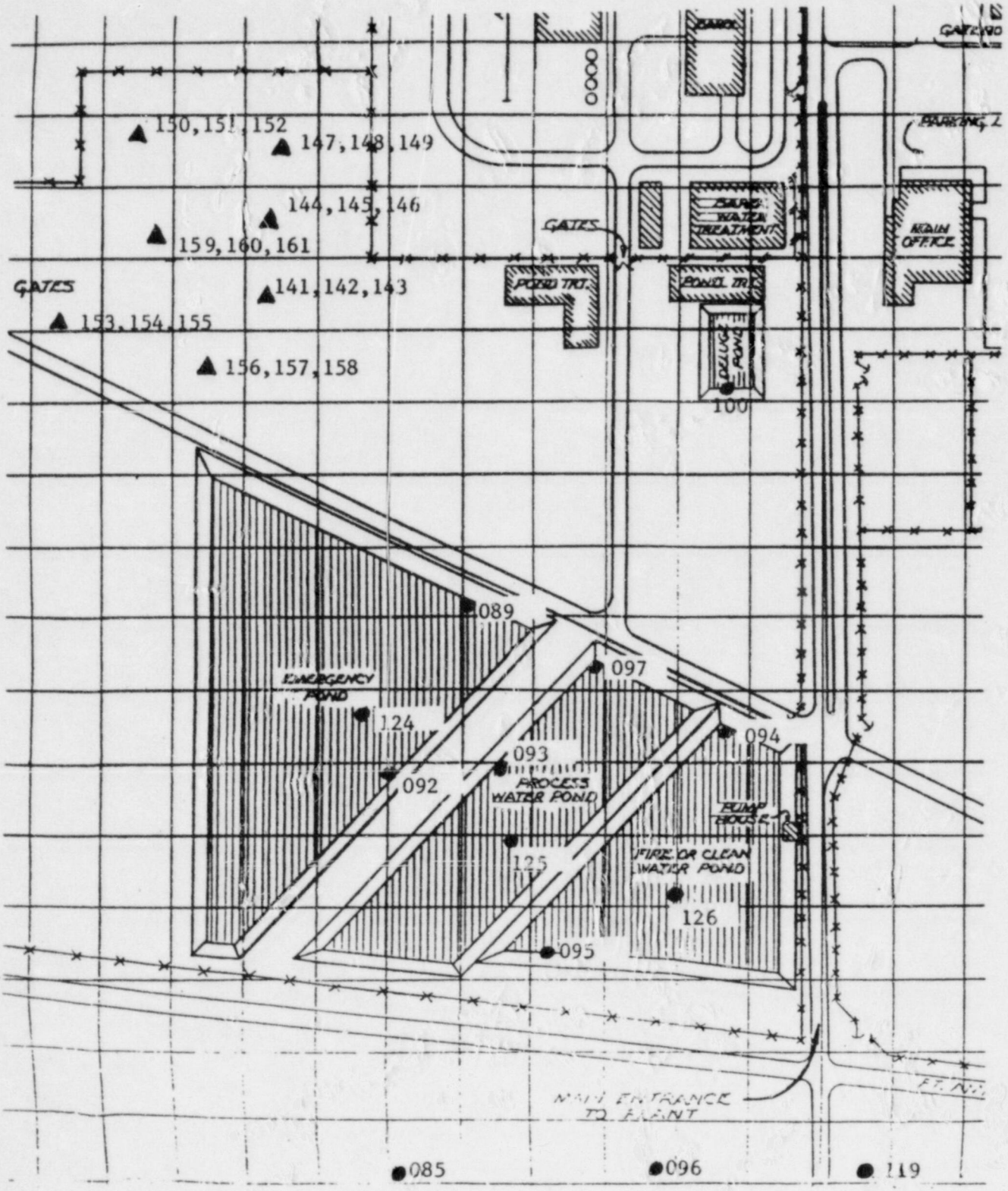
ORIGINATOR

FIELD SURVEY MAP

nes

MAP NO 36
LOCATION Sohio/Vistron NW Ponds
DATED 8/15/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (13)
▲ Soil Samples (7 x 3)
×
★

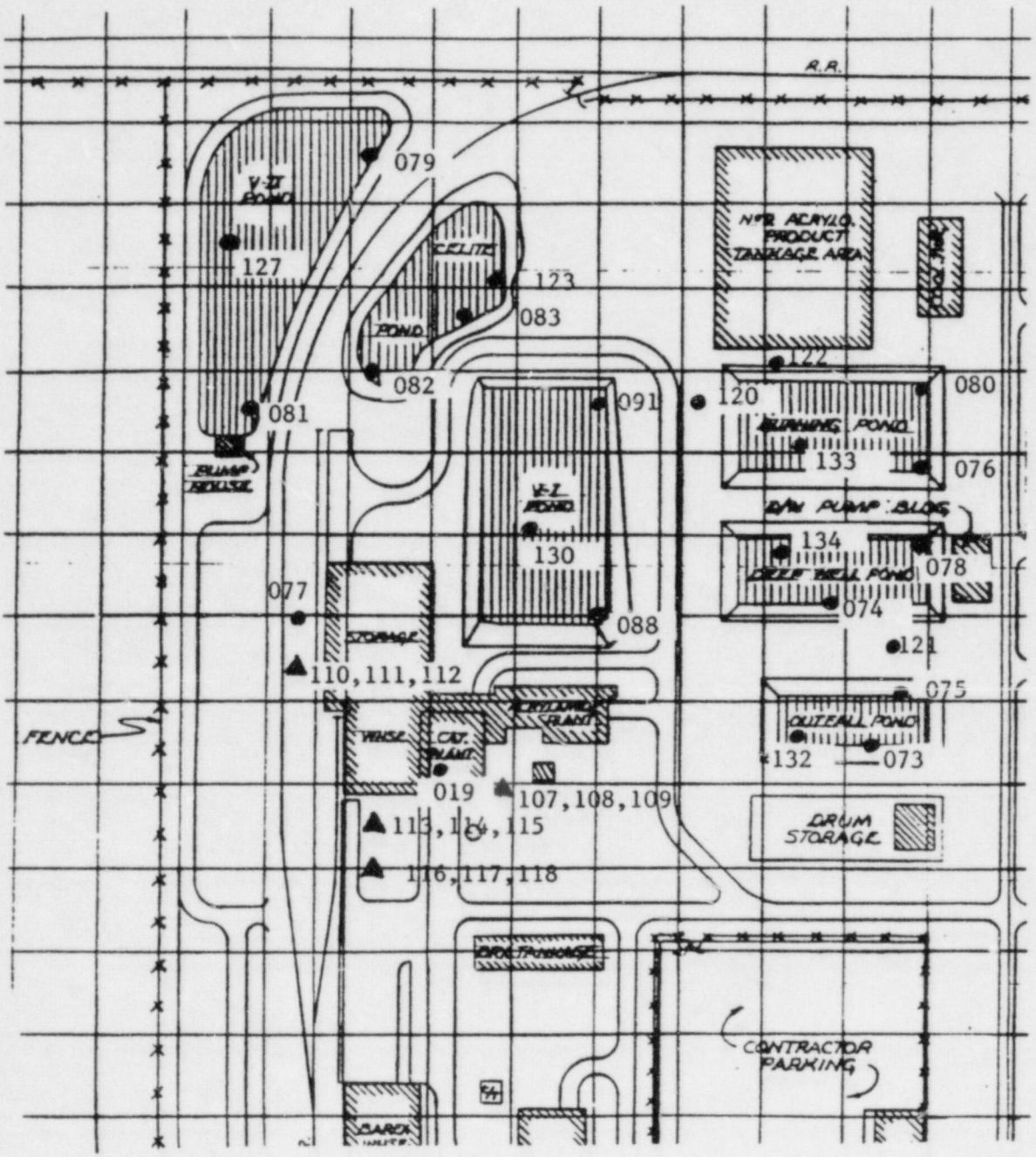


ORIGINATOR

FIELD SURVEY MAP

MAP NO 37
LOCATION Sohio/Vistron NE Ponds
DATED 8/15/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (23)
▲ Soil Samples (4 x 3)
×
★

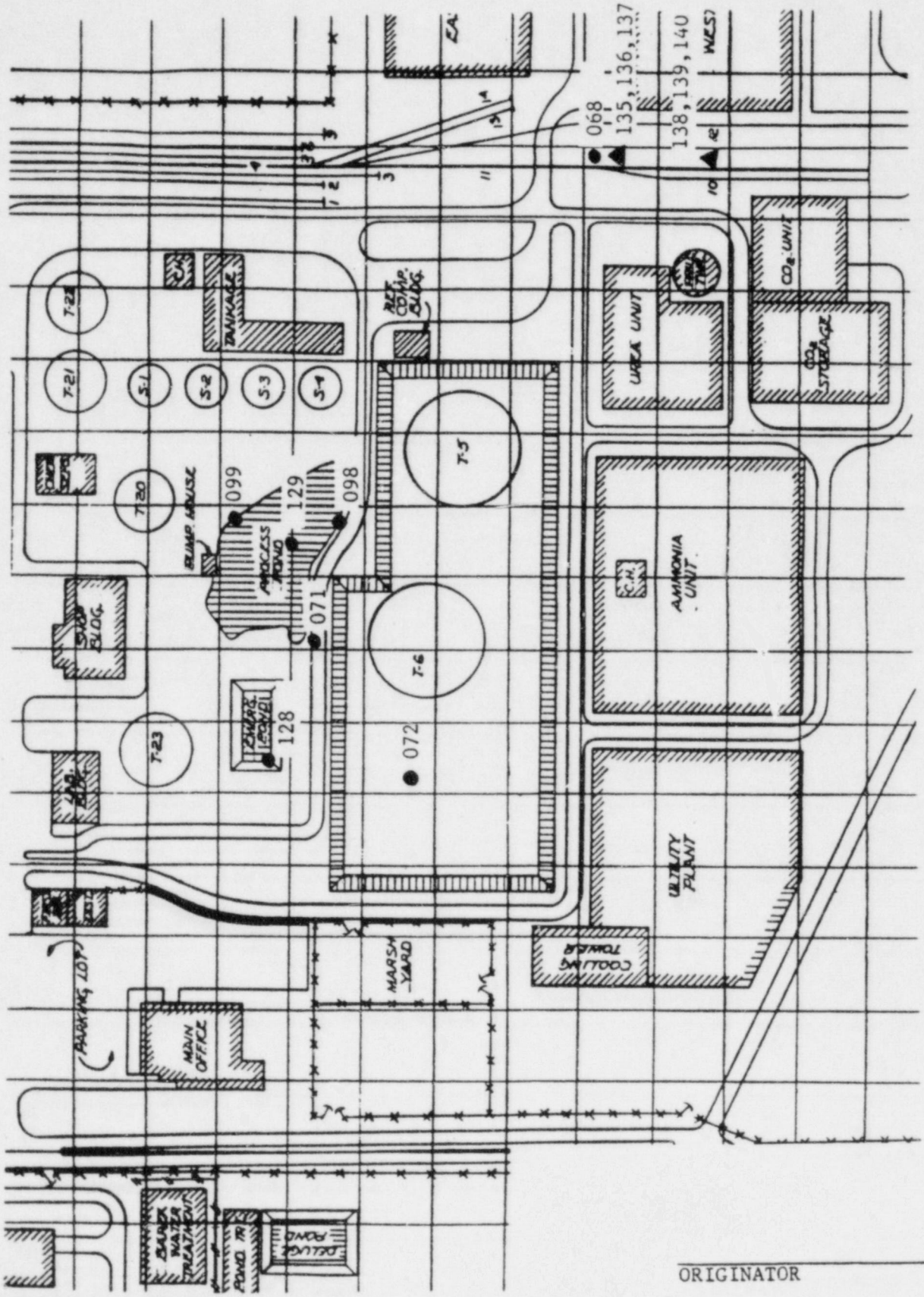


ORIGINATOR

FIELD SURVEY MAP

MAP NO 38
LOCATION Sohio/Vistron
DATED 8/15/85
ORIGINATOR F. S. Keithley
PROJECT 5436

TERRAIN
LEGEND:
● Water Samples (7)
▲ Soil Samples (2 x 3)
×
*



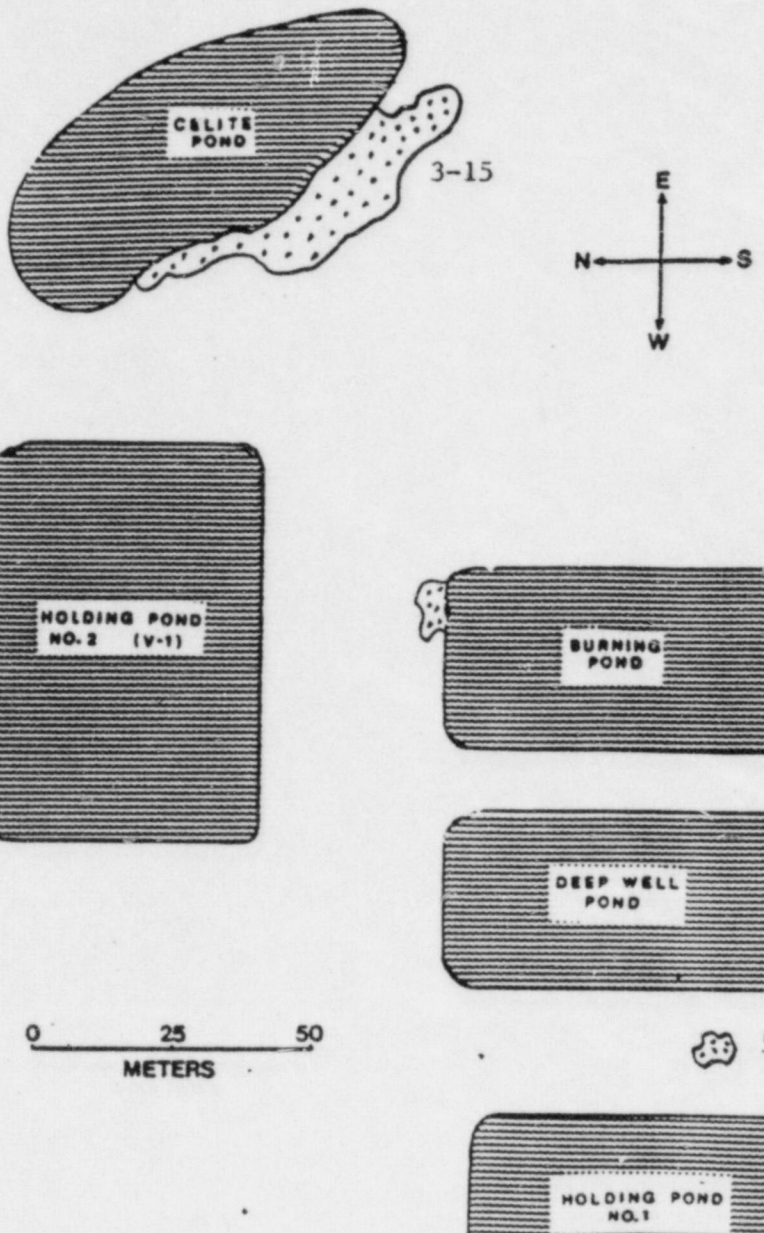
ORIGINATOR

FIELD SURVEY MAP

MAP NO 39
LOCATION Sohio/Vistron NE Boundary
DATED 8/16/85
ORIGINATOR C. J. Marino
PROJECT 5436

TERRAIN Gravel, grass & mud
LEGEND:
0
Δ
X
Contaminated area

All readings by direct probe in dpm



ORIGINATOR

nes

B-2 AIR SAMPLE SURVEY REPORTS

SAMPLE #1 thru SAMPLE #39

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1021 to 1026
AIR SAMPLE NUMBER: 1

PROJECT: 5436-200
LOCATION: 1st Floor Catalyst Plant (West End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1 \text{ ccpm} \times 4.64e^{-12} \text{ uCi/ml/ccpm} = 4.64e^{-12} \text{ uCi/ml}$$

Alpha radioactivity in air is calculated using the following formula:

$$1 \text{ ccpm} \times 1.77e^{-12} \text{ uCi/ml/ccpm} = 1.77e^{-12} \text{ uCi/mi}$$

Technician: [signature] Date: 8/27/85

Supervisor: _____ Date: _____

Project 5436-200 Page 2

Date 8/27/85

Technician R.R. RUSCHAK

NES AIR SAMPLE SHEET

AIR SAMPLE # 1	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	750	3.4×10^{-9}	78	1.4×10^{-10}		
2nd count	450	2.0×10^{-9}	46	8.1×10^{-11}		
3rd count	200	9.2×10^{-10}	33	5.8×10^{-11}		
4th count	100	5.0×10^{-10}	10	1.8×10^{-11}		
5th count	50	$< 5.0 \times 10^{-10}$	5	8.9×10^{-12}		

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0830 to 0835
AIR SAMPLE NUMBER: 2

PROJECT: 5436-200
LOCATION: 1st Floor Catalyst Plant (East End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama		Alpha	
Model #:	RM-20	#999	PRS-2	#549
Efficiency:		10%		30%
Background Count:	50 cpm		0 cpm	

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: [signature] Date: 8/27/85

Supervisor: _____ Date: _____

Project 5436-200 Page

Date 8/27/85

Technician PRPUSCHAK

NES AIR SAMPLE SHEET

AIR SAMPLE # 2	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	800	3.7×10^{-9}	82	1.5×10^{-10}		
2nd count	450	2.0×10^{-9}	50	8.9×10^{-11}		
3rd count	250	1.2×10^{-9}	28	5.0×10^{-11}		
4th count	100	5.0×10^{-10}	12	2.1×10^{-11}		
5th count	50	$< 5.0 \times 10^{-10}$	5	8.9×10^{-12}		

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1352 to 1357
AIR SAMPLE NUMBER: 3

PROJECT: 5436-200
LOCATION: 1st Floor Catalyst Plant (West End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: [signature] Date: 8/27/85

Supervisor: _____ Date: _____

Project 5436-200 Page

Date 8/28/65

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 4	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	650	3.0×10^{-9}	70	1.2×10^{-10}	"	
2nd count	400	1.8×10^{-9}	39	6.9×10^{-11}	"	
3rd count	200	9.2×10^{-10}	21	3.7×10^{-11}	"	
4th count	100	5.0×10^{-10}	9	1.6×10^{-11}	"	
5th count	50	$<5.0 \times 10^{-10}$	6	1.1×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0900 to 0905
AIR SAMPLE NUMBER: 5

PROJECT: 5436-200
LOCATION: Catalyst Plant Office
2nd Floor

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/ml$$

Technician: _____ Date: 8/27/85

Supervisor: _____ Date: _____

Project 5436-200

Date [illegible]

Technician [illegible]

NES AIR SAMPLE SHEET

AIR SAMPLE # 5	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	1000	4.6×10^{-9}	78	1.4×10^{-10}	"	
2nd count	450	2.0×10^{-9}	52	9.2×10^{-11}	"	
3rd count	300	1.4×10^{-9}	28	5.0×10^{-11}	"	
4th count	150	7.0×10^{-10}	16	2.8×10^{-11}	"	
5th count	75	$<5.0 \times 10^{-10}$	7	1.2×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1415 to 1420
AIR SAMPLE NUMBER: 6

PROJECT: 5436-200
LOCATION: 2nd Floor Catalyst Plant (East End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/ml$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

Project 5436-200 Page

Date 5/21/73

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 6	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	750	3.4×10^{-9}	67	1.2×10^{-10}	"	
2nd count	350	1.6×10^{-9}	31	5.5×10^{-11}	"	
3rd count	150	7.0×10^{-10}	12	2.1×10^{-11}	"	
4th count	50	$<5.0 \times 10^{-11}$	12	2.1×10^{-11}	"	
5th count	50	$<5.0 \times 10^{-10}$	6	1.1×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0845 to 0850
AIR SAMPLE NUMBER: 7

PROJECT: 5436-200
LOCATION: 2nd Floor Catalyst Plant (East End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: [signature] Date: 8/27/85

Supervisor: _____ Date: _____

Project 5436-200 Page

Date 9/27/85

Technician [illegible]

NES AIR SAMPLE SHEET

AIR SAMPLE # 7	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	800	3.7×10^{-9}	70	1.2×10^{-10}	"	
2nd count	350	1.6×10^{-9}	40	7.1×10^{-11}	"	
3rd count	200	9.2×10^{-10}	22	3.9×10^{-11}	"	
4th count	100	5.0×10^{-10}	18	3.2×10^{-11}	"	
5th count	50	5.0×10^{-10}	10	1.8×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1100 to 1105
AIR SAMPLE NUMBER: 8

PROJECT: 5436-200
LOCATION: 2nd Floor Catalyst Plant (West End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: [signature] Date: 8/27/85

Supervisor: _____ Date: _____

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Date 2/20/85

Technician [illegible]

NES AIR SAMPLE SHEET

AIR SAMPLE # 8	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity m	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	750	3.4×10^{-9}	66	1.2×10^{-10}	"	
2nd count	350	1.6×10^{-9}	29	5.1×10^{-11}	"	
3rd count	150	7.0×10^{-10}	29	5.1×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	29	5.1×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	12	2.1×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1422 to 1427
AIR SAMPLE NUMBER: 9

PROJECT: 5436-200
LOCATION: 2nd Floor Catalyst Plant (West End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: [signature] Date: 8/27/85

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 9	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	700	3.2×10^{-9}	65	1.2×10^{-10}	"	
2nd count	350	1.6×10^{-9}	40	$7.a \times 10^{-11}$	"	
3rd count	200	9.2×10^{-10}	19	3.4×10^{-11}	"	
4th count	100	5.0×10^{-10}	9	1.6×10^{-11}	"	
5th count	50	5.0×10^{-10}	2	3.5×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1436 to 1441
AIR SAMPLE NUMBER: 10

PROJECT: 5436-200
LOCATION: Catalyst Plant Office
2nd Floor

REMARKS: To determine airborne activity levels

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: 1 m^3

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

1 ccpm x $4.64e^{-12}$ uCi/ml/ccpm = $4.64e^{-12}$ uCi/ml

Alpha radioactivity in air is calculated using the following formula:

1 ccpm x $1.77e^{-12}$ uCi/ml/ccpm = $1.77e^{-12}$ uCi/mi

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 10	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	900	4.2×10^{-9}	69	1.2×10^{-10}	"	
2nd count	400	1.8×10^{-9}	52	9.2×10^{-11}	"	
3rd count	250	1.2×10^{-9}	22	3.9×10^{-11}	"	
4th count	150	7.9×10^{-10}	10	1.77×10^{-11}	"	
5th count	75	5.0×10^{-10}	5	8.9×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1430 to 1435
AIR SAMPLE NUMBER: 11

PROJECT: 5436-200
LOCATION: Catalyst Plant Office
2nd Floor

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: 8/27/85

Supervisor: _____ Date: _____

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Date 4/27/65

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 11	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	950	4.4×10^{-9}	80	1.4×10^{-10}	"	
2nd count	500	2.3×10^{-9}	43	7.6×10^{-11}	"	
3rd count	250	1.2×10^{-9}	28	5.0×10^{-11}	"	
4th count	100	5.0×10^{-10}	12	2.1×10^{-11}	"	
5th count	50	5.0×10^{-10}	7	1.2×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0930 to 0935
AIR SAMPLE NUMBER: 12

PROJECT: 5436-200
LOCATION: Catalyst Plant
3rd Floor

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama		Alpha	
Model #:	RM-20	#999	PRS-2	#549
Efficiency:		10%		30%
Background Count:	50 cpm		0 cpm	

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 12	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	650	3.0×10^{-9}	70	1.2×10^{-10}	"	
2nd count	400	1.8×10^{-9}	45	8.0×10^{-11}	"	
3rd count	250	1.2×10^{-9}	27	4.8×10^{-11}	"	
4th count	100	5.0×10^{-10}	14	2.5×10^{-10}	"	
5th count	50	$<5.0 \times 10^{-10}$	4	7.1×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930 to 0935
AIR SAMPLE NUMBER: 13

PROJECT: 5436-200
LOCATION: Catalyst Plant 3rd Floor

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

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Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 13	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	550	2.6×10^{-9}	77	1.4×10^{-10}	"	
2nd count	350	1.6×10^{-9}	33	5.8×10^{-11}	"	
3rd count	200	9.3×10^{-10}	18	3.2×10^{-11}	"	
4th count	100	5.0×10^{-10}	12	2.1×10^{-11}	"	
5th count	50	5.0×10^{-10}	5	8.9×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930 to
AIR SAMPLE NUMBER: 14

PROJECT: 5436-200
LOCATION: Catalyst Plant 3rd Floor

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/ml$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 14	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	600	2.8×10^{-9}	80	1.4×10^{-10}	"	
2nd count	400	1.8×10^{-9}	39	6.9×10^{-11}	"	
3rd count	200	9.3×10^{-10}	19	3.4×10^{-11}	"	
4th count	100	5.0×10^{-10}	13	2.3×10^{-11}	"	
5th count	50	$<5.0 \times 10^{-10}$	8	1.4×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0957 to 1002
AIR SAMPLE NUMBER: 15

PROJECT: 5436-200
LOCATION: Catalyst Plant Office
2nd Floor

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: 8-27-85

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 15	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	950	4.4×10^{-9}	77	1.4×10^{-10}	"	
2nd count	450	2.1×10^{-9}	60	1.1×10^{-10}	"	
3rd count	400	1.8×10^{-9}	29	5.1×10^{-11}	"	
4th count	200	9.2×10^{-10}	21	3.7×10^{-11}	"	
5th count	75	$< 5.0 \times 10^{-10}$	10	1.8×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0930
AIR SAMPLE NUMBER: 16

PROJECT: 5436-200
LOCATION: Catalyst Plant 3rd Floor

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 16	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	600	2.8×10^{-9}	78	1.4×10^{-10}	"	
2nd count	400	1.8×10^{-9}	38	6.7×10^{-11}	"	
3rd count	200	9.3×10^{-10}	22	3.9×10^{-11}	"	
4th count	100	5.0×10^{-10}	14	2.5×10^{-11}	"	
5th count	50	5.0×10^{-10}	3	5.3×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0915 to 0920
AIR SAMPLE NUMBER: 17

PROJECT: 5436-200
LOCATION: 4th Floor Catalyst Plant (East End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

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Date 5/2/65

Technician [illegible]

NES AIR SAMPLE SHEET

AIR SAMPLE # 17	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	600	2.8×10^{-9}	62	1.1×10^{-10}	"	
2nd count	350	1.6×10^{-9}	35	6.0×10^{-11}	"	
3rd count	100	5.0×10^{-10}	16	2.8×10^{-11}	"	
4th count	50	$<5.0 \times 10^{-10}$	8	1.4×10^{-11}	"	
5th count	50	$<5.0 \times 10^{-10}$	2	3.5×10^{-12}		

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1034 to 1039
AIR SAMPLE NUMBER: 18

PROJECT: 5436-200
LOCATION: 4th Floor Catalyst Plant (West End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: 1 m^3

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1 \text{ ccpm} \times 4.64e^{-12} \text{ uCi/ml/ccpm} = 4.64e^{-12} \text{ uCi/ml}$$

Alpha radioactivity in air is calculated using the following formula:

$$1 \text{ ccpm} \times 1.77e^{-12} \text{ uCi/ml/ccpm} = 1.77e^{-12} \text{ uCi/mi}$$

Technician: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 18	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	650	3.0×10^{-9}	65	1.2×10^{-10}	"	
2nd count	350	1.6×10^{-9}	39	6.9×10^{-11}	"	
3rd count	150	7.0×10^{-10}	18	3.2×10^{-11}	"	
4th count	80	$< 5.0 \times 10^{-10}$	7	8.0×10^{-12}	"	
5th count	50	$< 5.0 \times 10^{-11}$	1	1.8×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1400 to 1405
AIR SAMPLE NUMBER: 19

PROJECT: 5436-200
LOCATION: 4th Floor Catalyst Plant (East End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama		Alpha	
Model #:	RM-20	#999	PRS-2	#549
Efficiency:		10%		30%
Background Count:	50 cpm		0 cpm	

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

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Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 19	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	500	2.3×10^{-9}	58	1.0×10^{-10}	"	
2nd count	300	1.4×10^{-9}	30	5.3×10^{-10}	"	
3rd count	150	7.0×10^{-10}	17	3.0×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	10	1.77×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	6	1.1×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 1407 to 1412
AIR SAMPLE NUMBER: 20

PROJECT: 5436-200
LOCATION: 4th Floor Catalyst Plant (West End)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: 1 m^3

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

1 ccpm x $4.64e^{-12}$ uCi/ml/ccpm = $4.64e^{-12}$ uCi/ml

Alpha radioactivity in air is calculated using the following formula:

1 ccpm x $1.77e^{-12}$ uCi/ml/ccpm = $1.77e^{-12}$ uCi/mi

Technician: [signature] Date: 8/27/85

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 20	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	550	2.6×10^{-9}	59	1.0×10^{-10}	"	
2nd count	300	1.4×10^{-9}	23	4.1×10^{-11}	"	
3rd count	150	7.0×10^{-10}	11	1.9×10^{-11}	"	
4th count	100	5.0×10^{-10}	7	1.2×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	1	1.8×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0930
AIR SAMPLE NUMBER: 21

PROJECT: 5436-200
LOCATION: Catalyst Plant
Adjacent Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = \qquad uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

Project 5436-200 Page

Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 21	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	650	3.0×10^{-9}	92	1.6×10^{-10}	"	
2nd count	450	1.8×10^{-9}	40	7.1×10^{-11}	"	
3rd count	250	1.2×10^{-9}	31	5.5×10^{-11}	"	
4th count	100	5.0×10^{-10}	15	2.7×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	12	2.1×10^{-10}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0930
AIR SAMPLE NUMBER: 22

PROJECT: 5436-200
LOCATION: Catalyst Plant
Adjacent Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama		Alpha	
Model #:	RM-20	#999	PRS-2	#549
Efficiency:		10%		30%
Background Count:	50 cpm		0 cpm	

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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NES AIR SAMPLE SHEET

AIR SAMPLE # 22	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	800	3.7×10^{-9}	90	1.6×10^{-11}	"	
2nd count	400	1.8×10^{-9}	45	8.0×10^{-11}	"	
3rd count	200	9.3×10^{-10}	16	2.8×10^{-11}	"	
4th count	100	5.0×10^{-10}	17	3.0×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	8	1.4×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930
AIR SAMPLE NUMBER: 23

PROJECT: 5436-200
LOCATION: Catalyst Plant
Adjacent Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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NES AIR SAMPLE SHEET

AIR SAMPLE # 23	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	700	3.2×10^{-9}	85	1.5×10^{-10}	"	
2nd count	400	1.8×10^{-9}	42	3.5×10^{-12}	"	
3rd count	200	9.3×10^{-10}	18	3.2×10^{-11}	"	
4th count	100	5.0×10^{-10}	15	2.7×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	6	1.1×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930
AIR SAMPLE NUMBER: 24

PROJECT: 5436-200
LOCATION: Catalyst Plant
Adjacent Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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NES AIR SAMPLE SHEET

AIR SAMPLE # 24	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	700	3.2×10^{-9}	105	1.9×10^{-10}	"	
2nd count	400	1.8×10^{-9}	36	6.4×10^{-11}	"	
3rd count	200	9.3×10^{-10}	32	5.7×10^{-11}	"	
4th count	100	5.0×10^{-10}	15	2.7×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	6	1.1×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930
AIR SAMPLE NUMBER: 25

PROJECT: 5436-200
LOCATION: Catalyst Plant
"A" Frame Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

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NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930
AIR SAMPLE NUMBER: 26

PROJECT: 5436-200
LOCATION: Catalyst Plant
"A" Frame Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 26	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	1000	4.6×10^{-9}	95	1.7×10^{-10}	"	
2nd count	600	2.8×10^{-9}	75	1.3×10^{-10}	"	
3rd count	300	1.4×10^{-9}	36	6.4×10^{-11}	"	
4th count	200	9.3×10^{-10}	20	3.5×10^{-11}	"	
5th count	100	5.0×10^{-10}	8	1.4×10^{-11}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930
AIR SAMPLE NUMBER: 27

PROJECT: 5436-200
LOCATION: Catalyst Plant
"A" Frame Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 27	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	950	4.4×10^{-9}	102	1.8×10^{-10}	"	
2nd count	600	2.8×10^{-9}	78	1.4×10^{-10}	"	
3rd count	400	1.8×10^{-9}	39	6.9×10^{-10}	"	
4th count	200	9.3×10^{-10}	22	3.9×10^{-11}	"	
5th count	100	5.0×10^{-10}	5	8.9×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/27/85
TIME: 0930
AIR SAMPLE NUMBER: 28

PROJECT: 5436-200
LOCATION: Catalyst Plant
"A" Frame Warehouse

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

1 ccpm x $4.64e^{-12}$ uCi/ /ccpm = $4.64e^{-12}$ uCi/ml

Alpha radioactivity in air is calculated using the following formula:

1 ccpm x $1.77e^{-12}$ uCi/ml/ccpm = $1.77e^{-12}$ uCi/ml

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 28	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	1100	5.1×10^{-9}	97	1.7×10^{-10}	"	
2nd count	700	3.2×10^{-9}	85	1.5×10^{-10}	"	
3rd count	400	1.8×10^{-9}	40	7.1×10^{-11}	"	
4th count	200	9.3×10^{-10}	21	3.7×10^{-11}	"	
5th count	100	5.0×10^{-10}	4	7.1×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900
AIR SAMPLE NUMBER: 29

PROJECT: 5436-200
LOCATION: Central Stores
(Old Urea Warehouse)

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 29	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	400	1.8×10^{-9}	45	8.0×10^{-11}	"	
2nd count	200	9.3×10^{-10}	19	3.4×10^{-11}	"	
3rd count	200	9.3×10^{-10}	18	3.2×10^{-11}	"	
4th count	100	5.0×10^{-10}	8	1.4×10^{-12}	"	
5th count	50	$<5.0 \times 10^{-10}$	3	5.3×10^{-12}		

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900 to 0905
AIR SAMPLE NUMBER: 30

PROJECT: 5436-200
LOCATION: Central Stores - Gas Cylinder Bays

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/ml$$

Technician: _____ Date: 8/28/85

Supervisor: _____ Date: _____

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Date 5/27/65

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NES AIR SAMPLE SHEET

AIR SAMPLE # 30	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	300	1.4×10^{-9}	30	5.3×10^{-11}	"	
2nd count	150	7.0×10^{-10}	12	2.1×10^{-11}	"	
3rd count	50	$< 5.0 \times 10^{-10}$	11	1.9×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	4	7.1×10^{-12}	"	
5th count						
* NOTE: Sample counted every 30 minutes						

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0915 to 0920
AIR SAMPLE NUMBER: 31

PROJECT: 5436-200
LOCATION: Central Stores Bay F

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: 8/28/85

Supervisor: _____ Date: _____

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NES AIR SAMPLE SHEET

AIR SAMPLE # 31	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	300	1.4×10^{-9}	30	5.3×10^{-11}	"	
2nd count	200	9.2×10^{-10}	30	5.3×10^{-11}	"	
3rd count	100	5.0×10^{-10}	16	2.8×10^{-11}	"	
4th count	50	$<5.0 \times 10^{-10}$	4	7.1×10^{-12}	"	
5th count	50	$<5.0 \times 10^{-10}$	1	1.8×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0945 to 0950
AIR SAMPLE NUMBER: 32

PROJECT: 5436-200
LOCATION: Central Stores Bay F

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/ml$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

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NES AIR SAMPLE SHEET

AIR SAMPLE # 32	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	350	1.6×10^{-9}	35	6.2×10^{-11}	"	
2nd count	250	1.2×10^{-9}	33	5.8×10^{-11}	"	
3rd count	50	$< 5.0 \times 10^{-10}$	22	3.9×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	6	1.1×10^{-11}		
5th count						

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0930 to 0935
AIR SAMPLE NUMBER: 33

PROJECT: 5436-200
LOCATION: Central Stores Gas Cylinder Bay

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5387

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: [signature] Date: 8/28/85

Supervisor: _____ Date: _____

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NES AIR SAMPLE SHEET

AIR SAMPLE # 33	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	250	1.2×10^{-9}	29	5.1×10^{-11}	"	
2nd count	150	7.0×10^{-10}	10	1.77×10^{-11}	"	
3rd count	50	$< 5.0 \times 10^{-10}$	12	2.1×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	3	5.3×10^{-12}	"	
5th count						

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900
AIR SAMPLE NUMBER: 34

PROJECT: 5436-200
LOCATION: Central Stores

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

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NES AIR SAMPLE SHEET

AIR SAMPLE # 34	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	400	1.8×10^{-9}	35	6.2×10^{-11}	"	
2nd count	250	1.1×10^{-9}	29	5.1×10^{-11}	"	
3rd count	100	5.0×10^{-10}	16	2.8×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	5	8.9×10^{-12}	"	
5th count						
* NOTE: Sample counted every 30 minutes						

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900
AIR SAMPLE NUMBER: 35

PROJECT: 5436-200
LOCATION: Central Stores

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1 \text{ ccpm} \times 4.64e^{-12} \text{ uCi/ml/ccpm} = 4.64e^{-12} \text{ uCi/ml}$$

Alpha radioactivity in air is calculated using the following formula:

$$1 \text{ ccpm} \times 1.77e^{-12} \text{ uCi/ml/ccpm} = 1.77e^{-12} \text{ uCi/mi}$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

Project 5436-200 Page

Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 35	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	300	1.4×10^{-9}	25	4.4×10^{-11}	"	
2nd count	200	9.3×10^{-10}	20	3.5×10^{-11}	"	
3rd count	100	5.0×10^{-10}	16	2.8×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	7	1.2×10^{-11}	"	
5th count						

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900
AIR SAMPLE NUMBER: 36

PROJECT: 5436-200
LOCATION: Central Stores

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

Project 5436-200 Page

Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 36	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	300	1.4×10^{-9}	22	3.9×10^{-11}	"	
2nd count	150	7.0×10^{-10}	23	4.1×10^{-11}	"	
3rd count	100	5.0×10^{-10}	18	3.2×10^{-11}	"	
4th count	50	5.0×10^{-10}	9	1.6×10^{-11}	"	
5th count						

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900
AIR SAMPLE NUMBER: 37

PROJECT: 5436-200
LOCATION: Central Stores

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama		Alpha	
Model #:	RM-20	#999	PRS-2	#549
Efficiency:		10%		30%
Background Count:	50 cpm		0 cpm	

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

Project 5436-200 Page

Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 37	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	350	1.6×10^{-9}	40	7.1×10^{-11}	"	
2nd count	200	9.3×10^{-10}	20	3.5×10^{-11}	"	
3rd count	150	7.0×10^{-10}	17	3.0×10^{-11}	"	
4th count	100	5.0×10^{-10}	9	1.6×10^{-11}	"	
5th count	50	$<5.0 \times 10^{-10}$	3	5.3×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900
AIR SAMPLE NUMBER: 38

PROJECT: 5436-200
LOCATION: Central Stores

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

Project 5436-200 Page

Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 38	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	300	1.4×10^{-9}	23	4.1×10^{-11}	"	
2nd count	200	9.3×10^{-10}	20	3.5×10^{-11}	"	
3rd count	100	5.0×10^{-10}	16	2.8×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	9	1.6×10^{-11}	"	
5th count	50	$< 5.0 \times 10^{-10}$	4	7.1×10^{-12}	"	

* NOTE: Sample counted every 30 minutes

NES AIR SAMPLE SURVEY REPORT

DATE: 8/28/85
TIME: 0900
AIR SAMPLE NUMBER: 39

PROJECT: 5436-200
LOCATION: Nitrogen Maintenance Bldg

REMARKS: To determine airborne activity levels.

AIR SAMPLES

Model #: 5388

Sample Rate: 7 CFM CFM ($35ft^3 = 1\ m^3$)

Sample Time: 5 min.

Total Volume: $1\ m^3$

COUNTING SYSTEM

	Beta Gama	Alpha
Model #:	RM-20 #999	PRS-2 #549
Efficiency:	10%	30%
Background Count:	50 cpm	0 cpm

Background Count Time: 1 min.

Sample Count Time: 1 min.

Net Sample Count: See Page 2

CALCULATIONS

Beta-gamma radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 4.64e^{-12}\ uCi/ml/ccpm = 4.64e^{-12}\ uCi/ml$$

Alpha radioactivity in air is calculated using the following formula:

$$1\ ccpm \times 1.77e^{-12}\ uCi/ml/ccpm = 1.77e^{-12}\ uCi/mi$$

Technician: _____ Date: _____

Supervisor: _____ Date: _____

Project 5436-200 Page

Date

Technician

NES AIR SAMPLE SHEET

AIR SAMPLE # 39	beta/gamma ccpm	beta/gamma air activity uCi/ml	alpha ccpm	alpha air activity uCi/ml	Method Employed	Remarks
Minimum Detectable Activity	100	5.0×10^{-10}	1	1.8×10^{-12}	Radeco Air Sampler	
1st count	200	9.3×10^{-10}	19	3.4×10^{-11}	"	
2nd count	75	3.5×10^{-10}	17	3.0×10^{-11}	"	
3rd count	50	$< 5.0 \times 10^{-10}$	8	1.4×10^{-11}	"	
4th count	50	$< 5.0 \times 10^{-10}$	7	1.2×10^{-11}	"	
5th count						

* NOTE: Sample counted every 30 minutes

B-3 SOIL SAMPLE ANALYSIS

B-3

SOIL SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SERIAL NUMBER	CONTENT (pCi/gm) Uranium
Reactor D Enclosure	NES-S-0018	97.27
Catalyst Plant silica hopper	NES-S-0019	2.55
Hopper Tanks	NES-S-0020	52.99
NH3 near concrete slab	NES-S-0021	0.57
Catalyst Settling Tank	NES-S-0022	230.42
Area-A derrick #1	NES-S-0023	2.22
Urea Warehouse #18 gas storage bay	NES-S-0025	6.27
Area-A grounds	NES-S-0026	2.22
Area-A grounds	NES-S-0027	<0.30
Area-A grounds	NES-S-0028	0.60
Area-A grounds	NES-S-0029	<0.30
Area-A grounds	NES-S-0030	<0.30
Area-A grounds	NES-S-0031	25.95
Area-A grounds	NES-S-0032	0.99
Area-A grounds	NES-S-0033	<0.30
Area-A grounds	NES-S-0034	<0.30
Area-A grounds	NES-S-0035	<0.30
Area-A grounds	NES-S-0036	<0.30
Area-A grounds	NES-S-0037	0.47
Area-A grounds	NES-S-0038	2.65
Area-A grounds	NES-S-0039	0.87
Area-A grounds	NES-S-0040	<0.30
Area-A grounds	NES-S-0041	<0.30
Area-A grounds	NES-S-0042	<0.30
Area-A grounds	NES-S-0043	<0.30
Area-A grounds	NES-S-0044	3.52
Area-A grounds	NES-S-0045	5.00
Area-A grounds	NES-S-0046	0.69
Area-A grounds	NES-S-0047	<0.30
Area-A grounds	NES-S-0048	<0.30
Area-A grounds	NES-S-0049	<0.30
Area-A grounds	NES-S-0050	0.85
Area-A grounds	NES-S-0051	3.22
Area-A grounds	NES-S-0052	2.66
Area-A grounds	NES-S-0053	8.72
Area-A grounds	NES-S-0054	<0.30
Area-A grounds	NES-S-0055	3.32
Area-A grounds	NES-S-0056	2.16
Area-A grounds	NES-S-0057	2.41
Area-A grounds	NES-S-0058	8.76
Area-A grounds	NES-S-0059	<0.30
Area-A grounds	NES-S-0060	<0.30

B-3

SOIL SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SERIAL NUMBER	CONTENT (pCi/gm) Uranium
Area-A grounds	NES-S-0061	1.03
Area-A grounds	NES-S-0062	20.41
Area-A grounds	NES-S-0063	1.06
Area-A grounds	NES-S-0064	0.74
Area-A grounds	NES-S-0065	9.68
Area-A grounds	NES-S-0066	11.27
Area-A grounds	NES-S-0067	< 0.30
Urea warehouse #2 gravel	NES-S-0068	< 0.30
A-frame warehouse north wall	NES-S-0077	< 0.30
Area-A drain south of roadway	NES-S-0101	0.88
	NES-S-0102	< 0.30
	NES-S-0103	< 0.30
Area-A between railroad tracks	NES-S-0104	< 0.30
	NES-S-0105	0.47
	NES-S-0106	< 0.30
Catalyst Plant #4 south side	NES-S-0107	< 0.30
	NES-S-0108	< 0.30
	NES-S-0109	0.69
Catalyst Plant #3 north side	NES-S-0110	< 0.30
	NES-S-0111	< 0.30
	NES-S-0112	12.69
Catalyst Plant #2 west side	NES-S-0113	19.82
	NES-S-0114	17.80
	NES-S-0115	6.04
Catalyst Plant #1 west side drain	NES-S-0116	< 0.30
	NES-S-0117	< 0.30
	NES-S-0118	< 0.30
* Offsite Sample Burning Pond north side	NES-S-0119	< 0.30
	NES-S-0120	5.4
Between Deep Well & Outfall Ponds	NES-S-0121	1.7
Burning Pond east side	NES-S-0122	0.48
Celite Pond south side	NES-S-0123	0.37
West Urea warehouse truck loading bay	NES-S-0135	< 0.30
	NES-S-0136	< 0.30
	NES-S-0137	0.56
West Urea warehouse north side	NES-S-0138	1.76
	NES-S-0139	0.43
	NES-S-0140	< 0.30

B-3

SOIL SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SERIAL NUMBER	CONTENT (pCi/gm) (Uranium)
Previous Catalyst storage area #1	NES-S-0141	<0.30
	NES-S-0142	<0.30
	NES-S-0143	<0.30
Previous Catalyst storage area #2	NES-S-0144	1.22
	NES-S-0145	0.41
	NES-S-0146	<0.30
Previous Catalyst storage area #3	NES-S-0147	<0.30
	NES-S-0148	<0.30
	NES-S-0149	0.36
Previous Catalyst storage area w/gravel #1	NES-S-0150	0.35
	NES-S-0151	<0.30
	NES-S-0152	<0.30
Previous Catalyst storage area w/rock #1	NES-S-0153	0.59
	NES-S-0154	<0.30
	NES-S-0155	0.45
Previous Catalyst storage area w/rock #2	NES-S-0156	<0.30
	NES-S-0157	<0.30
	NES-S-1058	<0.30
Previous Catalyst storage area w/rock #3	NES-S-0159	<0.30
	NES-S-0160	<0.30
	NES-S-1061	<0.30

* Offsite sample taken at Shawnee Country Club for background comparison.

B-4 WATER SAMPLE ANALYSIS

B-4

WATER SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SERIAL NUMBER	CONTENT (uCi/ml) (Uranium)
East Fire Pond	NES-W-006	3.34 E-9
East Fire Pond #2	NES-W-007	4.0 E-9
Celite Pond #1	NES-W-008	1.827 E-8
Celite Pond #2	NES-W-009	1.603 E-8
Burning Pond #1	NES-W-010	3.507 E-8
Burning Pond #2	NES-W-011	4.0 E-8
Deep Well Pond #1	NES-W-012	2.338 E-7
Deep Well Pond #2	NES-W-013	3.507 E-8
Outfall Pond #1	NES-W-014	1.336 E-9
VII Pond #1	NES-W-015	<6.68 E-10
VII Pond #2	NES-W-016	2.004 E-9
Catalyst Settling tank #1	NES-W-017	1.403 E-8
Lima Water treatment #1	NES-W-018	<3.34 E-10
Lima Water treatment #2	NES-W-019	1.67 E-9
Catalyst Settling tank #2	NES-W-020	1.369 E-8
Area-A Fire Sump ac.to N2 station	NES-W-021	3.38 E-7
Emergency Pond near T-tanks #1	NES-W-022	1.336 E-9
Emergency Pond near T-tanks #2	NES-W-023	1.336 E-9
Waste Storage tank pond #1	NES-W-024	6.012 E-9
Inplant Process Pond #2	NES-W-025	4.008 E-8
Process Pond Canal #1	NES-W-026	
VI Pond #1	NES-W-027	4.008 E-8
VI Pond #2	NES-W-028	3.54 E-8
Process Pond Canal #2	NES-W-029	1.336 E-9
Fire Pond #1	NES-W-030	6.68 E-10
Fire Pond #2	NES-W-031	2.672 E-9
Process Pond #1	NES-W-032	1.336 E-9
Offsite Creek #1	NES-W-033	6.68 E-10
Offsite Creek #2	NES-W-034	1.002 E-9
Emergency Pond #1	NES-W-035	3.006 E-9
Emergency Pond #2	NES-W-036	6.68 E-10
Process Pond #2	NES-W-037	6.68 E-10
Inplant Process Pond #2	NES-W-038	1.002 E-9
Outfall Pond #2	NES-W-039	3.006 E-9
Soil Sample #34 decant	NES-W-040	1.136 E-7
East Catalyst settling tank	NES-W-041	2.34 E-6
Area-A pipe chase sump	NES-W-042	3.34 E-9

B-4

WATER SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SERIAL NUMBER	CONTENT (uCi/ml) (Uranium)
Area-A makeup water sump	NES-W-043	1.3026 E-8
Area-A thermal oxidizer sump	NES-W-044	2.004 E-9
* Main Vistron Office	NES-W-045	1.336 E-9
Mudhole north of A-frame warehouse	NES-W-046	5.678 E-9
Deluge Pond #1	NES-W-047	1.67 E-9
Site Outfall Canal (main entrance)	NES-W-048	1.002 E-9
East Fire Pond Center	NES-W-049	<3.34 E-10
Inplant Process Pond Center	NES-W-050	1.002 E-9
Inplant Emergency Pond	NES-W-051	2.338 E-9
Outfall Pond Center	NES-W-052	3.34 E-9
VII Pond Center	NES-W-053	1.67 E-9
Emergency Pond Center	NES-W-054	5.01 E-9
Deep Well Pond Center	NES-W-055	3.073 E-8
VI Pond Center	NES-W-056	3.44 E-8
Process Pond Center	NES-W-057	5.01 E-9
Burning Pond Center	NES-W-058	1.069 E-8
Celite Pond Center	NES-W-059	1.149 E-7
Fire Pond Center	NES-W-060	<3.34 E-10

* Main Vistron Office Sample for background comparison (drinking water)

nes

B-5 SEDIMENT SAMPLE ANALYSIS

B-5

SEDIMENT SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SERIAL NUMBER	CONTENT (pCi/gm) (Uranium)
Area-A manhole south 3rd street	NES-S-0069	<0.30
Area-A manhole west of reactor D	NES-S-0070	0.55
Process Pond Canal #1	NES-S-0071	<0.30
Storage Tank Pond #1	NES-S-0072	<0.30
Outfall Pond #2	NES-S-0073	2.52
Deep Well Pond #2	NES-S-0074	2.12
Outfall Pond #1	NES-S-0075	5.87
Burning Pond #1	NES-S-0076	0.73
Deep Well Pond #1	NES-S-0078	<0.30
VII Pond #1	NES-S-0079	<0.30
Burning Pond #2	NES-S-0080	<0.30
VII Pond #2	NES-S-0081	<0.30
Celite Pond #2	NES-S-0082	6.39
Celite Pond #1	NES-S-0083	1.44
East Fire Pond #1	NES-S-0084	<0.30
Offsite Creek #1	NES-S-0085	0.69
East Fire Pond #2	NES-S-0086	<0.30
Area-A pipe chase sump	NES-S-0087	2.08
VI Pond #2	NES-S-0088	<0.30
Emergency Pond east outfall pipe	NES-S-0089	<0.30
Catalyst Settling Tank	NES-S-0090	<0.30
VI Pond #1	NES-S-0091	<0.30
Emergency Pond #2	NES-S-0092	<0.30
Process Pond #1	NES-S-0093	1.10
Fire Pond #1	NES-S-0094	0.62
Fire Pond #2	NES-S-0095	1.37
Offsite Creek #2	NES-S-0096	<0.30
Process Pond #2	NES-S-0097	<0.30
Inplant Process Pond #1	NES-S-0098	<0.30
Inplant Process Pond #2	NES-S-0099	0.75
Deluge Pond #1	NES-S-0100	<0.30
Emergency Pond center	NES-S-0124	<0.30
Process Pond center	NES-S-0125	<0.30
Fire Pond center	NES-S-0126	<0.30
VII Pond center	NES-S-0127	<0.30
Inplant Emergency Pond	NES-S-0128	<0.30
Inplant Process Pond Center	NES-S-0129	<0.30
VI Pond center	NES-S-0130	<0.30
East Fire Pond center	NES-S-0131	<0.30
Outfall Pond Center	NES-S-0132	<0.38
Burning Pond center	NES-S-0133	<0.30
Deep Well Pond center	NES-S-0134	1.04

nes

B-6 RADIATION SUMMARY

B-6

RADIATION SUMMARY

Location	beta/gamma*	alpha**
Downtown Lima, Ohio	1,000.	1.0
NES Onsite Trailer	1,000.	1.0
Vistron Main Office	1,000.	1.0
Catalyst Plant:		
first floor	5,000- 900,000.	1.0
second floor	1,000-1,200,000.	↓
third floor	2,000-1,000,000.	
operations office	1,000- 5,000.	
warehouse	1,000- 40,000.	
A-frame warehouse	1,000-1,000,000.	
grounds	1,000- 100,000.	
Urea Warehouse:		
main floor	1,000- 200,000.	1.0
grounds	2,000- 60,000.	↓
Area-A:		
grounds	1,000- 350,000.	1.0
operations office	1,000.	↓
2nd reactor floor	1,000- 25,000.	
3rd reactor floor	1,000- 100,000.	
4th level tower	5,000- 800,000.	
derrick	3,000- 100,000.	
catalyst settling tank	2,000-1,000,000.	
Other Plan Areas:		
burning pond	1,000- 300,000.	1.0
Plant #2	1,000- 30,000.	↓
northwest field	1,000- 3,000.	
deep well pond	1,000- 5,000.	
outfall pond	1,000- 5,000.	
celite pond	1,000- 15,000.	
VI pond	1,000.	
VII pond	1,000.	
railyard tracks	1,000- 10,000.	
(southwest onsite)	1,000- 5,000.	
secondary storage dock	1,000- 8,000.	↓

* beta/gamma levels in DPM/probe area

** alpha levels in DPM/probe area

B-7 ENVIRONMENTAL DOSIMETRY MEASUREMENTS

B-7

Environmental Dosimetry Measurements

Badge No.	Location at Vistron Site	mrem received	ave mrem/wk
6032-0000	control - NES trailer	12.2	1.74
6032-0001	#1 plant; corner 18th & 3rd Sts.	19.8	2.83
6032-0002	#1 plant; pillar under hopper	66.3	9.47
6032-0003	#1 plant; under "B" reactor	19.2	2.74
6032-0004	#1 plant; outside ops. shack	16.8	2.40
6032-0005	#2 plant; outside ops. shack	15.0	2.14
6032-0006	#2 plant; "A"-"B" reactor pillar	35.2	5.03
6032-0007	#2 plant; east of 10th & 7th Sts.	14.5	2.07
6032-0008	catalyst plant; 1st fl,north tank	195.0	27.86
6032-0009	catalyst plant; 2nd fl,south wall	not measured	
6032-0010	catalyst plant; 3rd fl,north wall	541.8	77.40
6032-0011	perimeter fence; 2nd & 3rd Sts.	17.0	2.43
6032-0012	Area-A; corner 9th & 18th Sts.	15.3	2.18
6032-0013	Area-A; southside lightpole	14.0	2.00
6032-0014	#1 Urea Whse; Row #6 @ elec.outlet	14.7	2.10
6032-0015	West perimeter near firewater and process ponds	14.3	2.04

B-8 UNRESTRICTED RELEASE CRITERIA

SURFACE CONTAMINATION RELEASE LEVELS *

NUCLIDE	AVERAGE	MAXIMUM	REMOVABLE	UNITS
U-nat,U235,U238,and assoc.decay products	5,000.	15,000.	1,000.	dpm a / 100 sqcm.
Transuranics,Ra226, Ra228,Th230,Th228, Pa231,Ac227,I125,I129	100.	300.	20.	dpm/ 100 sqcm.
Th-nat,Th232,Sr90, Ra223,Ra224,U232, I126,I131,I133	1,000.	3,000.	200.	dpm/ 100 sqcm.
Beta-gamma emitters (decay modes other than alpha or spon.fission) except Sr90 and those listed above	5,000.	15,000.	1,000.	dpm b-g/ 100 sqcm.

RADIATION RELEASE LEVELS

An unrestricted area will have radiation levels ** such that:

1) if continuously present in the area no individual would receive in excess of 2.0 mRem in any one (1) hour,

2) if continuously present in the area no individual would receive in excess of 100.0 mRem in any seven (7) consecutive days,

3) that no individual would receive a dose to the whole body in any one period of one (1) calendar year in excess of 500.0 mRem.

furthermore;

4) quantities of airborne or waterborne radioactive materials is dependant upon the isotopes present and will be less than that specified in 10CFR20 App.B Table II.

LEVELS OF URANIUM IN SOIL

Levels of uranium in soil will not exceed 35 pCi/gm per previously enforced NRC requirements for unrestricted release of sites and license termination. (see reference 1.)

note: * - taken from NRC Regulatory Guide 1.86, 1974.
** - taken from 10 CFR 20, section 105, 1984.

WASTE DISPOSAL PLAN AND COST ESTIMATE

VISTRON CHEMICAL FACILITY

Project Application	Copy No	Assigned To
5436		

APPROVALS

TITLE / DEPT. - SIGNATURE - DATE

REV NO	PREPARED BY C. J. Marino	Project Manager	Dept. Manager		
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REVISION LOG

NUCLEAR ENERGY SERVICES, INC.

DOCUMENT NO. 83A2487

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1. OBJECTIVE

This plan and cost estimate is based on achieving a condition at the Vistron site wherein for all areas, surface, equipment, and materials the levels of radioactive material and radiation are less than those prescribed by the NRC for unrestricted release of site and license termination. The limits required are listed below for the Vistron site. Limits for airborne radioactive materials and effluents to the environment are specified by federal law in Title 10 Code of Federal Regulations, and will not be restated here. These limits, however, will be taken into account in the development of this waste disposal plan and in the accounting of its associated costs. In addition, a specific limit for airborne uranium has been specified by the NRC and is presented in Section 2.

2. RELEASE LIMITS

The following release limits were specified by the NRC in the attached submittal to the Sohio Chemical Co. for AN1 dismantlement, Rev. 1.

2.1 SURFACE CONTAMINATION LIMIT (ABOVE BACKGROUND):

2.1.a 5000 DPM alpha, beta, gamma/100 cmsq. averaged over 1 msq. or the total object if the object is less than 1 msq.

2.1.b 15000 DPM alpha, beta, gamma/100 cmsq. maximum, for an area less than or equal to 100 cmsq., on any one object or within any 1 msq.

2.1.c 1000 DPM beta, gamma/100 cmsq. removable - determined by wiping the area with dry paper and measuring with a survey meter as appropriate to the type(s) of radiation.

2.1.d 220 DPM alpha/100 cmsq. removable - determined as in 1.1.c above.

2.1.e The limits are applied and tested independently for alpha and for beta/gamma.

2.2 RADIATION LIMITS FOR BETA/GAMMA SURFACE CONTAMINATION:

2.2.a 0.2 mrad/hour average at 1 cm - over less than or equal to 1 msq.

2.2.b 1.0 mrad/hour maximum at 1 cm - over less than or equal to 100 cmsq.

2.2.c These limits are above background levels.

2.3 URANIUM-23 8 (U-23 8) CONCENTRATION LIMIT (ABOVE BACKGROUND):

2.3.a 34 pCi/gm of soil.

2.3.b 300 pCi/gm of insulation (asbestos) or other material in which U-23 8 could be homogeneously mixed and which will be disposed of in an approved landfill.

2.3.c These limits will be applied as an average value of all samples taken from a container of well-mixed material.

2.4 Background will be determined by the contractor on undisturbed soil and surfaces in or near the plant.

2.5 U-23 8 concentrations in water will be limited to 40,000 pCi/liter for any free-standing water to be released to an unrestricted area.

2.6 U-23 8 concentrations in air will be limited to 5 pCi/cubic meter in any area proposed as unrestricted.

3. WASTE DISPOSAL VOLUME

In accordance with the limits for release specified above, an estimate has been made of the following parameters for decontamination and waste disposal:

- volume of soil, water, and material to be removed
- amount of surface areas to be cleaned

These estimates are based on data collected in the June 1985 and September 1985 NES surveys conducted onsite.

3.1 VOLUMES:

3.1.a Soil to be removed includes a 10" average depth in the Area-A yard, 6" further below the derrick, and a small area in a north open field to a 6" depth. The area involved is between ~~300-400 ft^2~~. 30000 ft^2 Volume = 32,338 ft^3.

300 x 100

3.1.b Sediment as measured by NES did not exceed the uranium limit, although it is possible the beta/gamma radiation limit would be exceeded if the overlying water of the site ponds was removed. No sediment volume is presently accounted as requiring removal.

3.1.c Water measurements for uranium did not exceed the uranium limit in any of the onsite ponds.

3.1.d The amount of contaminated insulation on reactors A, B, C, D is estimated at 1,000 ft^3. Catalyst plant piping having contaminated insulation is estimated at 365 ft^3. The total amount of insulating material

Volume = 1,365 ft^3

3.1.e Process piping and valving is reasonably expected to have a percentage which is contaminated. Such pipe material is estimated at 2,083 ft^3 and 141 valves contribute 500 ft^3.

Volume = 2,583 ft^3

Estimated Total = 36,286 ft^3

4. DECONTAMINATION ALTERNATIVES

There are several approaches to decontamination of the Vistron site. A specific scheme is employed herein based upon the present information available. This scheme contains several paths which provide alternatives for one or more of the individual segments of work. A cost analysis is performed to ascertain the most economical yet effective approach.

4.1 UTILIZATION OF SKILLED VS. UNSKILLED LABOR

A local crew of laborers may be employed for the bulk of physical activities anticipated, such as digging, cleaning, and operating equipment. Such a crew has an inherently inexpensive hourly cost when compared to a previously trained and certified crew of radiation workers. The price for the hourly savings appears in the necessity of health physics/radiological training and certification, medical examinations, and increased supervision on the job. The initial pace of work will also reflect the unskilled level of the crews' experience. Conversely, a skilled

team of experienced radiation workers may be employed for the same work. The hourly rate for the crew will be higher. Benefits at this increased cost per unit hour include omission of extensive training, existing medical histories, and a degree of worker independence which relieves a measure of the supervisory burden.

Analysis of these factors based on an eight (8) hour day for a specific unit of work results in the following comparison between the two types of crews. The unskilled labor was determined using a $12./hr total cost per man and the skilled used $16./hr and a $30d/day perdiem.

Result: Unskilled labor cost = $ 96./effective man day
Skilled labor cost = $160./effective man day

The recommendation is for the use of unskilled over skilled labor in spite of their lack of experience and a requirement of a two (2) day training class as radiation workers.

4.2 SHUTDOWN OF SITE

Clearing the work site from competing activities will result in time (and therefore doliar) savings due to the following factors:

- availability of heavy equipment (forklift, backhoe, etc.)
- elimination of distractions to crew and supervision caused by nearby activities not decontamination related
- elimination of lost time due to other crews working in the decontamination areas on other projects
- availability of operating systems for internal piping inspection, versus waiting for an appropriate point in continuing operations for shutdown.

In either site shut down mode or operational mode, the immediate areas where decommissioning work is performed will have to be secured by a series of ropes and/or fences and the use of "step-off" pads for entry and egress. This is a primary means to control the spread of contaminated materials.

The cost differential may be expressed as a percentage of work duration. The shutdown of site will result in a savings of <5% of the duration of work and associated period dependent costs. This must be weighed against resulting loss in operating revenues (losses) should the facility be maintained in a fully operational status. Partial operation of the site will not result in any appreciable savings versus continuing routine site work at full capacity. Therefore, operations outside of the immediate work areas of the catalyst plant and Area-A may continue without undue harm to the decon work effort.

4.3 WASTE DISPOSAL COST ESTIMATE

There are currently three (3) available sites for disposal of low level radioactive materials as are found on the Vistron site. These are in Barnwell, SC, Hanford, WA, and Beatty, NV. The latter site has appreciable quality assurance and associated site response costs and so has not been considered further. The Barnwell site (operated by Chem-Nuclear) has potentially altering policy changes towards nonregional and asbestos waste materials. As a result, the Hanford site (operated by U.S. Ecology) is the basis for the radioactive waste disposal cost estimate.

A current value of $\$23.0/ft^3$ for low level waste burial has been utilized. In addition, packaging in disposable containers and transport from Lima, OH to Hanford increases the total cost of disposal of dry material to $\$54.0/ft^3$. We herein assume no curie, radiation, or overweight surcharges will apply, nor will cask loading or other special fees. The cost of burial is therefore calculated as shown:

- soil:	$32{,}338\ ft^3 \times \$54.0/ft^{3(1)}$	= $	1,746,252.
- insulation:	$1{,}365\ ft^3 \times \$54.0/ft^3$	= $	73,710.
- piping:	$2{,}083\ ft^3 \times \$54.0/ft^3$	= $	112,482.
- valves:	$500\ ft^3 \times \$54.0/ft^3$	= $	27,000.
- decon-generated:	$2{,}200\ ft^3 \times \$54.0/ft^3$	= $	118,800.
- wood or metal pcs.:	$256\ ft^3 \times \$54.0/ft^3$	= $	13,824.
- total radwaste:	$38{,}748\ ft^3 \times \$54.0/ft^3$	= $	2,092,400.

(1) Includes: disposal charges (as of 11/85), cost of container, packaging, labor and transportation costs.

4.4 VOLUME REDUCTION EFFECT

The potential to reduce radwaste volume (and thereby costs of disposal) should always be considered in an effort such as this. Of the wastes collected, only soil, valving, and miscellaneous solid pieces offer no potential significant volume reduction. Each of the other candidate categories of waste must be considered independently to determine if a volume reduction effort is worthwhile.

4.4.a insulation - Compactible if loaded in 55-gal. drums using a commercially available drum compactor. A 3-to-1 reduction is anticipated.

4.4.b piping - During contaminated piping removal, additional cuts must be made to enhance loading efficiency. A 2-to-1 reduction is anticipated. Small piping (4" od or less) is the most effective element to be cut, balancing increased labor costs with loading the resulting straight segments into 128 ft^3 B-96 containers used for soil transport.

4.4.c decon generated - Decontamination waste consisting of clothing, cloths, brushes, etc., are compressible using a drum compactor as employed for asbestos for loading in 55-gal. drums. A 3-to-1 compaction ratio is anticipated.

The recommendation is for rental of a 55-gal. drum compactor with HEPA filtered exhaust for use on insulation and decon generated waste. Piping 4" or less would be cut at all bends or at 7' lengths, whichever is smaller. The resulting radwaste change is represented below:

- soil:	32,338 ft^3 x \$54.0/ft^3	= \$	1,746,252.
- insulation:	455 ft^3 x \$54.0/ft^3	= \$	24,570.
- piping:	1,042 ft^3 x \$54.0/ft^3	= \$	56,268.
- valves:	500 ft^3 x \$54.0/ft^3	= \$	27,000.
- decon-generated:	733 ft^3 x \$54.0/ft^3	= \$	39,582.
- misc. solid pcs.:	256 ft^3 x \$54.0/ft^3	= \$	13,824.
- total radwaste:	35,324 ft^3 x \$54.0/ft^3	= \$	1,907,496.
- 55-gal. Compactor:		\$	16,000.
		\$	1,923,496.

Δ = \$2,092,400 - 1,923,496 = \$168,904 (savings)

5. OPERATIONAL PROCEDURE

The decontamination of the site is intended to result in a facility where all levels of radioactive material are less than the limits specified in Section 1.0 herein. To achieve this result, certain precautions and work practices must be employed concerning the spread of radioactive material, the assay of said materials, and the protection of radiation workers. A description of these details is beyond the scope of this report.

In general, the variety of radiological concerns at the Vistron site may be approached individually as described below. A detailed description of the radwaste package marking and shipping requirements has not been included herein.

All asbestos/insulation bearing pipes and valves which are contaminated will be surveyed, cut and bagged by hand, and re-surveyed on an individual bag basis to separate potentially clean materials in accordance with NRC guidelines and limits.

Reactor piping and valving will be measured for radiation and contamination levels, marked, and removed using portaband saws. The use of torches is a rapid cutout method, but is potentially a source of unwanted airborne contamination and may be prohibited during particular cutouts by site health physics personnel. All miscellaneous pieces will be surveyed after cutout, prior to loading by hand into the disposable B-96 containers. The containers are DOT Type A and will be placarded and manifested as such in accordance with Title 49 Code of Federal Regulations. Removal will occur from upper levels progressively down to the ground floor. Included in this portion of the work is removal of contamination (or the material it is attached to) on the 5th level of the siren derrick.

Soil at Area-A and other plant areas will be removed and loaded into B-96 containers both by hand and by use of a backhoe(s). The backhoe can strafe the surface, at which time a measurement of bucket content is made. If greater than release levels are found, the bucket is loaded for radwaste disposal. Otherwise, it is removed by dump truck to a convenient area until it is required to re-fill the gouged grounds. Small, discrete hot spots may be dug with hand shovels as required to support backhoe operations.

The catalyst plant and adjoining warehouses will be decontaminated in the same manner as the Area-A reactors: from top down, insulation first followed by equipment and finally a gross area surface decon with mops, brushes, and cloths. The wooden A-frame warehouse poses a potential additional problem in that the wood may have to be removed if radiation levels are excessive, even after decon. Also, painting may be required if removable contamination levels cannot be reduced to the required limits by the decon described. We have assumed the wood will remain intact and in place.

An additional concern at the catalyst plant are the elevated levels of airborne radiation already found therein and the potential to increase them further during decon activities. An ambient air circulating system consisting of several large ventilation fans is recommended to keep airborne levels due to radon leakage from inherent structural materials (concrete, etc.) at safe levels. All decon personnel should be required, however, to wear the same respiratory equipment required during work at other radiation work locations onsite.

A final area by area survey will be required to ensure nothing in excess of unrestricted limits has been overlooked and to confirm the adequacy of re-contamination controls. All decon personnel will then undergo whole body counting for comparison to levels recorded to the commencement of work.

ATTACHMENT I

RADIATION DETECTION AND CONTROL PLAN

FOR

AN1 DISMANTLEMENT

Rev. 1

Scope of Work

Radiation Detection and Control Plan for ANl Dismantlement
Rev. 1

Outline

I. Limits to Reach

II. Policy on what to check

III. Methodology

A. Finding and controlling Radioactive Contamination

B. Personnel/equipment protection

This document specifies the radiation limits and methodology that will be used to control the radiation contamination during ANl dismantlement.

Plan

I. Limits. (The contractor will ensure that nothing above these limits leaves the work site, and that all above-ground equipment, materials and structures above these limits remaining on the work site are identified for decontamination.)

A. Surface Contamination Limit - above background:

1. 5000 dpm alpha, beta, gamma/100 cm^2 averaged over $1m^2$ or the total object if the object is less than $1m^2$.

2. 15000 dpm alpha, beta, gamma/100 cm^2 maximum, for an area $\leq$ 100 cm^2, on any one object or within any 1 m^2.

3. 1,000 dpm beta, gamma/100 cm^2 removable - determined by wiping the area with dry filter paper and testing the filter paper with an appropriate survey meter.

4. 220 dpm alpha/100 cm^2 removable - determined as in 3. above.

5. The limits are applied and tested for independently for alpha and for beta, gamma.

B. Radiation Limits associated with beta, gamma surface contamination:

1. 0.2 mrad/hour average at 1 cm - over $\leq 1 m^2$

2. 1.0 mrad/hour maximum at 1 cm - over $\leq 100 cm^2$

3. These limits are above background

C. U-238 nuclide concentration limit - above background.

1. 35 pCi/gm of soil. (Under this dismantlement operation of above-ground structures, it is expected that no soil will be removed from the work site).

2. 300 pCi/gm of insulation (asbestos) or other material in which U-238 could be homogeneously mixed and which will be disposed of in an approved landfill.

3. These limits will be applied as an average value of all samples taken from a container of well-mixed material.

D. Background will be as determined by the contractor on undisturbed soil and surfaces in or near the plant.

E. U-238 concentration in water limit will be 40,000 pCi/liter for any free-standing water to be released to an unrestricted area.

F. U-238 concentration in air limit will be 5 pCi/m^3 air in any area proposed as unrestricted.

II. Policy

A. Equipment and material will not be released from the Plant unless it is below the Limits shown in I. above.

B. Contaminated Material

1. Material from areas identified on previous surveys (ORAU or NES) as having a contamination or radiation level above the Limits will be put into radiological waste containers separate from other material.

2. This contaminated material will be tested for all appropriate limits to determine if it is releasable.

C. Equipment

1. All equipment and bulky scrap (e.g. pipes) will be checked for surface contamination where it might reasonably be expected to be found. (For example, catalyst piping and process piping from the reactors to the waste water column will be checked inside the piping, with special attention to testing low points and valve packings. Piping in the Purification area will not be checked inside the pipe, since there was no process condition that should have caused its contamination.)

2. Where feasible, contaminated surfaces will be decontaminated in place by washing with water and degreaser if appropriate, then rechecked. Either Sohio or the contractor can do this decontamination.

3. When any decontamination technique is used, it is to be applied to the maximum extent that the technique can take it. If several techniques are possible and reasonable, the most effective technique is to be used.

D. Other Material

1. All other material, such as insulation not previously found to be contaminated, will be spot checked against the Limits before release. The target will be to check 20% of this material for alpha, beta, gamma surface radiation and up to 1% for U-238 concentration.

2. The percentage of checking for U-238 concentration in any area will be adjusted based on initial results.

3. The contractor must establish correlations between the 300 pCi U-238/gram asbestos insulation and the alpha or beta/gamma surface radiation. Any container of material found to have surface radiation above these correlations will be sampled for U-238 concentration.

4. Dilution for Decontamination

a. Where safe and cost effective, contaminated material that cannot be segregated with reasonable methods can be mixed with uncontaminated material to bring the radiation levels below the Limits.

b. If the material above the Limits can be segregated with reasonable methods, it is not to be diluted. Bags of asbestos will not be diluted with other bags of asbestos, to limit the hazard of asbestos handling.

E. Control of Contaminated Material

Any material found to have radiation levels above the Limits, and not subsequently decontaminated, will be relocated to a controlled area on the Plant site and contained to prevent contamination of the environment or exposure of personnel.

F. The calibration of radiation detection instruments will be checked at least once every day against standards appropriate for the isotope we're trying to detect.

G. Documentation

Records will be kept showing

- personnel exposure to radiation

- radiological conditions on site during the work
- all calibration checks of radiation detection instruments
- what equipment or material was tested
- its original location
- the results of the test(s)
- whether decontamination was attempted
- the results of any retest(s)
- where it was sent (i.e., to Waste Management, released to Tilton, radioactive containment area, etc.)

H. Material will not be removed to a "clean" area for testing unless a high radiation level in its immediate vicinity is the primary factor in causing a test result to be over the limit.

III. Radiation Detection/Control Plan Methodology

A. Finding and controlling radioactive contamination

1. Receive NES radiation survey results

2. Pinpoint problem areas with appropriate alpha and beta, gamma survey meters. Mark problem areas (areas showing a surface radiation level above the Limits or above the correlation with a high U-238 concentration).

3. Take steps to isolate or remove high contamination areas by placement in radioactive waste containers or decontamination. Such removal or decontamination will follow the pattern of a)radiation check, b)decontamination, c)recheck; while constantly monitoring for any personnel hazard.

4. Asbestos removal

- Check for radiation prior to removal
- Bag asbestos per OSHA guidelines
- Separate suspect asbestos from clean asbestos (in separate bags)
- Check all bags of asbestos for radiation prior to removal from site
  - Degree of check per Section II "Policy".
- Sohio Chemical to dispose of asbestos below the Limits.
- Material above the Limits to be removed to a "radioactive material containment area" designated by Sohio Chemical.

5. Pipe removal, vessel removal, miscellaneous equipment removal

- Safety check of piping, vessels prior to cutting
- Pipe vessels removed, and tested inside and outside per sections I and II above.
- Equipment or scrap above the Limits to be decontaminated in place by the contractor, or removed to an area for decontamination by Sohio.
  - Pipe retested (by radiation contractor) to ensure radiation below the limits.
- The contractor removes the "clean" equipment or scrap from the plant.
- The contractor moves material remaining above the Limits to the "radioactive material containment area" on site.
- Degree of check may vary with location of pipe and equipment removed from unit, per section II.C.

B. Demolition personnel, equipment protection

1. Prior to work starting, clean up contaminated areas which pose a likely risk of personnel or equipment contamination. (Note: This has already been done by NES.)

2. All personnel in area during asbestos removal will be in full protective clothing until testing proves not required.

3. Following asbestos removal begin pipe and equipment removal.

A. Check pipe at several flanged connections for contamination.

B. Use respiratory protection during cuts at "hot" spots

C. During early phase of dismantlement use respiratory protection everywhere until testing proves it unwarranted. Continue testing to see if respiratory protection becomes warranted again. The criteria is as shown in section I. Limits.

D. For vessel cuts, enter vessels and test prior to cutting. Follow "B" if necessary.

E. Control ingress and egress to area through one gate. Check for radiation at the gate.

F. Check all equipment for radiation prior to leaving area. Decontaminate as necessary.

G. Use area monitoring to assure that dismantlement procedure is not compounding contamination problem.

H. Piping and vessel sampling should be highest in areas of likely contamination.

BCRiddel/CLGasperetti:ll
September 16, 1985
Rev.1 - 9/30/85