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ABSTRACT

Following cleanup of all detected radioactivity exceeding specified limits, a radiation survey was performed in the parts of Building 001 identified as Region IIB. The results of this survey show that these regions meet the criteria established by NRC for release for unrestricted use.

The radiation survey for Phase I (Regions IA and IB) has been described in a previous report (N001SRR130011).

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CONTENTS

FIGURES

I. INTRODUCTION

Various portions of Building 001 at the Headquarters site have been used for fabrication of reactor fuel elements using enriched uranium. This work has most recently been conducted under the NRC Special Nuclear Materials License No. SNM-21.[1] It has been decided to decontaminate this building and related areas at Headquarters, and eliminate them from the license.

Conditions 22 and 46 of the license impose Annex C (attached here as Appendix A) as a requirement for decontamination of facilities and equipment for release for unrestricted use. The requirements of Annex C have been followed. An additional criterion, communicated during telephone discussions between M. E. Remley (ESG) and W. T. Crow (NRC), is the imposition of a limit of 30 pCi U/g soil above natural background subject to the interpretations presented in the Federal Register.[2]

II. IDENTIFICATION OF PREMISES

The premises to be released consist of part of Building 001 at the Headquarters (or De Soto) site. This site is shown in Figure 1. It is located at 8900 De Soto Avenue in Canoga Park, California.

In order to provide an orderly and effective transfer of this building to the Rocketdyne Division of Rockwell International, separate regions have been identified and scheduled for decommissioning, and these will be prepared for release in three phases.

The radiation survey for Phase I was reported in N001SRR130011, "Radiation Survey for Phase I Release for Unrestricted use of ESG Headquarters, Building 001."

For Phase II, this survey and report covers a portion of Building 001, designated Region IIB, that is shown in Figure 2. The area, identified as Region IIA, will be included in the survey for the Phase III release. A mezzanine floor is in the western quarter of the building. This consists of an enclosed office area, and a partially exposed equipment platform for air conditioning and ventilating equipment and other similar building utilities. Although these areas were not subject to contamination during any of the work performed here, the office mezzanine and the southern part of the equipment mezzanine were included in Phase I; the northern part of the equipment mezzanine is included in Region IIB for completeness. This part of the mezzanine is directly above Region IIB and is approximately the same size. In many cases, the room identification shown in Figure 2 reflects the past arrangement: many walls have been removed in preparation for renovations.

The separation into two regions (A and B) has been a scheduling convenience and does not indicate any significant difference between the regions. Region IIA has been attached to Region III (the fuel fabrication area) in order to provide confinement of airborne contamination.

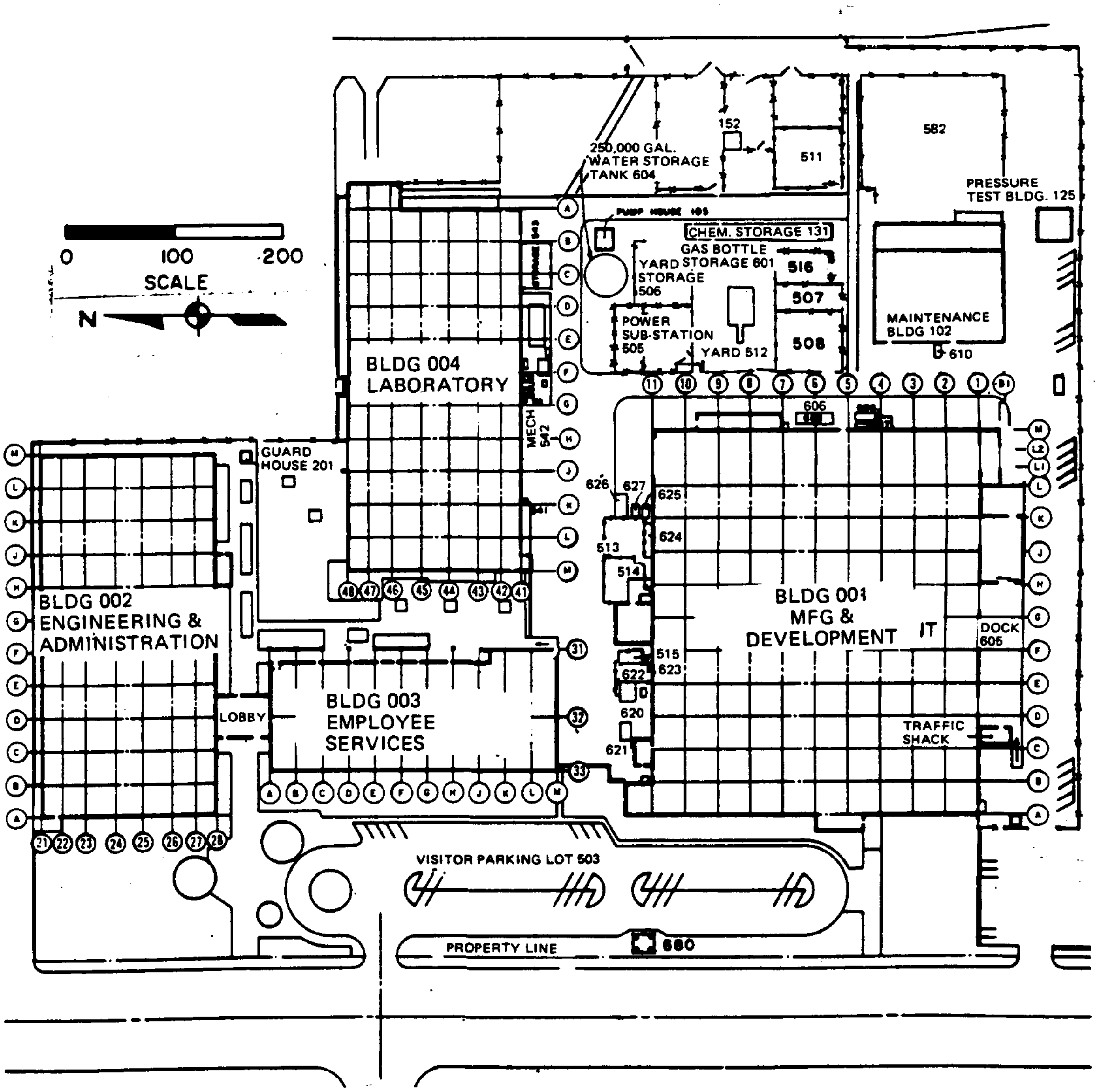

Figure 1. De Soto Avenue (Headquarters) Site in Canoga Park

III. DECONTAMINATION EFFORTS

Region IIB was used for fabrication of a variety of reactor fuel elements using a broad range of uranium enrichments from about 2 percent to 93 percent. This work began in 1959. Uranium fabrication in this area had ended by the early 1970's and, as the projects ended and as work areas were relocated, the areas were generally cleaned to acceptable levels. In some areas, work with radioactive material in support of fuel fabrication continued. These were the Quality Assurance and Metallurgical Laboratories located along the west building wall. Small quantities of enriched uranium were tested and analyzed in these laboratories until the end of ATR/TRTR fuel fabrication in late 1982.

Decontamination of this area was accomplished by cleaning and removal of walls and utilities, removal of all floor covering (with concrete scabbling in some cases), and air blowing and vacuuming. During this work, surveys were performed with GM pancake survey instruments and alpha scintillator survey instruments. All surfaces exceeding the acceptance criteria (Appendix A) were cleaned or disposed of as radioactive waste.

Some drain lines that had serviced sinks and floor drains in the radioactive material areas during the fuel fabrication operation were simply capped as the areas were converted to nonnuclear work and left in place in anticipation of any possible future use. Other drain lines had continued in use for radioactively contaminated water.

All radioactive drain lines were removed in the current decontamination project by saw-cutting the concrete floor, digging out the soil overburden, and disposing of the drain pipes as radioactive waste. Additional soil was dug out below the pipe level to provide a clean trench surface and easily sampled dirt piles. The drain lines and small amounts of soil were disposed of as radioactive waste. The arrangement of trenches is shown in Figure 3. These were backfilled with soil after sampling and analysis by ESG had shown

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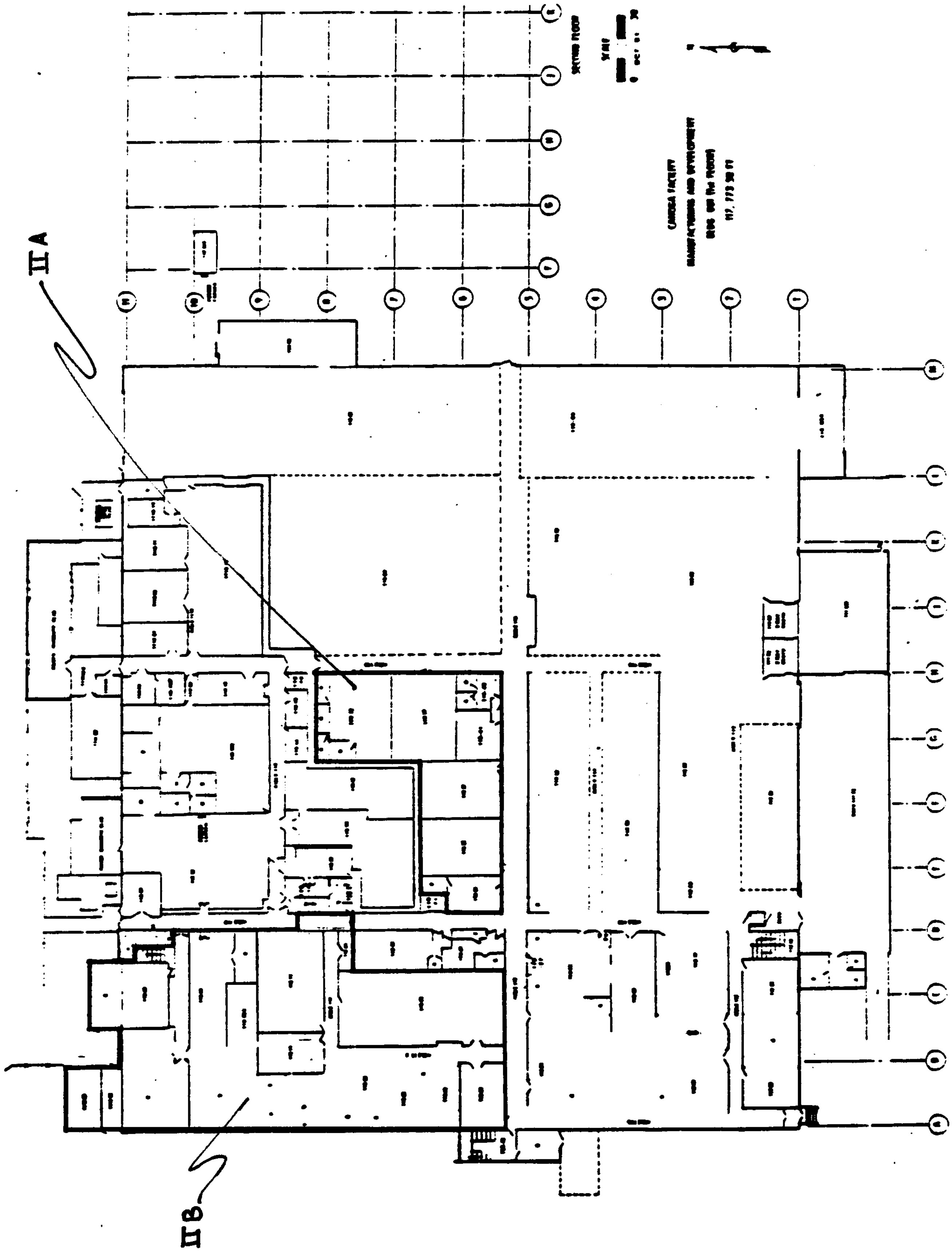

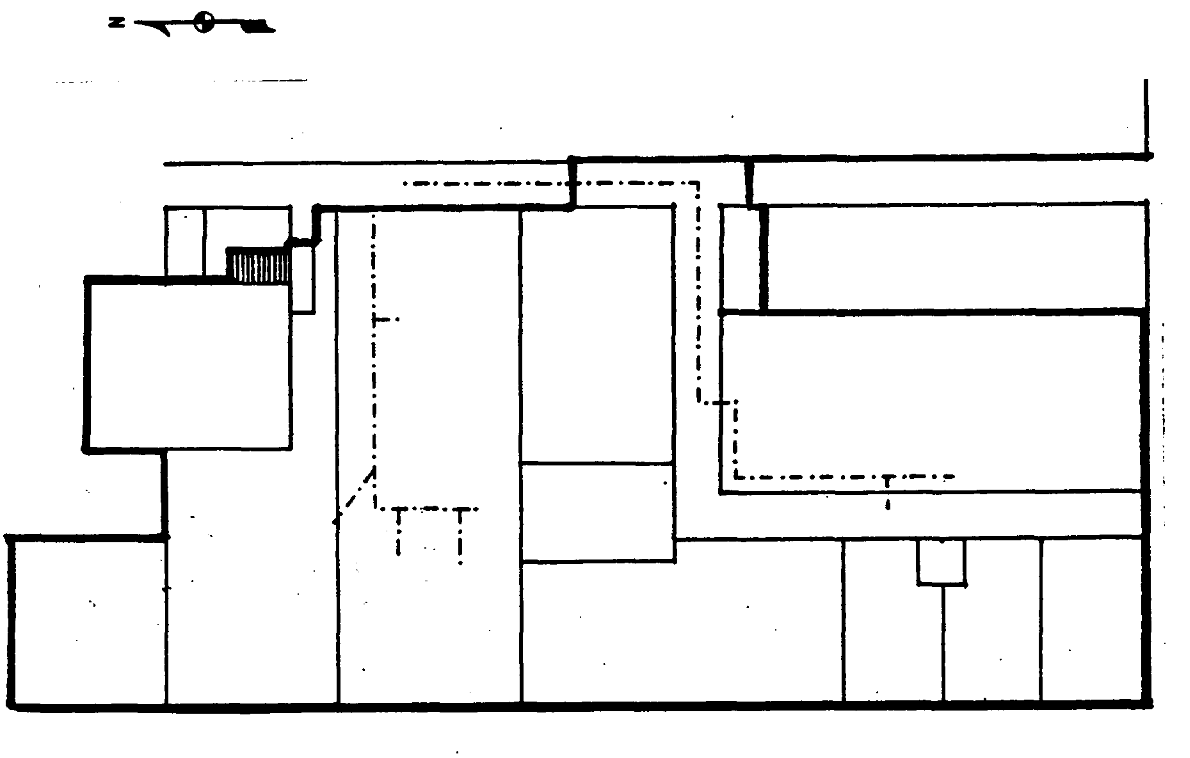

Figure 3. Region IIB Showing Arrangement of Trenches for Removal of Radioactive Waste Liquid Drain Lines

the soil activity to be below the acceptance limit. NRC had independently sampled the trenches and soil prior to this backfilling.

As a final step, a general housecleaning was performed to remove the overall deposits of industrial dust and grime from structural and utility surfaces.

IV. SURVEY SCOPE AND PROCEDURES

A. SURVEY SCOPE

A sampling inspection plan using variables has been used to demonstrate that the residual contamination in the area is below the following limits:

Total average over 1 m^2	5000 dpm α/100 cm^2
Total maximum over 100 cm^2	15000 dpm α/100 cm^2
Removable	1000 dpm α/100 cm^2
Soil	30 pCi U/g soil in excess of naturally present uranium

The sampling inspection plan that was used is based upon a uniform 3-meter (10-ft) square grid superimposed on the area as shown in Figure 4. A 3-m-square grid has been adopted to be consistent with NRC and State of California guidance. (As shown in these figures, this grid is illustrative only; the actual grid in each room was benchmarked in the northwest corner of the room. An identical grid was reflected onto the ceiling. A similar grid structure was also applied to the walls, benchmarked in the upper left corner of each wall. Each survey area has been identified with codes indicating the surface (F = floor; C = ceiling; N, E, S, W = north, east, south, west walls, respectively) and a two-figure Cartesian coordinate showing the distance in meters from a local benchmark.

Within each square defined by the grid lines, a single 1-m^2 area was surveyed. Each area was outlined by felt marker or paint, with its coordinates marked within or beside the 1-m^2 area. The location of this 1-m^2 area was left to the surveyor's judgment: it was to be the area that, in his judgment, was most likely to have retained the most residual contamination of any similar area within the grid square. The surveyor was instructed to do this conscientiously to assure that any significant residual contamination would be detected before a report of acceptability was made to a regulatory agency. The use of a predetermined grid with discretion for the exact

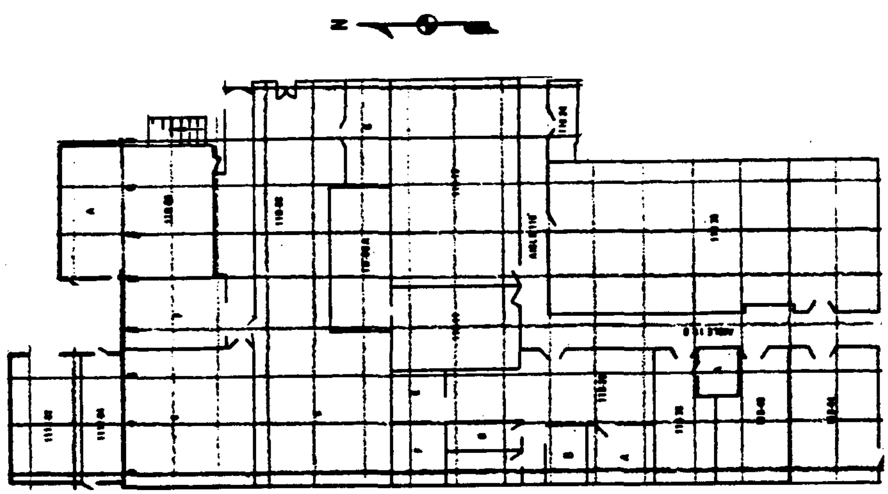

Figure 4. Region IIB Showing Overlay of 3-m (10-ft) Square Grid Used for Survey

location provides a biased-uniform survey; Selection of one 1-m^2 area out of the nine within each grid square provides an 11% sampling of the surface; selection of one 1-m^2 area for every other grid square provides a 5.5% sampling.

Sampling inspection consists of a <u>sampling plan</u> for selection of items to be tested, in this case, locations to be measured for radioactivity, and the method of analysis, and a <u>plan of action</u>, establishing the acceptance/rejection criteria. The <u>sampling plan</u> used for this phase was to inspect one 1-m^2 area out of every 3-m grid square throughout the regions.

The 1-m^2 area is first measured for total activity and then for removable activity.

The values resulting from these measurements (converted to the proper units) are analyzed in the following manner:

The test statistic $\overline{x} + ks$ is compared to the acceptance limit U, where

$\overline{x}$ = average (arithmetic mean of measured values)
s = observed sample standard deviation
k = tolerance factor calculated from the number of samples to achieve desired sensitivity for this test
U = acceptance limit.

The State of California has stated[3] that the consumer's risk of acceptance (β) at 10% defective (LTPD, Lot Tolerance Percent Defective) must be 0.1. For these choices of β and LTPD, $K_\beta = K_2 = 1.282$. The number of samples is n. Values of k for each sample size are calculated from[4]:

$$k = \frac{K_2 + \sqrt{K_2^2 - ab}}{a}; \quad a = 1 - \frac{K_\beta^2}{2(n-1)}, \quad b = K_2^2 - \frac{K_\beta^2}{n} .$$

For example, for n = 10, k = 2.41; n = 100, k = 1.47; n = 1000, k = 1.34.

The criteria for acceptance are presented as a plan of action. The plan of action is:

1) Acceptance: If the test statistic ($\bar{x}$ + ks) is less than or equal to the limit (U) accept the region as clean. (If any single measured value exceeds the limit, decontaminate that location to below the limit, but do not change the value in the analysis.)
2) Collect additional measurements: If the test statistic ($\bar{x}$ + ks) is greater than the limit (U), but $\bar{x}$ itself is less than U, independently resample and combine all measured values to determine if $\bar{x} + ks \leq U$ for the combined set; if so, accept the region as clean. If not, reject the region.
3) Rejection: If the test statistic ($\bar{x}$ + ks) is greater than the limit (U) and $\bar{x} \geq U$, reject the region.

The specifications of the sampling plan assure that a reasonable number of locations will be inspected so that the data will be representative, but not an excessive number so that the effort may be reasonably expended. The plan of action assures (by Step 1) that the general level of contamination is confidently below the acceptance limit, while it guarantees that no area known to be contaminated in excess of the limit remains so. (It is important that the new measurement of contamination at that location not be entered in the data set used for the acceptance test since it represents special treatment not afforded to the rest of the region.)

Step 2 takes advantage of the improved discrimination of the acceptance test resulting from an increase in the number of samples to reduce the risk of rejecting a region that is acceptably clean. This false rejection should be avoided if possible to avoid the unnecessary expense of further decontamination. If the result of the additional inspection does not show acceptability, further decontamination is required.

Step 3 assures that no truly contaminated area will be accepted. The contamination measurements made at the inspected location may be used to guide further decontamination, but these locations should be avoided in the subsequent inspection.

B. PROCEDURES

The following procedures were used in performing this survey.

1. <u>Average Contamination Measurement</u>

1) Identify 1-m^2 area to be measured.
2) With a portable scaler (Technical Associates FS-8 or equivalent) set for 5-min count time, use an alpha probe (Ludlum Model 43-1 or equivalent) or a beta probe (Ludlum Model 44-9 or Associates Model P-11 or equivalent) and uniformly scan the area. (Watch for and note any "hot spots" where the radioactivity may exceed the average limit. These are to be resurveyed later.)
3) Record the location and total count.
4) The total count is converted to dpm/100 cm^2 total surface activity by:

$$SA_T = \left(\frac{C - B}{5}\right)E\left(\frac{100}{A}\right)$$

Where

SA_T = total surface activity in dpm/100 cm^2
C = total count in 5 min
5 = count time, min
B = background count in 5 min (generally 0-5 for alpha and about 200-220 for beta)
E = efficiency factor, dpm/cpm (generally 4 for alpha and 7 for beta)
100 = 100 cm^2 standard area
A = probe sensitive area (69 cm^2 for Ludlum Model 43-1 alpha scintillator; 20 cm^2 for Ludlum Model 44-9 and Technical Associates Model P-11 pancake G-M).

(Note that the analysis is done using counts rather than count rates.)

2. Maximum Contamination Measurement

1) Return to any area identified as having a "hot spot."
2) Repeat the uniform scan of only the hot spot area, covering approximately 100 cm^2 with the probe.
3) Record the location and total count, as a "hot spot" measurement.
4) The total count is converted to dpm/100 cm^2 as shown above.

3. Removable Contamination Measurement

1) Identify 1-m^2 area to be measured.
2) Using a Whatman 540 filter paper (2.4 cm diameter), wipe a "Z" or "S" pattern, with legs approximately 6 in. long, so as to sample removable contamination from an area of approximately 100 cm^2.
3) Place smear paper in file card "book" until ready for counting.

4) Count radioactivity using gas-flow proportional counter (NMC Model ACS-77 or equivalent) for 5 min.

5) Record the location and both the total alpha count and the total beta count.

6) The total counts are converted to dpm/100 cm^2 removable surface activity by:

$$SA_R = \left(\frac{C - B}{5}\right)E$$

where the appropriate alpha and beta backgrounds and efficiency factors are used. Backgrounds are typically 1-3 counts for alpha and 120-150 counts for beta. Efficiency factors are about 4 dpm/cpm for alpha and beta.

4. Soil Contamination Measurement

1) Identify 1-m^2 area to be measured.

2) Collect approximately 5 lb of soil (avoid large rocks, concrete rubble, re-bar, and similar nonsoil material).

3) Dry on hot plate or in microwave oven.

4) Tumble in ball mill jar with suitable number of balls to homogenize the soil.

5) Pass through No. 20 sieve, collecting soil in pan.

6) Place 2 grams of soil in a counting planchet, wet with alcohol to distribute well, and allow to dry.

7) Count in gas-flow proportional counter (Canberra low-background alpha-beta counting system or equivalent) for 30 min.

8) Record location and total counts.

9) The total counts are converted to pCi/g distributed soil activity by:

$$SA_S = \left(\frac{C - B}{30}\right)E'$$

where E' for alpha is determined from counts of spiked soil and sand and is approximately 30 pCi/g per cpm and E' for beta is determined from counts of 2 g KCl, with a specific activity of 831 dpm/g (374 pCi/g), and is approximately 1.5 pCi/g per cpm.

C. CALIBRATION OF INSTRUMENTS

Instruments are calibrated by measuring the instrument background for a 5-min count, and the count for an electroplated U-235 alpha source or electroplated Tc-99 beta source. The scalers indicate 1 count per event detected in the detector and the efficiency factor (dpm/cpm) is calculated as the ratio of 2 times the 2π emission rate of the source (dpm) to the net count rate of the instrument (cpm).

The radioactivity of the calibration sources is traceable to NBS. The KCl is reagent-grade with a calculated value for the specific activity. The spiked soil was prepared by adding a measured mass of highly enriched uranium, in solution, to a measured mass of average local soil. The activity was determined by calculation from the isotopic composition and was confirmed by later analysis by NRC. The calculated activity was 40 pCi/g; the activity measured by NRC was 40.07.

D. SOIL RADIOACTIVITY ANALYSIS

The method for analyzing soil activity used by NRC differs markedly from that used by ESG. Samples of soil are sent by NRC to the Radiological and Environmental Sciences Laboratory at the Idaho National Engineering Laboratory (INEL). The soil samples are acid-leached, and the uranium is chemically extracted and separated from other alpha-emitting elements. The uranium is then deposited and alpha-counted to determine the uranium activity per gram. This method of analysis includes all naturally occurring uranium but excludes all other natural alpha-emitters.

The ESG method simply involves alpha counting a plancheted soil sample and includes all alpha emitters in the uranium and thorium decay chains.

A cross-calibration between the two methods has been done using samples of natural (uncontaminated) soil, a calibration standard, and samples of contaminated soil taken by NRC on March 9, 28, and June 21, 1983, and split with ESG.

Radioactivity concentration values reported by ESG and NRC for these samples are:

Sample Origin	ESG Identification	ESG Result pCi α/g	NRC Result pCi U/g
Composite	Spike	55.0	42.65*
Composite	Bkg	18.7	2.58*
11D08	1a } splits	145.8 }	
11D08	1b } splits	112.4 }	91*
11D08	1c } splits	166.9 }	
11D08	2	40.2	3.96
11D08	3	33.1	5.31
11D08	4	42.8	2.22
11D08	5	56.8	2.86
Composite	Spike	67.8	42.65*
Composite	Bkg	17.6	2.58*
Composite	Spike	58.8	42.65*
Composite	Bkg	18.6	2.58*
Composite	Spike	65.0	42.65*
Composite	Bkg	13.4	2.58*
Composite	Bkg	25.8	2.58*
Composite	Spike	49.6	42.65*
Region IB	1	6.2	1.05
Region IB	2	8.3	2.21
Region IB	3	11.4	1.70
Region IB	4	15.5	1.25
Region IB	5	18.6	5.36
Region IB	6	15.5	2.50
Region IB	7	29.9	3.17
Region IB	8	23.7	4.77
Region IB	9	12.4	2.68
Region IB	10	10.3	2.44
Offsite	Plummer	19.6	2.94
Offsite	Nordhoff	18.6	2.38
Composite	Bkg	18.6	2.58*
Composite	Spike	63.0	42.65*

Sample Origin	ESG Identification	ESG Result pCi α/g	NRC Result pCi U/g
Composite	Spike	48.6	42.65
Region IIA	1	19.6	5.91
Region IIA	2	9.3	1.40
Region IIA	3	14.5	0.34
Region IIA	4	7.2	2.00
Region IIA	5	12.4	2.50
Region IIA	6	10.3	1.52
Region IIA	7	3.1	1.84
Region IIA	8	15.5	2.82
Region IIA	9	13.4	2.86
Region IIA	10	16.5	6.05
Region IIA	11	14.5	5.84
Region IIA	12	16.5	2.97
Region IIA	13	12.4	3.47
Region IIA	14	11.4	4.84
Region IIA	15	9.3	1.87
Region IIB	16	22.7	7.48
Region IIB	17	11.4	4.04
Region IIB	18	12.4	5.40
Region IIB	19	17.6	3.95
Region IIB	20	27.9	7.87
Region IIB	21	19.6	2.55
Region IIB	22	14.5	2.38
Region IIB	23	19.6	3.05
Region IIB	24	20.7	4.40
Region IIB	25	22.7	5.71
Region IIB	26	14.5	1.58
Region IIB	27	8.3	2.76
Region IIB	28	23.8	3.99
Region IIB	29	23.8	3.73
Region IIB	30	14.5	2.32

*Only one NRC analysis was performed for each of these sample types.

These results are shown in Figure 5. With the exception of the "contaminated soil" and the "calibration standard," all results have been essentially at background, showing the naturally present uranium activity in the NRC analyses and the alpha activity from both the natural uranium and thorium decay chains in the ESG analyses. The average values of the uncontaminated samples are 3.26 pCi U/g for the NRC analyses and 17.99 pCi α/g for the ESG analyses. These values are shown, with the standard deviation for each set of

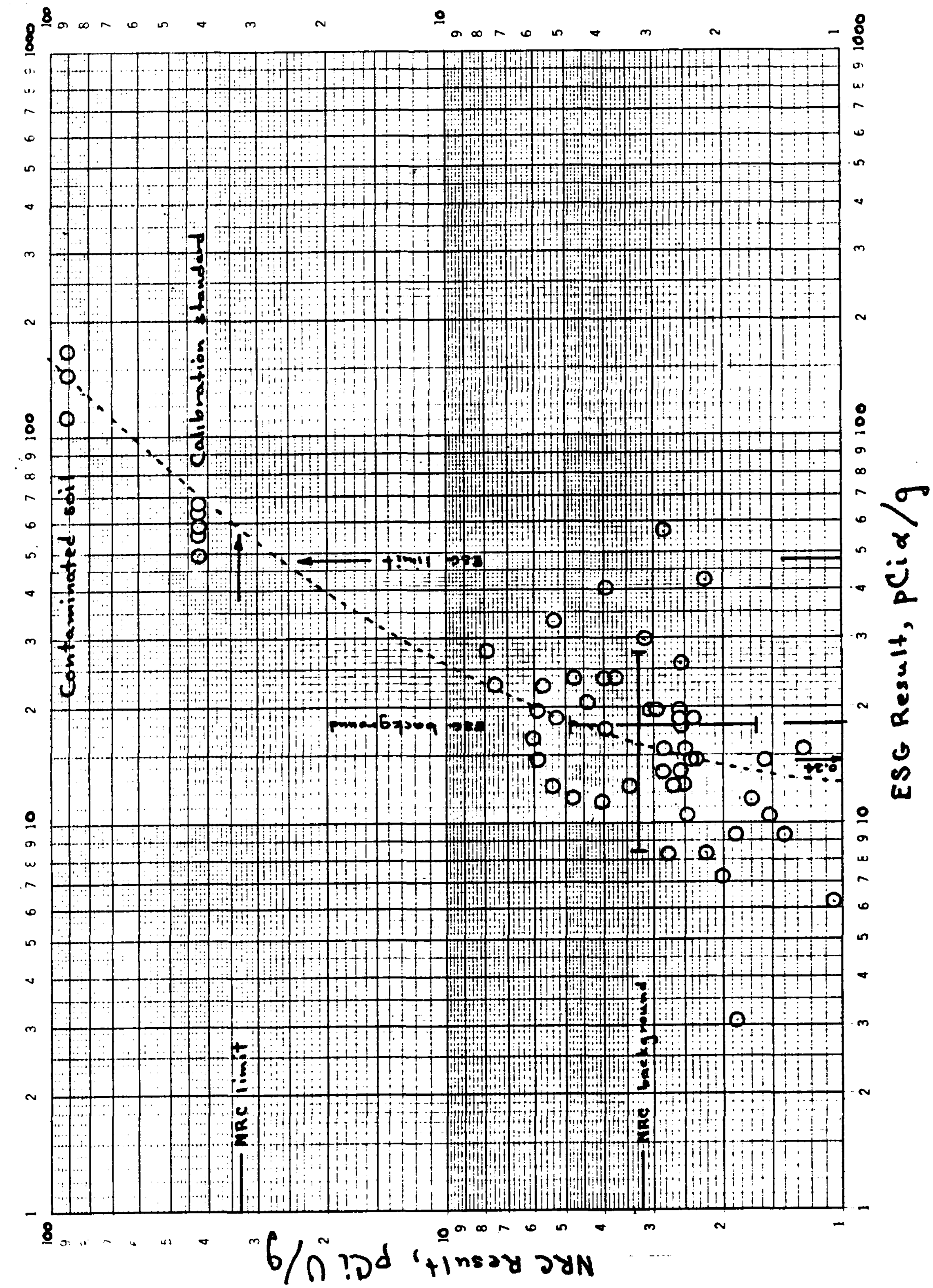

Figure 5. Comparison of NRC and ESG Soil Analysis Results

data, as crossed error bars. A linear least-squares fit was calculated for all the data and is shown as a dashed line in the figure. (The curvature of this line is a consequence of plotting a linear equation on a log-log graph.) The equation is: NRC = -7.85 + 0.697 ESG.

The derived NRC limit ("30 pCi U/g soil above natural background") is 33.3 pCi U/g. A similarly derived ESG limit is 48.0 pCi α/g. The least-squares fit indicates that this corresponds to an NRC value of 26 pCi U/g, which provides some margin of conservatism relative to the actual NRC limit. (In fact, none of the final samples from Region IIB exceeded 35 pCi α/g, corresponding to an NRC value of 16.5 pCi U/g, or approximately 50% of the allowable limit.)

E. "UNUSUAL" FEATURES

Manufacturing buildings frequently have unusual features, such as pits, machine foundations and trenches, small storage areas, and similar places that, because of their uniqueness, do not fit well in a sampling inspection plan. However, as a result of their uniqueness, they attract suspicion even more so than contamination. Features of this sort in Region IIB were checked qualitatively with survey instruments (countrate meters) and smears. No indications of contamination were found.

V. SURVEY RESULTS

Since unencapsulated material had been used and contamination had been found exceeding the release criteria prior to decontamination in Regions IIA and IIB, 10% inspection was used for alpha and for beta on walls and floors throughout Region IIB, including the mezzanine area. A 5% inspection of ceilings was used. All data were combined for the statistical analysis. The results are summarized in Table V-1. The "Inspection Test Statistic" is $\bar{x} + ks$, which must be less than the limit.

TABLE V-1

SUMMARY OF SURVEY RESULTS
REGIONS IIA and IIB

Measurement	Number of Locations	Average Value	Maximum Value	Inspection Test Statistic	Limit	Test Result
Average alpha	404	13	178	41	5,000	Accept
Maximum alpha	4	--	4,000	**	15,000	Accept
Removable alpha	429	0	42	4	1,000	Accept
Alpha soil activity	42	17	35	28	48	Accept
Average beta	400	176	2,470	930	5,000	Accept
Maximum beta	2	--	60,000	**	15,000	Accept
Removable beta	409	7	98	26	1,000	Accept
Beta soil activity	42	20	24	24	100*	Accept

*No requirement for beta activity in soil has been established. The value assumed here as a limit has been used in DOE decommissioning projects.
**Insufficient number of data values to apply statistical test. All detected hot spots were specifically removed after the survey.

With the exception of two beta "hot spots" which exceeded the allowable limit and were decontaminated immediately after detection, all data and inspection test statistic values are well below the limits. The room containing the beta hot spots was exhaustively surveyed and no other areas of significant contamination were found. These results confirm that the area is acceptable for release for unrestricted use.

The results of the surveys are shown in Figures 6 through 13, relative to the mean value of each type of measurement. Figures 6 through 13 provide a convenient way of reviewing all the survey data from a particular type of measurement, in context with the full set of data and relative to the limit. The method of display chosen for the data is similar to the log-normal probability display frequently used for radiometric data with two exceptions: The abcissa scale is in standard deviation units rather than cumulative percent, and a linear, rather than logarithmic, representation has been used. This method allows presentation of data that are distributed according to the familiar "bell-shaped" Gaussian curve as a straight line. The closer to the straight line that the data points are, the better the fit of a Gaussian distribution to the sample.

The relation between the standard deviation scale and cumulative percent is

Standard Deviations	Cumulative Percent
-4.0	0.0032
-3.0	0.13
-2.0	3.3
-1.0	15.9
0.0	50.0
1.0	84.1
2.0	97.7
3.0	99.87
4.0	99.9968

A logarithmic representation is not satisfactory in this case because the areas surveyed are so clean that the results are scattered about zero, with negative and zero values as well as positive values.

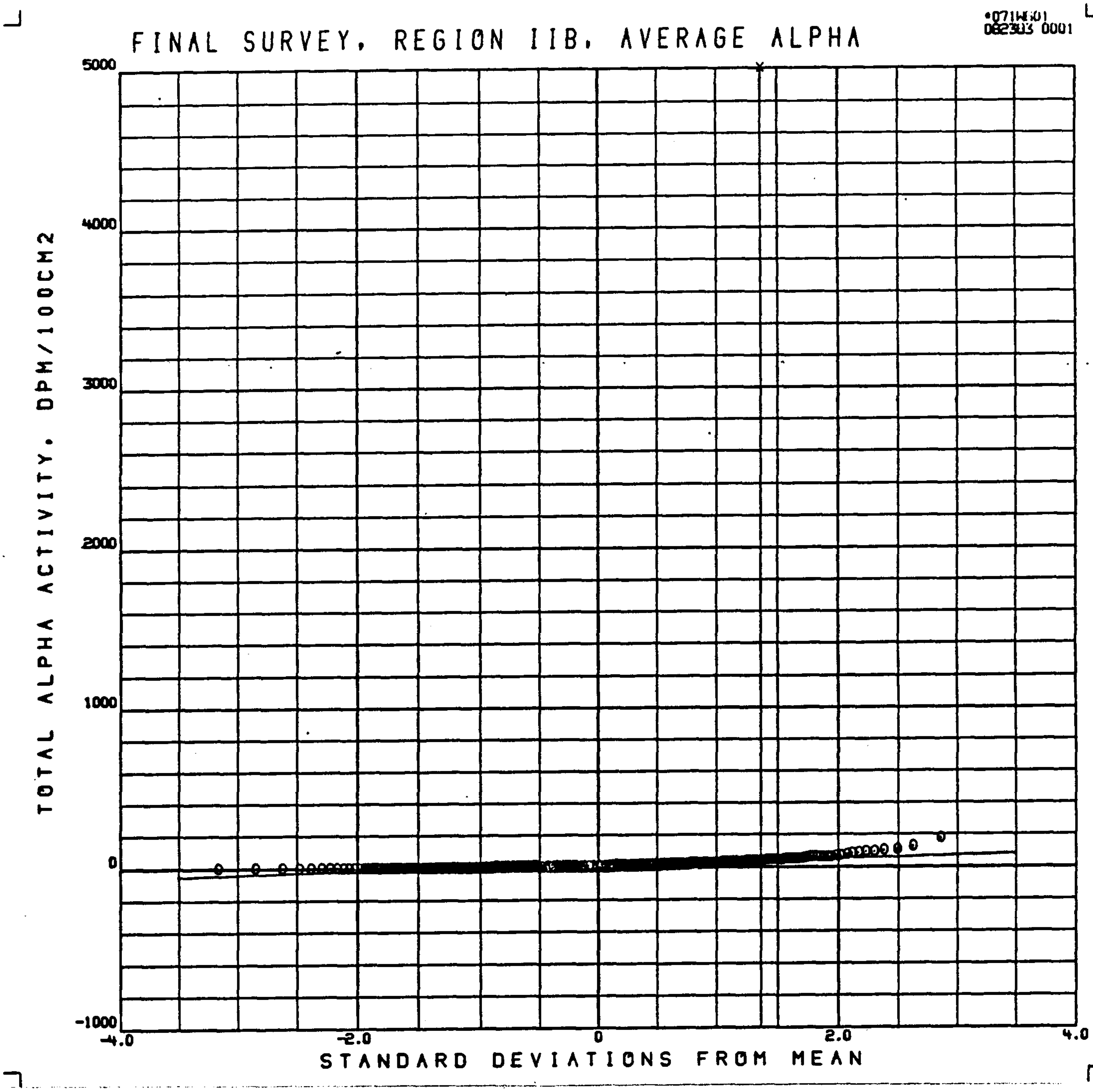

Figure 6. Cumulative Probability Plot for Average Alpha Contamination in Region IIB

Four "hot spots" were found. The locations and values were:

Room	Grid	Surface Activity (dpm/100 cm^2)
11B26	F5, 2	4000
11D08	F1, 5	700
11D08	F2, 9	1000
11813	F5, 1	2600

Each spot was removed after being detected.

Figure 7. Cumulative Probability Plot for Maximum Alpha Contamination in Region IIB

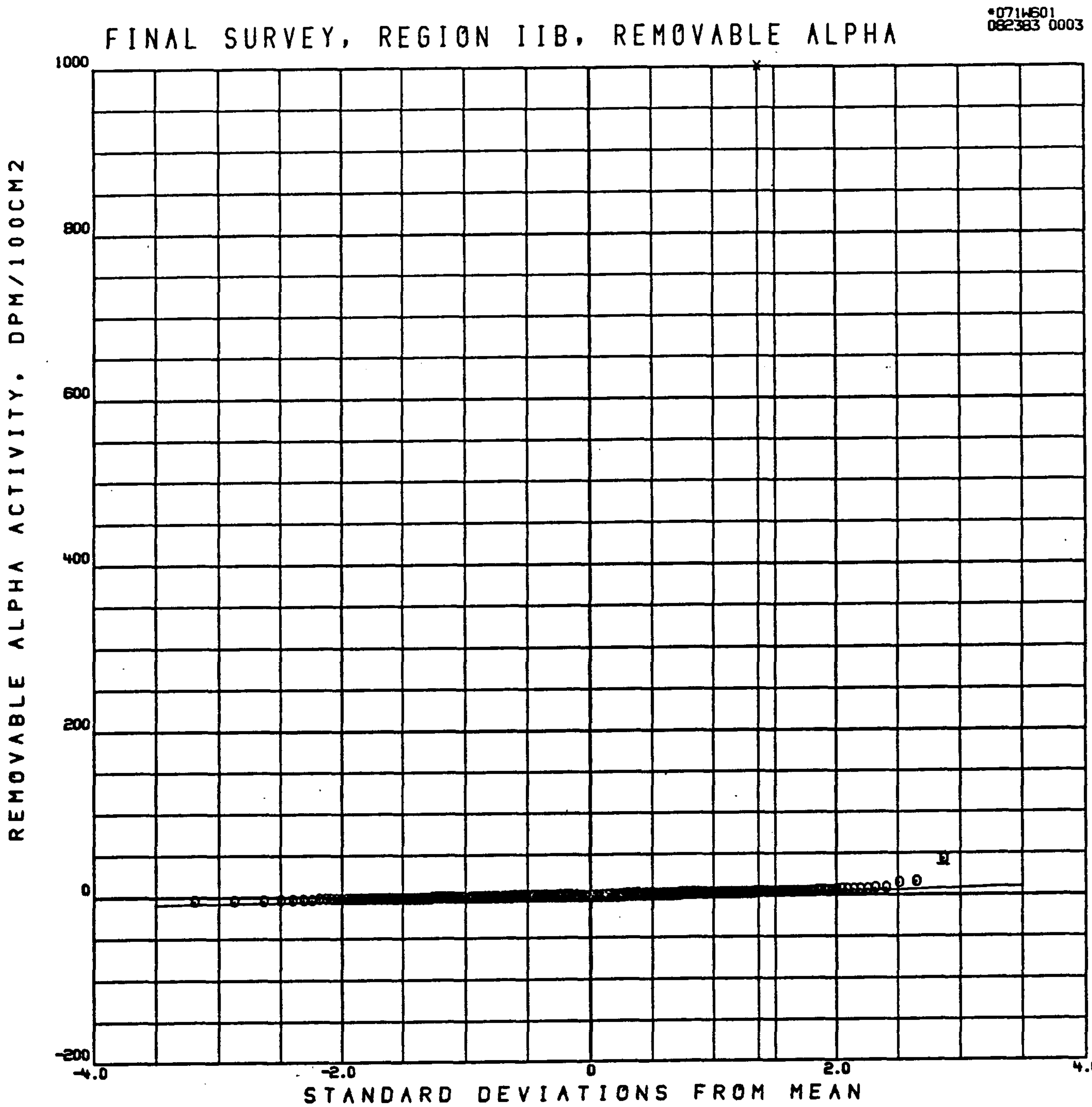

Figure 8. Cumulative Probability Plot for Removable Alpha Contamination in Region IIB

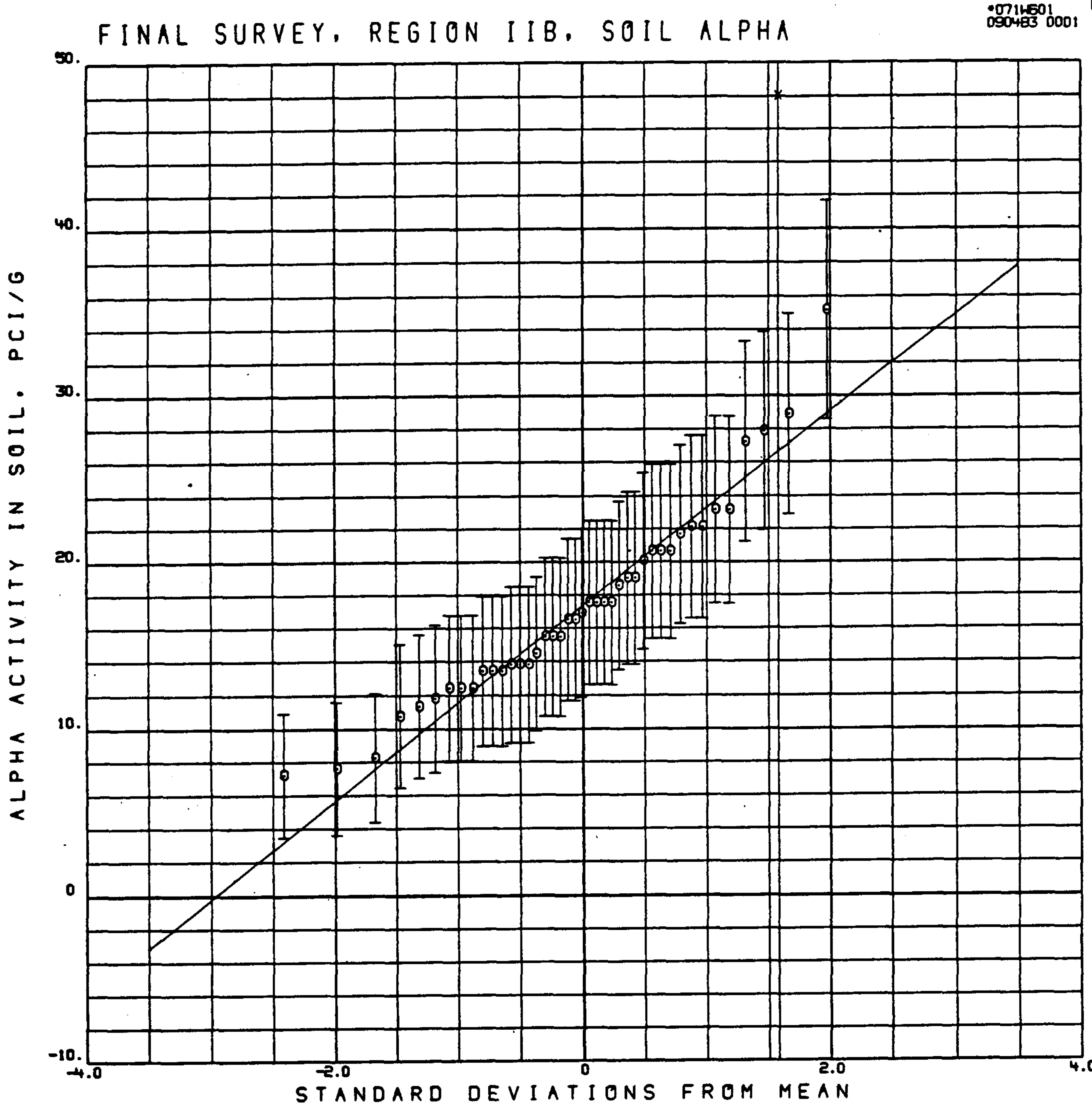

Figure 9. Cumulative Probability Plot for Alpha Soil Activity in Region IIB

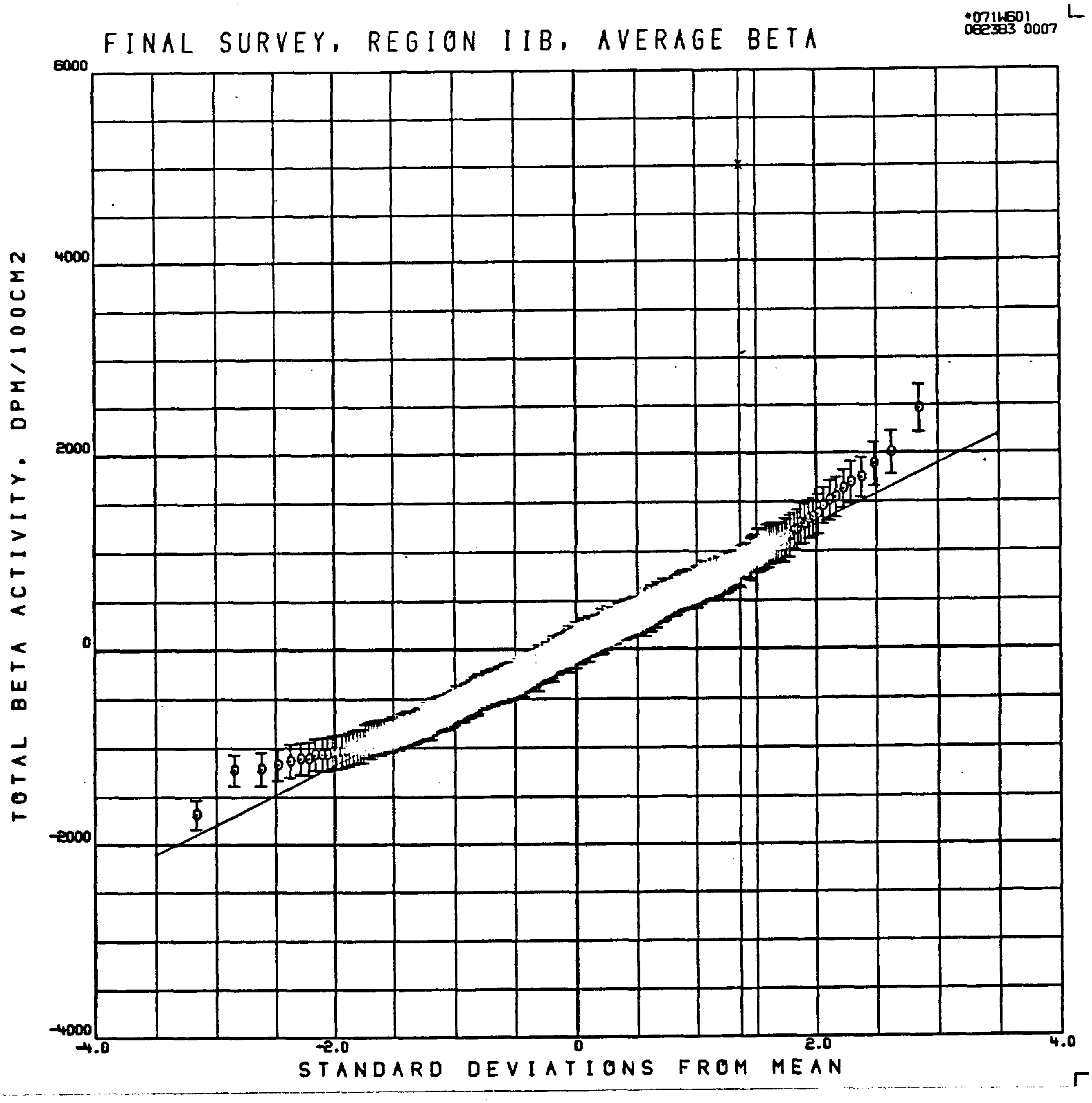

Figure 10. Cumulative Probability Plot for Average Beta Contamination in Region IIB

Two "hot spots" were found. The locations and values were:

Room	Grid	Surface Activity (dpm/100 cm^2)
11B36	F1, 4	29000
111202	N5, 2	60000

Each spot was removed after being detected.

Figure 11. Cumulative Probability Plot for Maximum Beta Contamination in Region IIB

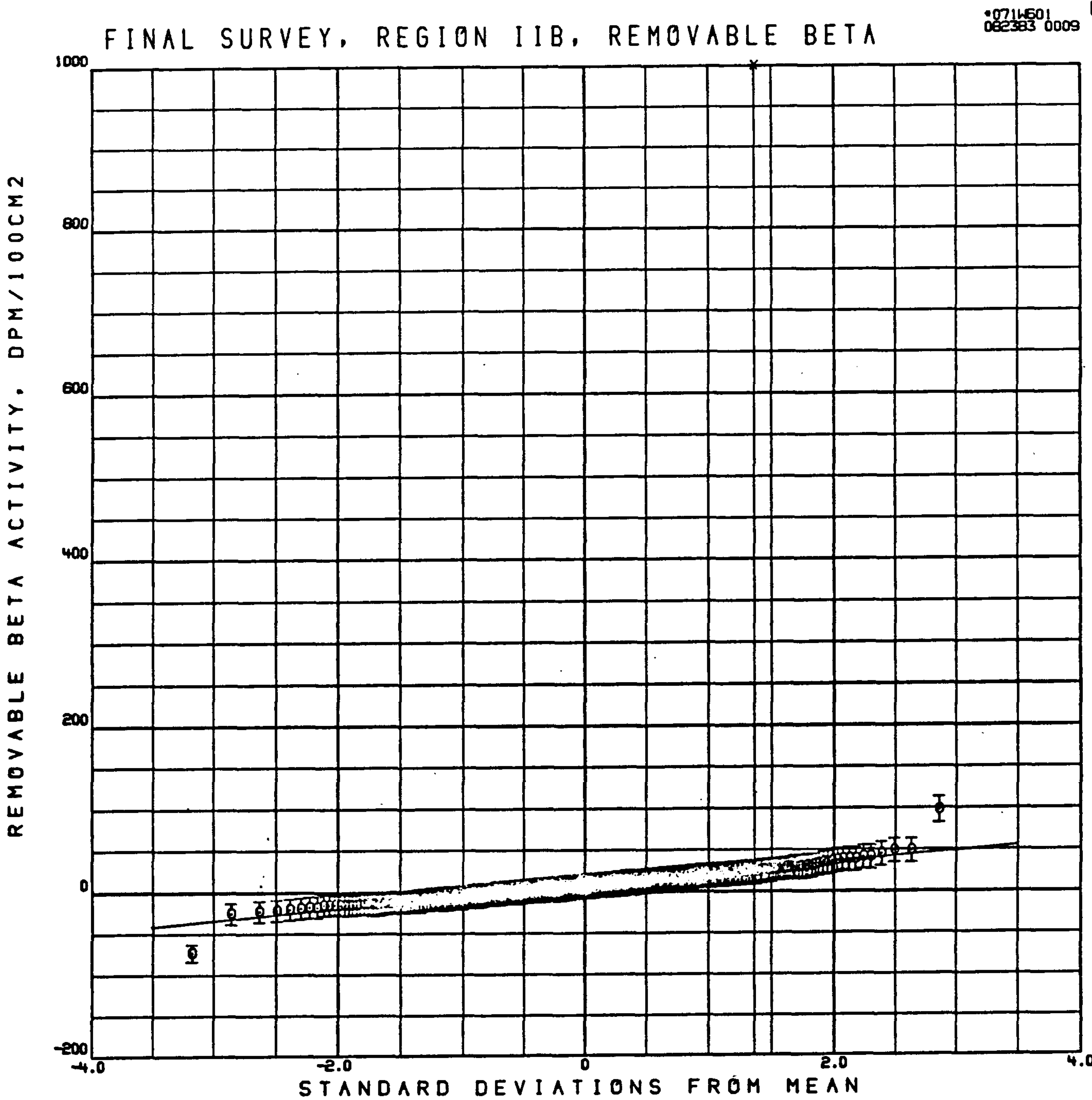

Figure 12. Cumulative Probability Plot for Removable Beta Contamination in Region IIB

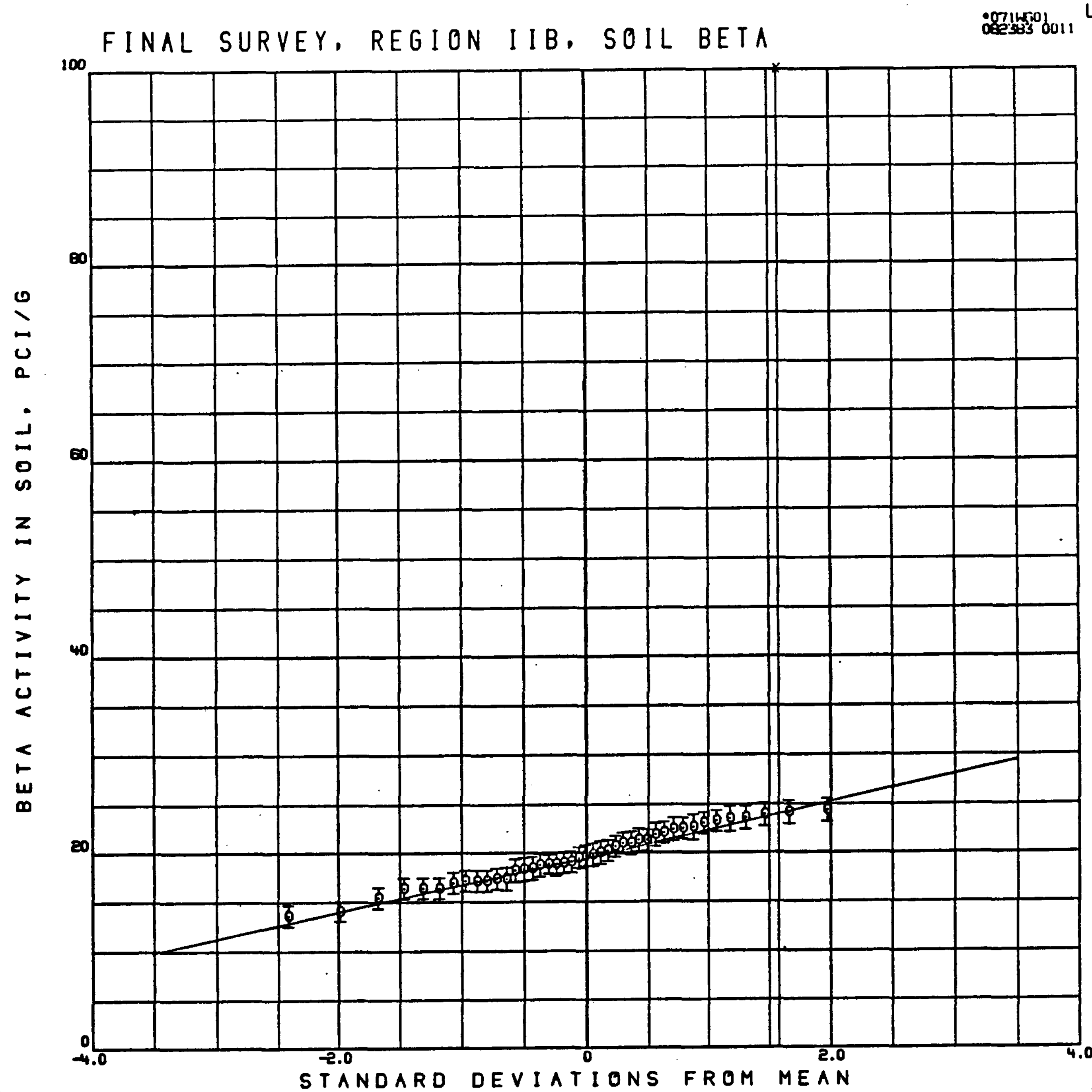

Figure 13. Cumulative Probability Plot for Beta Soil Activity in Region IIB

VI. CONCLUSIONS

An appropriate survey has been conducted throughout the area to be released. All remaining measured values of residual radioactivity are below the acceptance limit and analysis of the data according to the sampling plan shows, in every case, the Inspection Test Statistic ($\bar{x}$+ks) is also below the acceptance limit. This method of analysis shows that any other similar set of measurements should be found acceptable also, and further, that all locations in the regions have residual radioactivity below the limits. The results of this survey show essentially no residual contamination and demonstrate a negligible risk of there being any undetected contamination exceeding the acceptance limits. Therefore, upon concurrence by NRC, the area may be released for unrestricted use.

VII. REFERENCES

1. Special Nuclear Materials License No. SNM-21 and Technical Specification for Operations at Atomics International, AI-75-46 and License Conditions

2. "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations," Federal Register 46, (205), 52061, October 23, 1981

3. "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use," ("DECON-1") State of California, Radiologic Health Branch, Department of Health Services (June 1977)

4. "Techniques of Statistical Analysis," C. Eisenhart, M. W. Hastay, W. A. Wallis, editors, McGraw-Hill, New York (1947)

APPENDIX A

ANNEX C TO SPECIAL NUCLEAR MATERIAL LICENSE NO. SNM-21

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ANNEX C

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U. S. Nuclear Regulatory Commission
Division of Fuel Cycle and
Material Safety
Washington, D.C. 20555

NOVEMBER 1976

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The instructions in this guide in conjunction with Table I specify the radioactivity and radiation exposure rate limits which should be used in accomplishing the decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table I do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control will be considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table I prior to applying the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

    a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

    b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table I. A copy of the survey report shall be filed with the Division of Fuel Cycle and Material Safety, USNRC, Washington, D.C. 20555, and also the Director of the Regional Office of the Office of Inspection and Enforcement, USNRC, having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

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TABLE I

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES [a]	AVERAGE [b c f]	MAXIMUM [b d f]	REMOVABLE [b e f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except SR-90 and others noted above.	5,000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

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TABLE I
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[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

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TABLE I
2

[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

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