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TITLE: POST-REMEDIATION AMBIENT GAMMA RADIOLOGICAL SURVEY OF THE FORMER SODIUM DISPOSAL FACILITY (T886)

- APPROVALS -

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ABSTRACT

A comprehensive baseline radiological survey for ambient gamma exposure rate was conducted in 1991 (Reference 3) just prior to the site remediation of the former Sodium Disposal Facility (SDF) (T886). That survey covered the lower and upper pond areas of the SDF and was used as a guide in beginning remediation (i.e., excavation). After the remedial efforts were completed (which included numerous operational gamma surveys) the stage was set for the post-remedial ambient gamma exposure survey. This survey covered the lower and upper pond areas as well as adjacent land.

Results of this survey show the ambient gamma exposure rates of the former SDF and surrounding land to be indistinguishable from each other. These results presented here along with the planned soil sampling by an outside contractor will serve as a basis to release the SDF for use without radiological controls. This document represents the ambient gamma survey as performed in accordance with Reference 1.

REFERENCES

1. J. J. Collins, "Final Radiological Sampling and Gamma Survey Procedures to Follow Site Remediation of the Former T886 Sodium Disposal Facility, ETEC, 886-ZR-0006 (July 20, 1993)

2. J. Chapman, "Radiological Survey of the Sodium Disposal Facility Bldg T886," ETEC, GEN-ZR-0004 (June 3, 1988)

3. J. J. Collins, "Baseline Radiological Survey of the Sodium Disposal Facility (T886)," Rockwell International, Rocketdyne Division, N704SRR990034 (August 31, 1992)

4. "Radiological Soil Sampling and Pathways Dose Analysis for the Sodium Disposal Facility (T886)" to be published

5. L. Mountford, "Interim Report (March - May 1994), Area IV, Radiological Characterization Study," A4CM-ZR-0008, June 28, 1994

6. L. Mountford, "Interim Report (June - August 1994), Area IV, Radiological Characterization Study," A4CM-ZR-0009, October 6, 1994

7. "Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservancy," draft, November 18, 1994

1.0 INTRODUCTION

This report documents the post-remediation radiological ambient gamma survey of the former Sodium Disposal Facility (SDF) (T886) and subsequent data analyses. The post-remediation ambient gamma survey was undertaken to evaluate the radiological conditions after the completion of the site remediation. The surveyed areas included the remediated lower and upper pond basins, the surrounding land, and the site drainage pathways. The ambient gamma exposure rate results used in conjunction with the soil sampling analyses as outlined in Reference 1 will serve as a basis to quantitatively release the SDF from radiological controls. This document represents the gamma survey as performed in accordance with Reference 1.

2.0 SUMMARY AND CONCLUSIONS

Analyses of the ambient gamma exposure rates show the remediated areas are statistically indistinguishable from background readings elsewhere in SSFL Area IV. The entire site averaged 15.6 μR/hr with maximum readings up to 21.4 μR/hr occurring next to or on the surrounding rock formations, which is consistent with data and results from References 2 and 3, data being accumulated in the Area IV radiological characterization survey (References 5 and 6) and EPA measurements taken during the off-site multimedia sampling program (Reference 7). Table 1 provides the summarized data from the survey.

Table 1. Data Analysis Results Summary

Location	No. of Data Points	Mean (μR/hr)	Std. Dev. (μR/hr)	μR/hr		Ref. Fig. No.	Page No.
				Min	Max		
All areas	2316	15.6	1.5	10.4	21.0	7	21
Lower & upper pond basins	419	14.6	0.9	12.2	17.2	8	22
Lower & upper pond basins excluded	1897	15.7	1.5	10.4	21.0	9	23
Upper pond basin	244	14.2	0.7	12.2	15.8	10	24
Lower pond basin	175	15.3	0.7	13.2	17.2	11	25
Grid #1	16	17.0	0.6	16.3	18.6	13	27
Grid #2	17	17.0	0.4	16.2	17.6	14	28
Grid #4	51	16.7	0.8	15.2	19.0	15	29
Grid #5	112	16.6	0.6	15.5	18.6	16	30
Grid #6	70	17.2	0.4	16.1	18.2	17	31
Grid #7	Inaccessible or not in survey scope					18	32
Grid #8	50	18.7	0.9	17.2	21.4	19	33
Grid #9	82	16.6	0.9	15.1	21.4	20	34
Grid #10	103	15.2	0.8	11.3	16.8	21	35
Grid #11	37	16.0	0.4	14.9	16.8	22	36
Grid #13	20	18.4	0.7	17.8	19.6	23	37
Grid #14	61	17.0	1.1	15.2	19.6	24	38
Grid #15	110	17.1	1.1	14.9	19.7	25	39
Grid #16	113	16.3	0.4	15.5	17.2	26	40
Grid #17	31	16	0.4	15.3	16.9	27	41

Table 1. Data Analysis Results Summary

Location	No. of Data Points	Mean (μR/hr)	Std. Dev. (μR/hr)	μR/hr		Ref. Fig. No.	Page No.
				Min	Max		
Grid #21	13	17.2	1.0	15.8	18.6	28	42
Grid #22	118	15.6	0.7	13.9	18.4	29	43
Grid #23	115	14.7	0.7	13.3	16.6	30	44
Grid #24	61	16.0	0.3	15.1	16.7	31	45
Grid #29	90	16.1	0.9	14.9	19.4	32	46
Grid #30	121	15.2	0.6	13.7	17.6	33	47
Grid #31	96	14.3	0.7	12.0	15.6	34	48
Grid #32	10	16.2	0.4	15.7	16.8	35	49
Grid #33	33	16.8	0.4	16.2	18.1	36	50
Grid #36	75	16.4	1.1	14.5	19.8	37	51
Grid #37	121	15.6	0.6	14.5	17.4	38	52
Grid #38	121	14.6	0.7	13.2	17.2	39	53
Grid #39	86	14.2	0.7	12.5	15.4	40	54
Grid #40	48	17.3	0.7	16.2	18.8	41	55
Grid #41	22	17.0	0.6	15.2	18.4	42	56
Grid #43	64	16.8	1.2	14.7	19.9	43	57
Grid #44	120	15.1	1.0	13.5	17.9	44	58
Grid #45	121	14.4	0.6	13.0	15.6	45	59
Grid #46	121	13.8	0.5	12.6	15.5	46	60
Grid #47	104	13.2	1.1	10.4	15.4	47	61
Grid #48	40	16.5	0.8	15.1	18.7	48	62
Grid #52	14	14.7	0.2	14.1	15.0	49	63
Grid #53	44	14.0	0.9	10.4	15.3	50	64
Grid #54	66	14.3	0.6	13.1	16.1	51	65
Grid #55	66	13.7	1.0	10.9	15.0	52	66
Grid #3, 12, 18, 19, 20, 25, 26, 27, 28, 34, 35, 42, 49, 50, 51, 56, 57, 58	Inaccessible areas or outside the survey scope					12	26

Figure 1 demonstrates the homogeneity of the results from the survey. The remediated areas averaged lower exposure rate readings than the rock formations as expected and the standard deviation of the entire data set was only 1.5 μR/hr

In conclusion, the post-remediation ambient gamma exposure rate survey results show that the SDF site and surroundings to be indistinguishable from one another and from other referenced gamma survey reports.

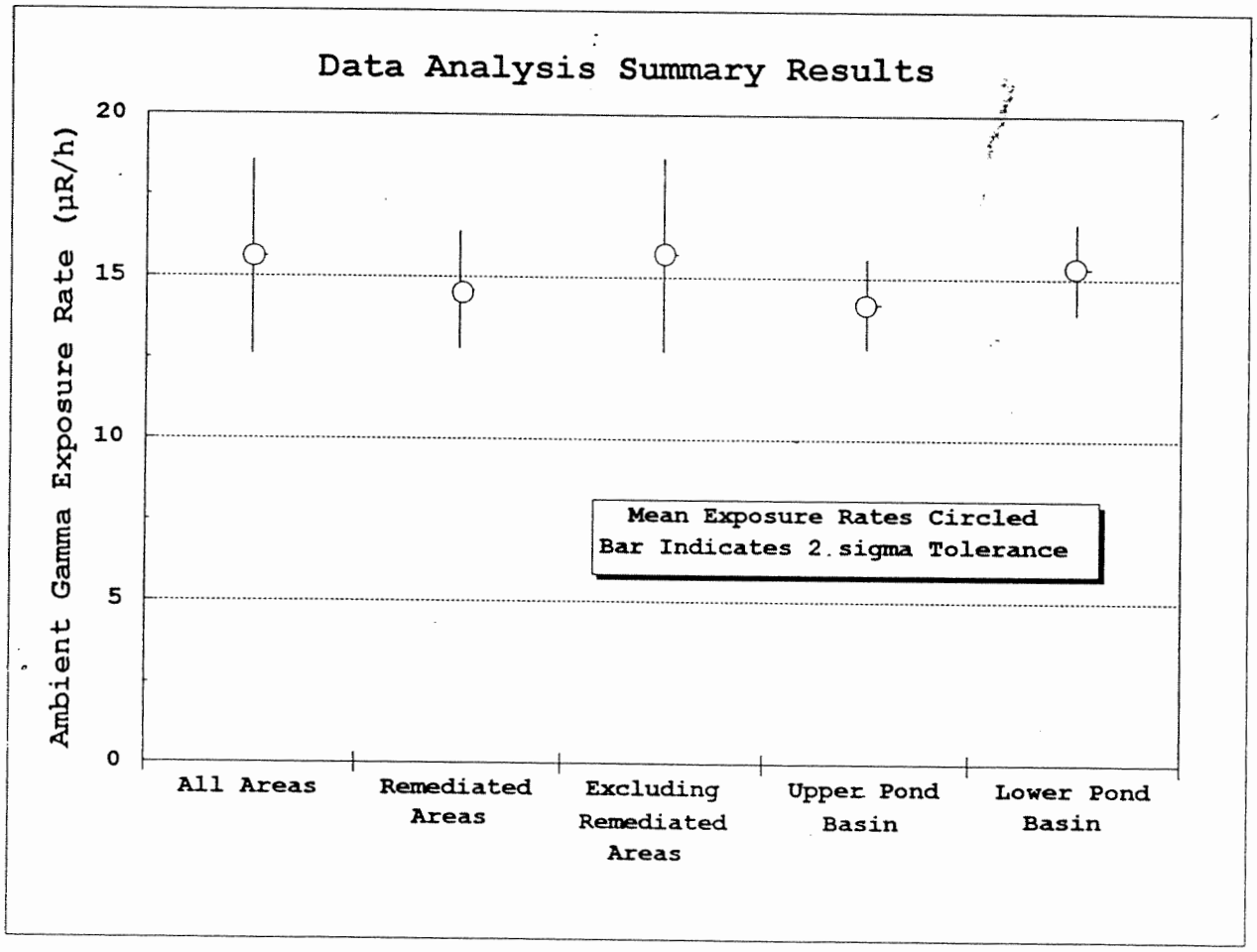

Figure 1. Data Analysis Summary Results

3.0 BACKGROUND

3.1 Location

The Sodium Disposal Facility (SDF) is located within Rockwell International's Santa Susana Field Laboratory (SSFL) in the Simi Hills of southeastern Ventura County, California, adjacent to the Los Angeles County line and approximately 29 miles northwest of downtown Los Angeles, directly south of the City of Simi Valley. Location of the SSFL relative to the Los Angeles and vicinities in shown in Figure 1. An enlarged map of neighboring SSFL communicate is shown in Figure 2. Figure 3 is a plot plan of the western portion of SSFL known as Area IV, where the SDF is located. A drawing (plan view) of the SDF and its adjoining areas is shown in Figure 4. The SDF is located on Rockwell-owned land.

3.2 Topography and Site Characteristics

The SDF is located at the west end of Rockwell International's SSFL. The SDF is commonly called the "Old Sodium Burn Pit," and is designated as SSFL site T886. The facility occupies the high ground of an alluvial flat that is roughly triangular in shape, and about two acres in area. The site is bordered by siltstone rock formations on two sides, which come together at the north end of the site to form a blunted apex to the triangle. Site drainage is through the siltstone narrows to the northwest.

The SDF was once used as a disposal site for sodium and sodium-potassium alloys, and combustible materials from US DOE/AEC nuclear programs. The disposal activity was mostly confined to a concrete pool, and two open-field pits that are referred to as the Upper Pond Basin and the Lower Pond Basin. Previous radiological survey and decontamination work have been done at the site. A more detailed description of the site's physical location, its relevant operational history, and a discussion of previous survey and decontamination efforts can be found in Reference 2.

3.3 Remediation Activities

A total of 12,000 cubic yards of soil were excavated from the lower pond basin and portions of the upper pond basin. Field gamma surveys of each cubic yard of soil resulted in approximately 750 cubic yards (~6%) being declared radioactively contaminated. Eighty composite soil samples were taken from the 750 cubic yards of soil and analyzed by an independent laboratory for gamma emitters (gamma spectroscopy), Sr-90, H-3, isotopic uranium, isotopic thorium and isotopic plutonium. Based on the concentration results, a total quantity of 6 millicuries of Cs-137 and

Figure 2. Location of SSFL in Relation to Los Angeles and Vicinity

Figure 3. Map of Neighboring SSFL Communities

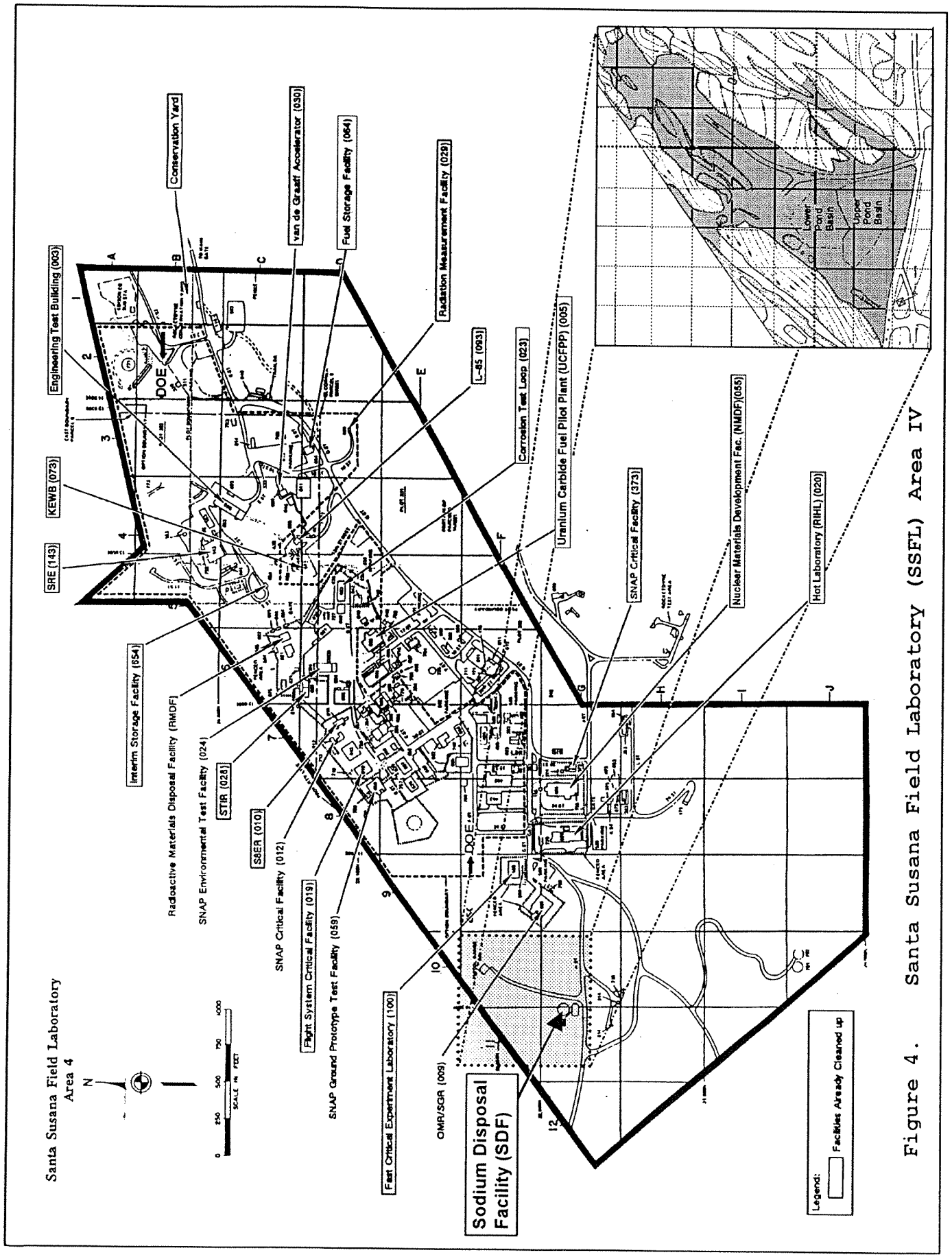

Figure 4. Santa Susana Field Laboratory (SSFL) Area IV

1 millicurie of Sr-90 was identified as contamination. Cs-137 concentrations ranged from 0.09 - 52 picocuries per gram of soil (pCi/gm) with an average of 8 pCi/gm, while Sr-90 concentrations ranged from 0.11 to 38 pCi/gm with an average of 1.6 pCi/gm. Of this radiologically contaminated soil, the mixed waste portion was disposed of to Envirocare in Utah while the radwaste portion is to be shipped to Hanford, Washington.

4.0 SURVEY RESULTS

4.1 Overview

The radiological survey of this report was performed to establish a post-remedial ambient gamma exposure rate comparison between the remedial areas (Upper and Lower Basins, see Figure 5) and the surrounding adjacent land. The previous baseline survey of Reference 3 had clearly shown residual radioactivity present in an enclosed 10′ x 10′ area. Subsequent soil excavation and removal along with numerous operational surveys indicated remediation was complete. This document will serve as one of the checks for completeness (soil sampling and RESRAD analyses will be documented in Reference 4).

4.2 Survey Procedures

The survey procedures are detailed in Reference 1 and are essentially the same as the survey of Reference 3. The zero-zero (0,0) coordinate for both surveys is the same, however, and the SDF site was again overlaid by a 10-ft (spacing intervals) north/south, east/west grid. Wood stakes were placed at the intersection of the 200-ft grid lines and survey measurement taken every 10-ft intersection at 1-meter height. For data analyses and interpretation, 100-ft by 100-ft grid squares were analyzed as one statistical distribution. Additional analyses of the site compared the affected areas (Upper and Lower Pond Basins) separately and together. Figure 6 shows the pond basins and locations of the grid squares.

The survey consisted of measurements of detected activity counts during a 1-minute time interval. All measurements were made with paired sets of independent survey instruments--two 1-inch NaI gamma detectors at 1-meter height. To insure precision in reproducing the 1-meter height at each location, the two gamma detectors were mounted on a fixture made from a PVC pole and assorted PVC fittings. Details about the fixtures can be found in Reference 1.

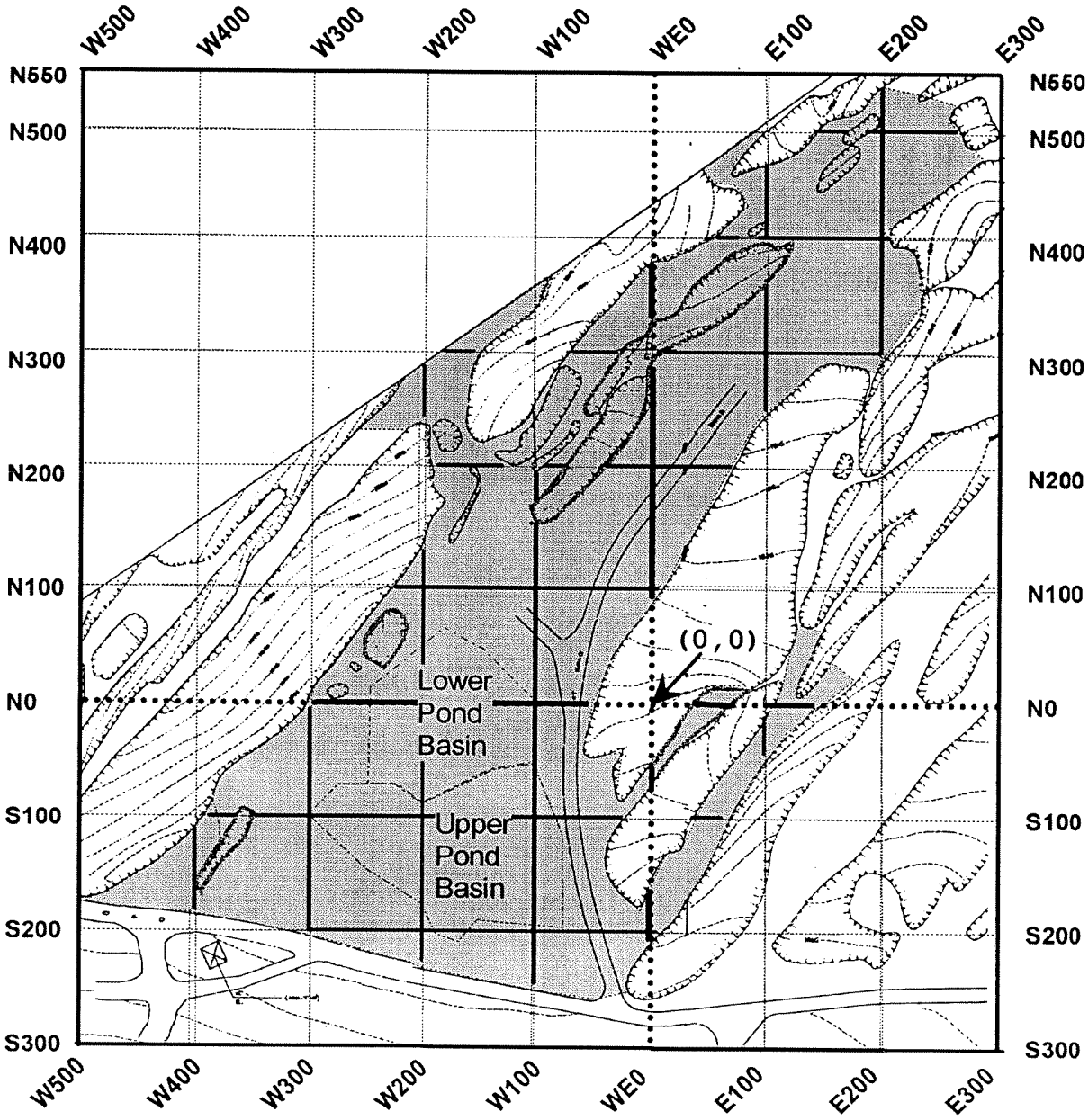

Figure 5. Sodium Disposal Facility Plan View

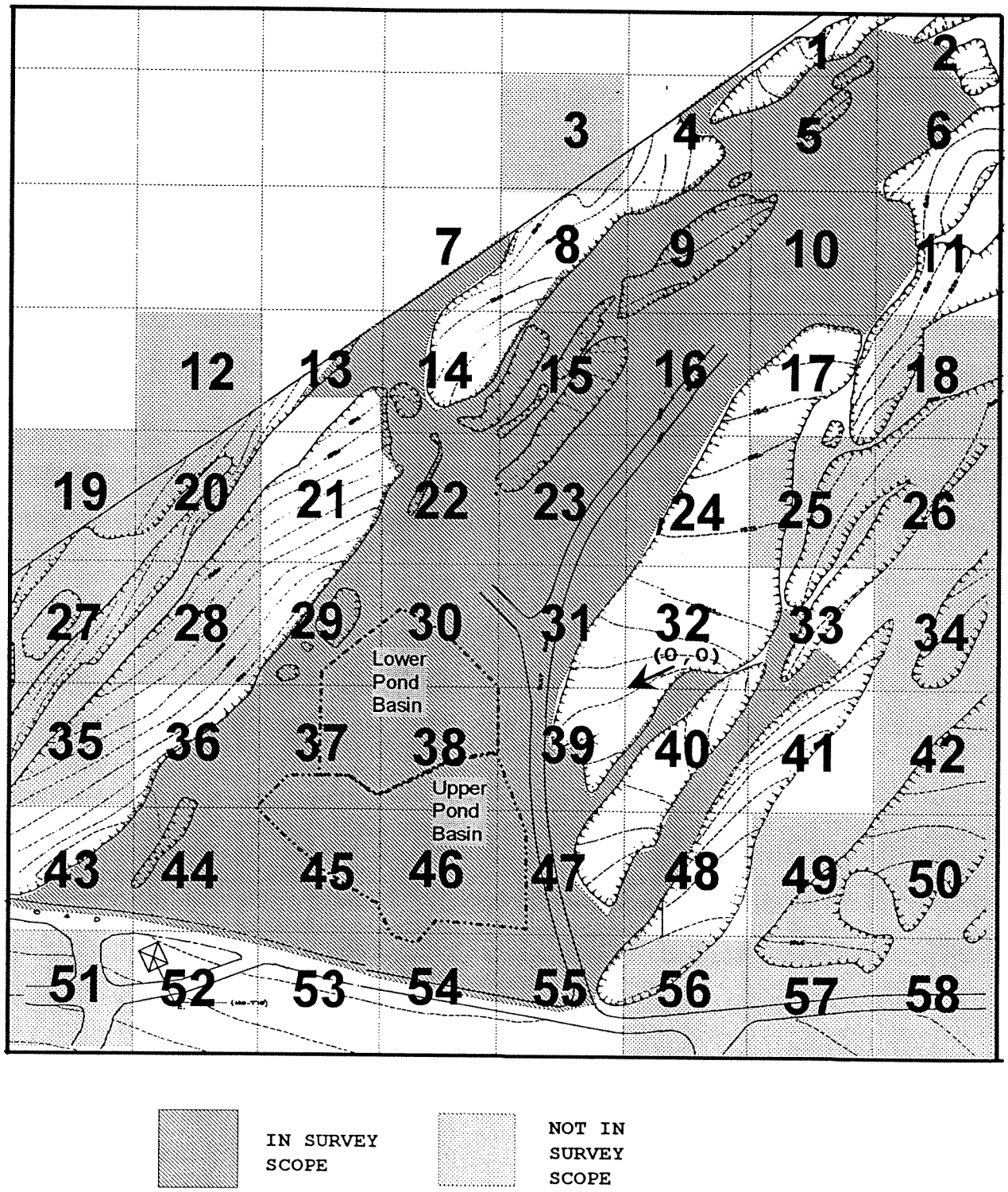

Figure 6. Sodium Disposal Facility Post-remediation Survey Grid Map

During the survey, the readings from the independent instrument pairs were compared for consistency and reasonableness. Anomalous or disparate readings at any time caused the survey team to interrupt the survey to check for instrument malfunctions and to retake the measurements if needed. All of the data (2 instruments averaged) from each location were ultimately used in analyses. Some data points are missing from the location plots of the data; however, the missing plots correspond to inaccessible locations (e.g., rock, heavy growth, poison oak, etc.).

Instrument performance was monitored throughout the survey by regular checks at a designated location which remained unchanged throughout the survey. The performance checks included measuring the instrument response to the ambient background radiation level, as read from a calibrated Reuter-Stokes meter, and measuring the instrument and Reuter-Stokes response to a 5 μCi Cs-137 check source at 1 meter. The performance checks for the instruments were recorded three times daily. The 3-point average Reuter-Stokes information was used to determine the efficiency conversion factor to convert the recorded counts per minute (cpm) to μR/hr for data comparison. Specific details about the instrument check sources, and the hardware used for the performance checks are given in Reference 1.

4.3 Data Analyses and Results

All of the raw data were entered into a Microsoft Excel spreadsheet as counts per minute (cpm) along with the grid coordinates and calibration factors from the survey data sheets. The data was then converted into exposure rate (μR/hr) from the daily Reuter-Stokes calibration data. Since each 10-ft grid point measurement was performed by an instrument pair, the exposure rate analyses on the following plots and graphs are for the average of the paired data. Statistical analyses of the data to determine the mean exposure rate and standard deviation was plotted on a cumulative probability distribution graph. When this type of graph is used, the x-axis is a Gaussian distribution function, so that a perfect fit of the data set to a Gaussian (bell) curve would plot along a straight line and the slope of the line would be greater for a larger standard deviation value of the data set.

The survey data was analyzed in several ways. First, the entire site with all areas combined was graphed. Figure 7 represents the 2316 data points for each separate 10-ft grid point surveyed. The mean site exposure rate which included the remediated areas and surrounding land was 15.6 μR/hr with a standard deviation of 1.46 μR/hr (9%).

Second, the remediated areas (the lower and upper pond basins) data was compared separately from the entire area surveyed. The results are shown in Figure 8. The remediated areas show a mean exposure rate of 14.6 μR/hr (std. dev. = 0.897 μR/hr) for 419 grid points. Figure 9 represents the mean exposure rate excluding the upper and lower pond basins. Figure 10 shows the upper pond basin mean exposure rate analysis and Figure 11 shows the lower pond basin mean exposure rate analysis. Lastly, each 100-ft by 100-ft grid square was given a numbering system to locate the data as shown in Figure 12. Each grid square's data is shown along with the resulting statistical analysis graph and is given in Figures 13-52. These figures also show the minimum and maximum exposure rate (used in Table 1) in larger typeface.

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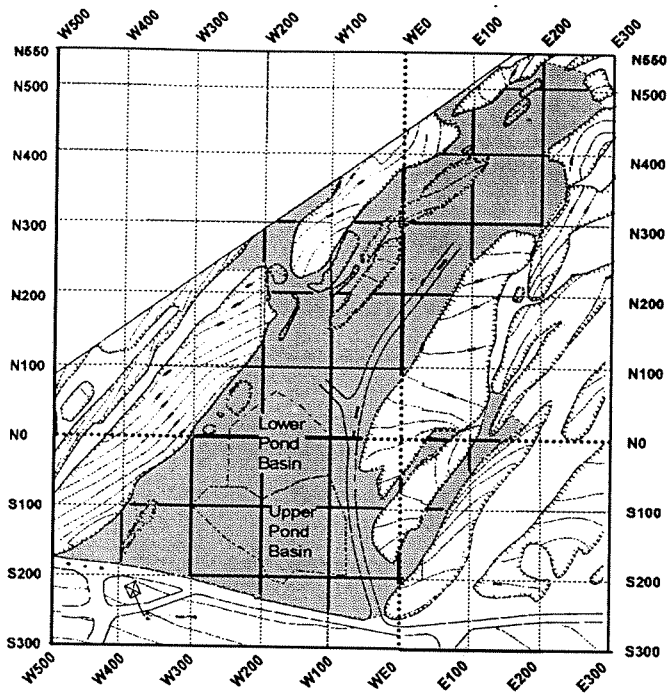


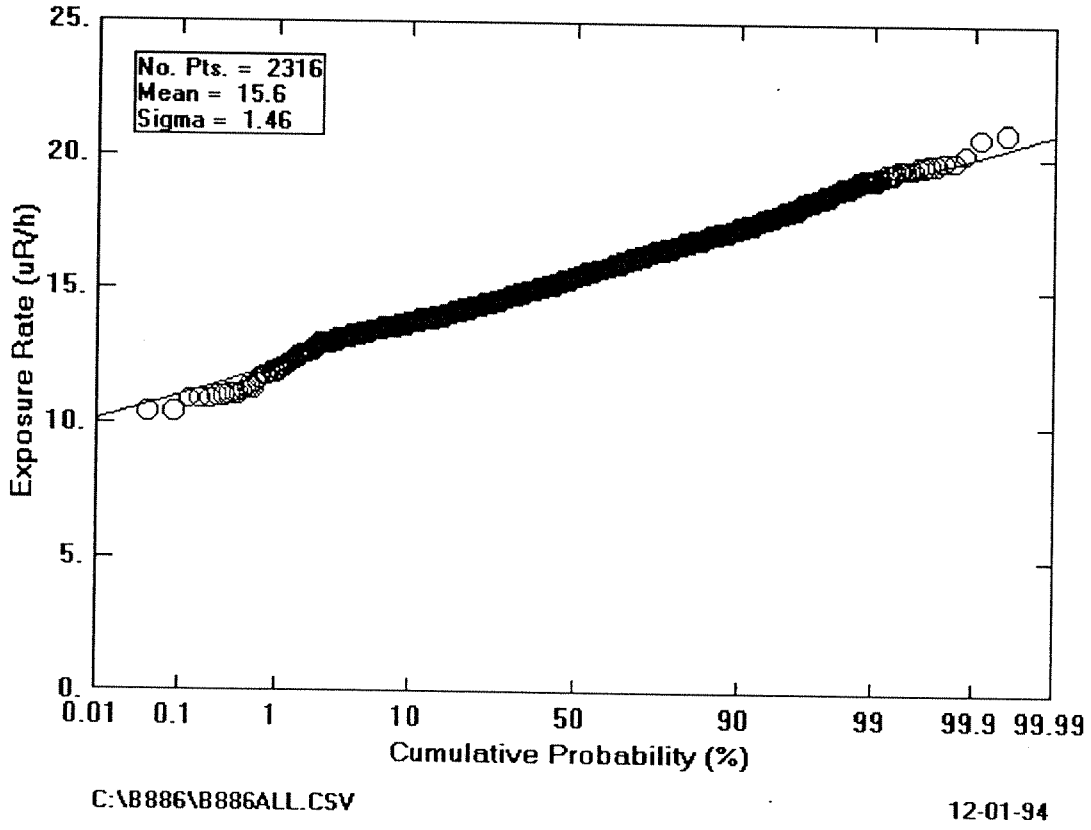
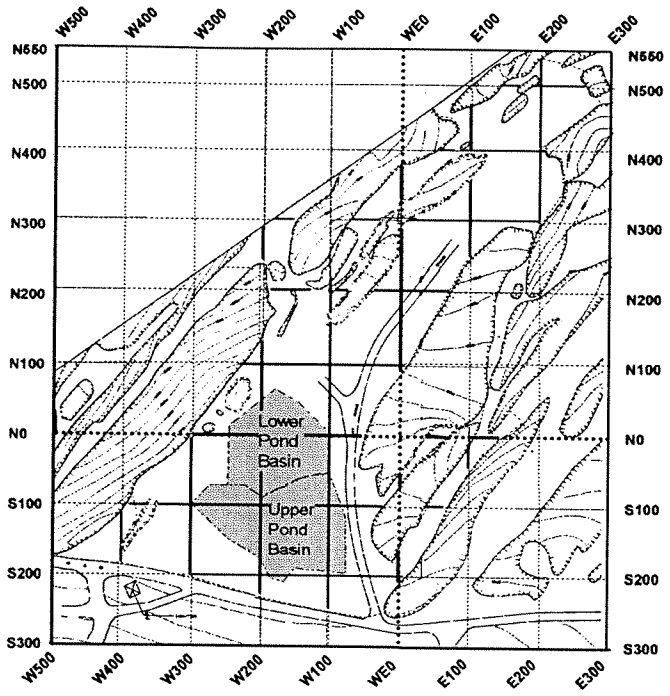


Figure 7. All Areas Combined Ambient Gamma Exposure Rate.



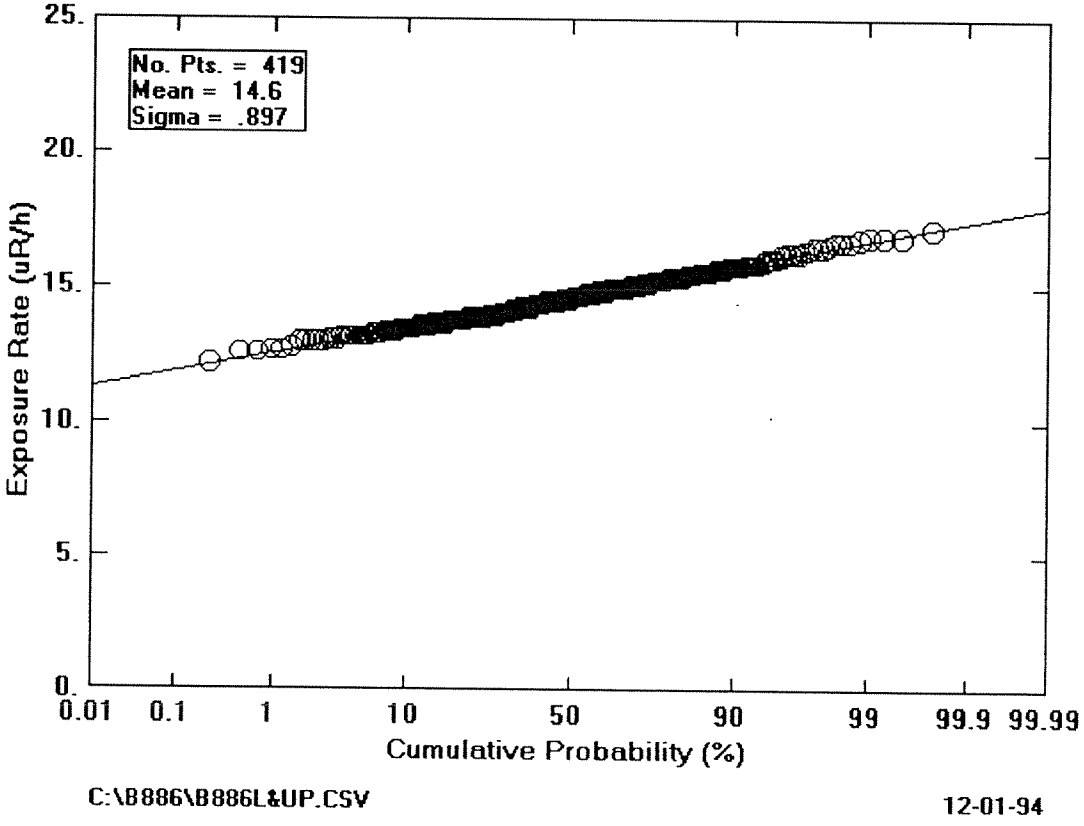
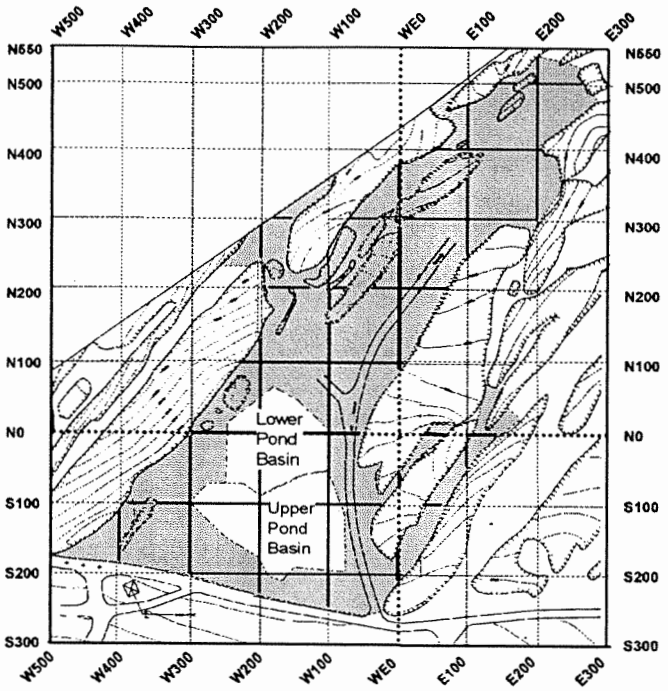


Figure 8. Lower and Upper Pond Basins Ambient Gamma Exposure Rate.



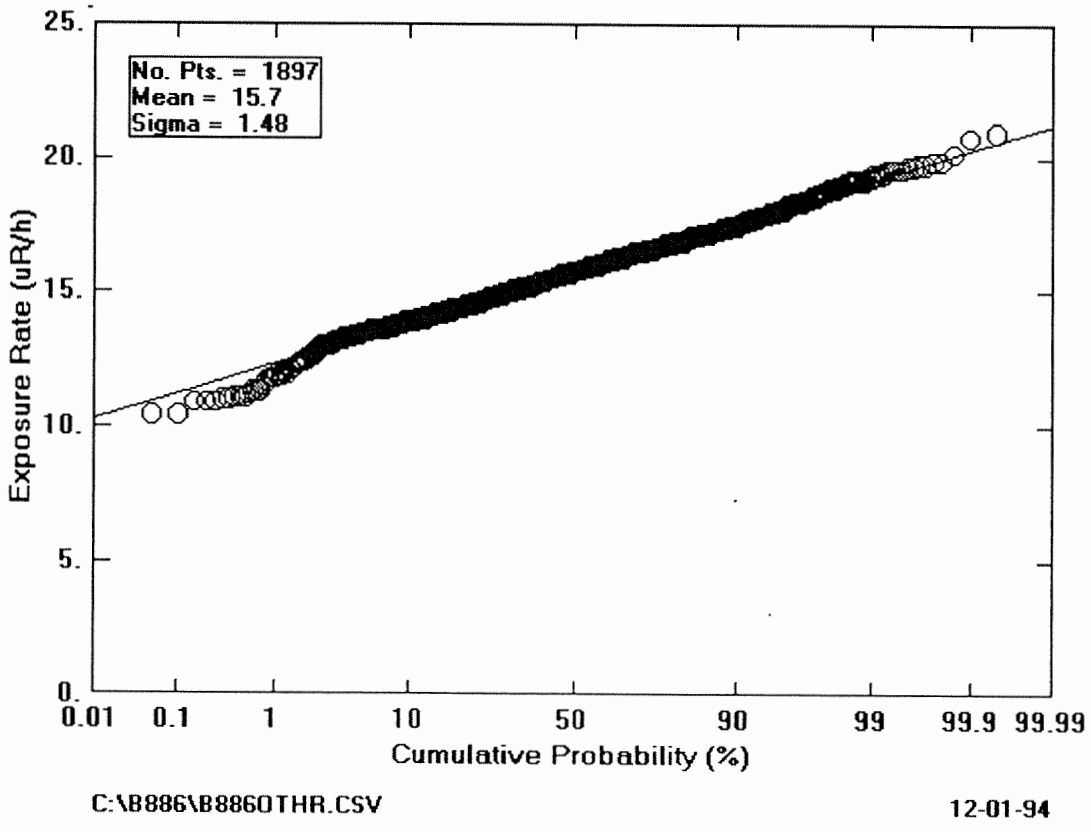
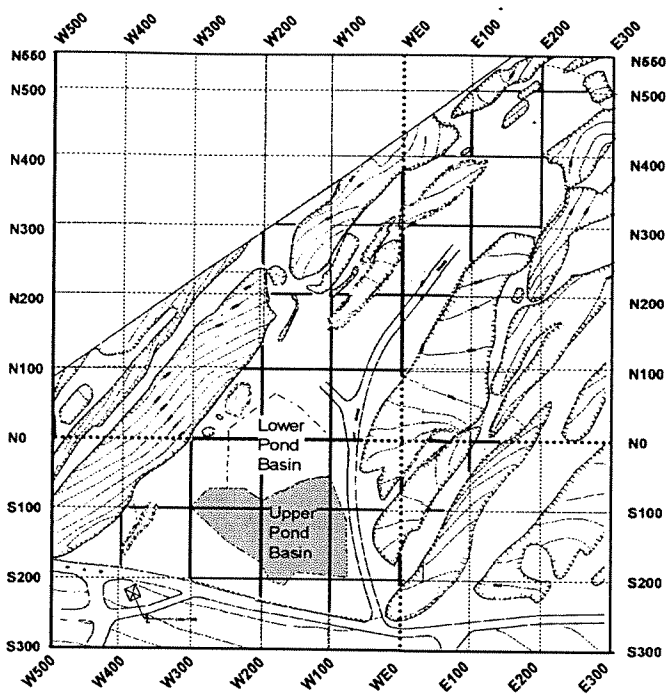


Figure 9. Ambient Gamma Exposure Rate Excluding the Lower and Upper Pond Basins.



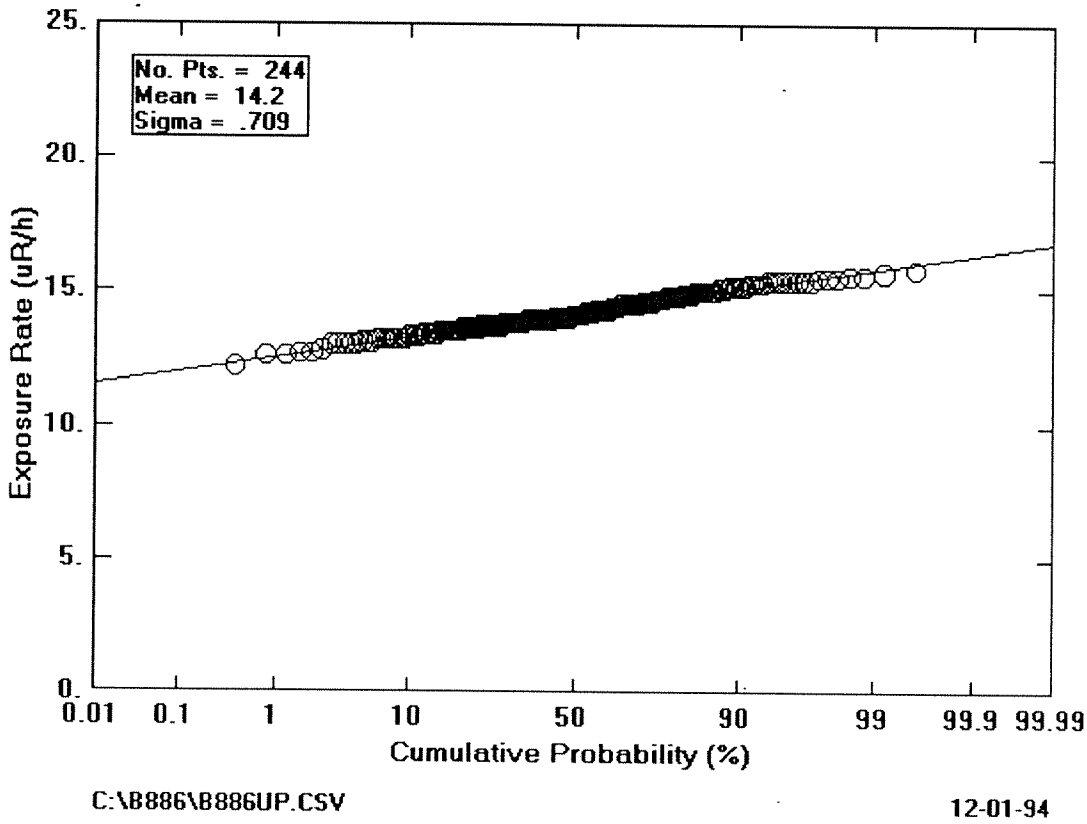
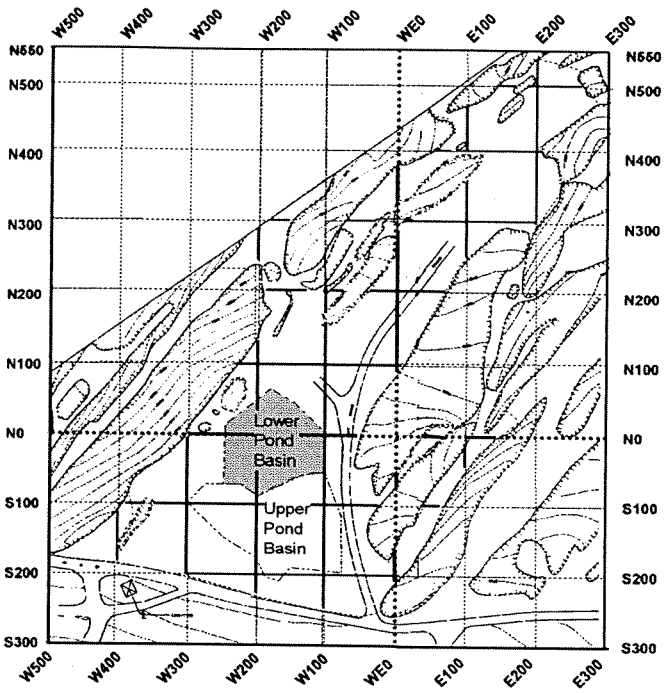


Figure 10. Upper Pond Basin Ambient Gamma Exposure Rate.



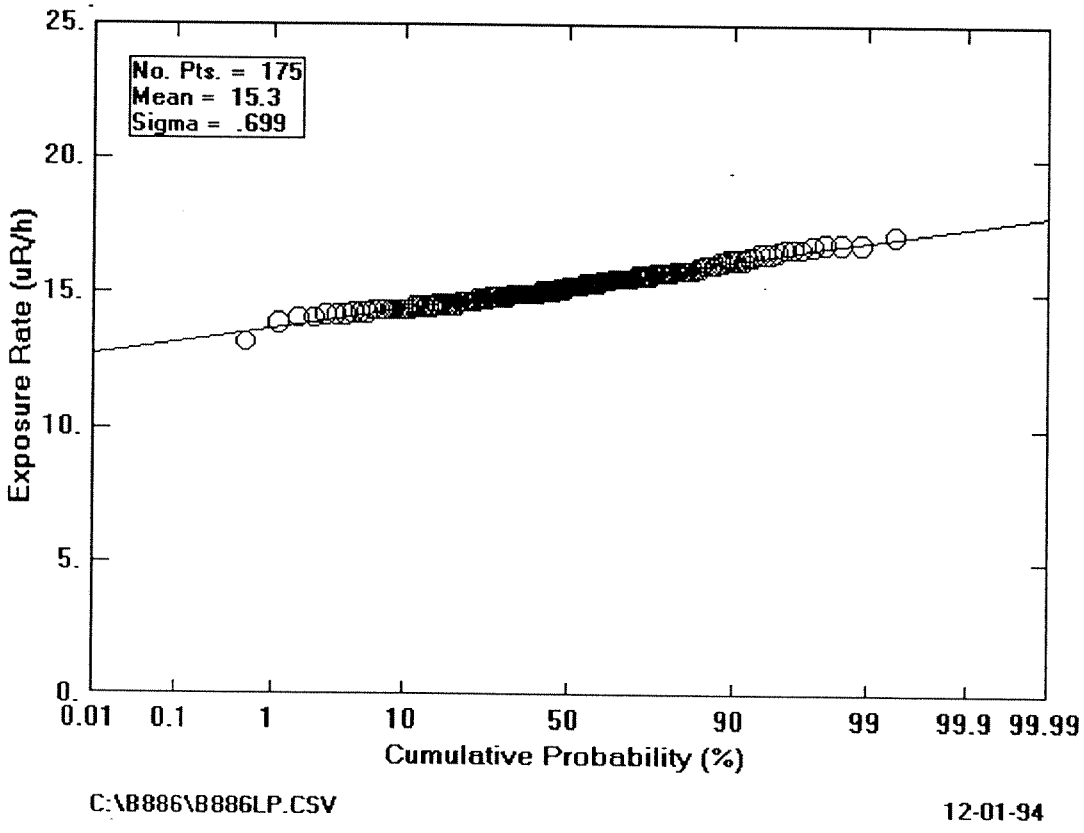


Figure 11. Lower Pond Basin Ambient Gamma Exposure Rate.

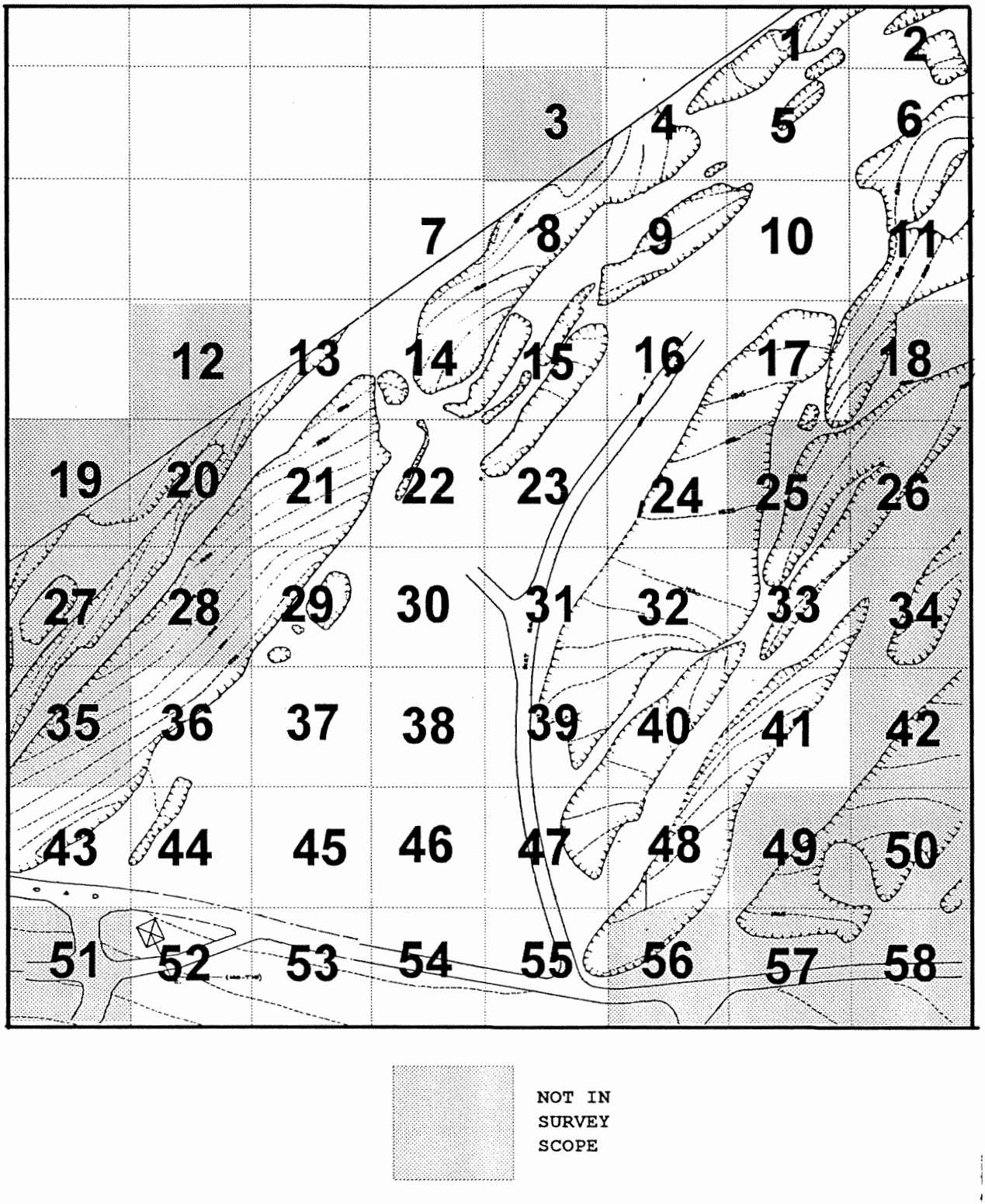
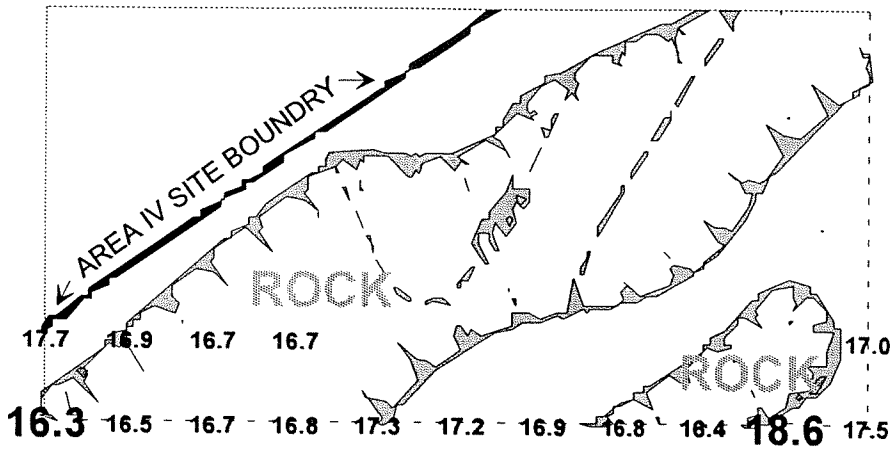
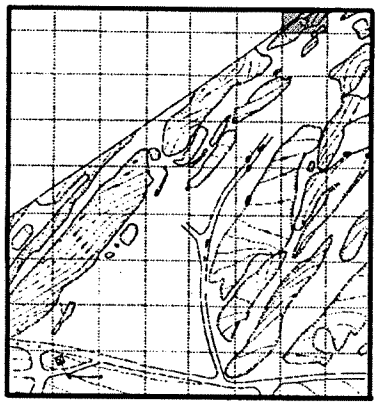


Figure 12. Grid Locator Map for Survey Results





Grid #1
N500ft - 550ft
E100ft - 200ft

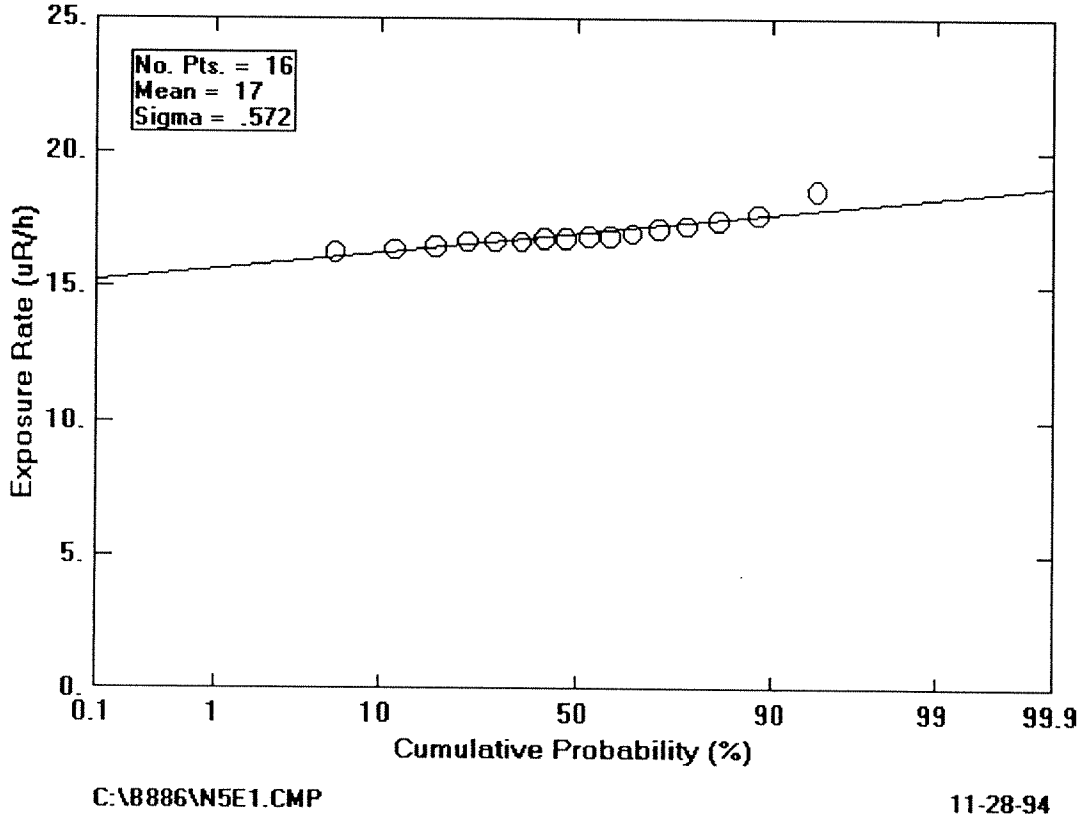
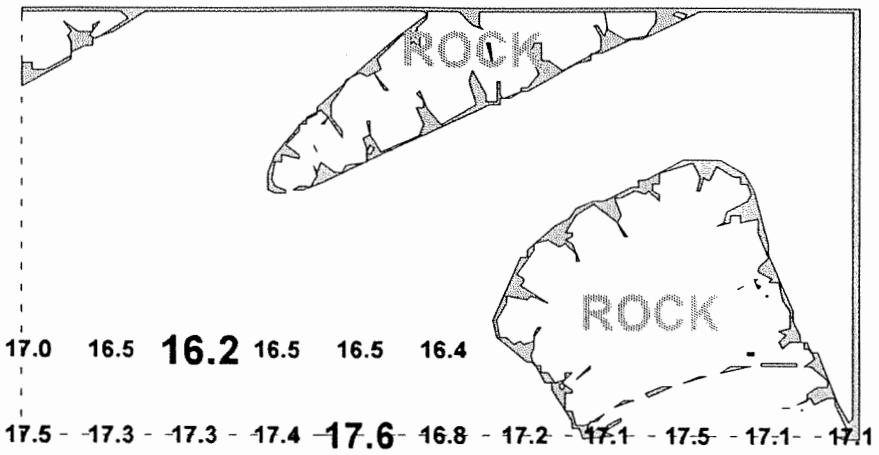
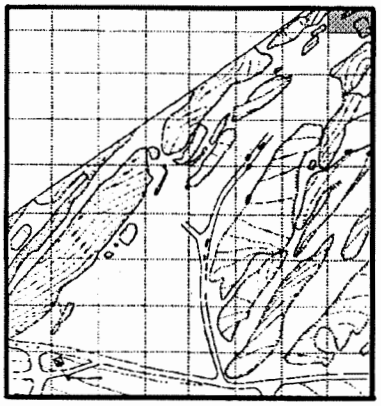


Figure 13. Grid #1 Ambient Gamma Exposure Rate.





Grid #2
N500ft - 550ft
E200ft - 300ft

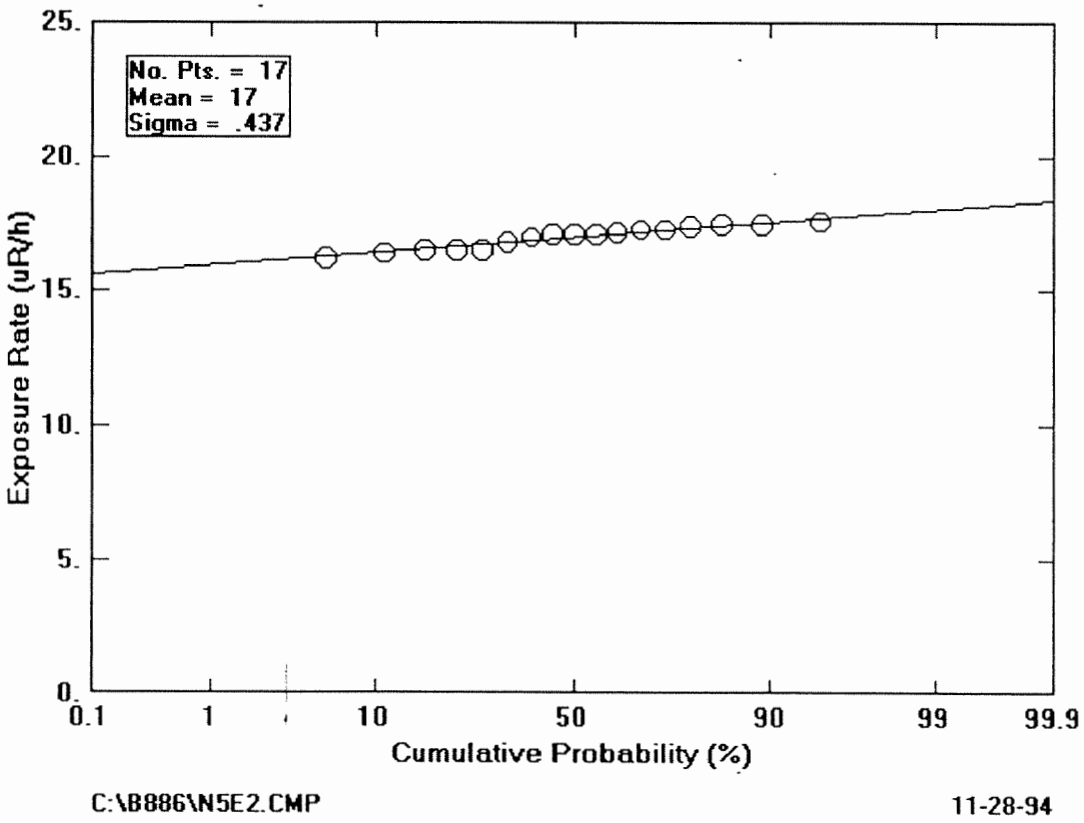
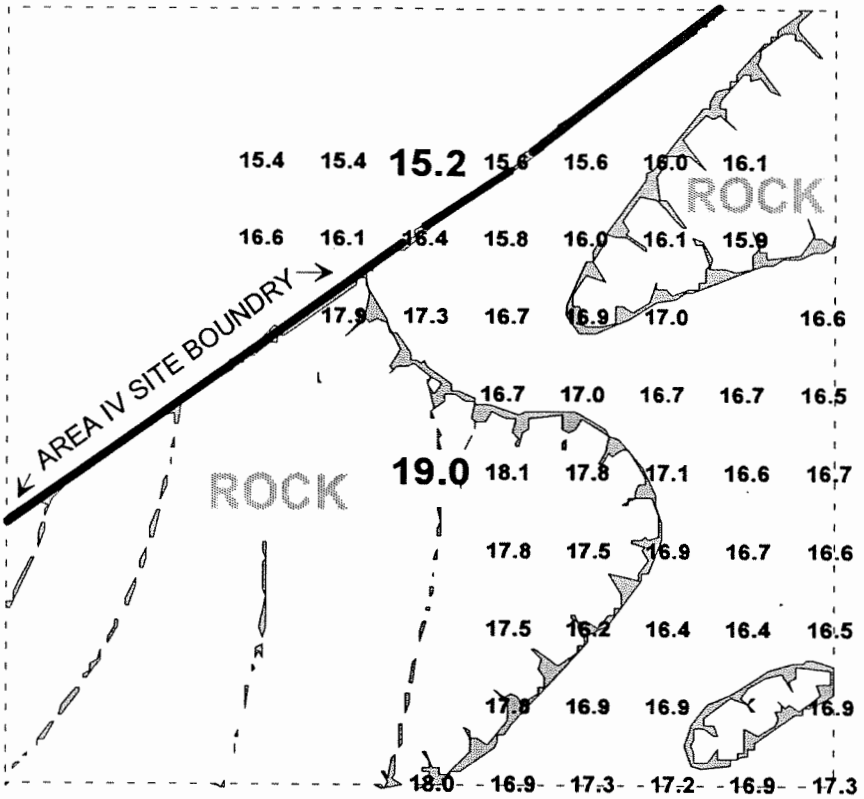
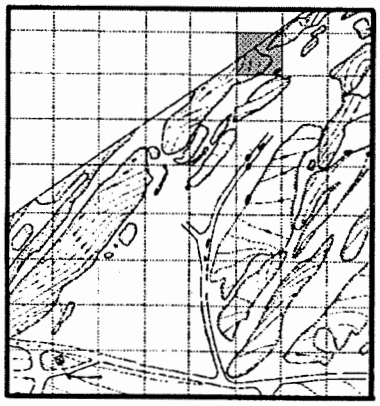


Figure 14. Grid #2 Ambient Gamma Exposure Rate.





Grid #4
N400ft - 500ft
E000ft - 100ft

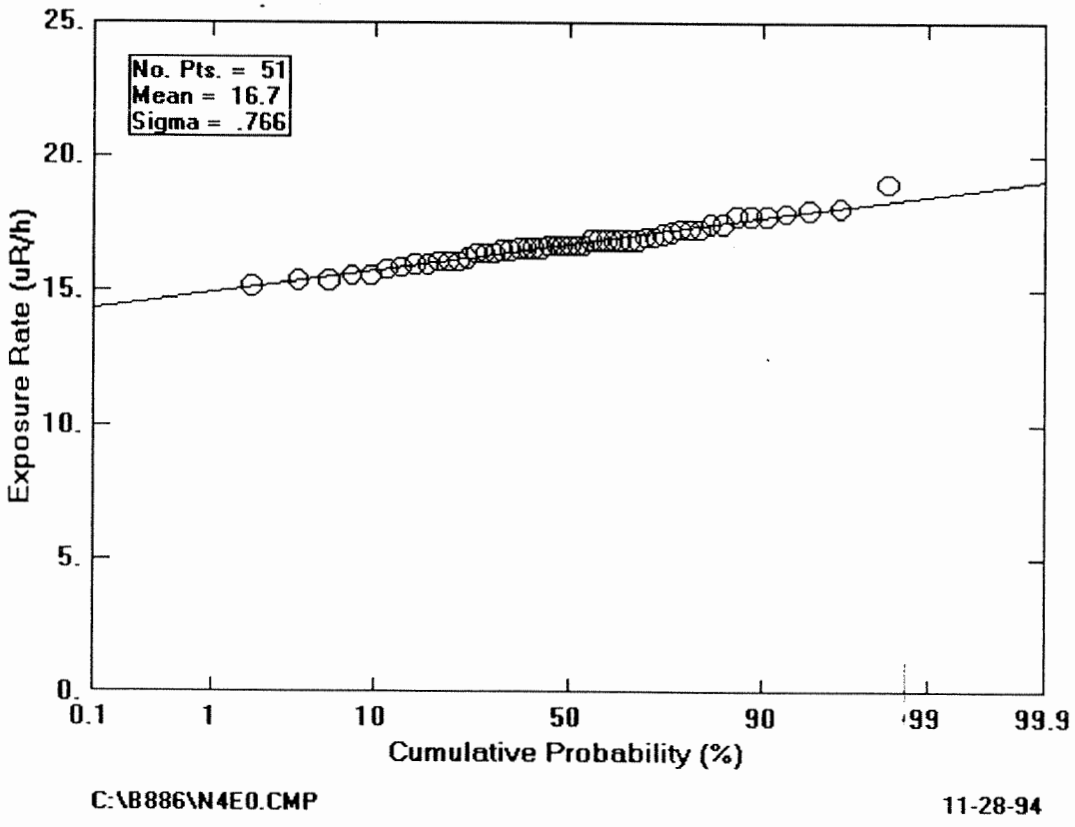
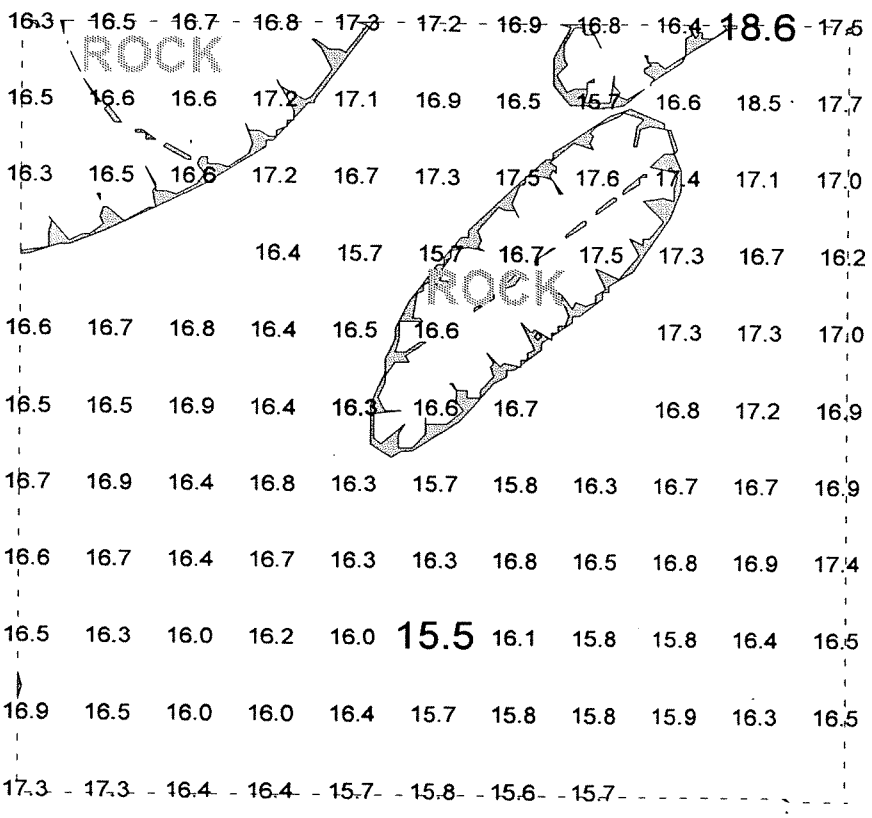
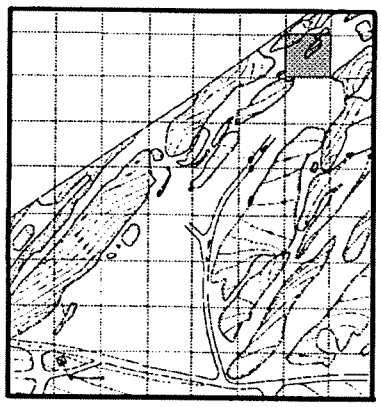


Figure 15. Grid #4 Ambient Gamma Exposure Rate.





Grid #5
N400ft - 500ft
E100ft - 200ft

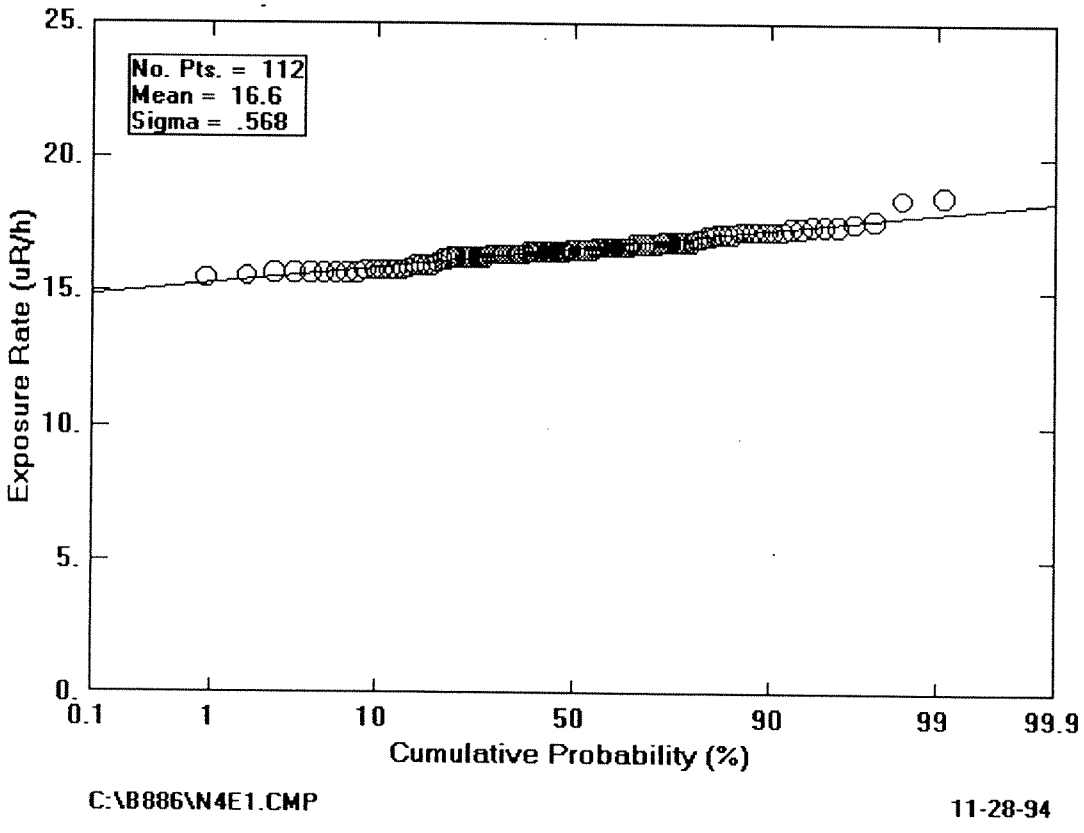
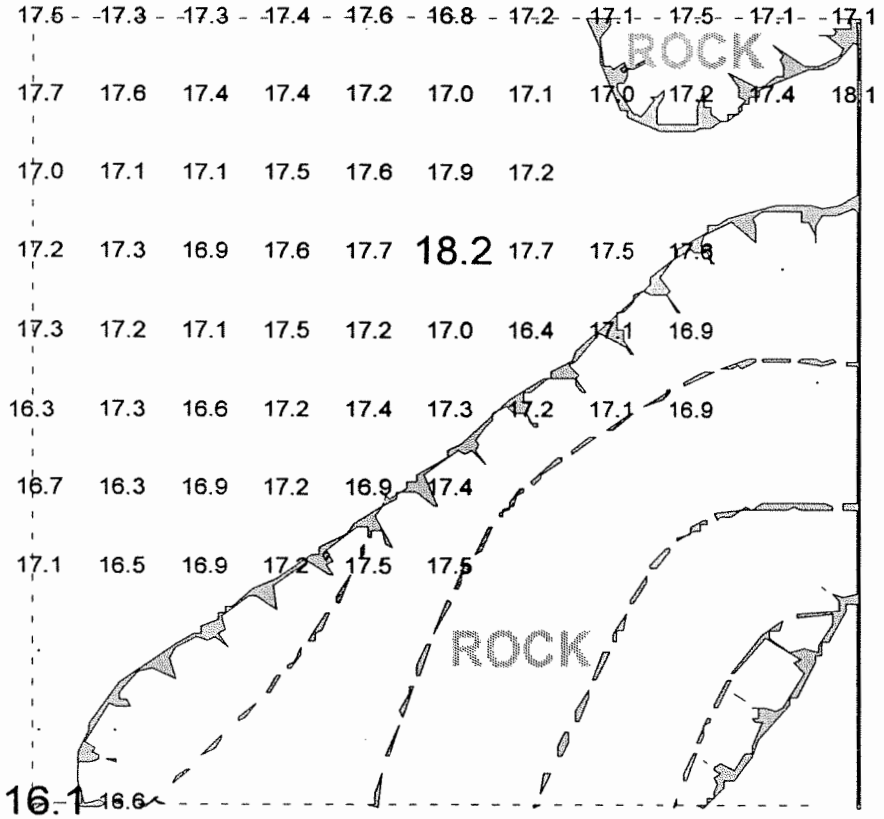
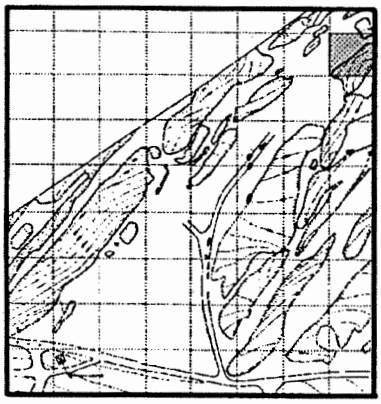


Figure 16. Grid #5 Ambient Gamma Exposure Rate.





Grid #6
N400ft - 500ft
E200ft - 300ft

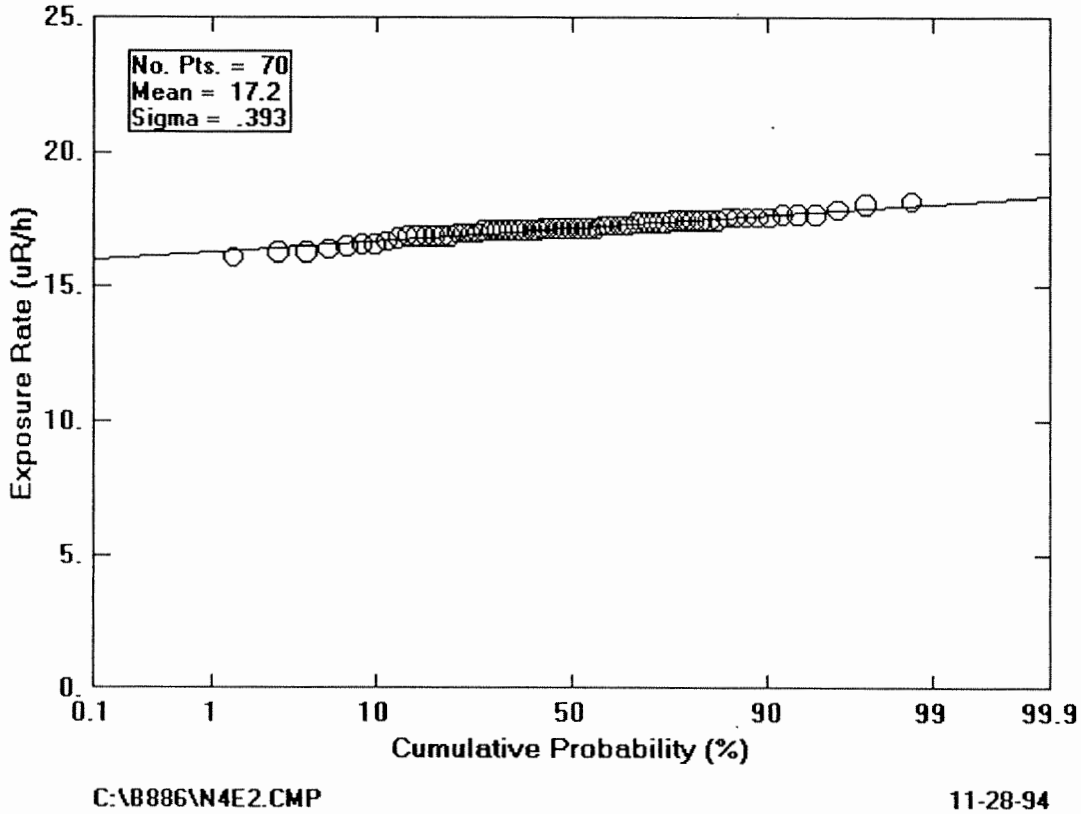
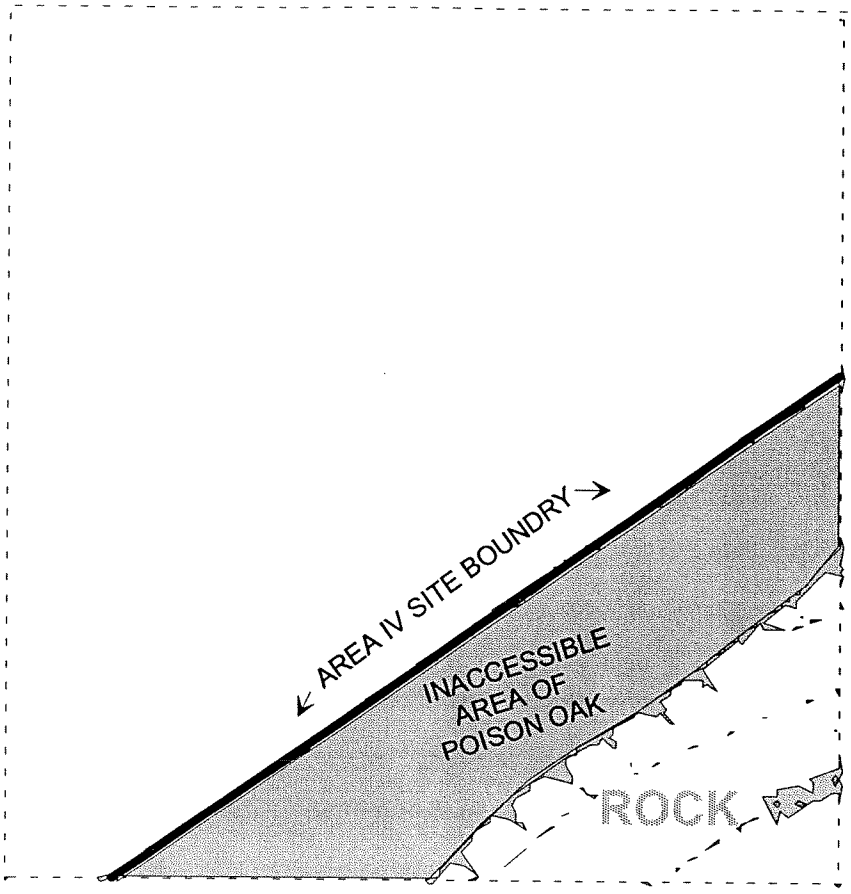
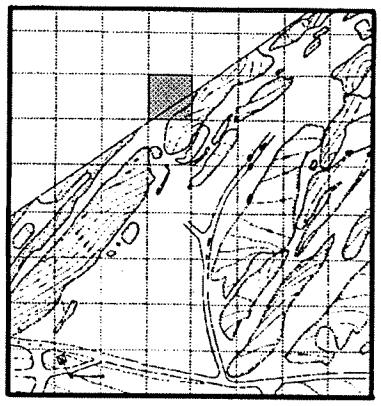


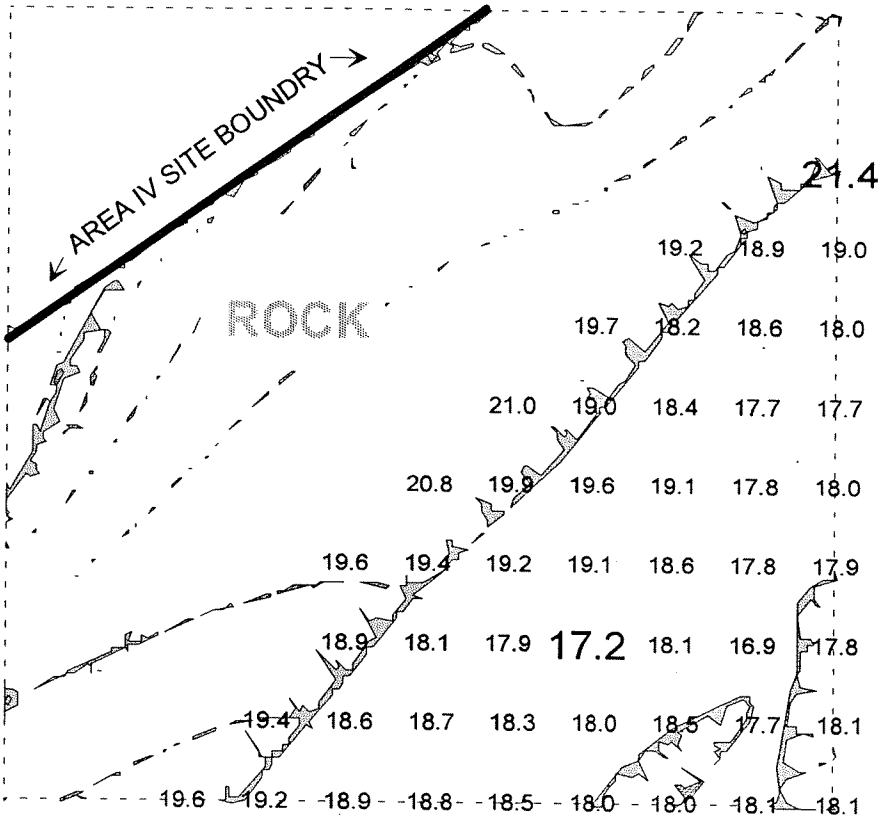
Figure 17. Grid #6 Ambient Gamma Exposure Rate.

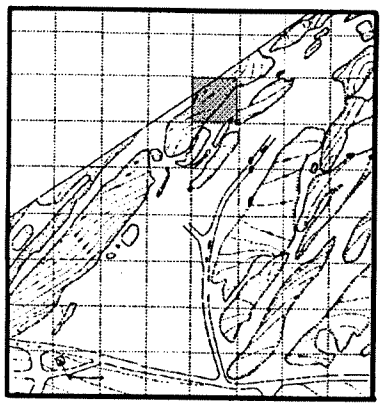




Grid #7
N300ft - 400ft
W200ft - 100ft

Figure 18. Grid #7 Plotview - Inaccessible area





Grid #8
N300ft - 400ft
W100ft - 0ft

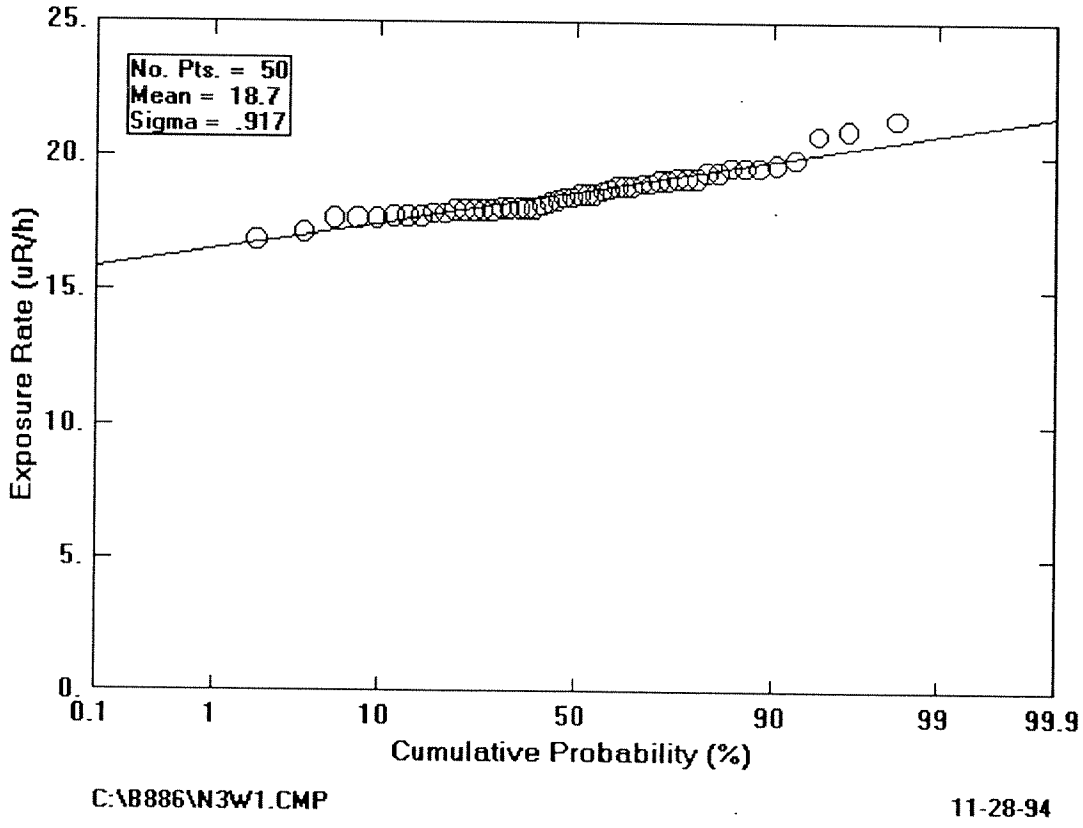
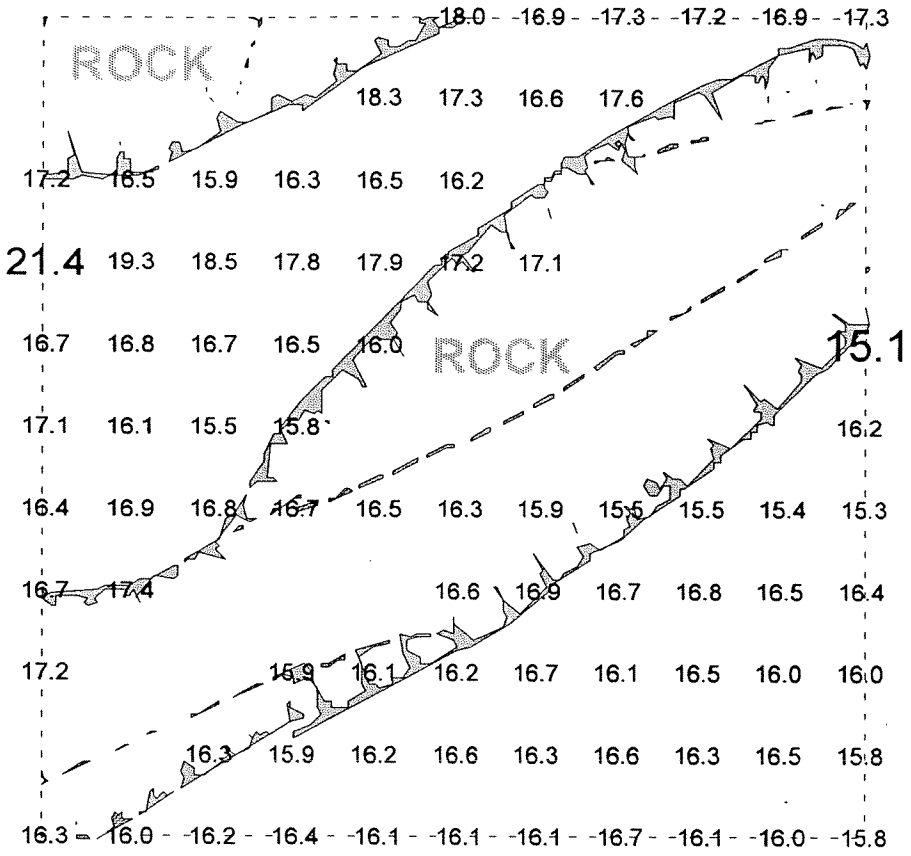
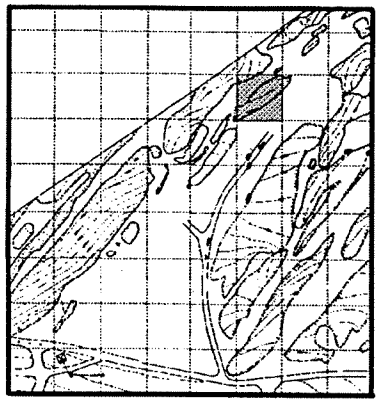


Figure 19. Grid #8 Ambient Gamma Exposure Rate.





Grid #9
N300ft - 400ft
E 0ft - 100ft

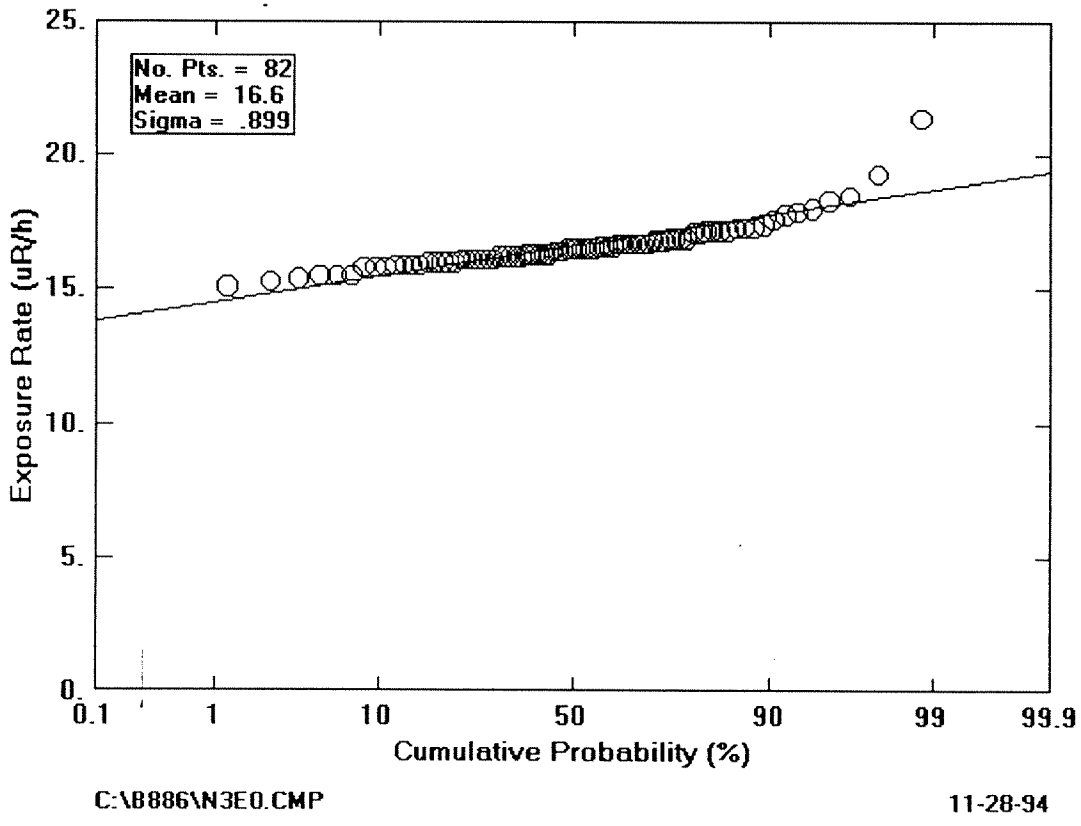
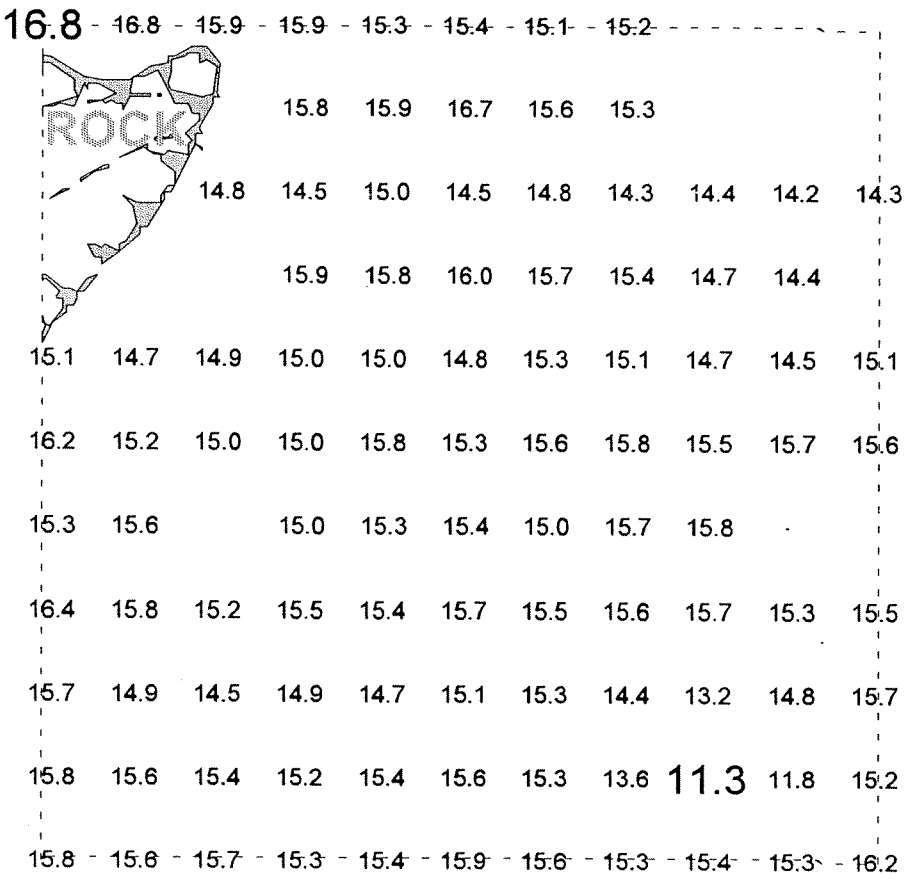
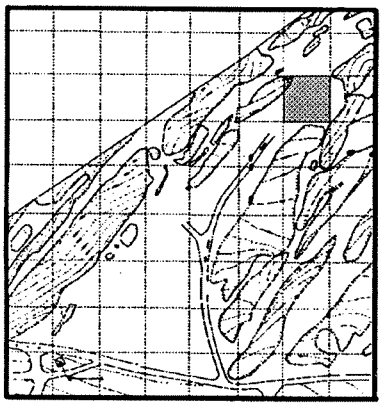


Figure 20. Grid #9 Ambient Gamma Exposure Rate.





Grid #10
N300ft - 400ft
E100ft - 200ft

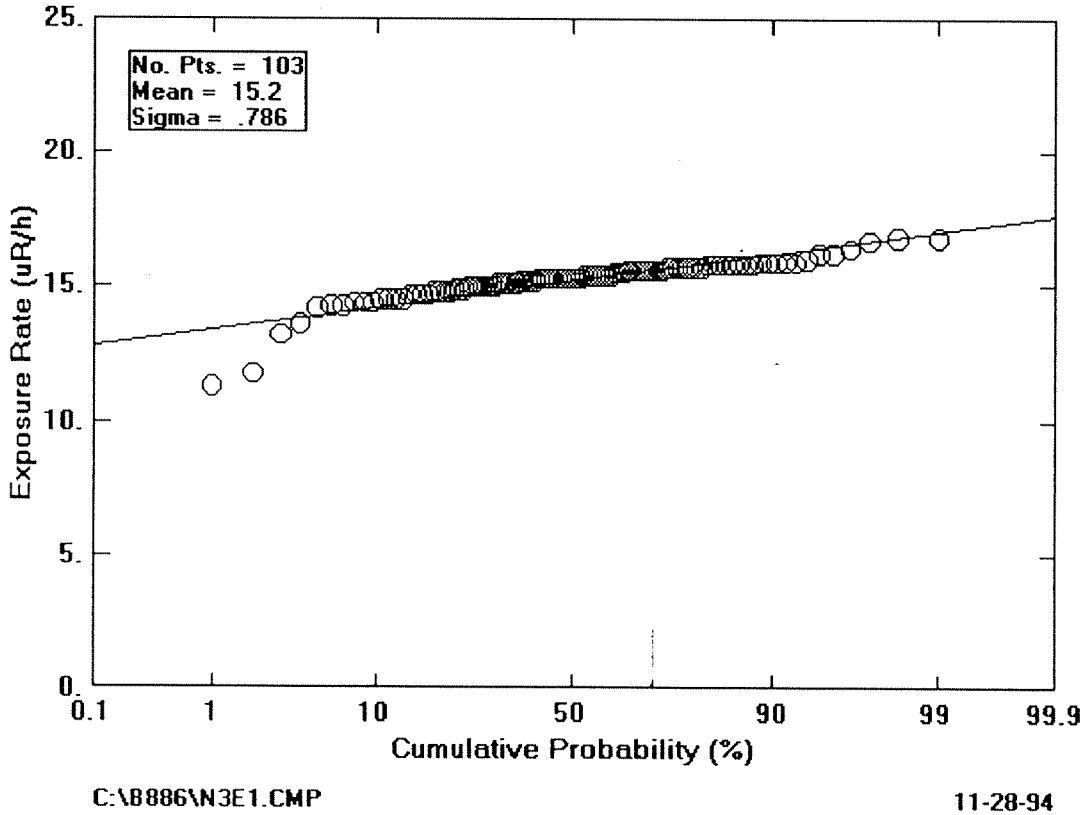
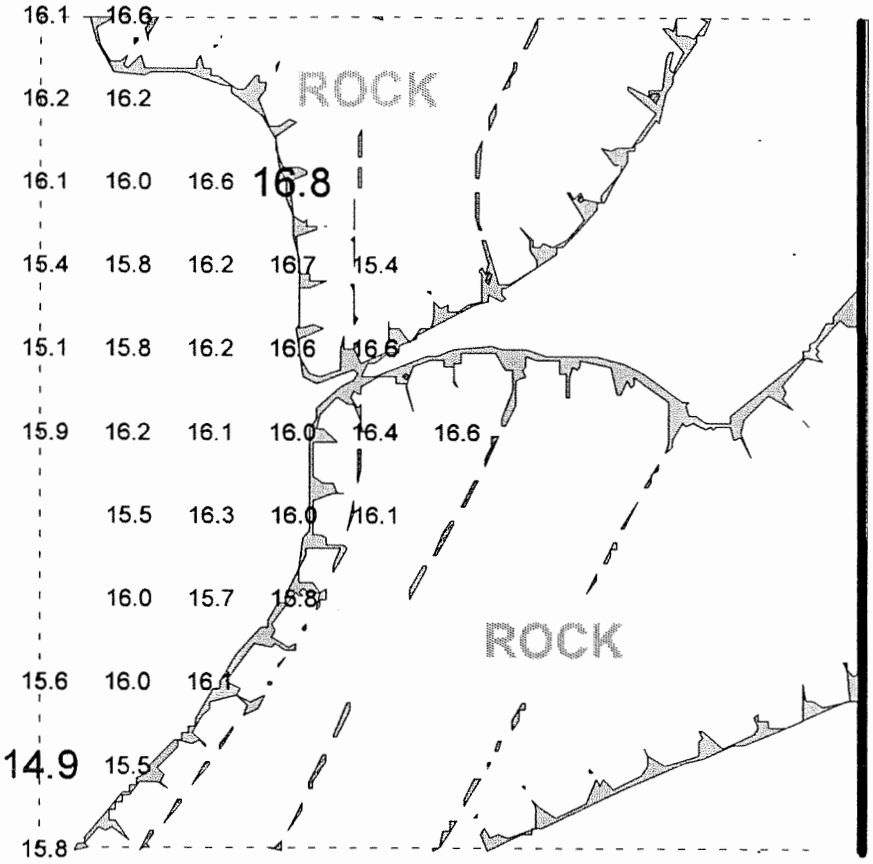
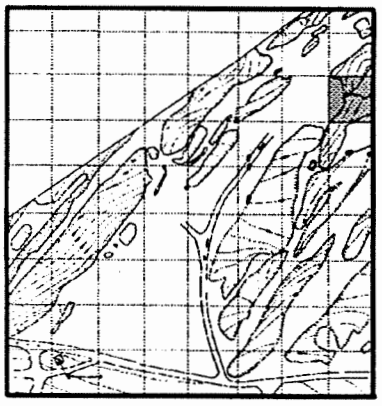


Figure 21. Grid #10 Ambient Gamma Exposure Rate.





Grid #11
N300ft - 400ft
E200ft - 300ft

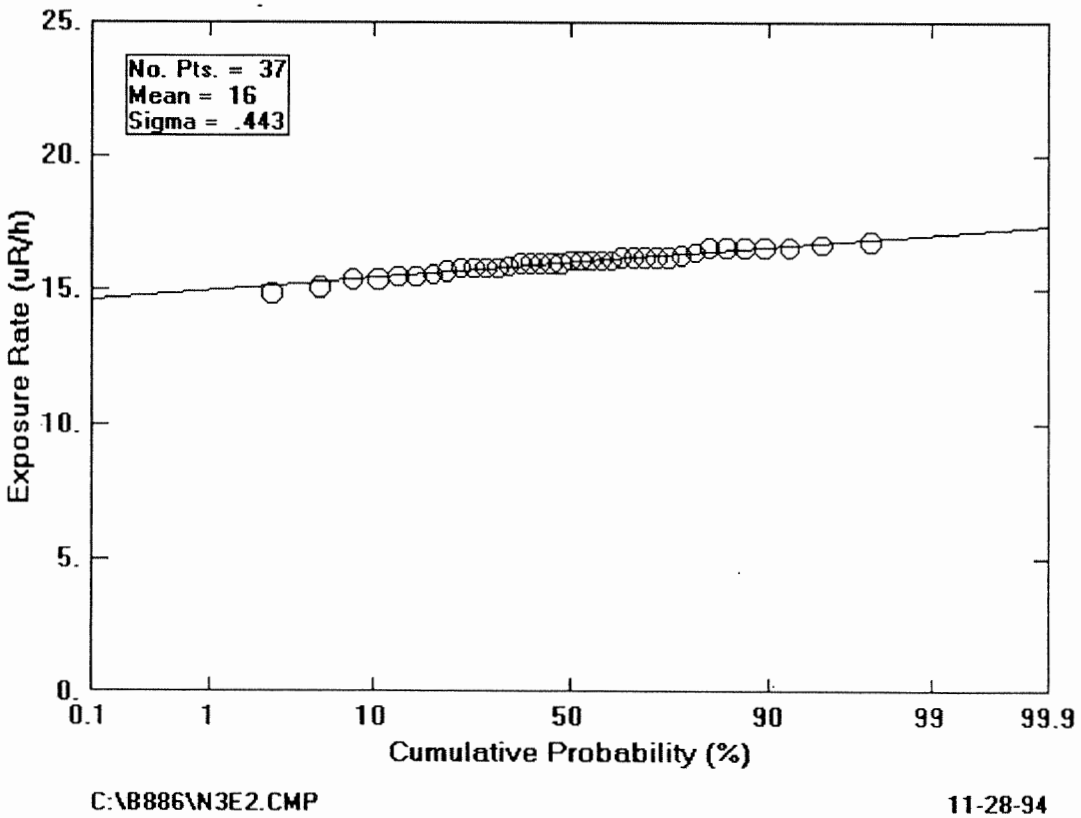
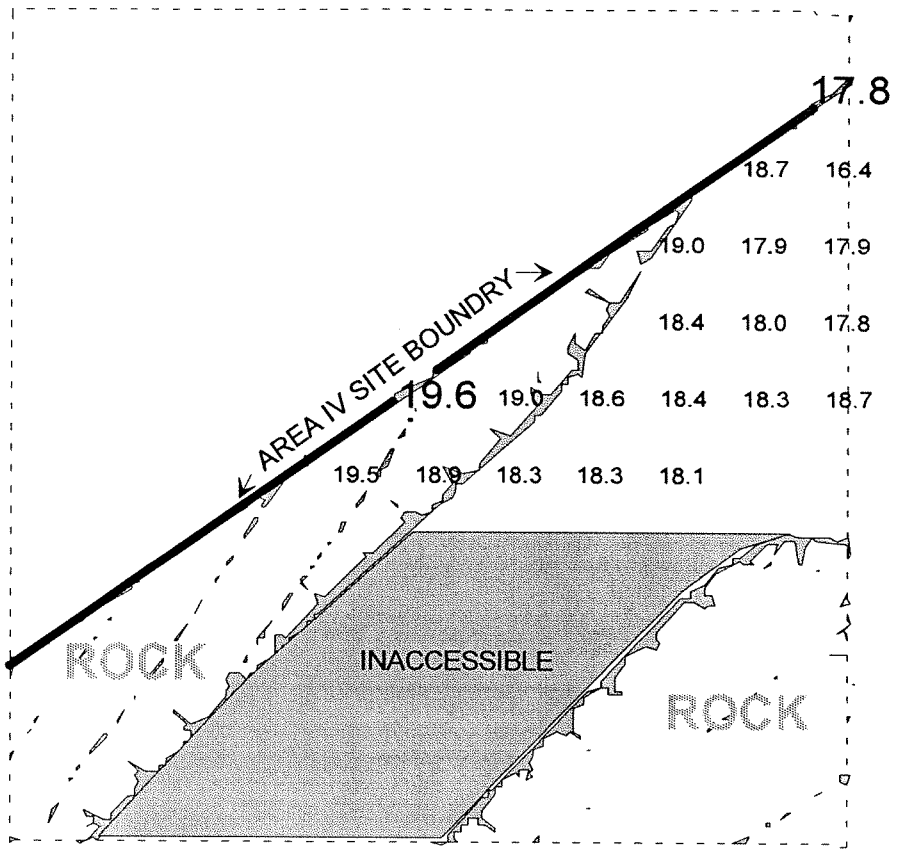
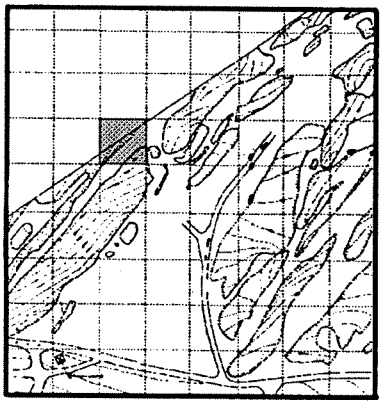


Figure 22. Grid #11 Ambient Gamma Exposure Rate.





Grid #13
N200ft - 300ft
W300ft - 200ft

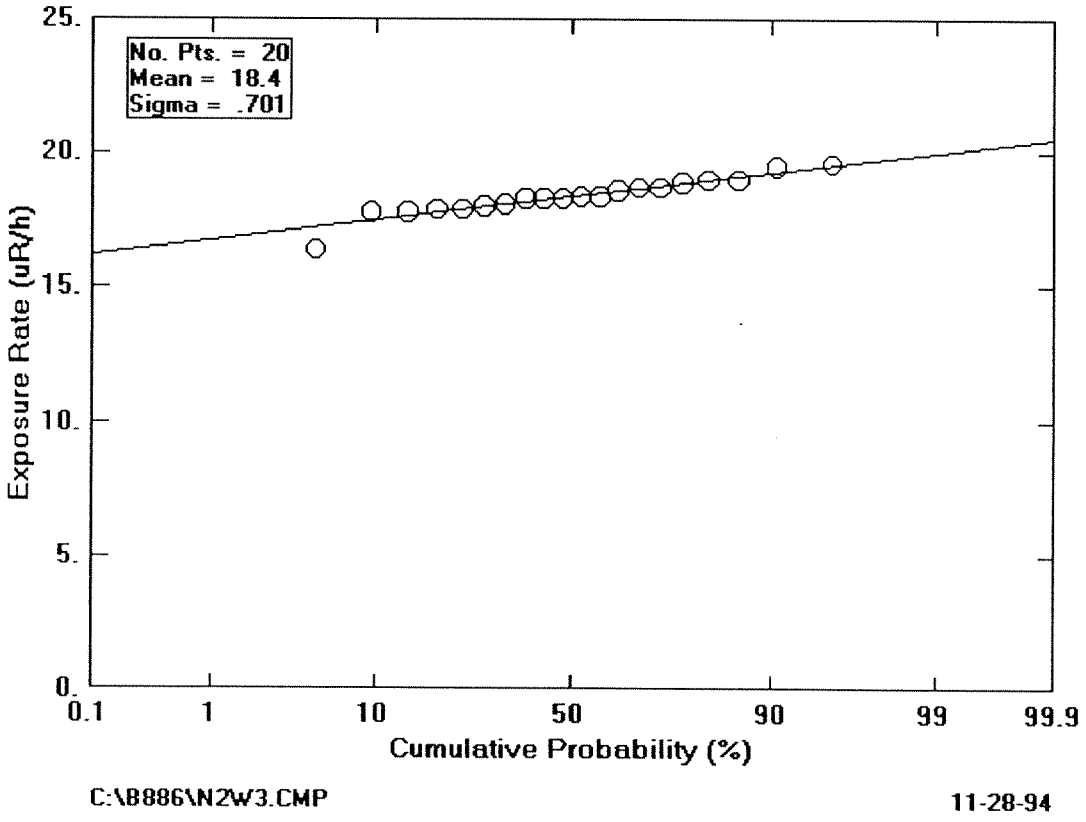
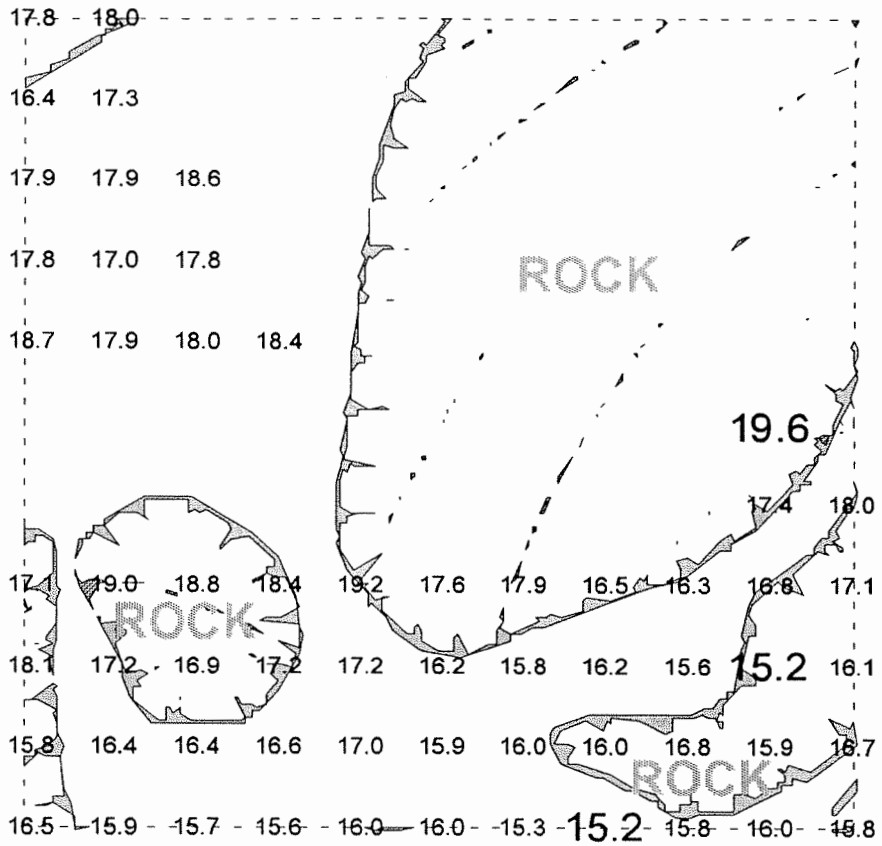
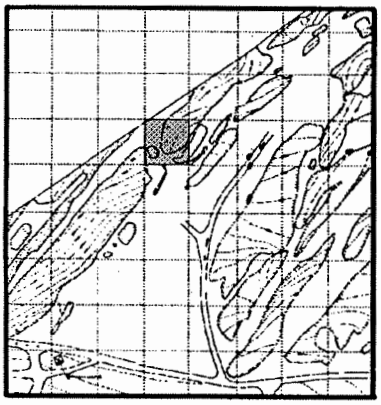


Figure 23. Grid #13 Ambient Gamma Exposure Rate.





Grid #14
N200ft - 300ft
W200ft - 100ft

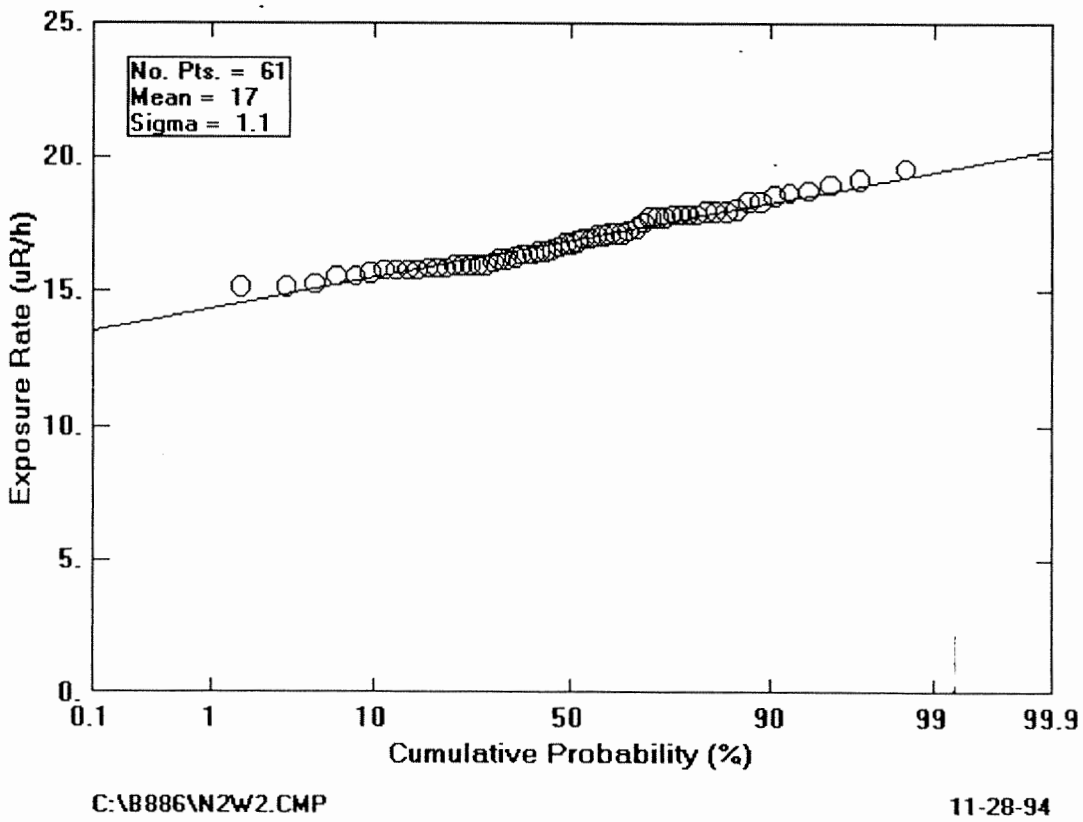
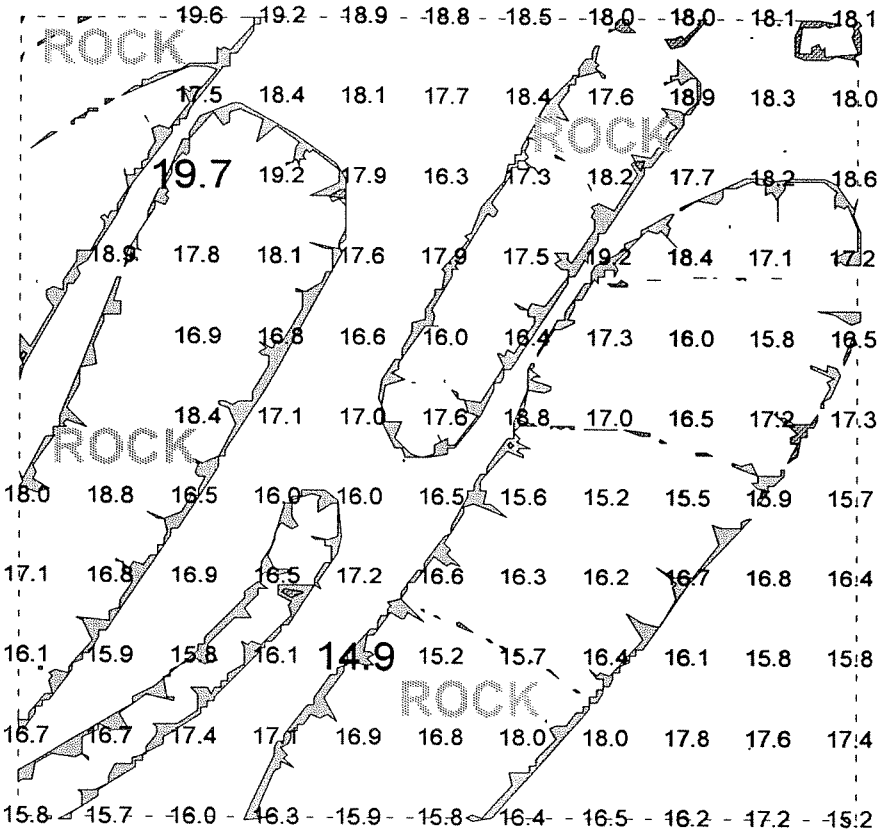
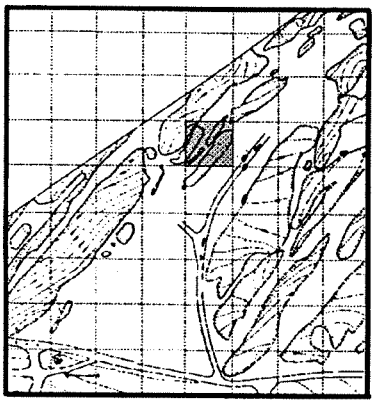


Figure 24. Grid #14 Ambient Gamma Exposure Rate.





Grid #15
N200ft - 300ft
W100ft - 0ft

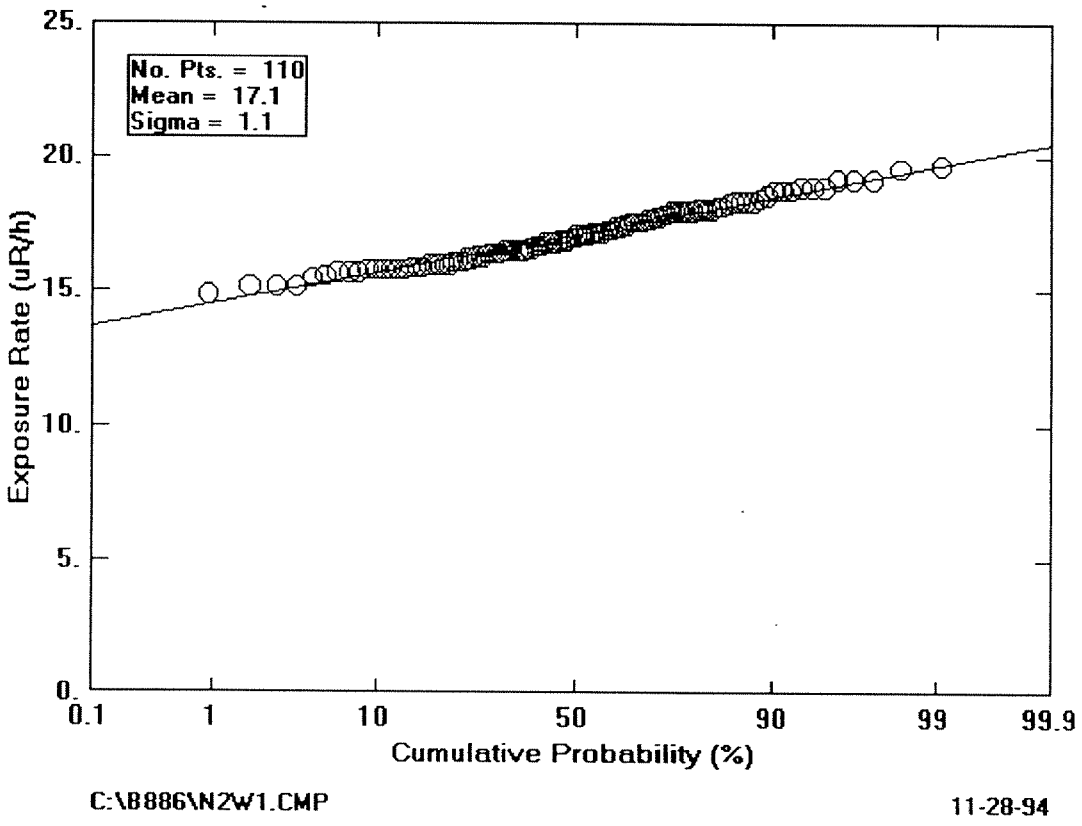
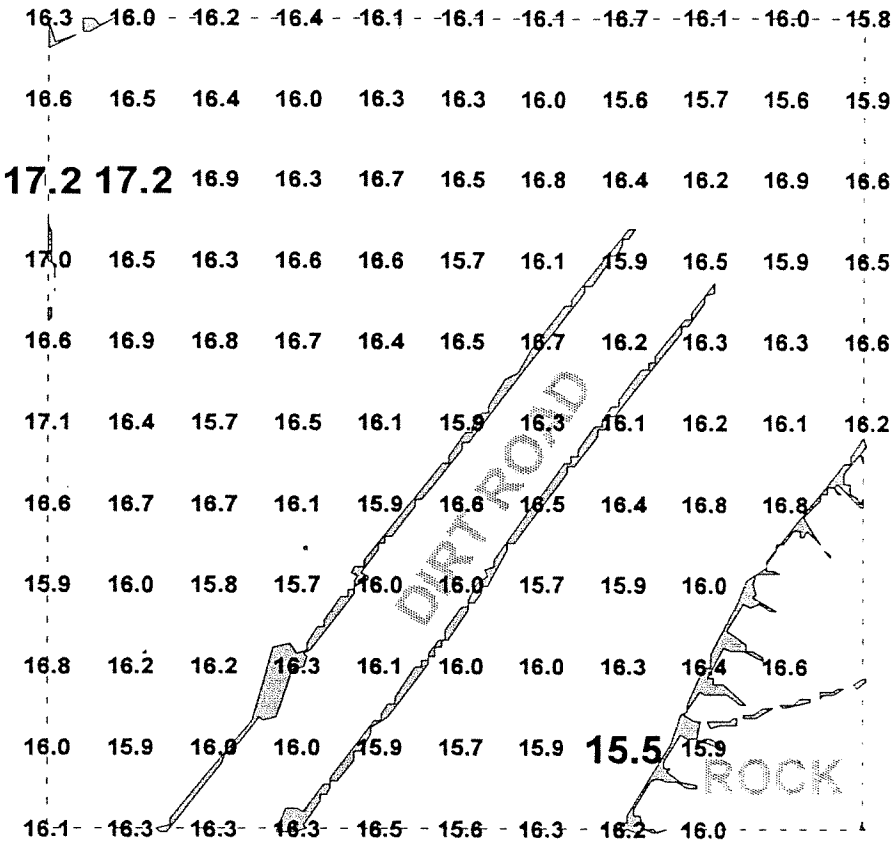
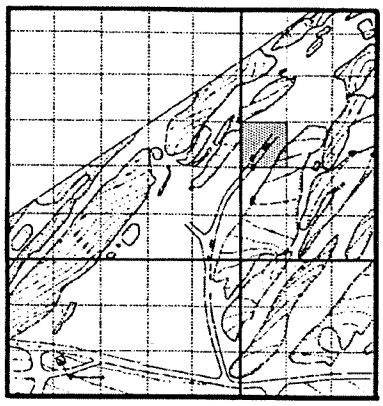


Figure 25. Grid #15 Ambient Gamma Exposure Rate.





Grid #16
N200ft - 300ft
E 0ft - 100ft

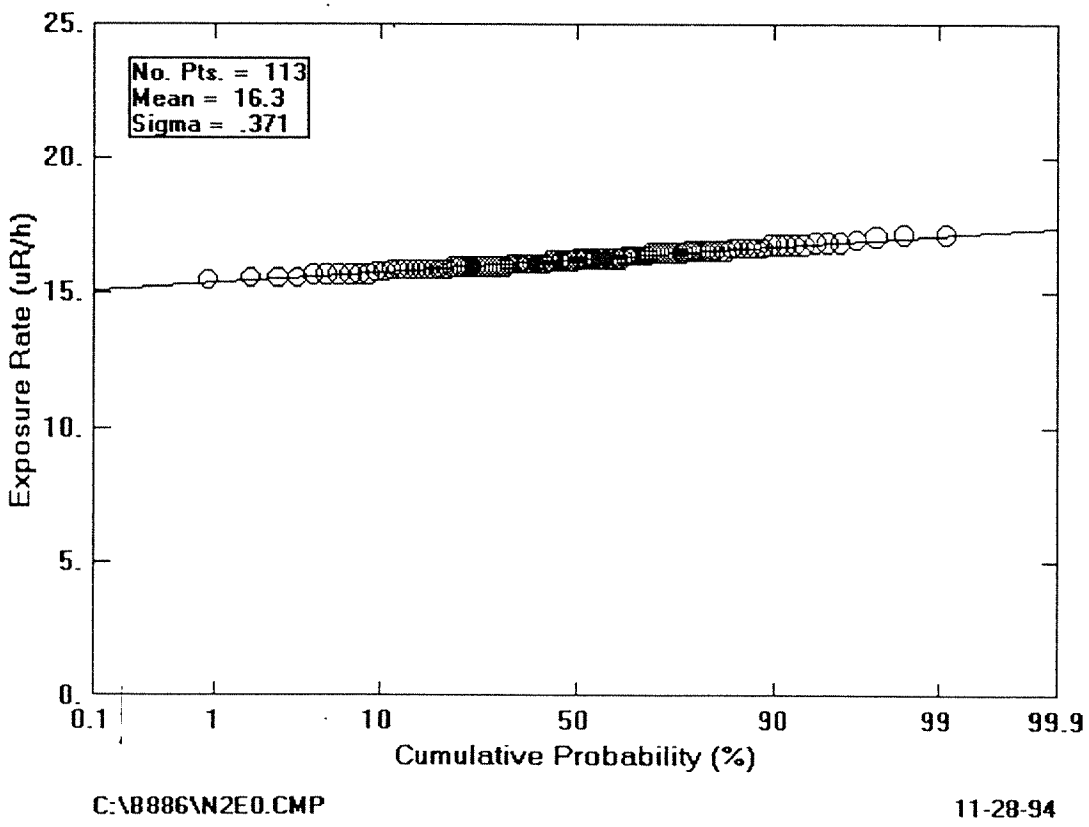
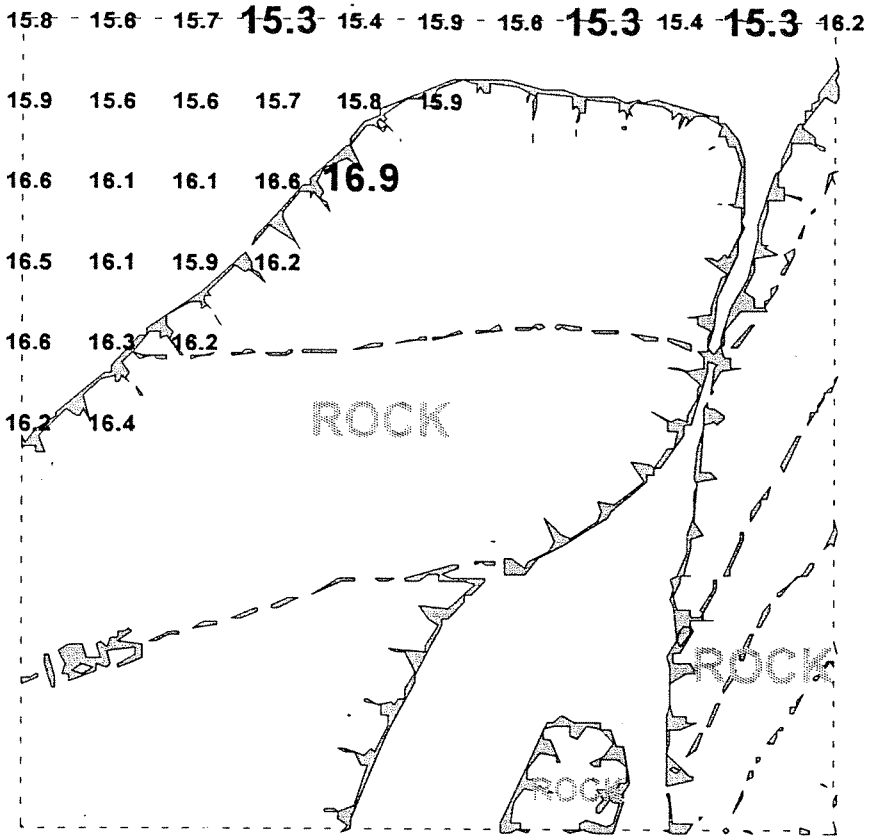
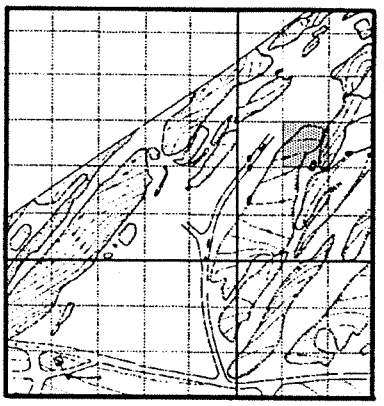


Figure 26. Grid #16 Ambient Gamma Exposure Rate.





Grid #17
N200ft - 300ft
E100ft - 200ft

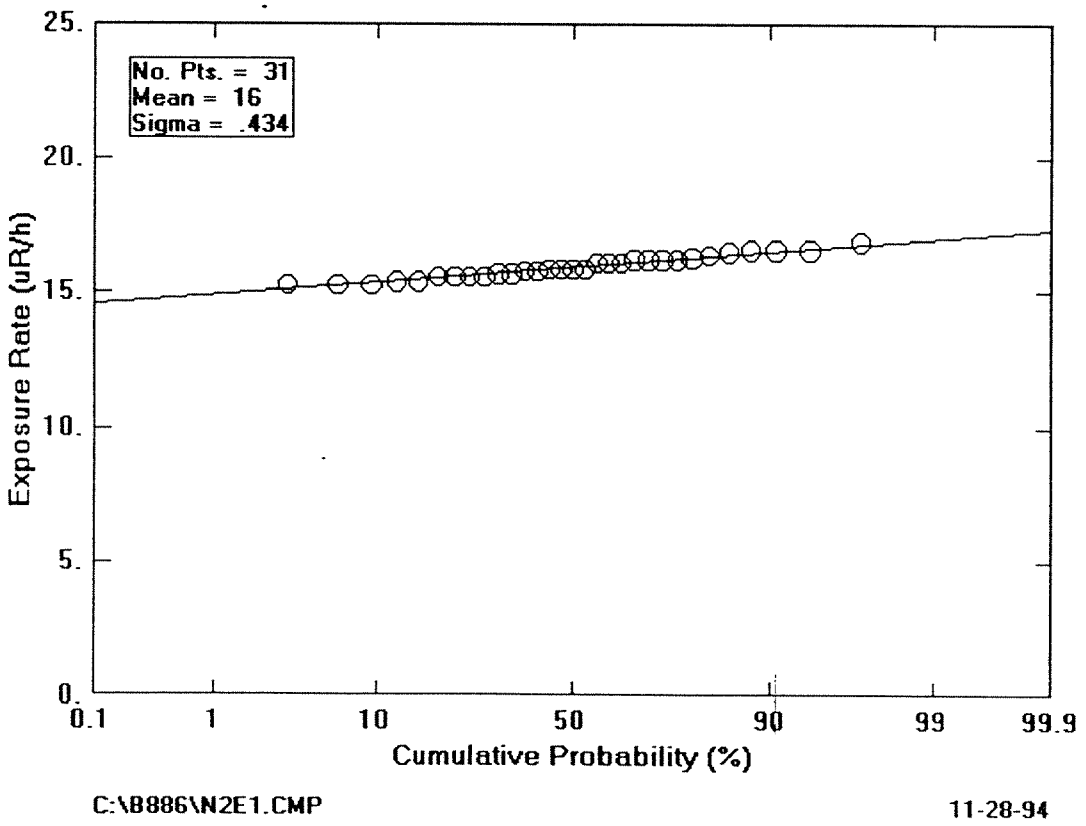
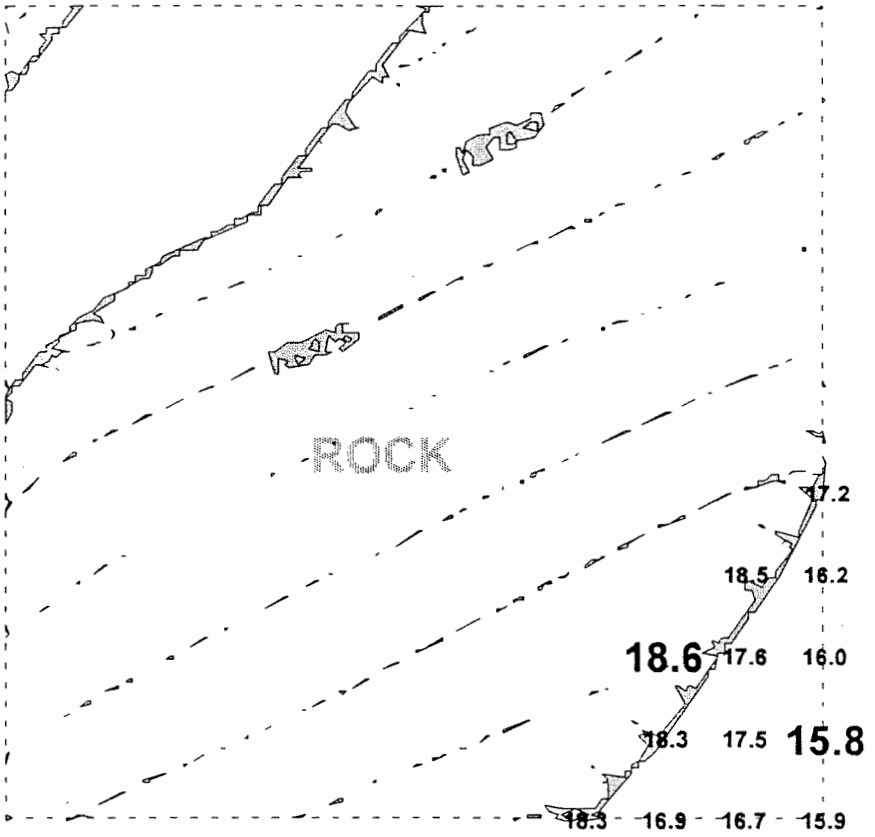


Figure 27. Grid #17 Ambient Gamma Exposure Rate.



Grid #21
N100ft - 200ft
W300ft - 200ft

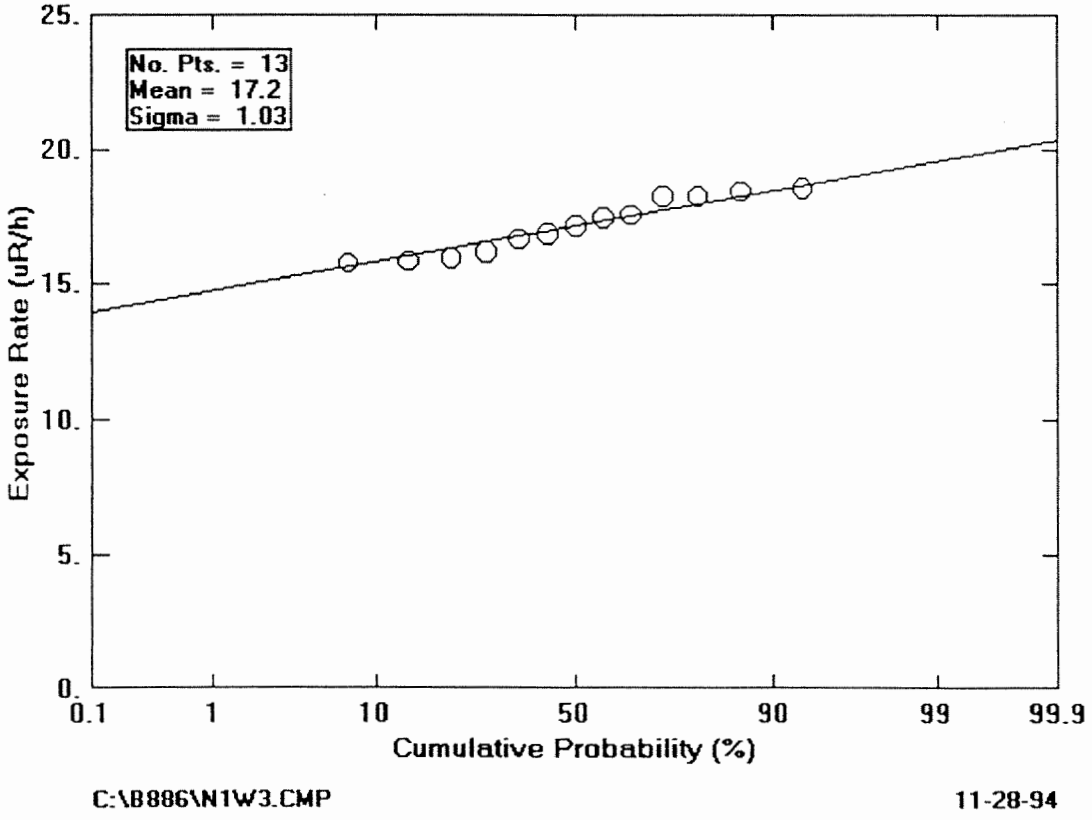
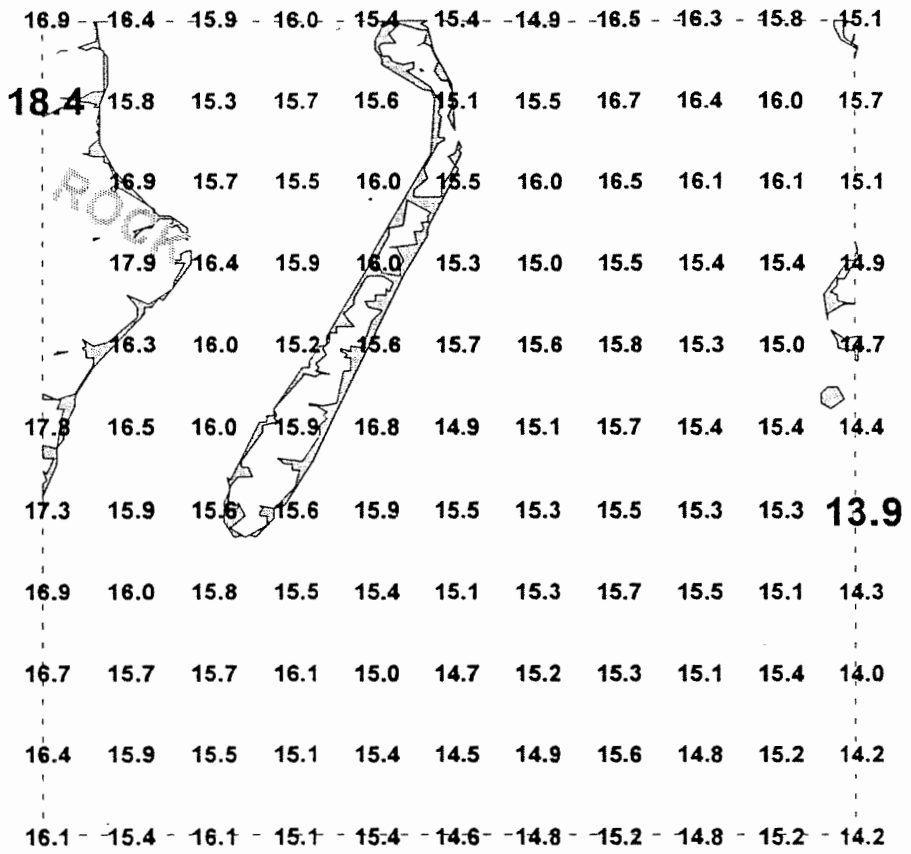
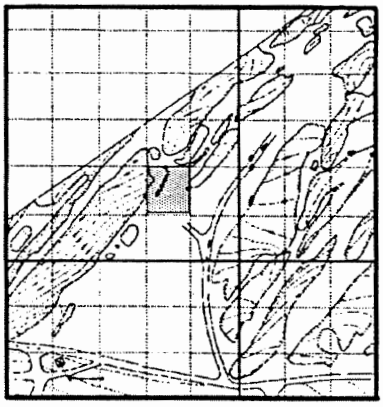


Figure 28. Grid #21 Ambient Gamma Exposure Rate.





Grid #22
N100ft - 200ft
W200ft - 100ft

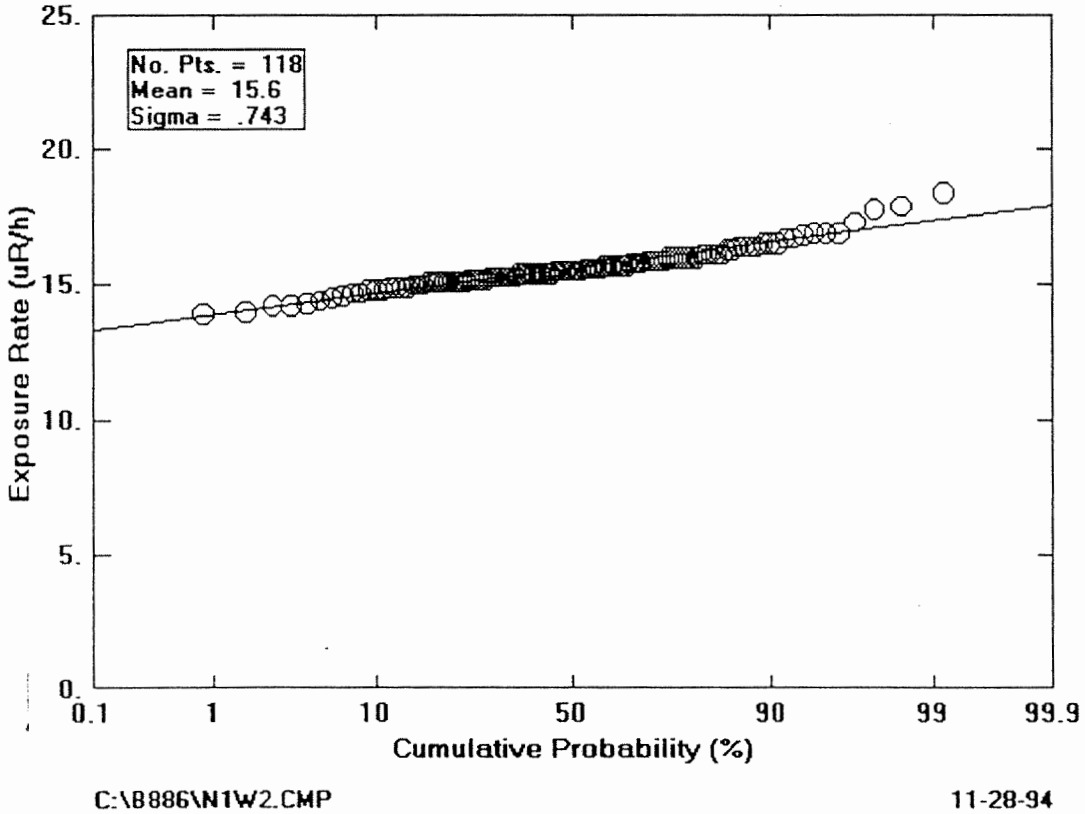
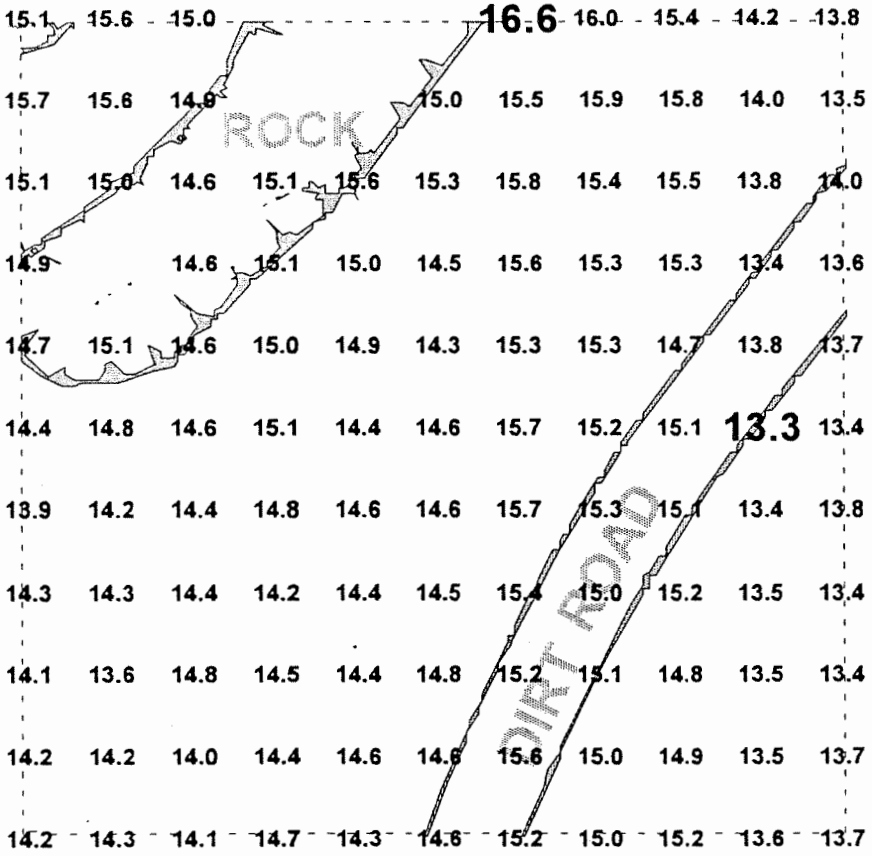
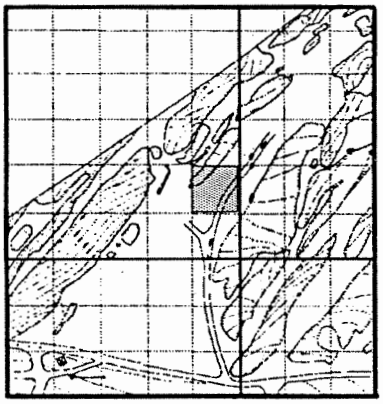


Figure 29. Grid #22 Ambient Gamma Exposure Rate.





Grid #23
N100ft - 200ft
W100ft - 0ft

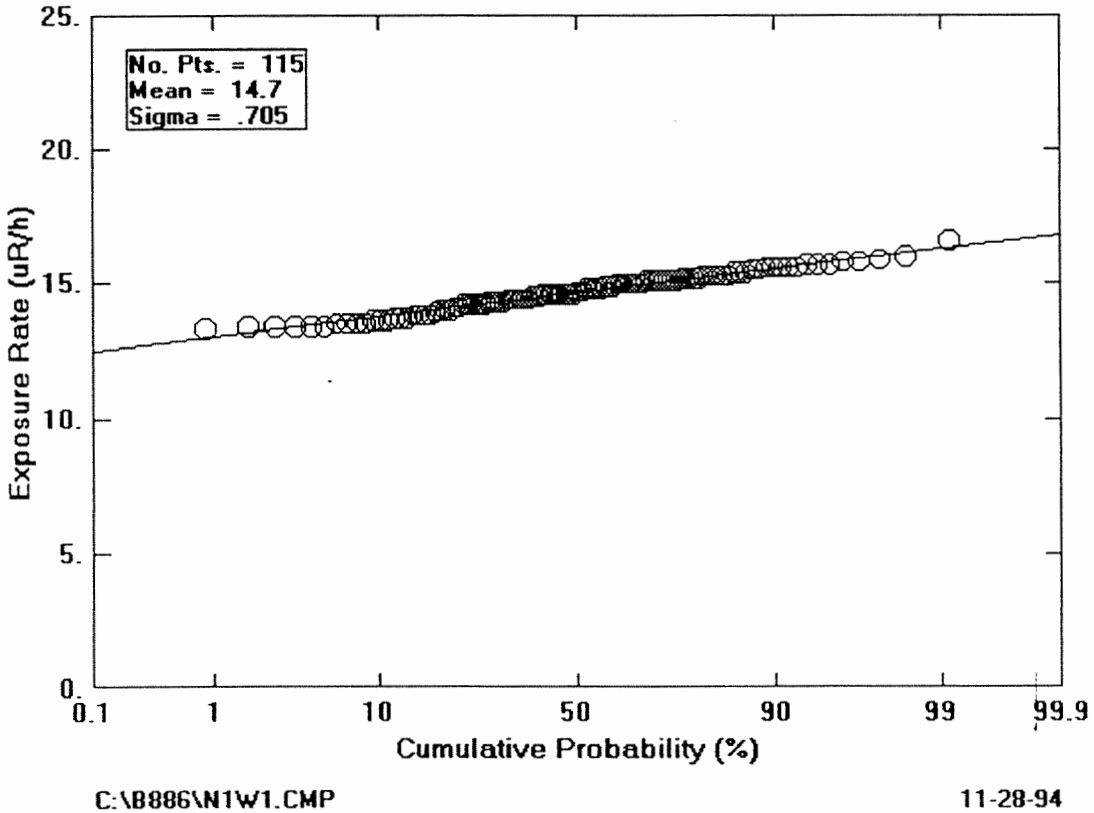
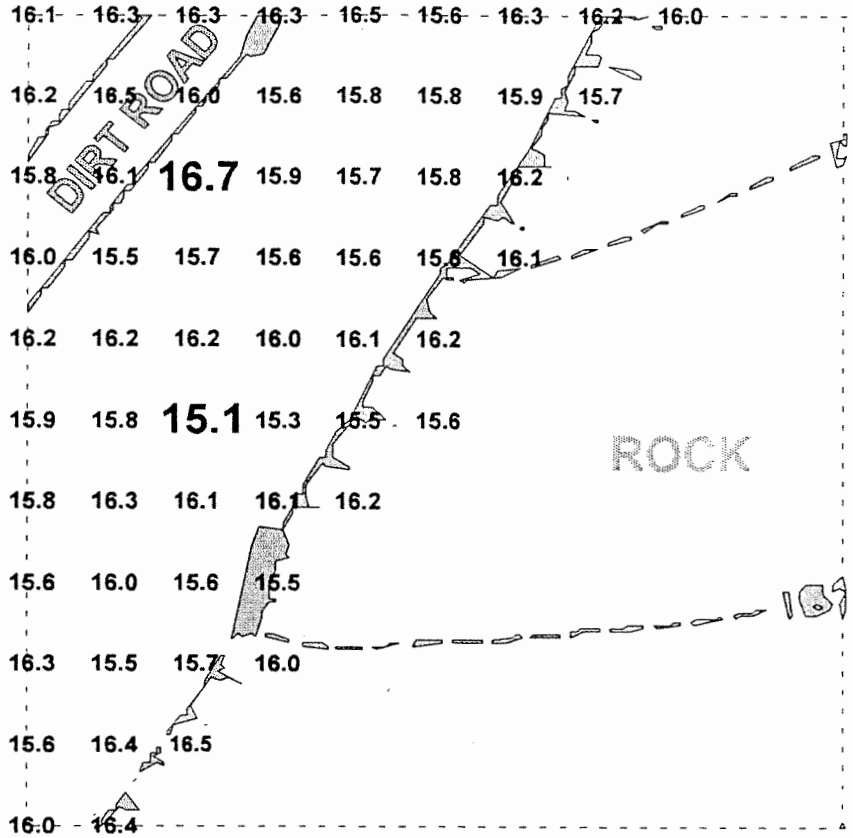
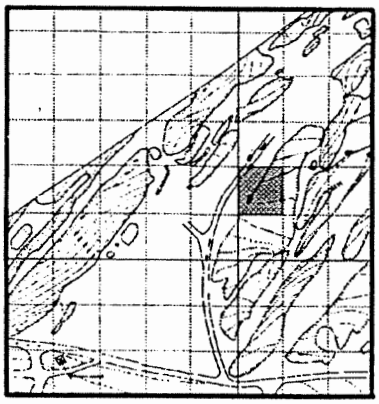


Figure 30. Grid #23 Ambient Gamma Exposure Rate.





Grid #24
N100ft - 200ft
E 0ft - 100ft

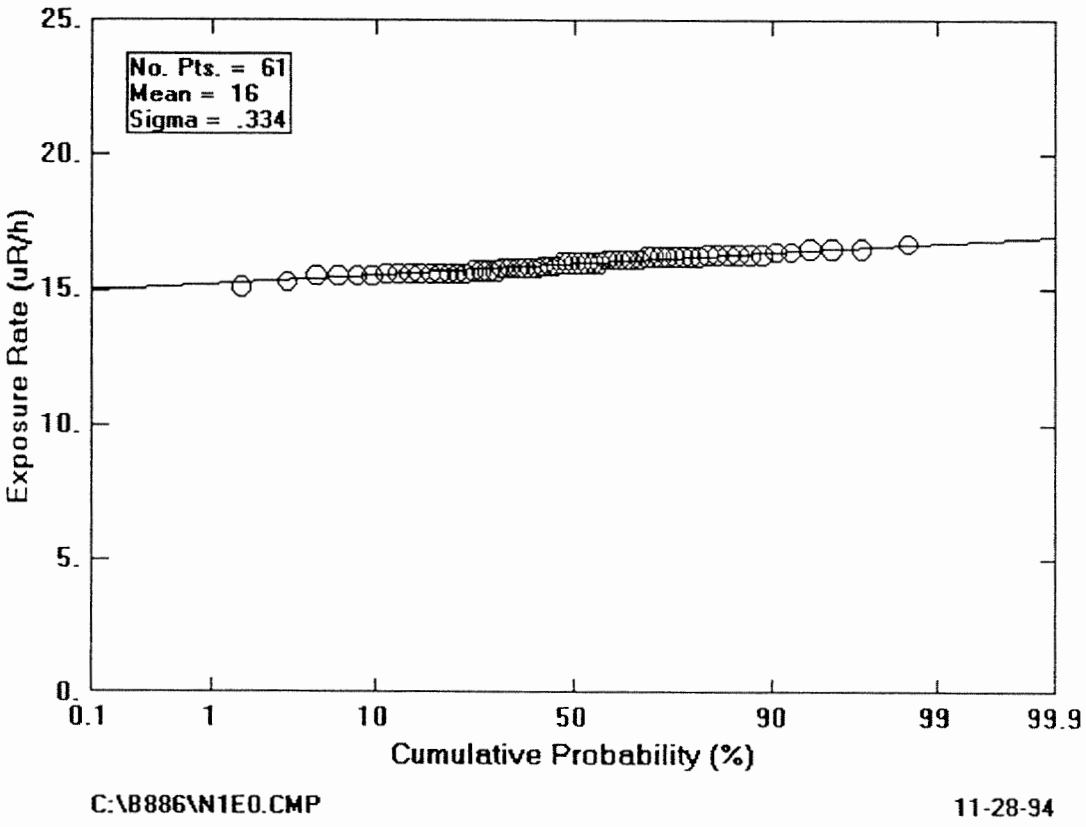
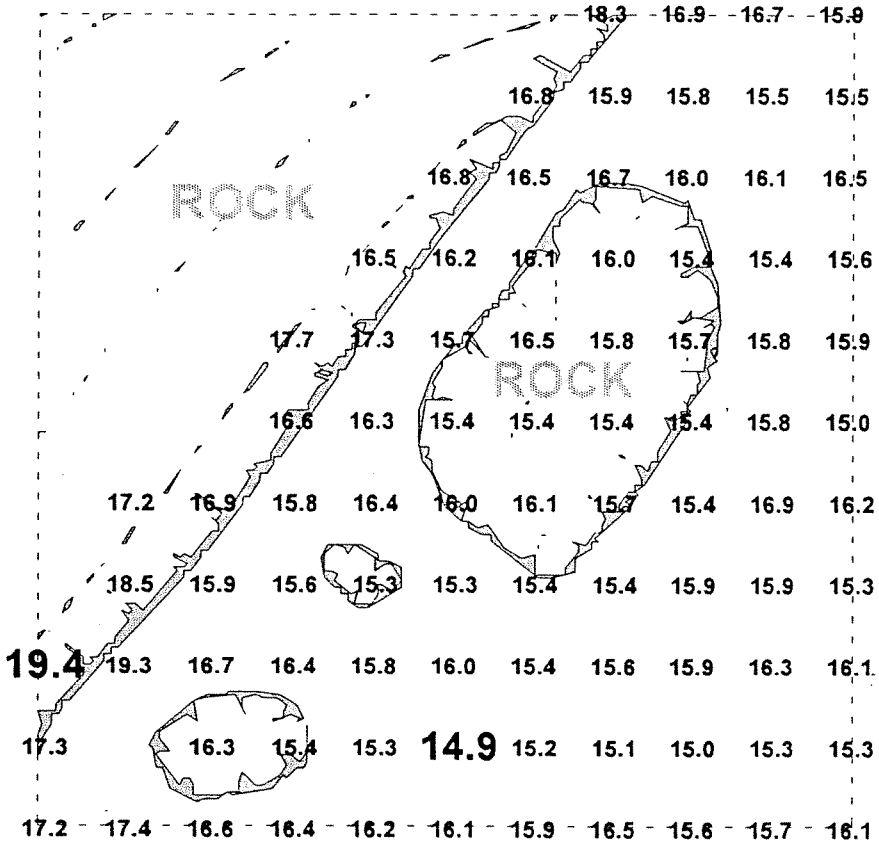
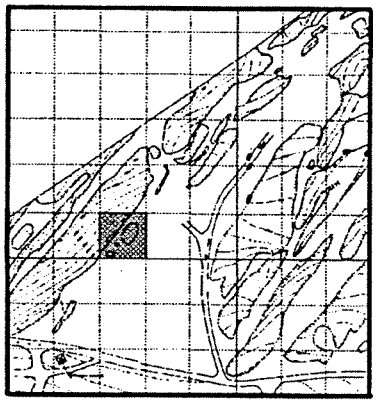


Figure 31. Grid #24 Ambient Gamma Exposure Rate.





Grid #29
N 0ft - 100ft
W300ft - 200ft

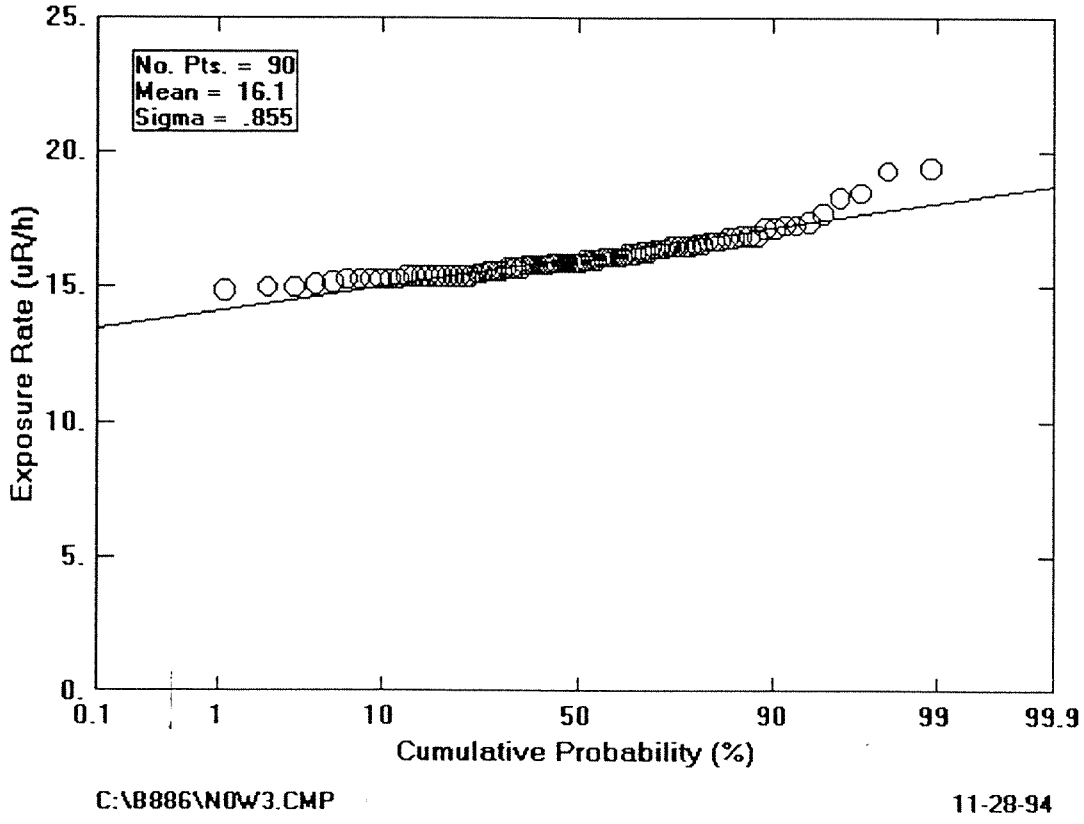
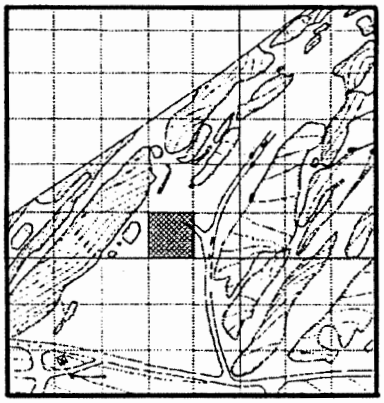


Figure 32. Grid #29 Ambient Gamma Exposure Rate.

16.1	15.4	16.1	15.1	15.5	14.6	14.8	15.2	14.8	15.2	14.2
16.2	15.2	16.1	15.1	14.9	14.4	15.1	14.9	15.0	14.8	14.0
15.7	15.5	15.1	15.6	14.9	14.0	14.8	14.7	14.9	14.9	14.2
16.0	15.8	15.2	16.2	15.3	14.8	14.9	15.3	14.6	14.5	14.3
15.7	15.3	15.1	15.9	14.9	14.4	14.8	14.8	14.7	15.1	13.7
15.9	15.1	15.3	15.6	15.4	14.6	14.4	14.6	14.6	14.8	14.1
16.4	15.3	15.8	15.3	15.5	15.9	15.0	15.2	14.9	14.9	14.2
15.7	15.6	15.6	15.0	15.6	14.8	15.0	15.2	15.0	15.2	14.0
17.6	15.7	15.4	14.9	15.1	14.5	15.0	15.8	15.2	14.7	14.4
17.3	15.5	15.6	14.6	15.1	14.8	15.1	15.6	15.0	14.9	14.3
17.2	15.3	14.6	15.0	15.2	15.9	14.9	16.2	15.4	15.4	14.5

DIRT ROAD



Grid #30
N 0ft - 100ft
W200ft - 100ft

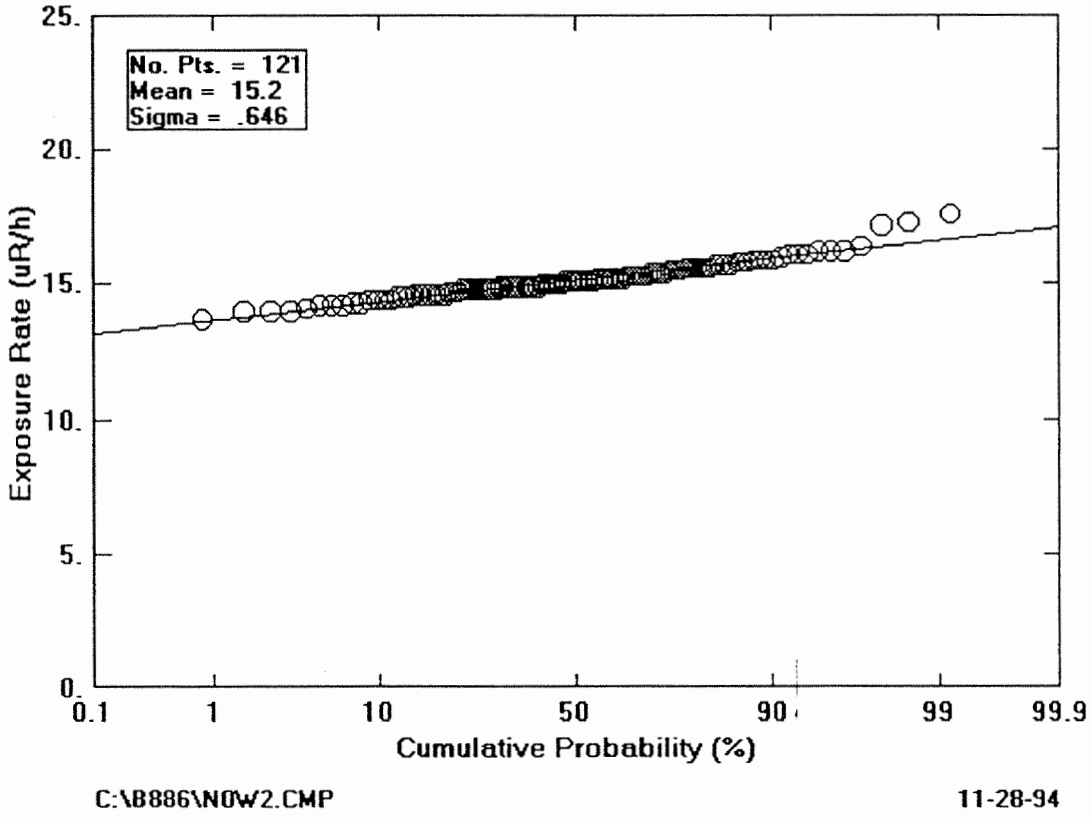
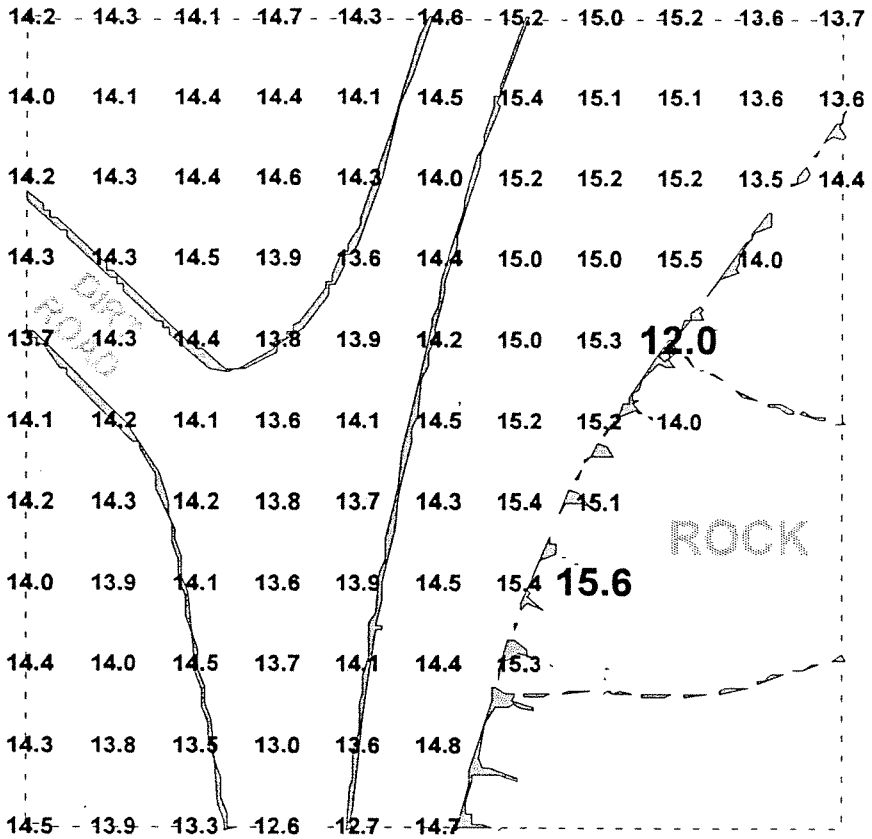
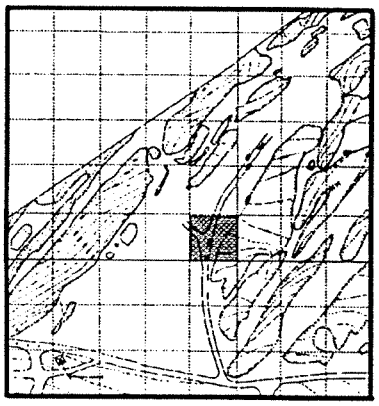


Figure 33. Grid #30 Ambient Gamma Exposure Rate.





Grid #31
N 0ft - 100ft
W100ft - 0ft

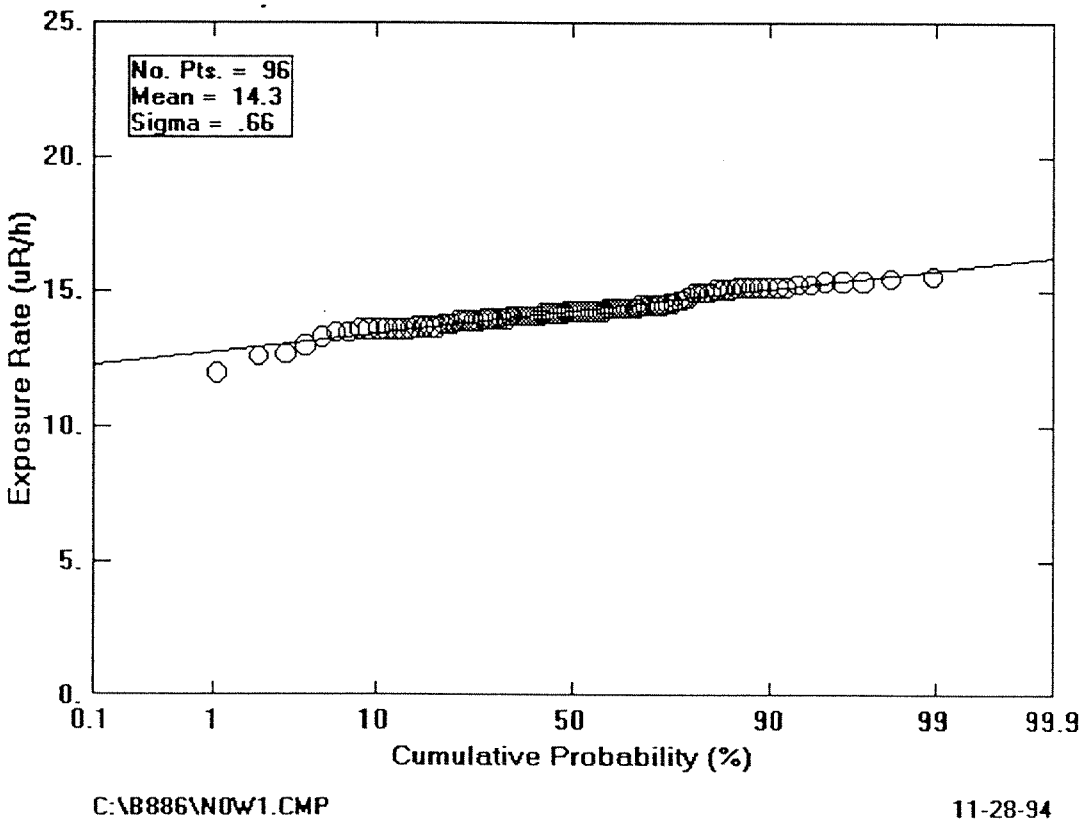
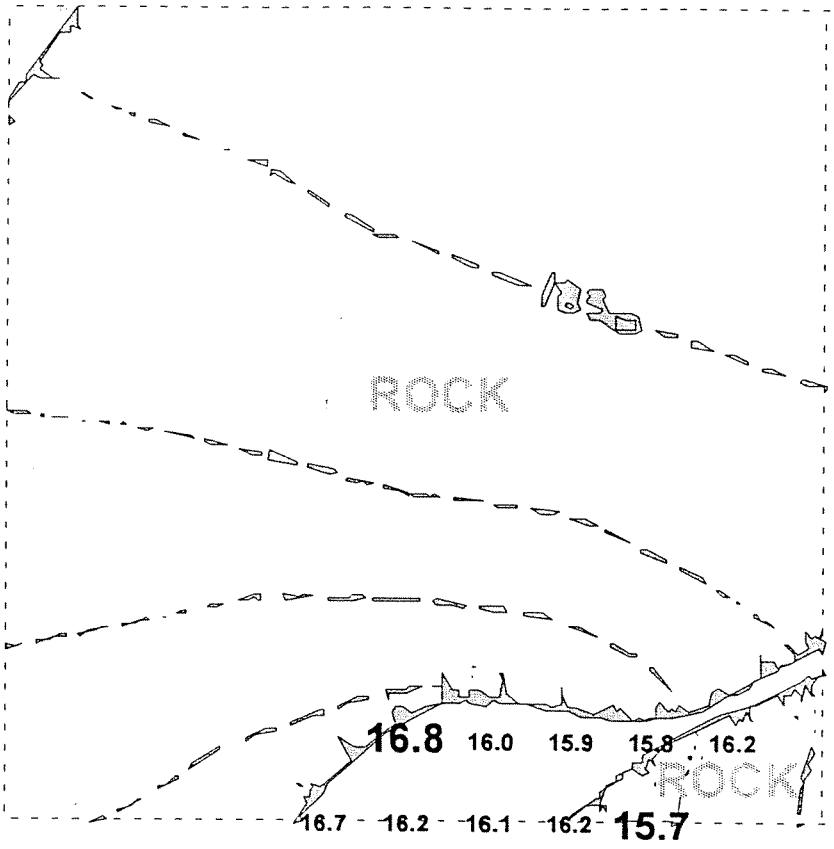
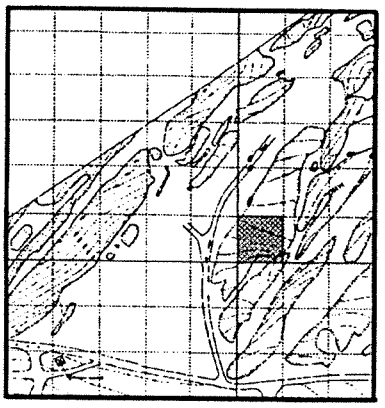


Figure 34. Grid #31 Ambient Gamma Exposure Rate.





Grid #32
N 0ft - 100ft
E 0ft - 100ft

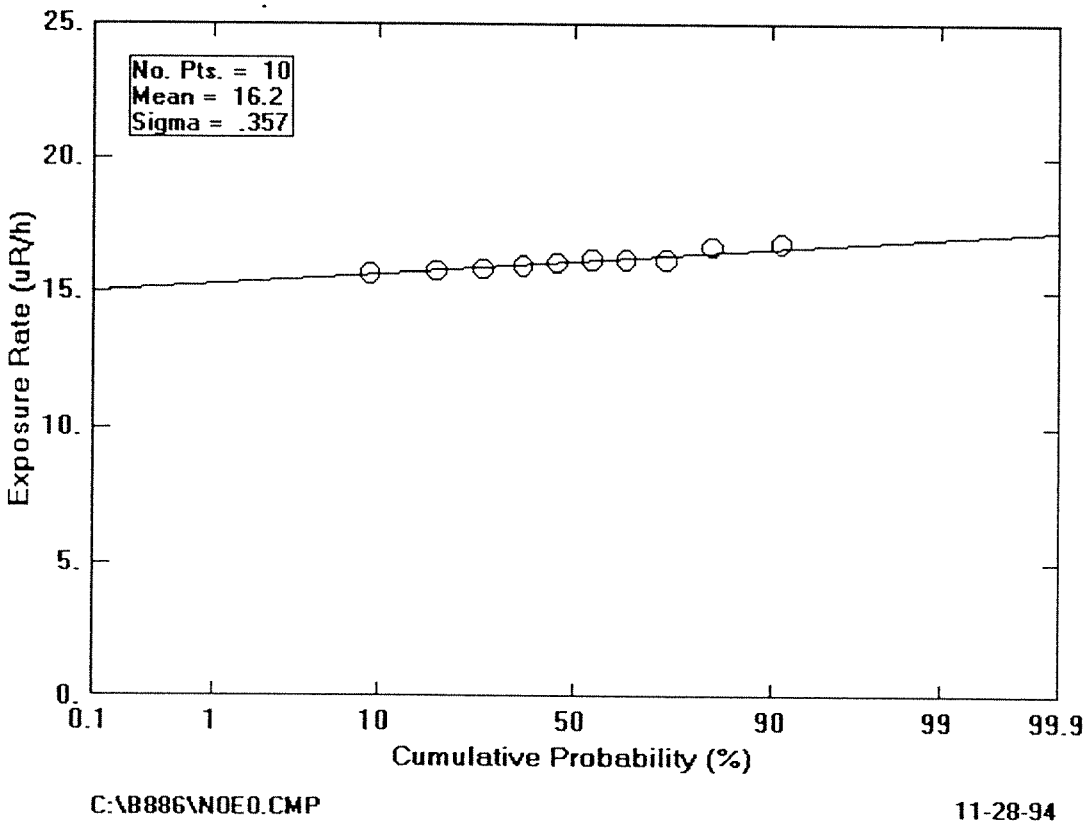
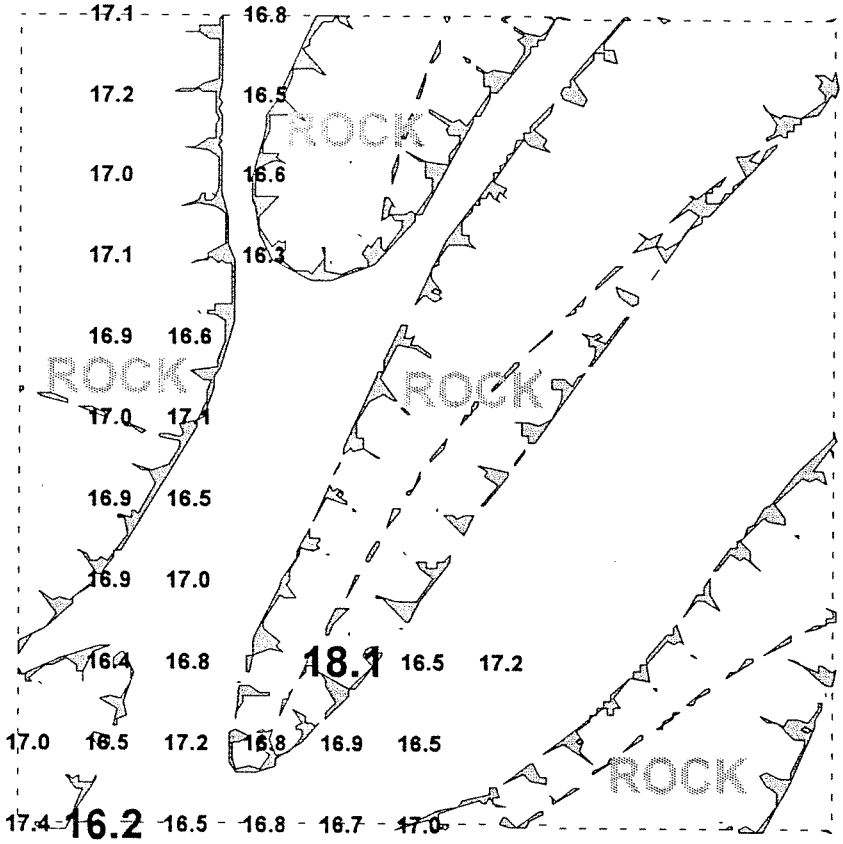
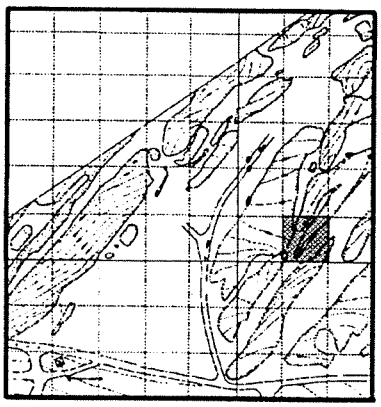


Figure 35. Grid #32 Ambient Gamma Exposure Rate.





Grid #33
N 0ft - 100ft
E100ft - 200ft

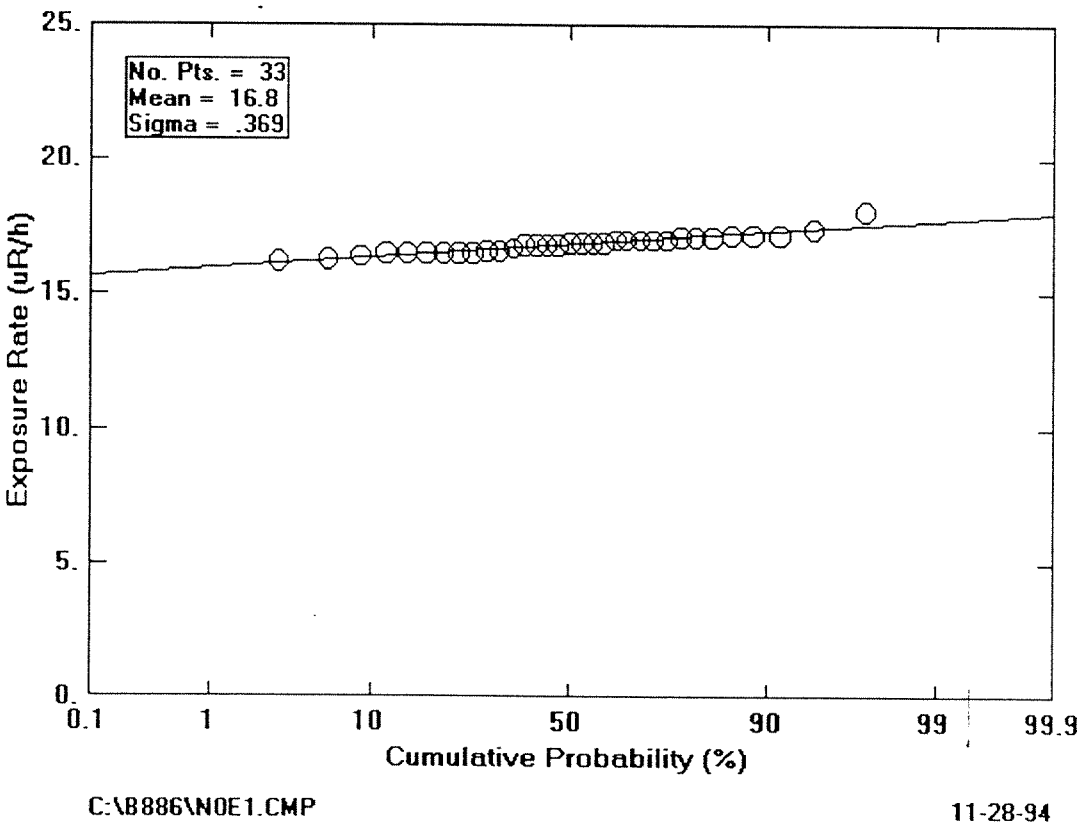
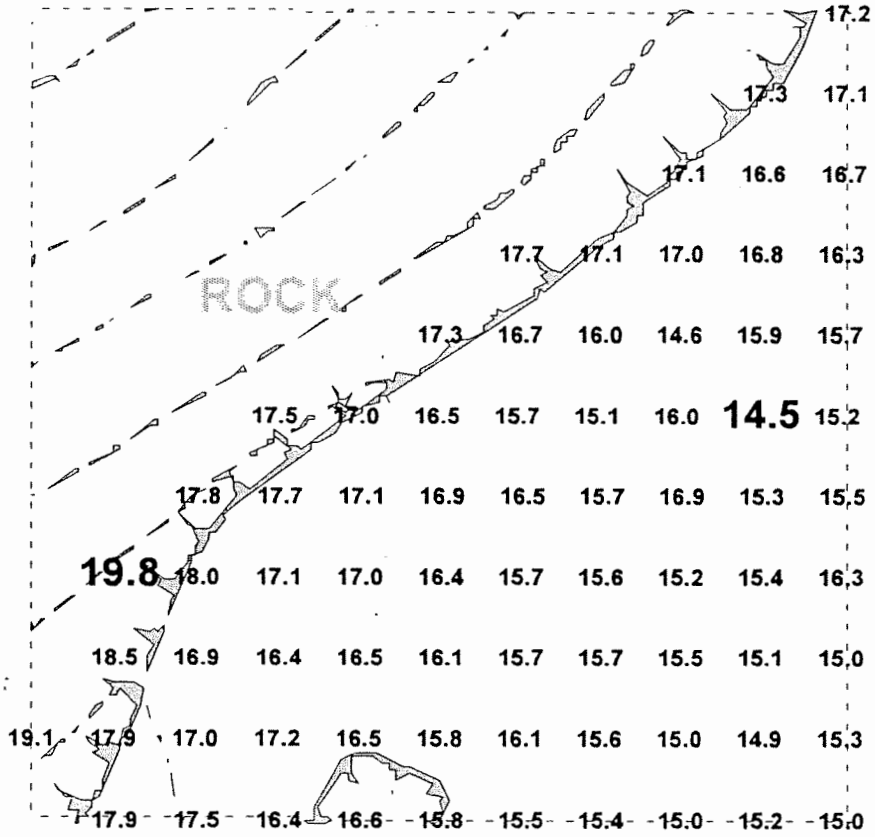
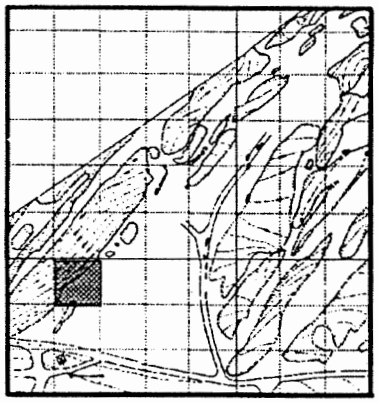


Figure 36. Grid #33 Ambient Gamma Exposure Rate.





Grid #36
S 0ft - 100ft
W400ft - 300ft

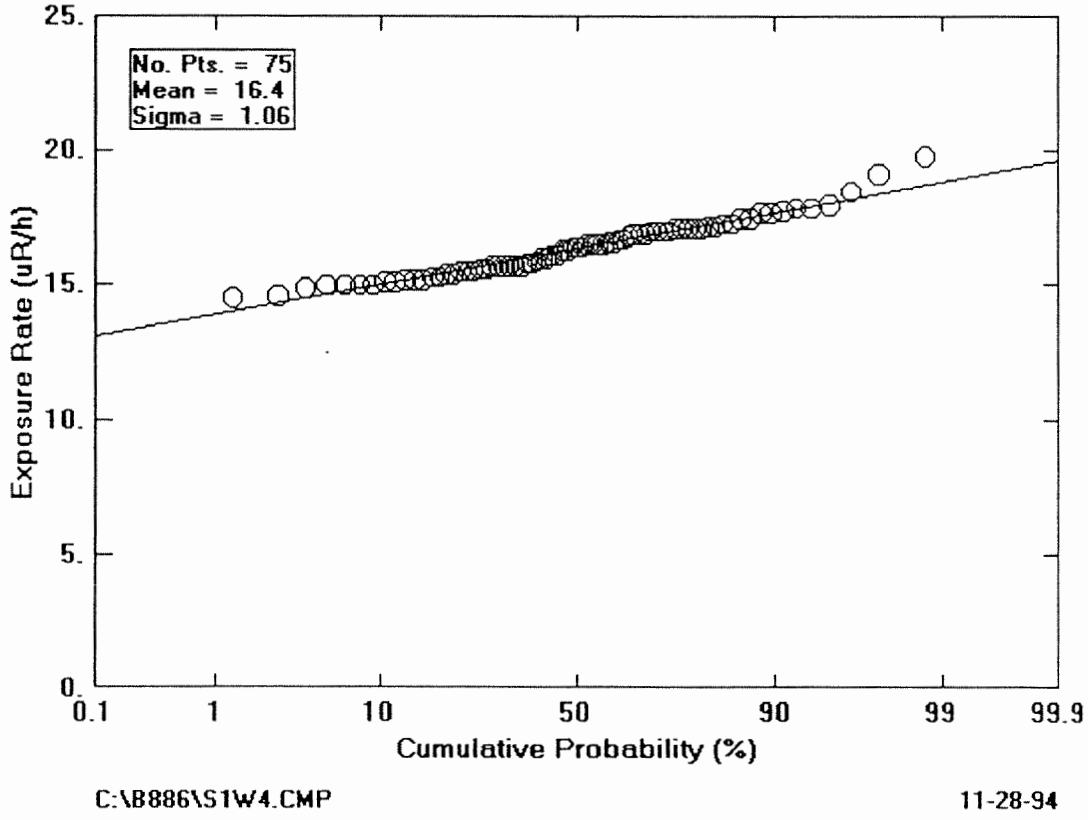
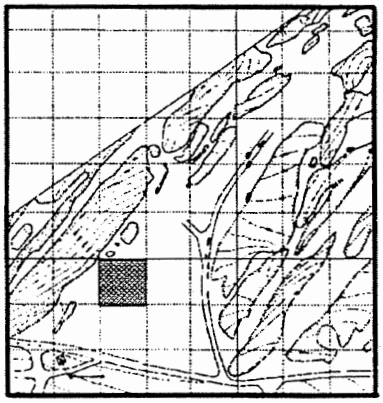


Figure 37. Grid #36 Ambient Gamma Exposure Rate.

17.2	**17.4**	16.6	16.4	16.2	16.1	15.9	16.5	15.6	15.7	16.1
17.1	16.5	16.4	16.0	15.3	15.3	16.0	16.5	15.8	15.9	15.9
16.7	15.8	16.3	15.6	15.6	16.8	17.2	16.5	16.4	16.1	15.5
16.3	15.7	15.2	15.3	14.9	15.7	15.7	16.4	16.3	15.7	15.3
15.7	15.7	15.2	15.4	15.2	14.9	15.4	15.8	16.1	15.7	16.1
15.2	15.2	15.0	15.1	15.1	15.1	15.0	16.1	16.6	15.7	15.4
15.5	15.0	15.0	15.2	15.1	15.4	15.1	15.8	16.3	16.9	16.0
16.3	15.1	15.3	15.0	15.4	15.7	16.1	15.6	16.2	15.9	15.9
15.0	15.1	14.7	**14.5**	15.0	15.5	15.3	15.5	15.0	15.0	15.1
15.3	14.6	15.2	14.6	**14.5**	14.8	15.4	15.4	15.0	15.4	14.7
15.0	15.0	14.9	14.9	15.2	15.3	15.3	15.4	15.2	15.0	16.2



Grid #37
S 0ft - 100ft
W300ft - 200ft

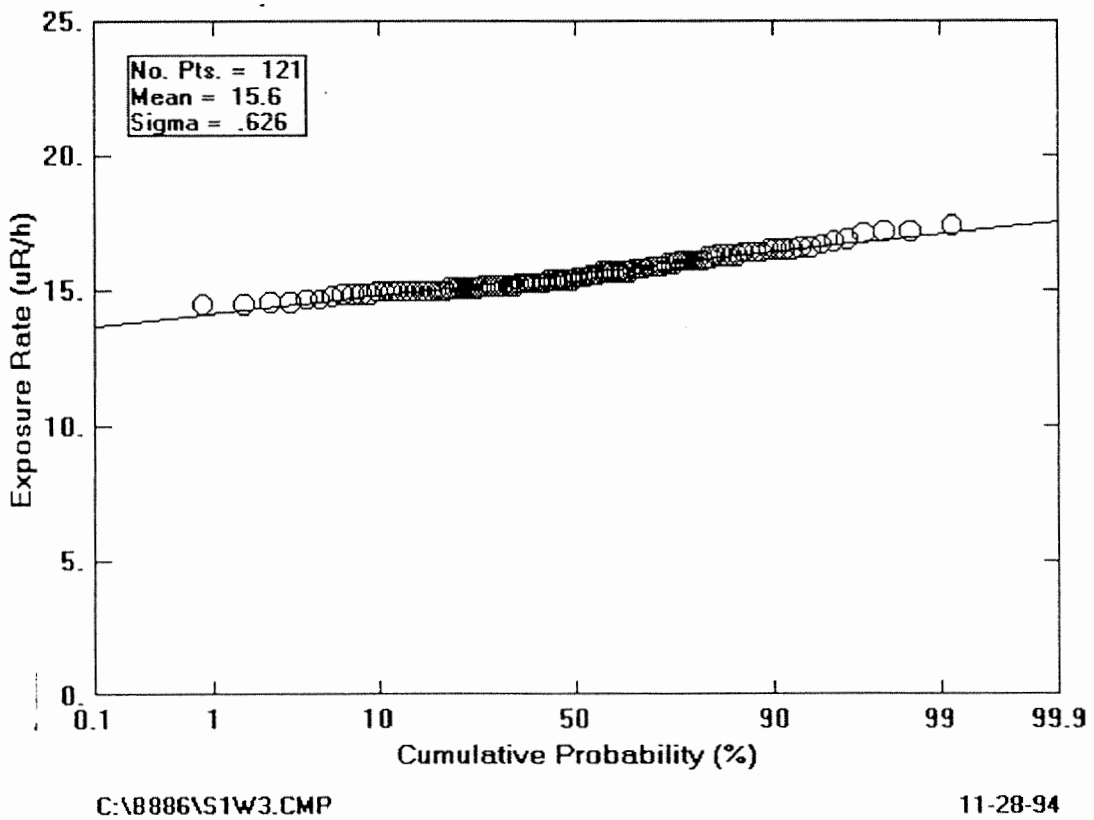
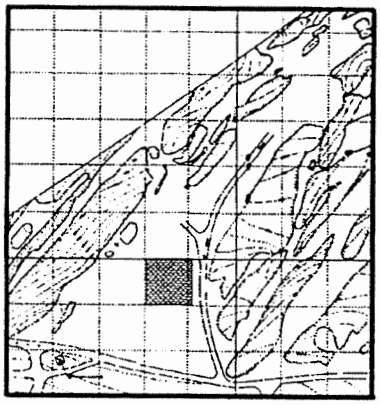


Figure 38. Grid #37 Ambient Gamma Exposure Rate.

17.2	15.3	14.6	15.0	15.2	15.9	14.9	16.2	15.4	15.4	14.5
15.7	15.3	16.0	16.7	16.7	15.6	14.9	15.0	15.5	15.5	14.1
15.1	15.3	15.2	14.4	15.4	15.0	14.7	14.7	15.0	14.7	14.4
14.9	14.9	14.2	14.6	14.7	14.4	14.2	14.4	14.8	14.9	14.2
15.0	14.4	14.4	15.0	14.8	14.6	14.4	14.7	15.0	14.4	13.9
14.9	14.6	14.6	14.8	14.9	14.9	15.0	14.6	14.3	14.5	13.2
15.3	15.0	14.7	14.5	14.3	14.5	14.1	14.5	14.3	14.0	13.7
15.0	14.6	14.4	14.7	14.1	14.3	14.0	13.7	13.8	13.5	13.4
14.2	14.3	14.5	14.1	13.9	14.0	14.0	14.5	14.3	14.2	14.0
14.3	14.1	13.9	13.9	14.3	13.7	13.6	13.9	14.0	14.0	13.9
14.7	14.0	14.1	14.3	14.4	13.8	13.6	14.1	13.8	13.8	14.2



Grid #38
S 0ft - 100ft
W200ft - 100ft

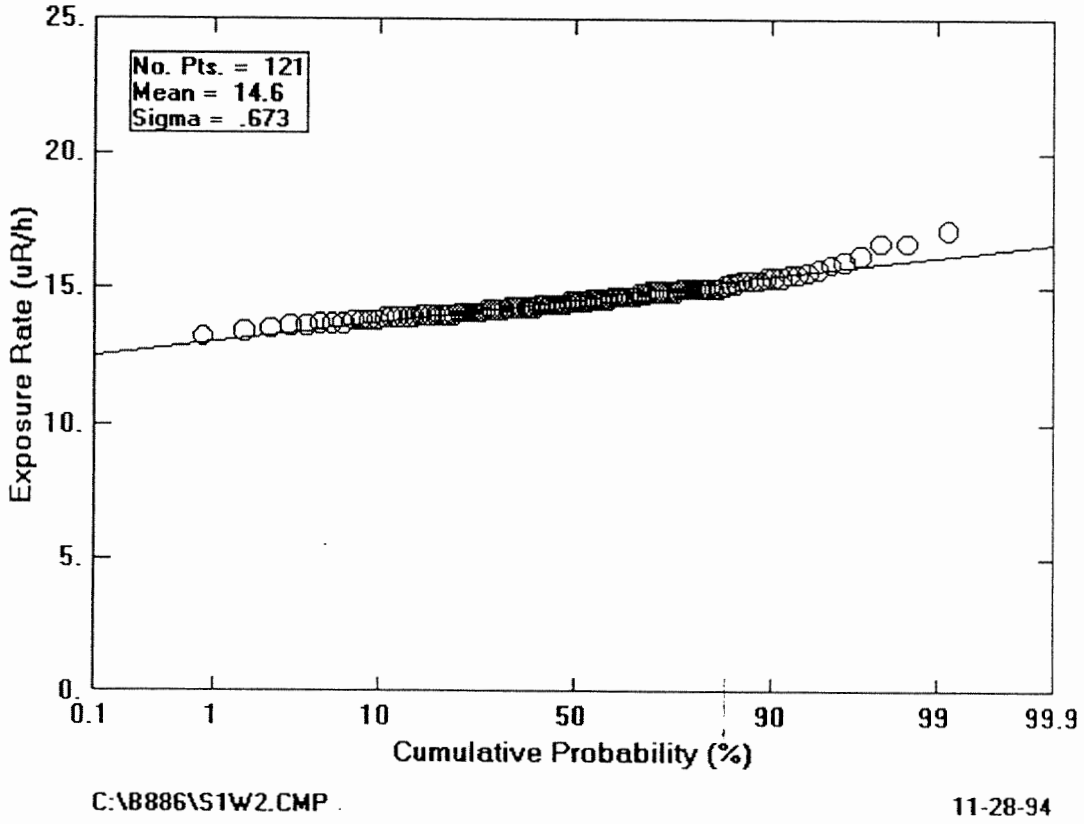
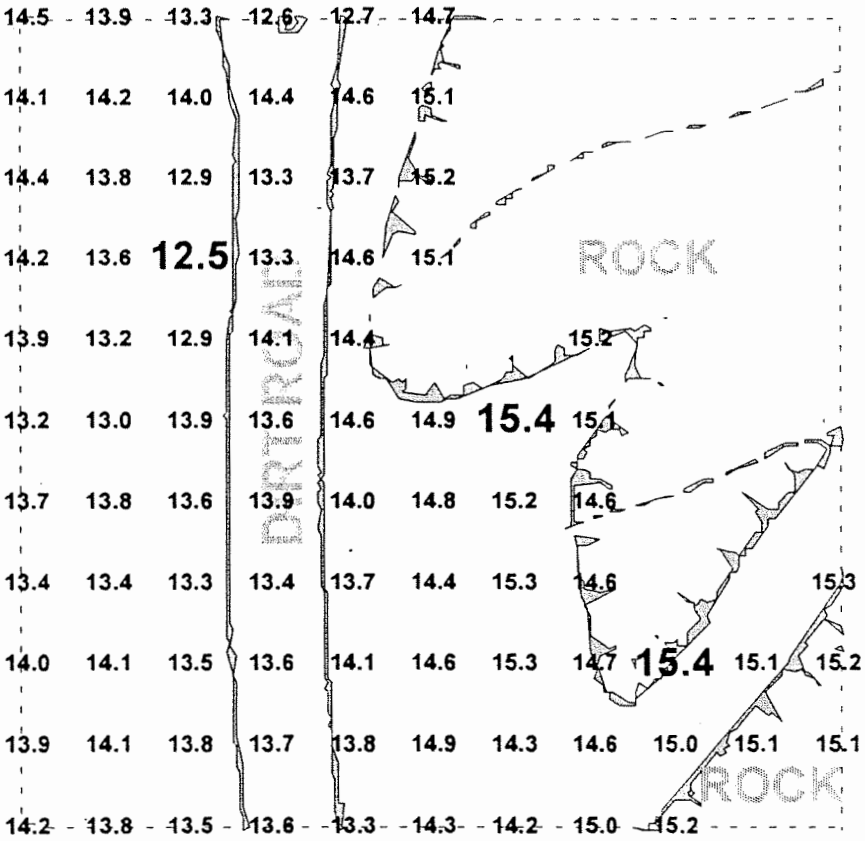
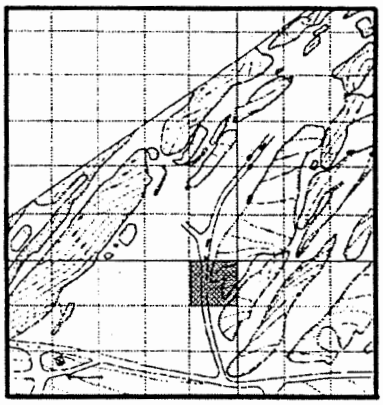


Figure 39. Grid #38 Ambient Gamma Exposure Rate.





Grid #39
S 0ft - 100ft
W100ft - 0ft

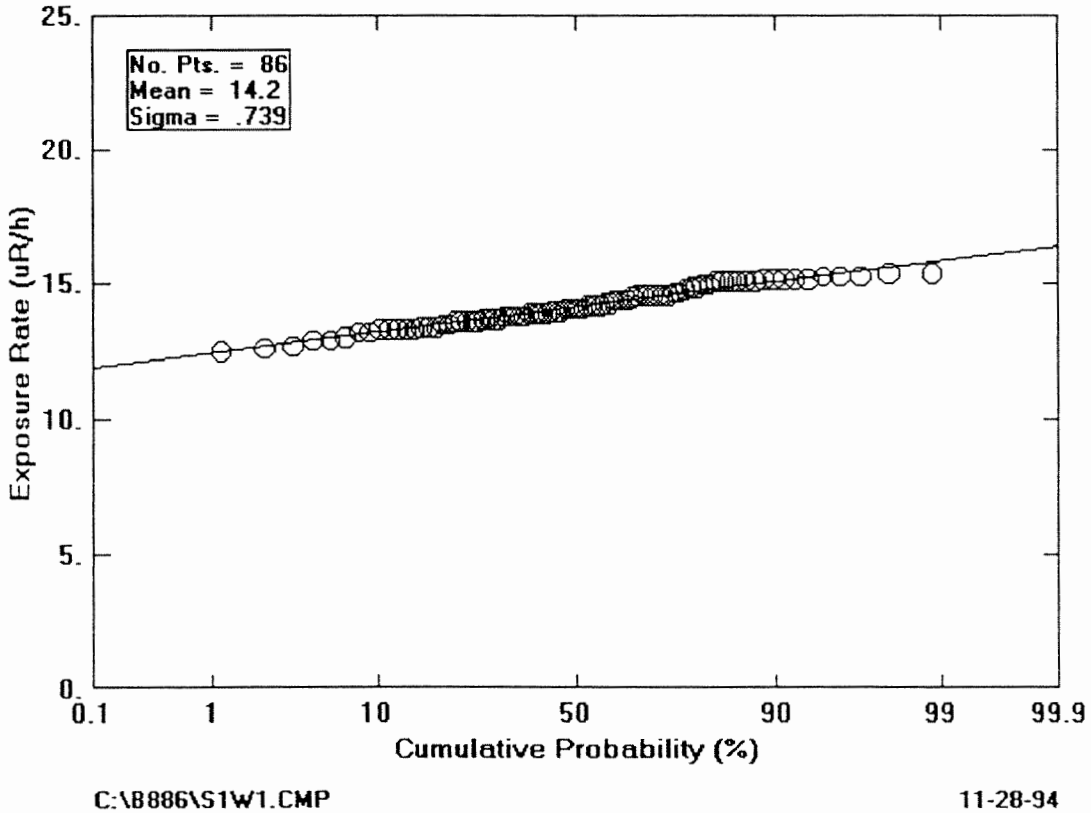
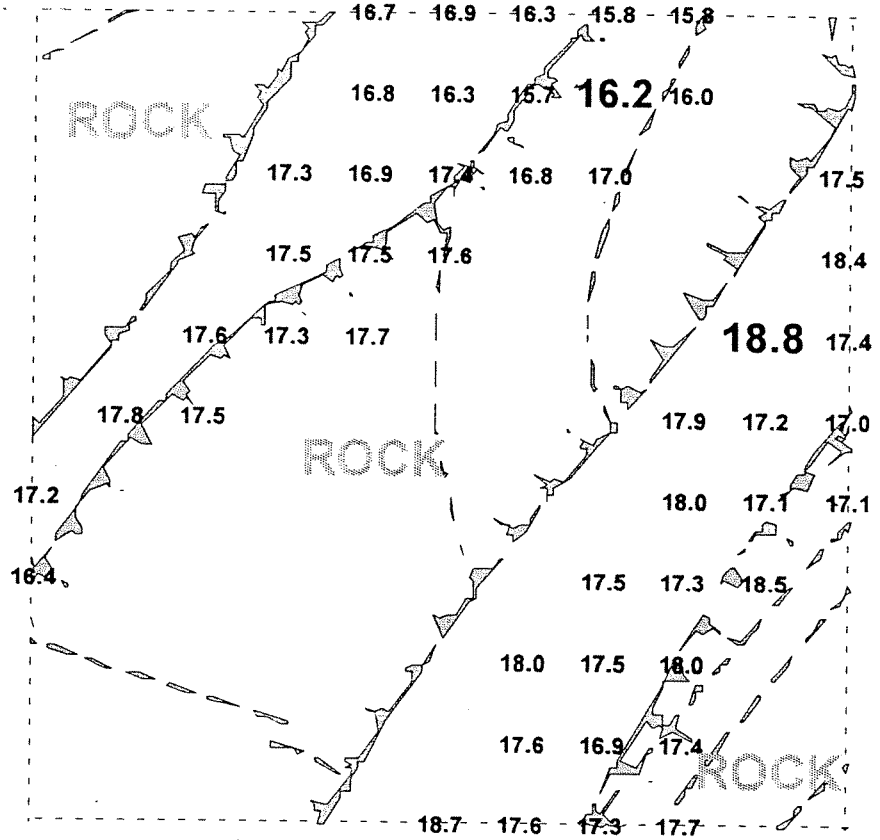
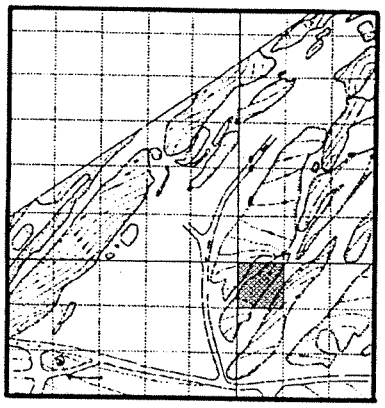


Figure 40. Grid #39 Ambient Gamma Exposure Rate.





Grid #40
S 0ft - 100ft
E 0ft - 100ft

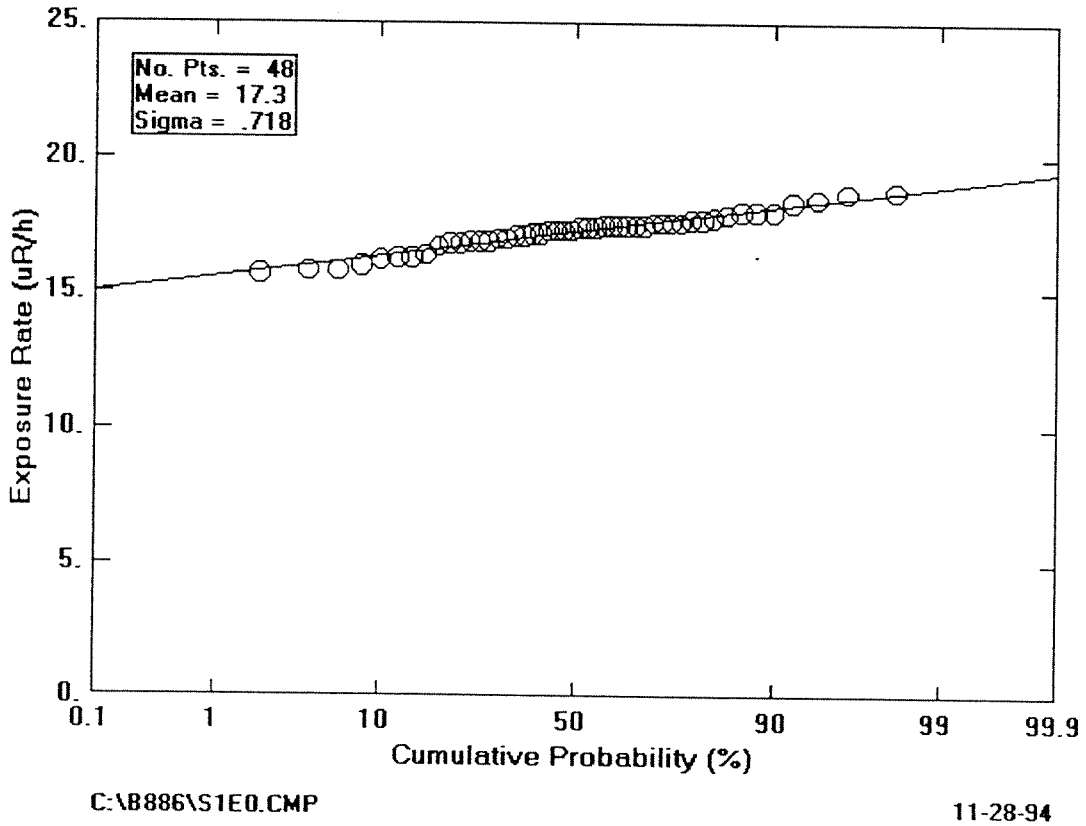
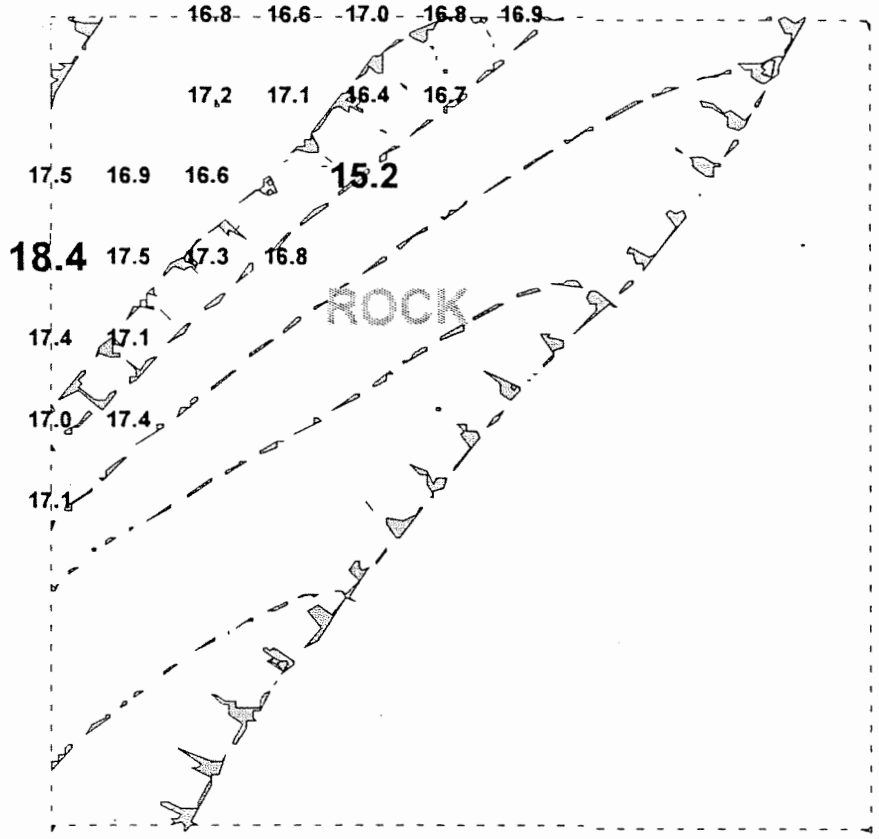
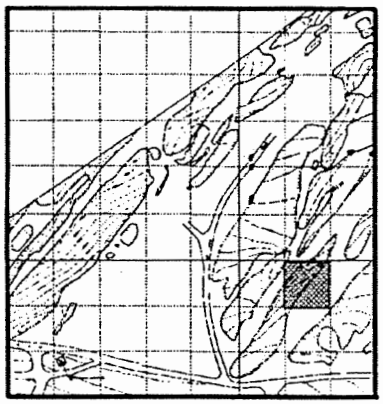


Figure 41. Grid #40 Ambient Gamma Exposure Rate.





Grid #41
S 0ft - 100ft
E100ft - 200ft

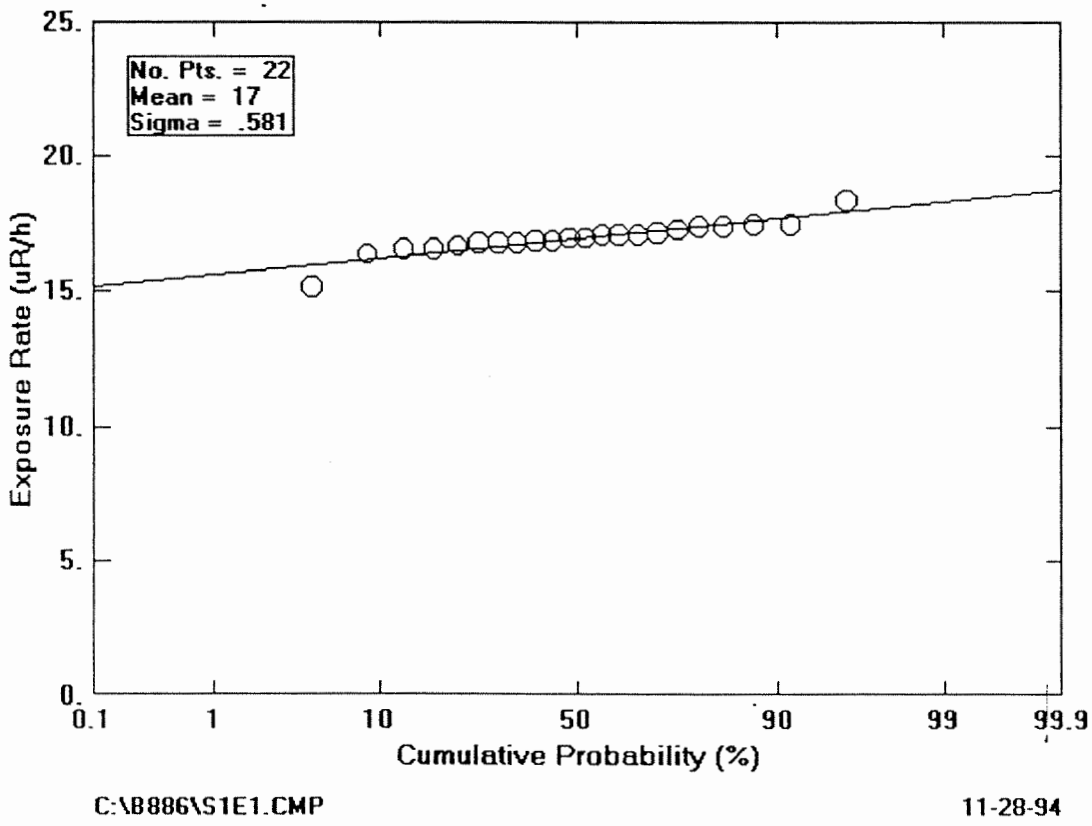
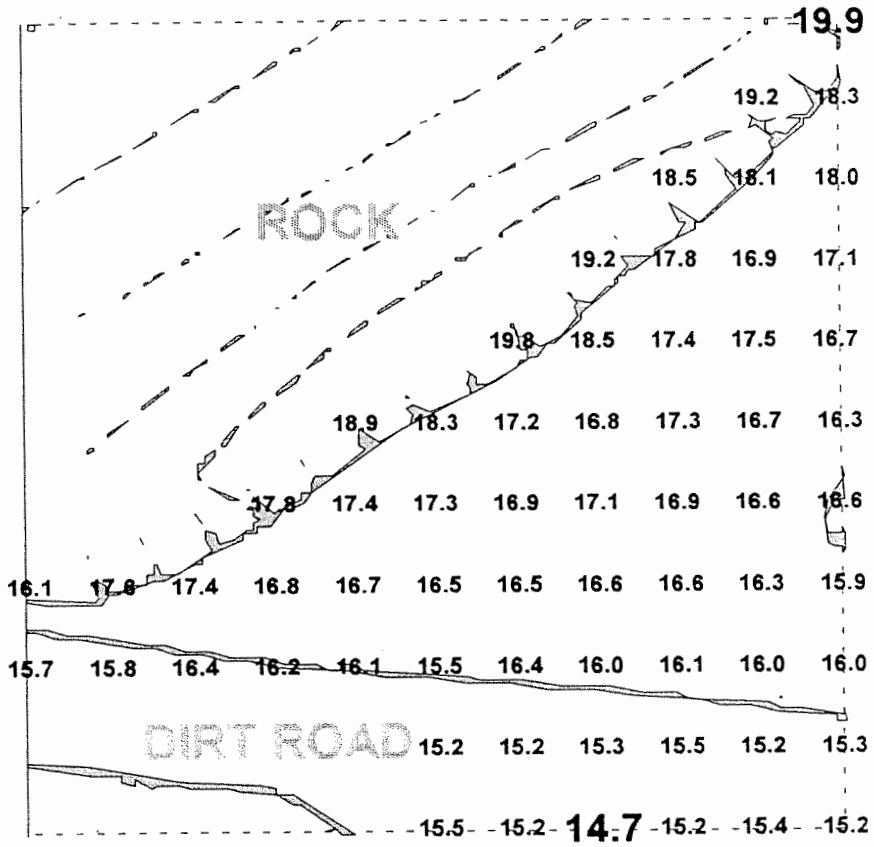
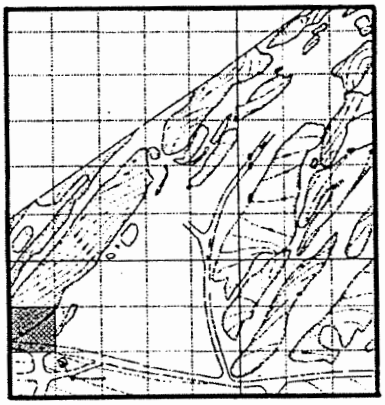


Figure 42. Grid #41 Ambient Gamma Exposure Rate.





Grid #43
S100ft - 200ft
E 500ft - 400ft

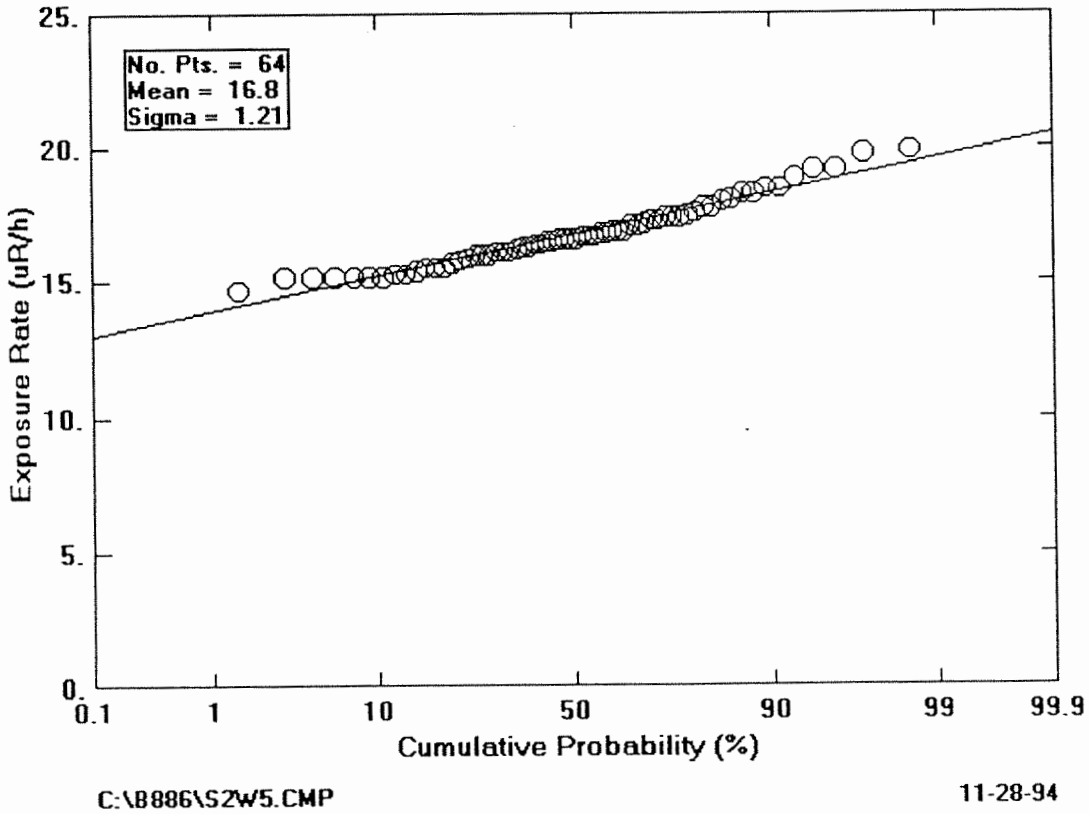
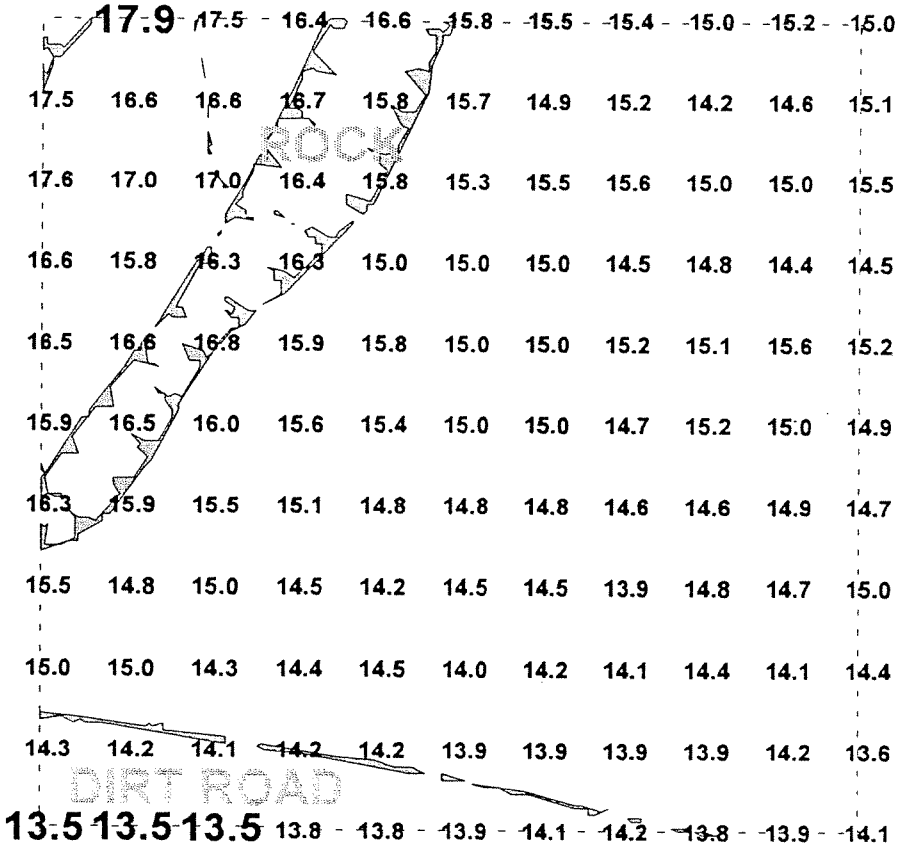
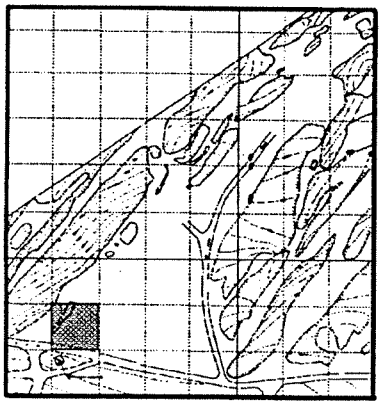


Figure 43. Grid #43 Ambient Gamma Exposure Rate.





Grid #44
S100ft - 200ft
E400ft - 300ft

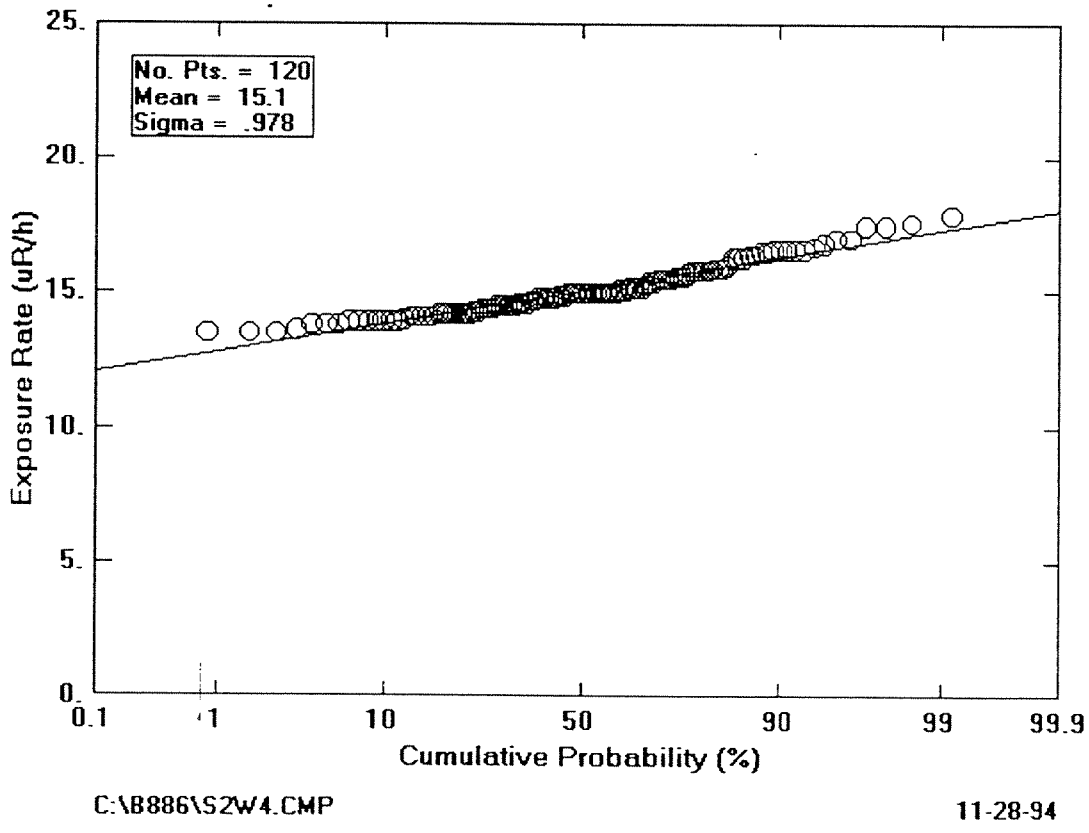
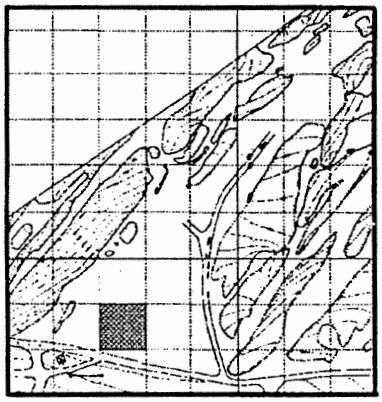


Figure 44. Grid #44 Ambient Gamma Exposure Rate.

15.0	15.0	14.9	14.9	15.2	15.3	15.3	15.4	15.2	15.0	15.2
15.1	14.9	14.7	14.6	14.9	14.4	14.4	14.8	14.7	14.7	14.5
15.5	15.2	14.8	14.8	15.3	15.4	**15.6**	15.0	15.1	15.0	15.4
14.5	14.1	13.8	14.1	14.1	14.0	14.8	14.3	14.5	14.5	14.3
15.2	14.9	14.3	14.4	14.5	14.8	14.8	14.2	15.2	14.7	14.9
14.9	14.6	14.6	14.3	14.4	14.4	15.2	14.4	14.3	14.8	14.7
14.7	14.9	14.4	14.3	14.2	14.7	14.8	14.9	14.7	15.0	15.2
15.0	14.5	14.0	13.7	14.1	**13.0**	14.4	13.9	14.4	13.5	13.5
14.4	13.9	14.0	13.9	14.1	13.5	13.8	13.9	13.6	13.1	13.2
13.6	14.2	13.2	14.0	13.7	13.4	13.9	13.5	13.7	13.6	13.8
14.1	14.3	14.2	13.8	13.9	13.3	13.3	13.5	13.4	13.4	13.6



Grid #45
S100ft - 200ft
W300ft - 200ft

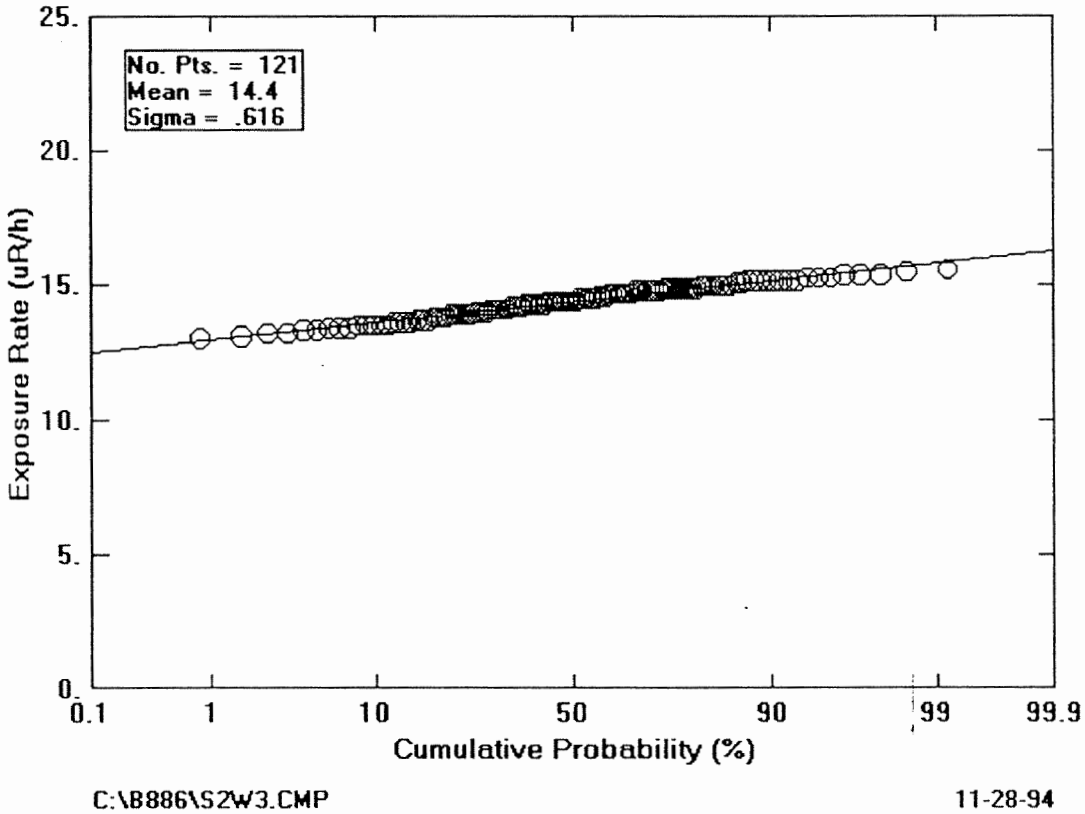
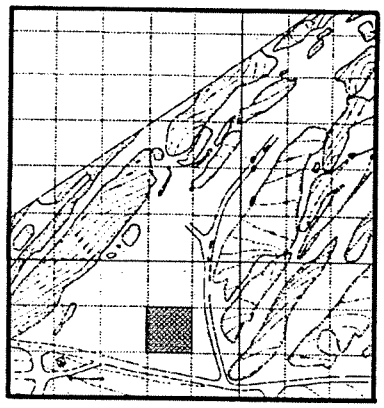


Figure 45. Grid #45 Ambient Gamma Exposure Rate.

14.7	14.0	14.1	14.3	14.4	13.8	13.6	14.1	13.8	13.8	14.2
14.4	13.9	14.2	14.2	14.0	13.9	13.5	13.9	13.7	13.8	13.1
13.8	13.9	13.9	13.9	14.3	13.9	13.9	13.9	13.7	13.4	14.0
14.0	14.1	13.8	13.3	13.8	13.2	13.6	13.8	13.0	13.4	13.4
14.0	14.1	14.2	13.5	13.9	13.9	13.7	13.9	13.7	13.3	13.2
13.4	13.6	13.7	13.7	14.3	13.8	13.5	13.2	13.3	13.4	13.5
13.8	13.6	13.6	13.5	13.6	13.2	13.2	**12.6**	13.0	13.2	13.3
13.9	14.3	14.6	14.4	14.3	13.8	13.5	13.1	13.3	13.8	13.8
13.5	14.7	14.6	14.6	14.3	14.0	13.5	12.7	13.1	12.8	13.8
14.0	14.5	14.7	14.6	14.5	14.5	13.9	13.5	13.0	13.7	13.7
13.8	**15.5**	15.3	**15.5**	**15.5**	13.1	13.1	13.1	13.2	13.8	13.6



Grid #46
S100ft - 200ft
W200ft - 100ft

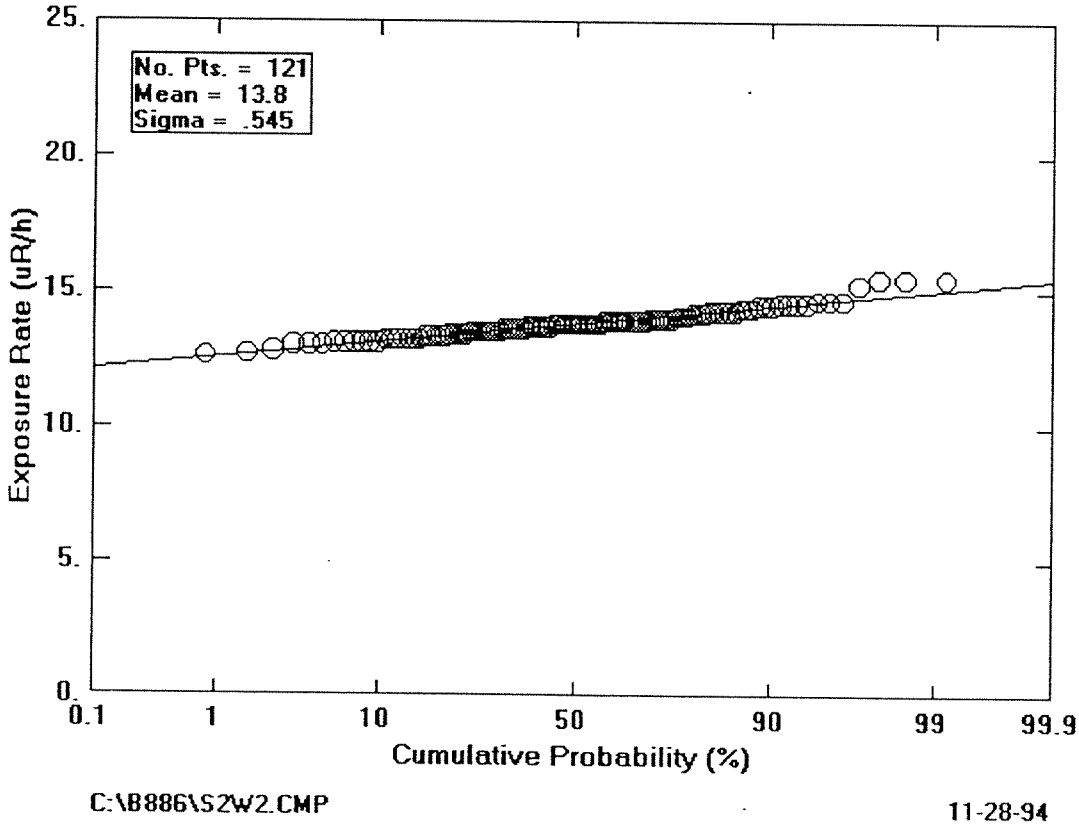
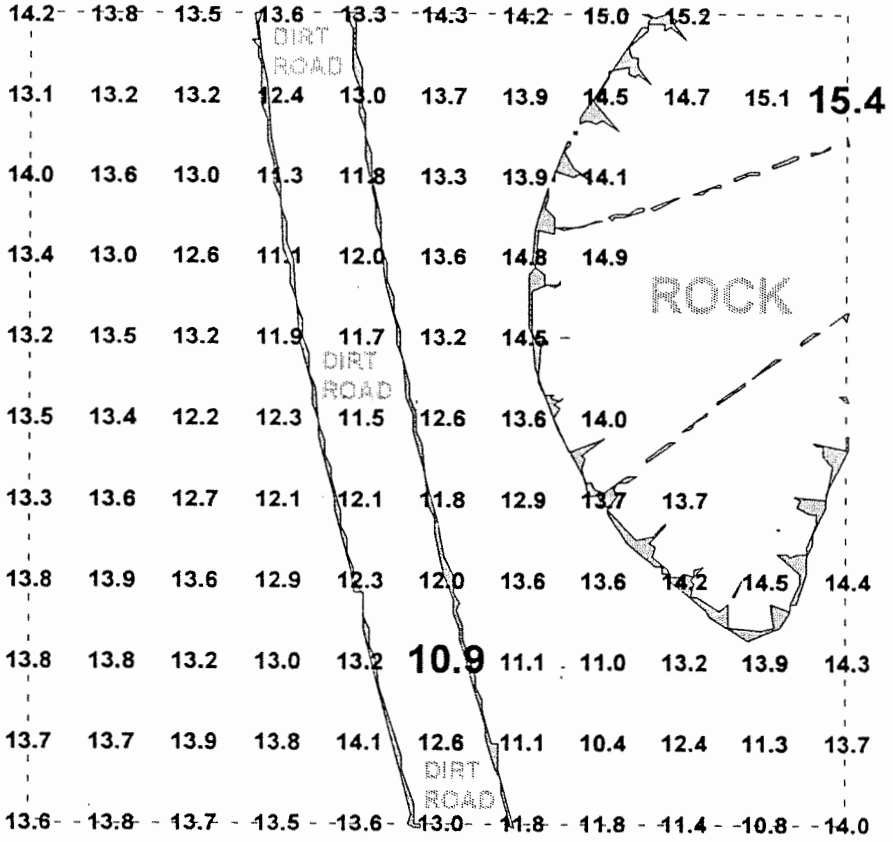
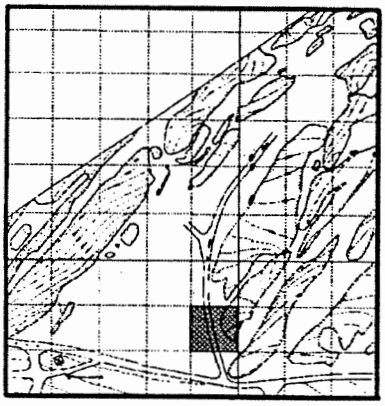


Figure 46. Grid #46 Ambient Gamma Exposure Rate.





Grid #47
S100ft - 200ft
W100ft - 0ft

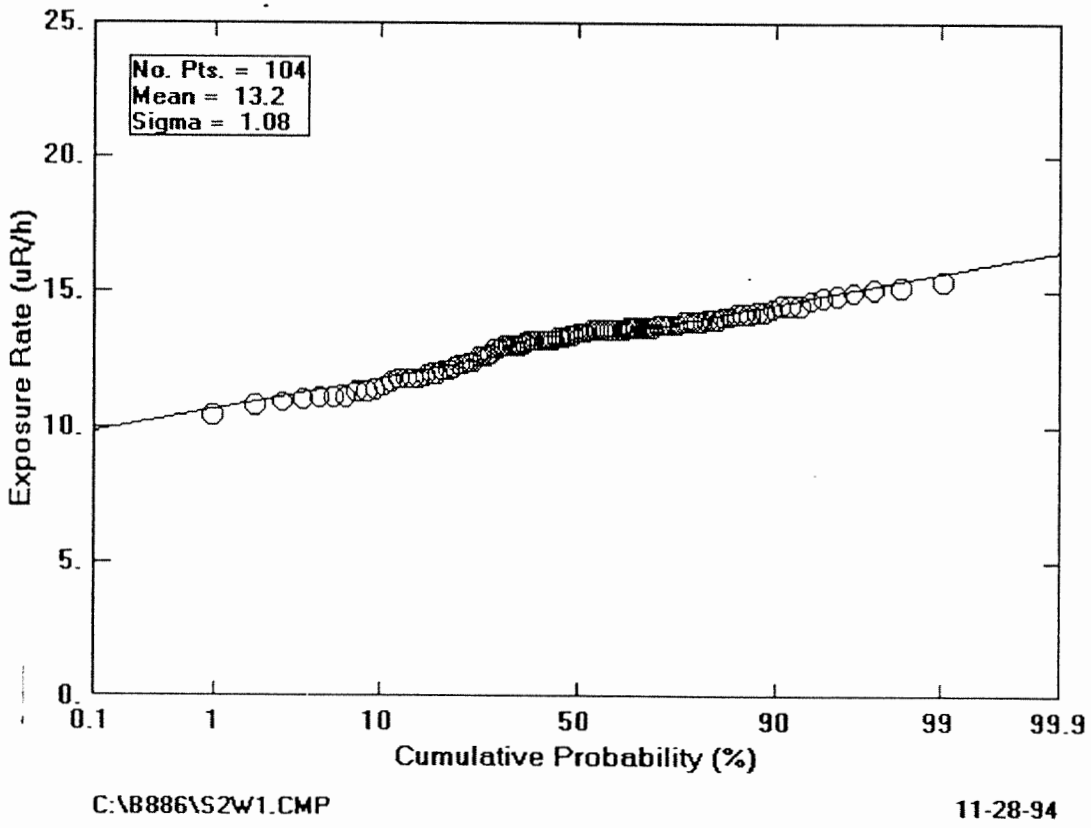
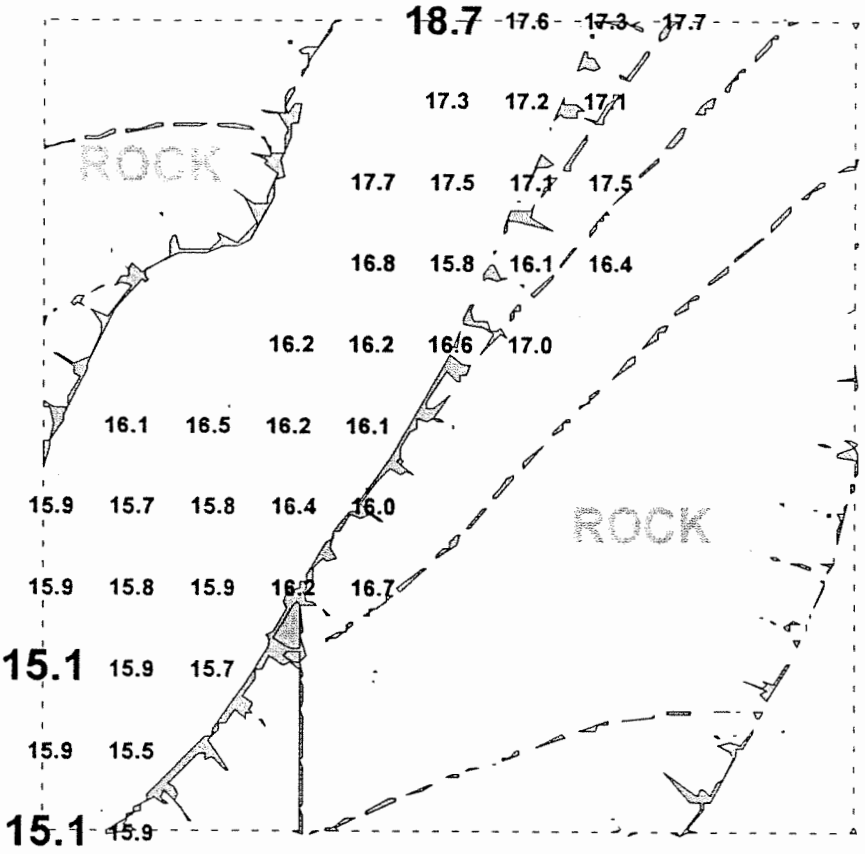
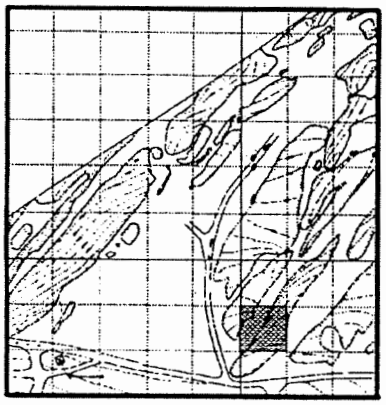


Figure 47. Grid #47 Ambient Gamma Exposure Rate.





Grid #48
S100ft - 200ft
E 0ft - 100ft

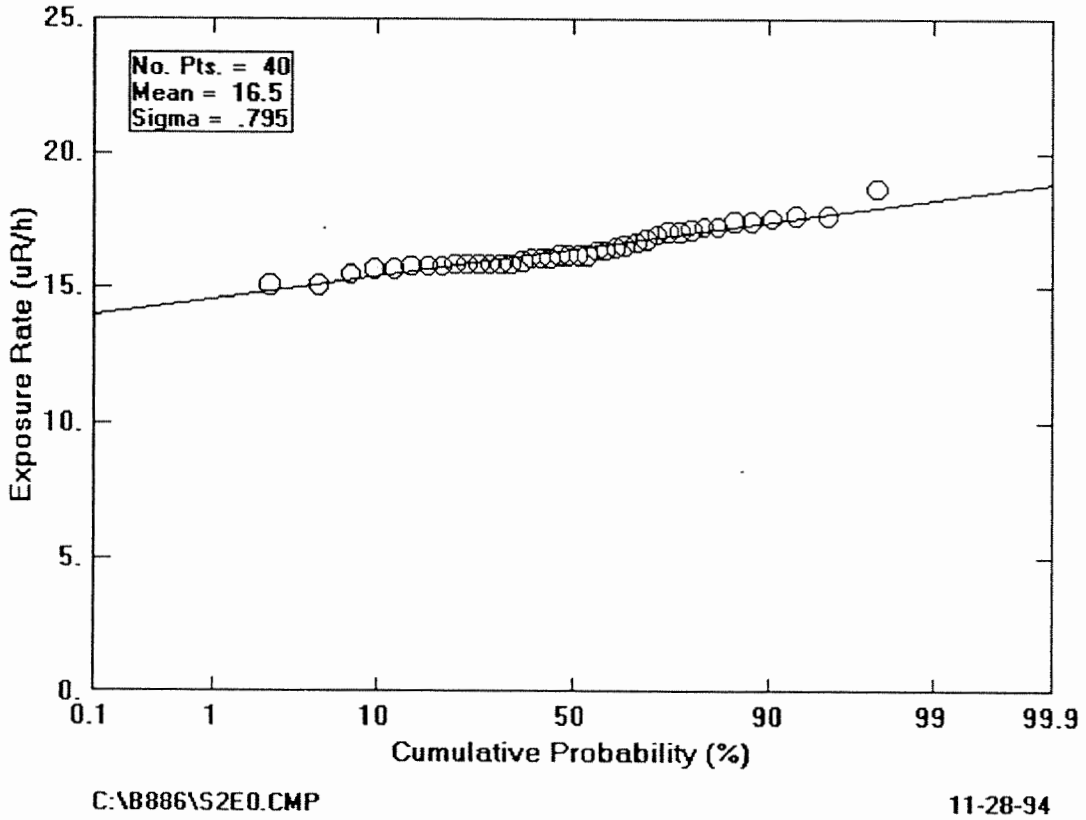
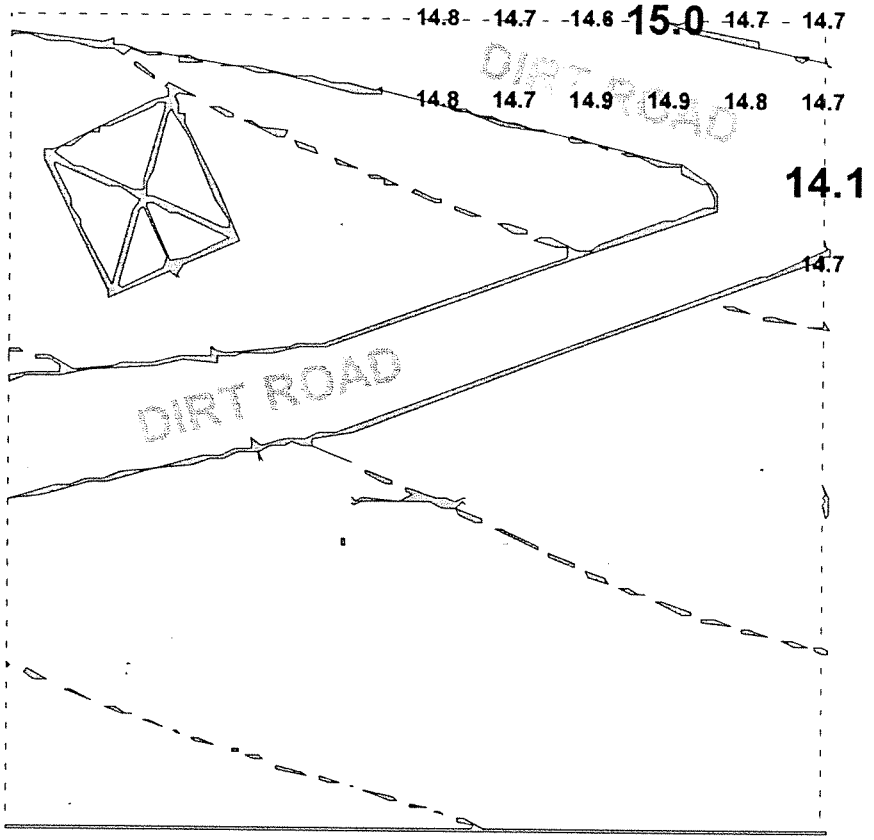
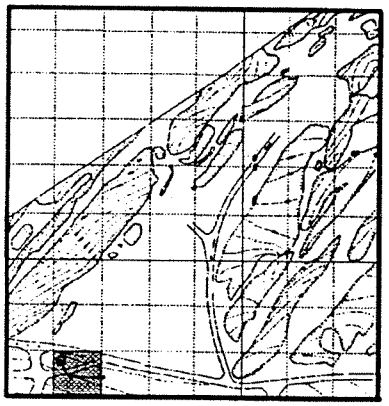


Figure 48. Grid #48 Ambient Gamma Exposure Rate.





Grid #52
S200ft - 300ft
W400ft - 300ft

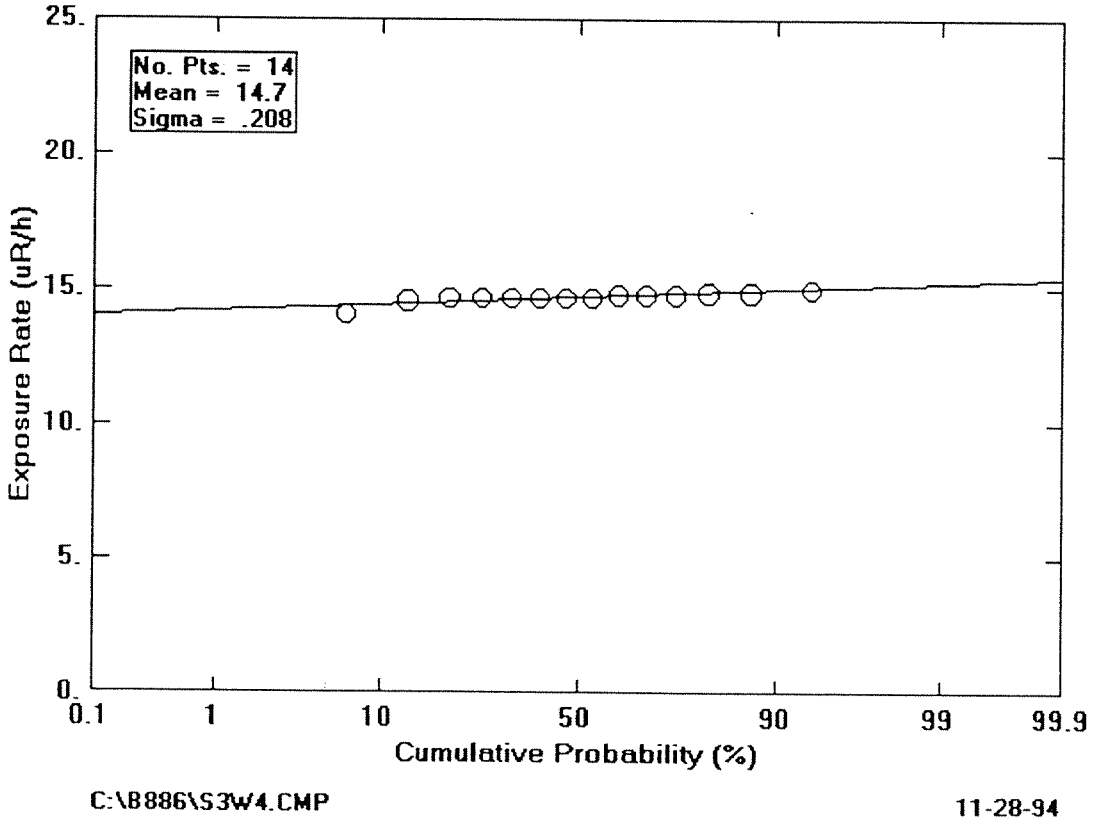
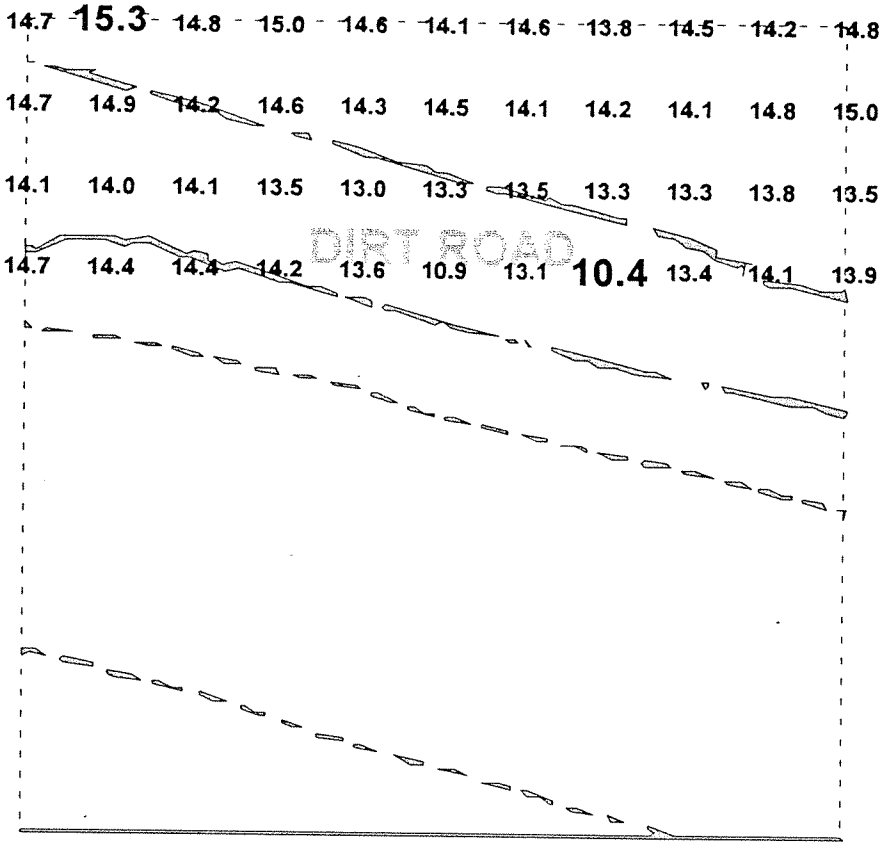
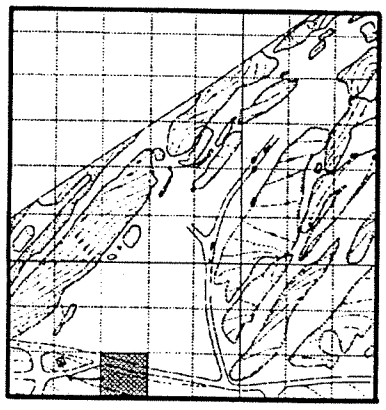


Figure 49. Grid #52 Ambient Gamma Exposure Rate.





Grid #53
S200ft - 300ft
W300ft - 200ft

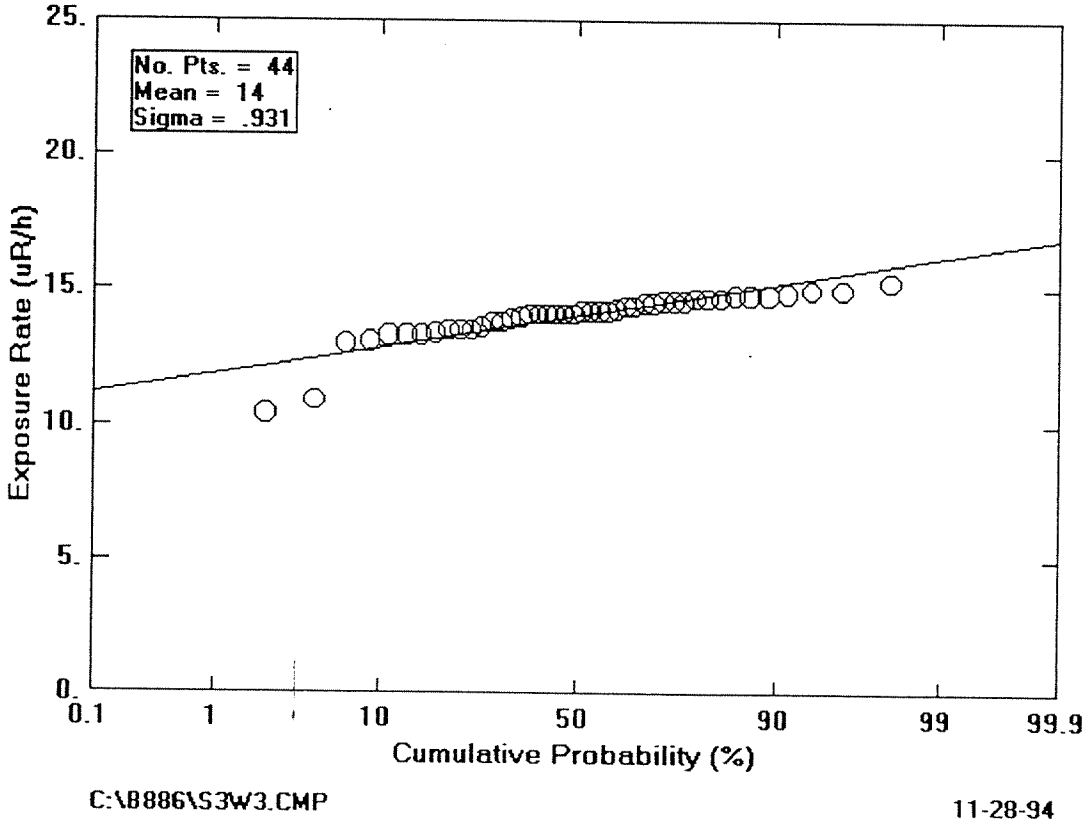
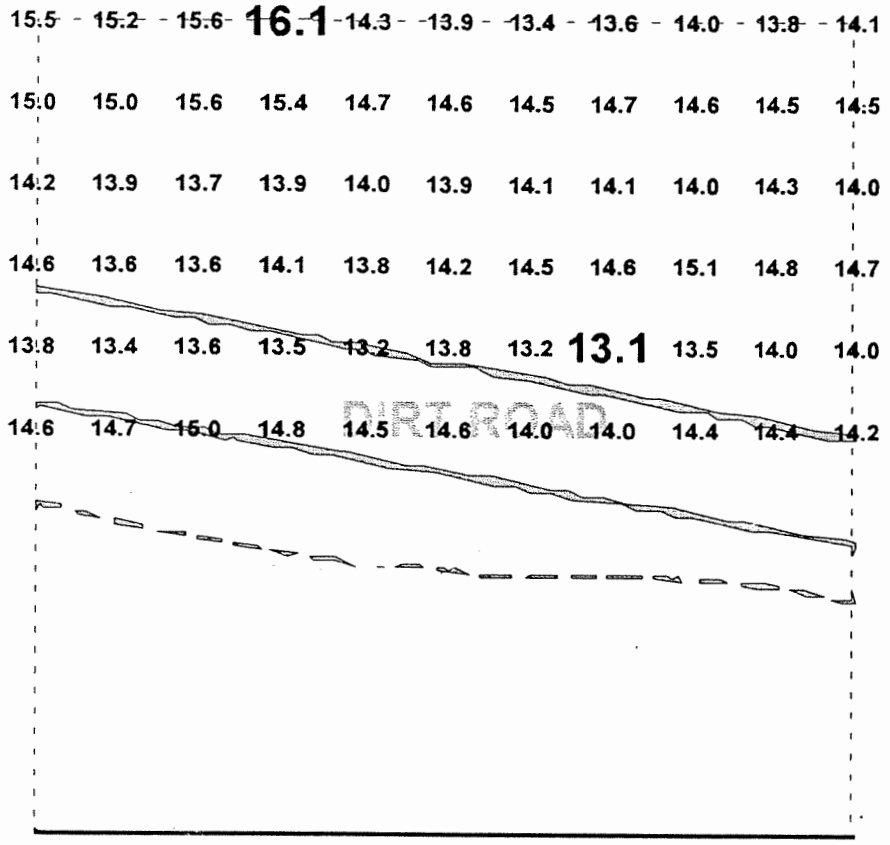
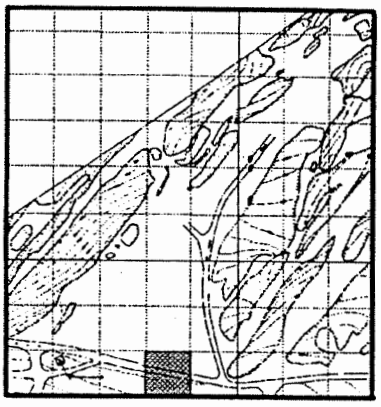


Figure 50. Grid #53 Ambient Gamma Exposure Rate.





Grid #54
S200ft - 300ft
W200ft - 100ft

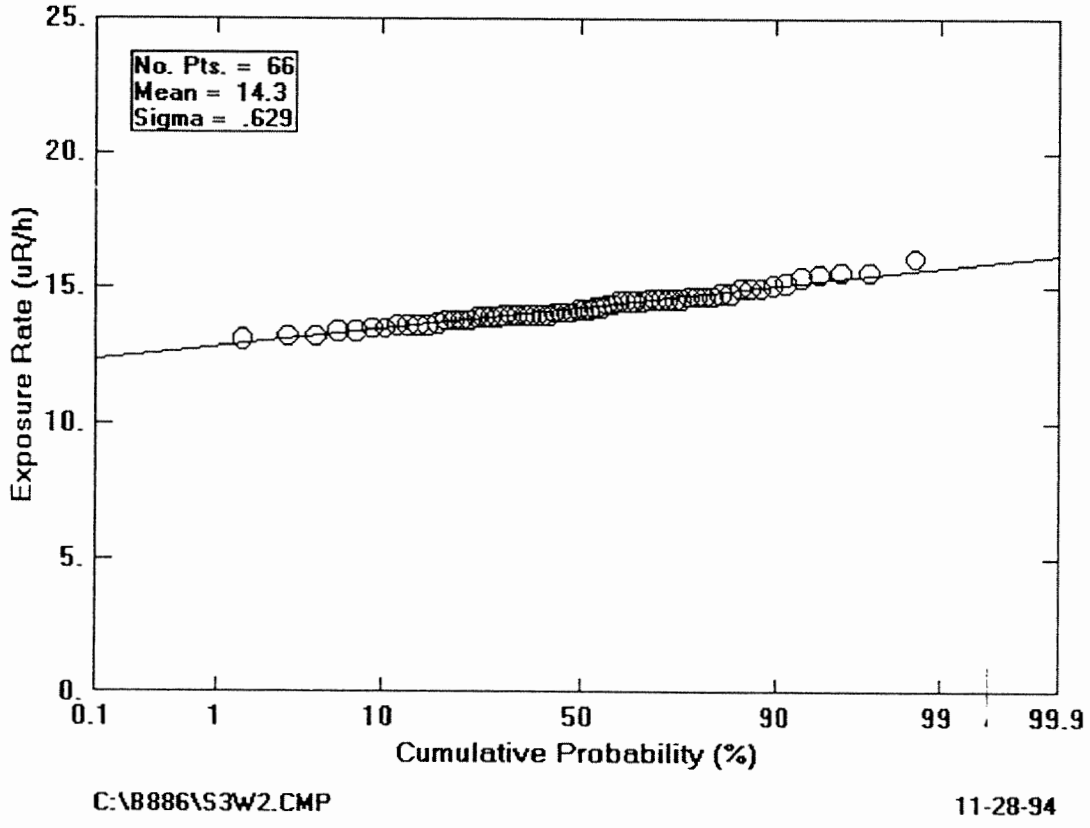
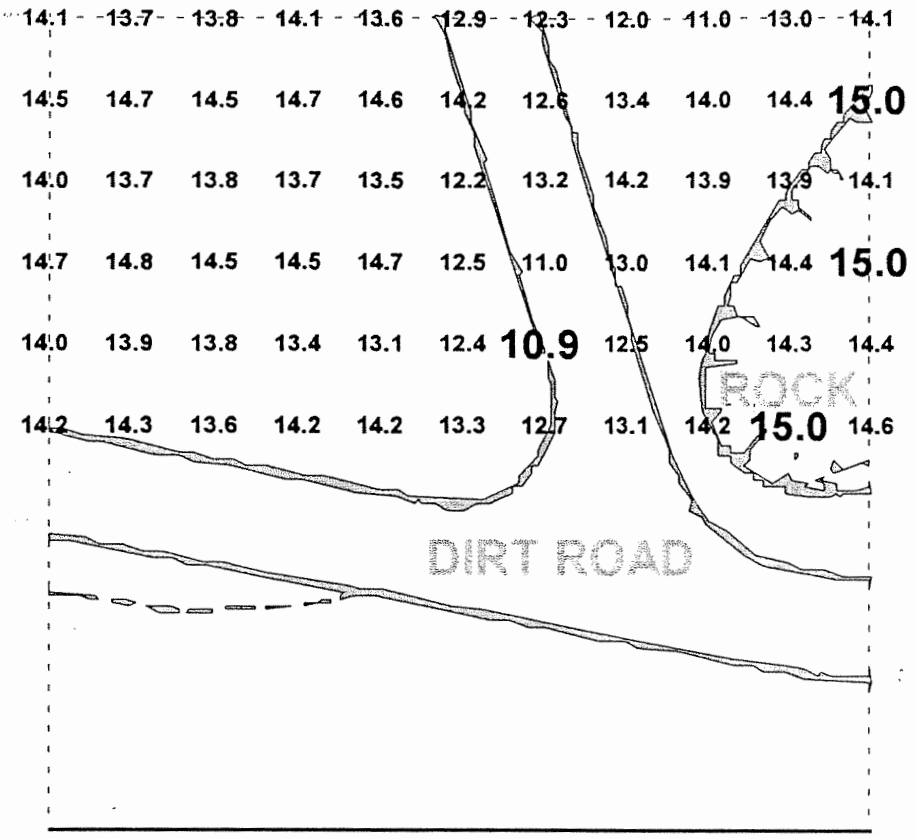
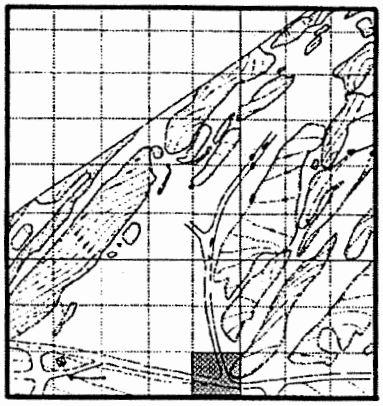


Figure 51. Grid #54 Ambient Gamma Exposure Rate.





Grid #55
S200ft - 300ft
W100ft - 0ft

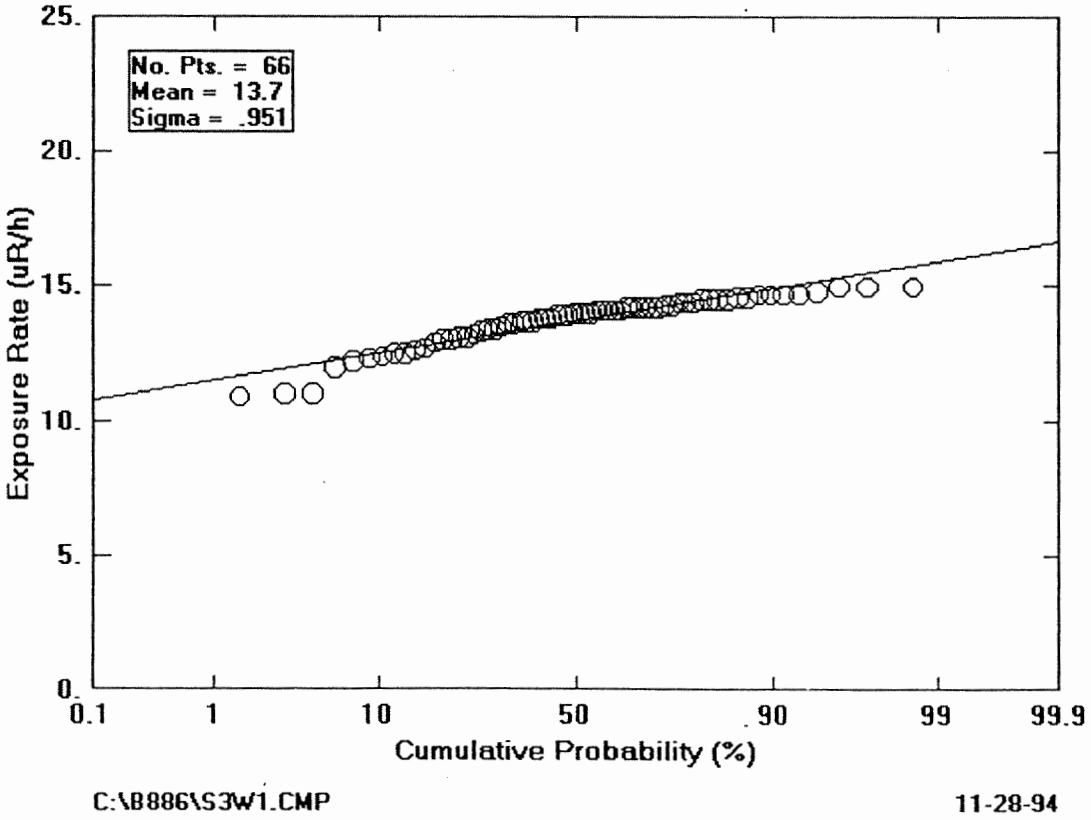


Figure 52. Grid #55 Ambient Gamma Exposure Rate.