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Abstract

This document provides the survey design and results for a radiation survey, requested by the California Department of Toxic Substances Control, of Building 4133, the Hazardous Waste Management Facility (HWMF) and its fenced yard at the Santa Susana Field Laboratory. All measurements confirm that both the facility and its fenced yard are not contaminated and meet the release limits approved by the Department of Energy (DOE) and the State of California Department of Health Services (DHS).

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EXECUTIVE SUMMARY

At the request of the Department of Toxic Substance Control (DTSC), a radiation survey was performed at Building 4133, and soil samples were taken confirming that the facility and area are below the release limits approved by the Department of Energy, and the Department of Health Services (Reference 1).

Building 4133 was installed to treat non-radioactive sodium and NaK from non-radioactive test loops and secondary sodium loops, and was first permitted in 1993. Building 4133 is located in Area IV of the Boeing, Rocketdyne, Santa Susana Field Laboratory (SSFL). The building is fenced in encompassing an area of approximately 87 feet by 71 feet.

Prior to the closure by the Department of Toxic Substances Control (DTSC) of the permitted Hazardous Waste Management Facility (HWMF), Rocketdyne agreed to perform a radiation survey of Building 4133. Building 4133 was not a radiological facility. However to demonstrate that the permitted facility closure project could proceed without further radiological concerns, a radiation survey was performed. The survey included the building structure and fenced yard area. The survey types were smears and scans of the facility structure and equipment for alpha, beta, and gamma isotope emissions and gamma scans, ambient gamma readings and soil and asphalt samples of the surrounding yard.

The building survey was designed using protocols from the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), a guideline document produced jointly by the Environmental Protection Agency (EPA), the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) (see section 3.1). The only deviation from the protocol was in the selecting of the smear, scan and sample locations. Because of the purpose of the survey, a conservative bias relative to the sampling and survey locations were utilized in areas most likely to harbor contamination, such as low lying areas and dust accumulation points, rather than follow the uniform grid nature of the MARSSIM design.

Subsequent to the Rocketdyne survey, the Oak Ridge Institute for Science and Education (ORISE) and the California Department of Health Services (DHS) also surveyed the facility in October 1999. The ORISE survey results verified the Rocketdyne conclusion that Building 4133 satisfies the criteria for release for unrestricted use had the HWMF had been a licensed facility or a radiological facility (Reference 3).

The highest total alpha surface contamination measured at the facility was 36 dpm/100cm^2, and the highest removable alpha surface contamination measured at the facility was 6 dpm/100cm^2. The highest total beta surface contamination measured at the facility was 1292[a] dpm/100cm^2 and the highest removable beta surface contamination measured at the facility was 24[a] dpm/100cm^2 (see Appendix A). 302 of the 304 surface contamination measurements were at or below the minimum detectable activity of the instrumentation, and all 304 were well below the

a. Backgrounds were taken in a fixed location. Background levels are variable depending on the types of material being surveyed. The two beta measurements that exceeded MDA were due to this background variability and were most likely due to natural radioactivity in concrete.

surface contamination release criteria (Reference 1). The survey demonstrated that Building 4133 is not radiologically contaminated.

The highest observed net ambient gamma reading found inside the fenced facility was 2.9 µR/h which is below the action level of 5 µR/hr. Gamma backgrounds vary with proximity to soil, rocks and concrete, all which contain natural gamma emitters in varying quantities. The 2.9 µR/h is within the typical range of natural background variability.

The results of soil and asphalt sampling indicated one soil sample at 0.1 pCi/g Cs-137 and all others with no detectable man-made activity. The activity of the one detectable sample is typical of local background levels of Cs-137 from global fallout. This background (0.2 pCi/g, upper 95 percentile) was determined in the off-site sampling program conducted by McLaren/Hart Environmental Engineering Corporation in 1994 (Reference 2). This coupled with the fact that all of the scans and smears of the building and equipment were well below release limits therefore indicated that the facility and yard would be suitable for "release for unrestricted use" if Building 4133 had been a licensed facility or a radiological facility.

1.0 INTRODUCTION

This document describes a radiological survey performed for Building 4133 of the Hazardous Waste Management Facility (HWMF) (Figure 1). The HWMF is a Resource Conservation and Recovery Act (RCRA)-permitted Treatment Storage and Disposal Facility (TDSF) currently undergoing regulatory closure under the jurisdiction of the Department of Toxic Substance Control (DTSC). The HWMF is comprised of two buildings, 4133 and 4029. Building 4029 was previously used as a radioactive source calibration and storage facility. Building 4029 was radiologically surveyed and released by the Department of Energy (DOE) for unrestricted use in 1997 and was not involved in the characterization effort described in this report. Radioactive materials were never used at Building 4133 and the building was not classified as a radiological facility.

The draft revised closure plan for 4133 was submitted for DTSC review and comment in January of 1999. During that initial review, the subject of radiological contamination at the site became a concern with DTSC. To validate Boeing's position that the possibility of radiological impacts should not be considered further, a radiological survey was performed.

It was determined that a complete radiation survey would be performed of Building 4133, and the fenced area. This survey included measurements for total and removable surface contamination of the facility surfaces, radiation exposure measurements of land surfaces, radiation exposure measurements at 1 meter above the surface, and asphalt and underlying soil samples. The survey design followed all of the applicable requirements of MARSSIM, the guidance document recognized as appropriate for use in the survey of Building 4133. This report describes the history associated with Building 4133, the type of materials used at the site, how the radiological survey was performed and the results of the survey.

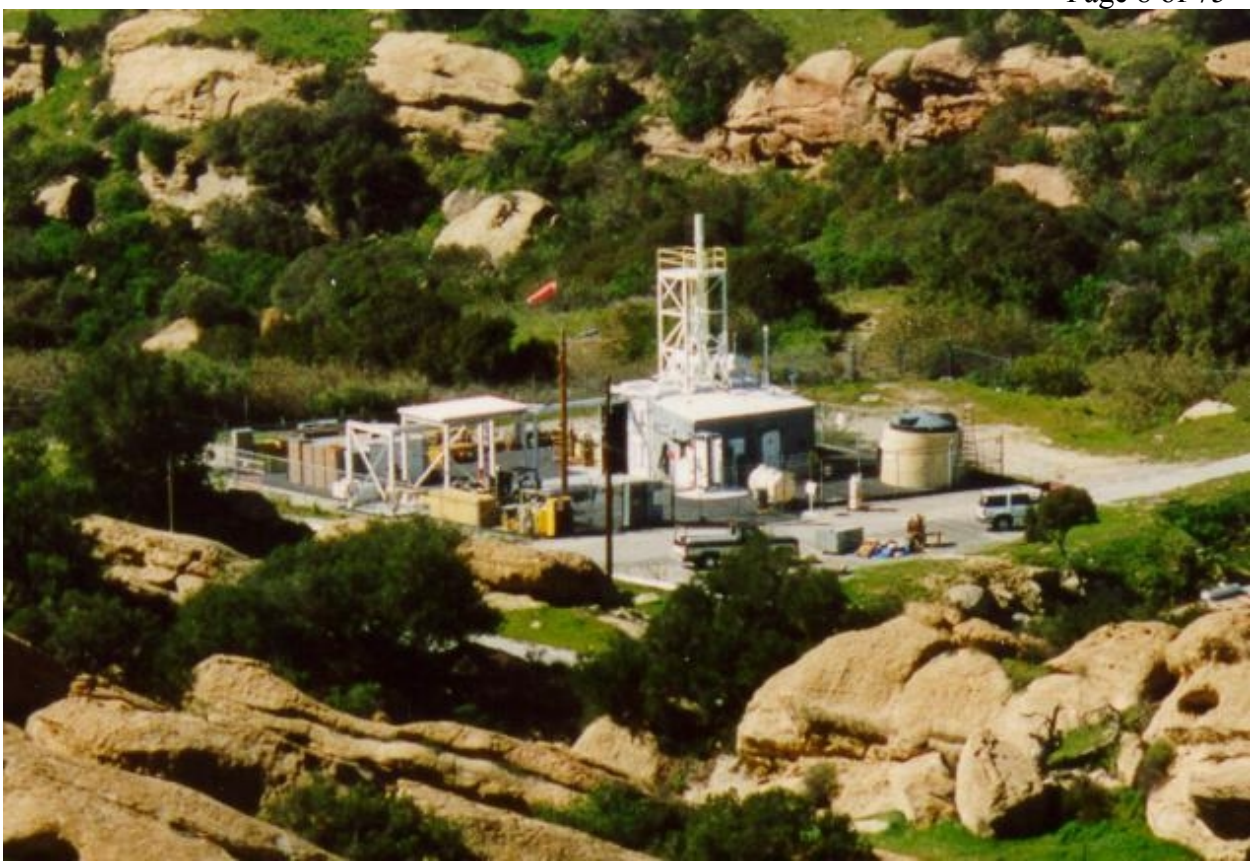


Figure 1. Former Hazardous Waste Management Facility (Building 4133)
The fence line measures approximately 87 feet by 71 feet

2.0 BACKGROUND AND FACILITY HISTORY

2.1 Energy Technology Engineering Center (ETEC) Waste Generation Process

ETEC was a DOE installation located in Area IV of SSFL. It was a complex of experimental research, development and testing facilities. DOE conducted large-scale heat transfer and fluid mechanics experiments using non-radioactive sodium in a molten state. Over time, the alkali metals would become saturated with impurities such as oxygen, hydrogen or other carbonaceous compounds. At this point they were no longer acceptable for testing purposes and were declared waste material.

2.2 Description of Building 4133 Area

The alkali metals were treated at the Building 4133 area. The overall area is fenced and is approximately 87 feet by 71 feet. The 4133 area was designed and constructed in 1977 for the treatment of alkali metals. This area includes the treatment building, the office building, two sodium hydroxide storage tanks (referred to as tanks T-1 and T-3) and a NaK (sodium-potassium liquid metal) feed tank (referred to as tank T-2).

2.3 Treatment Process Description

All hazardous waste treatments were conducted at Building 4133. There were basically only two types of treatment processes performed at the facility. The first was the treatment of solid alkali metals (sodium) and the second the treatment of liquid alkali metals (NaK). In both cases the reactive metals were converted to caustic aqueous solutions. The two treatments differed in that for sodium, the process was a batch process, while for the treatment of eutectic NaK. A specially designed feed system was utilized since this material is a liquid at room temperature.

The sodium containing components were transferred to the treatment pan and heated with a natural gas burner until the metal melted. The metal in the pan reacted with the air (oxidized) in the treatment chamber to form oxides that either remained in the pan or were exhausted from the room through a wet (water) scrubber to remove the oxide aerosols prior to effluent release to the atmosphere.

After the oxidation was completed, the treatment pan was washed with water to remove remaining oxides. In the wash down process the oxides were converted to a solution of NaOH (sodium hydroxide). The wash down liquids were directed to the T-1 tank. Caustic solution was transferred from T-1 to T-3 through an above ground rubber hose. Tank T-3 was installed to provide additional storage capacity for caustic solution. Finally, the caustic solution was transferred offsite, via vacuum truck, for disposal or recycling.

2.4 Area IV Grid System and Facility Location

In 1995, the accessible, non-radiological areas of Area IV of SSFL were surveyed and sampled to demonstrate that radioactive materials had not migrated from the licensed radiological facilities. This survey was designated as the Area IV Survey. To track the locations of survey and sample points, the entire area was subdivided and marked into 200 foot by 200 foot square grid blocks. The blocks were designated with an alphanumeric system starting with Grid A0 in the Southwest corner, and ending with Grid X30 in the Northeast corner. The area around Building 4133 was included in this survey.

Figure 2 shows the location of Building 4133 in relation to the Area IV grid blocks S19 and T19.

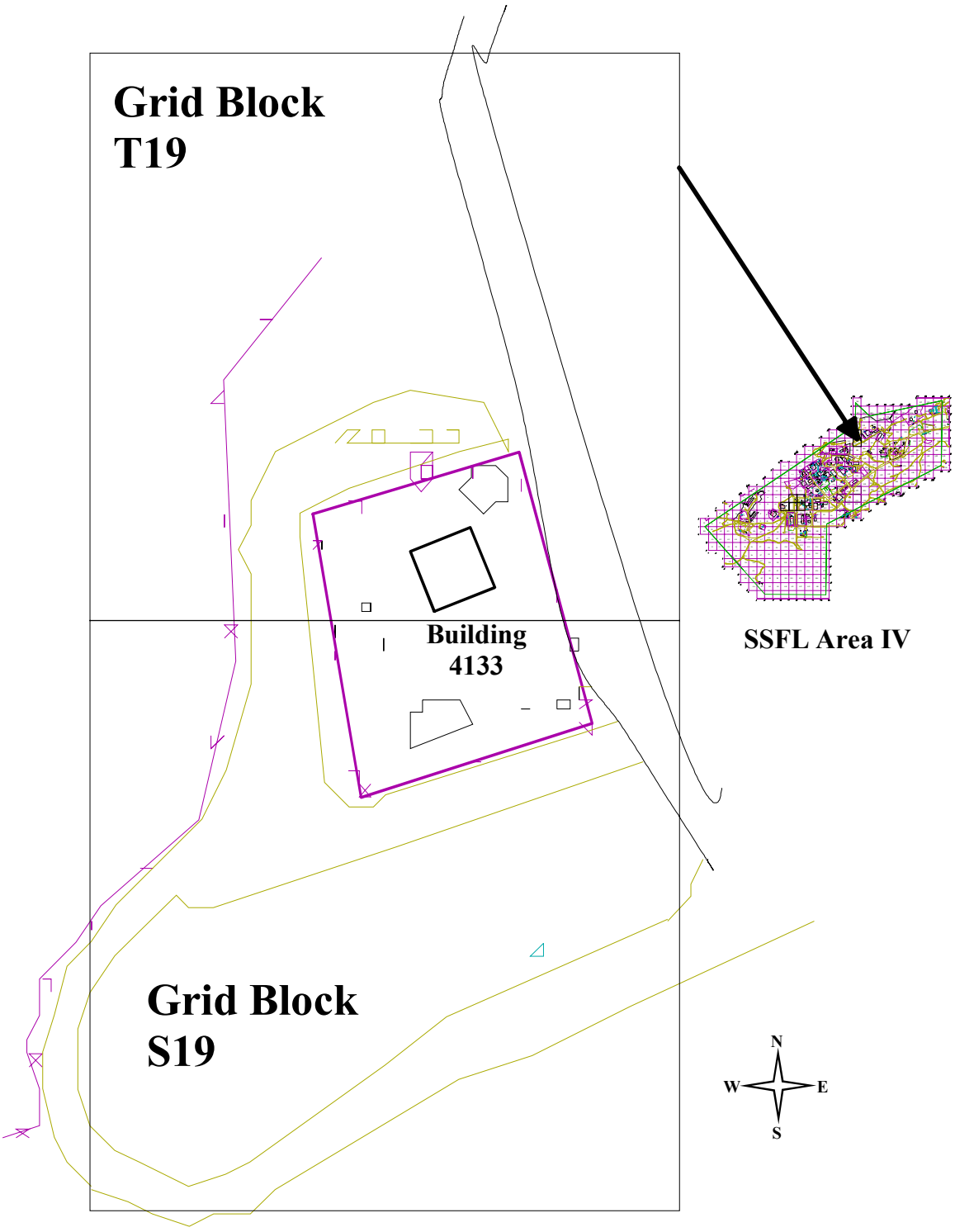


Figure 2. Building 4133 in Relation to SSFL Area IV Grid Map

3.0 SURVEY DESIGN

This section describes what the survey looked for, the acceptable concentration which may remain at the site and the guidance used to design the survey.

3.1 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)

The Multi-Agency Radiation Surveys and Site Investigation Manual (MARSSIM) provides detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with a dose- or risk-based regulation (Reference 5). MARSSIM focuses on the demonstration of compliance during the final status survey following scoping, characterization, and any necessary remedial actions. The DOE, the EPA and the Nuclear Regulatory Commission (NRC) developed the manual in a joint effort. It is not a regulatory requirement to follow the protocol. It is a guidance document only.

The survey described in this report was not done fully to the MARSSIM protocol, but MARSSIM guidance was used to establish a more conservative classification of the area and to determine the number of survey measurements and samples taken. The sampling and survey locations were randomly selected in areas most likely to harbor contamination, such as low lying areas and dust accumulation points, rather than follow the uniform grid nature of the MARSSIM design. The selection of the sampling and survey locations rather than using the uniform grid represents a conservative departure from the MARSSIM protocol. No other deviations were made.

3.2 Derived Concentration Guideline Limits (DCGLs)

The term DCGL, is a term from MARSSIM and is another term for release limit. The structural release limits are expressed in dpm/100cm^2.

The MARSSIM design specifies three classifications for areas to establish the number of survey locations required. Class I areas are areas that are known to have been contaminated to levels above the DCGL. Class II areas are areas that were or may have been contaminated but are not expected to be above the DCGL. Class III areas are areas that are not expected to contain any residual radioactivity or most likely will be at a small fraction of the DCGL. As the classification increases, the density of the sample population decreases. This is because the lower numbered classes have smaller upper bounds for the size of the survey unit.

Building 4133 and other structures were conservatively classified as Class II areas for the purposes of this survey. This resulted in a higher sample density being taken than strict adherence to MARSSIM protocols would require.

3.3 Data Quality Objectives and Number of Sample Measurements

In order to establish the design survey, MARSSIM recommends a series of calculations, based on site data. The survey design is based on protocols MARSSIM calls Data Quality Objectives (DQO). There are calculations in these protocols that yield the number of samples required to confirm that the survey unit meets Derived Concentration Guide Limits (DCGLs).

The DQO methodology for determining the number of survey points per survey unit requires calculation of a "relative shift" as a function of the relevant clean-up standard and "a priori" knowledge of the standard deviation of the distribution of contamination (Reference 5, Chapter 5). MARSSIM assumes the facility being surveyed was a radioactive facility and that the survey designer has data from residual contamination from previous surveys. The level of residual contamination relative to the release limit affects the number of survey points. Since there is no direct relevant evidence of surface contamination in terms of dpm/100cm^2 at Building 4133, this approach is not possible because a value of zero does not work in the equation. The number of survey points for a non-radioactive facility would actually be zero, so any number of survey points is conservative.

Two values used in the equation for calculating the number of survey points are the decision errors, alpha and beta. Beta is the probability of accepting the null hypothesis when it is false and is also called the false negative error. Alpha is the probability of rejecting the null hypothesis when it is true and is also called the false positive error. Recent MARSSIM designed surveys (References 6, 7 and 8) for Building 4059 (structure), Area 4020 (land) and the 17th Street Drainage Area (land) have been completed. The number of sample points in their respective surveys was determined to be 20, 14 and 20 per survey unit for a user's risk (α) of 0.05 and a regulator's risk (β) of 0.05. Accordingly, "20" was conservatively chosen as the number of sample/measurement points for most of the Building 4133 survey units (16 measurement locations were used in SU 3 because it was all equipment with no walls, floors or ceilings involved).

3.4 Survey Units

The upper bound area for Class II structural survey units is 1,000 m^2 (~10,000 ft^2) per MARSSIM guidelines. The entire Building 4133 structure has less surface area than 10,000 ft^2; however, it was divided into four separate survey units (SU) as described below. This resulted in conservatively surveying 4 times as many locations than would have been required by treating it as one survey unit.

There is no upper bound for land surface area for Class III land survey according to the MARSSIM limits. The total yard area surveyed was 6,200 ft^{2,} which was less than the upper bound for Class II areas.

Table 1. Survey Unit Areas-Includes Vertical Surface Areas

CLASS	SU	DESCRIPTION	APPROX AREA (FT^2)
II	1	Treatment Room (inside)	1,200
II	2	Outside surface of building (and equipment)	1,500
II	3	T1 tank, pipechase, rain water sumps	200
II	4	Inside Building (office area & restroom)	1,400
III	5	Yard inside fenced area	6,200

*See Section 3.7

3.5 Types of Equipment and Facility Measurements Performed

Several types of radiological measurements were performed on the physical building and building structures. These were identical to measurements performed in standard final post-remedial surveys of radiological facilities including measurements specified by the MARSSIM manual (Reference 5). Table 2 itemizes the number and type of survey measurements that were performed in each survey unit.

A qualitative survey, as specified in MARSSIM, is a scan survey, where numbers are not recorded and statistically analyzed. It is a backup to the quantitative surveys where the numbers are recorded and statistically analyzed. The instrument is used in count-rate mode, which means it is displaying counts per minute in real time, fluctuating with background counts per minute. The surveyor scans back and forth, at a specified speed, covering the required area in a continuous motion. If a location indicates an elevated reading above background, then that location is marked for further investigation and possible remediation. If no elevated readings are observed, then the qualitative term no detectable activity (NDA) is recorded.

In a quantitative survey, as specified in MARSSIM, the instrument remains stationary for a specified period of time. It is operated in scaler mode. In this mode, a timer is utilized. When the start button is pressed, the instrument begins collecting counts. When the timer stops, the observed counts are divided by the count time to obtain counts per minute for that location. These data are statistically analyzed to determine if the area is releasable for unrestricted use. It is not expected to find elevated areas during this survey, since it is performed after the quantitative scan survey, and had something been identified previously, it would have been remediated.

A smear survey involves wiping small cloth discs (smears) across a $100cm^2$ surface. These smears are then analyzed in a sensitive radiation counter, in scaler mode. The results are used to determine $dpm/100cm^2$ that can be compared to the release limits.

All hand-held instruments were fully calibrated on a quarterly basis. The smear analyzer was calibrated daily. To ensure their accuracy during the survey, qualitative instruments were performance tested on a daily basis, the industry and regulatory standard for count-rate instruments. Since the statistical data was more critical in showing the condition of the facility, quantitative instruments were tested three times a day; before the start of the survey, at

lunchtime and at the end of the shift. Any deviation in performance would have invalidated the data for that half of the day and those areas would have been resurveyed. If the survey only lasted a half of a day, then there would only be two performance tests, at the beginning and the end of the survey.

3.6 Facility Structural Surfaces and Plant Equipment

These measurements apply to Survey Units 1, 2, 3, and 4. These surfaces involve floors, ceilings and walls of a building, and equipment inside and outside of the building, including pumps, pipes and tanks, as noted in Table 2. Table 3 contains a summary of this section.

3.6.1 Qualitative Alpha and Beta Scan Counts

A qualitative measurement of total alpha and beta contamination was performed on all Building 4133 surfaces. This survey was performed with a calibrated count-rate instrument, with alpha and beta detector probes. Floors, sumps, and surfaces and walls up to 2 meters were surveyed 100%, and 10% of ceiling and walls above 2 meters were surveyed in a selective, but randomized manner. Surveys were performed at a half-inch from the surface, at a linear speed of about 2 inches per second.

The results were recorded on Rocketdyne's form 732-A, "Radiation Survey Report", and calibration, efficiency and background data for the survey instrument were included in the reports. An example of a completed 732-A can be found in Appendix C, Figure C1. These results are summarized in Section 5.2.1

3.6.2 Quantitative Total Alpha and Beta Counts for Survey Units 1 to 4

For buildings, two of the regulatory release limits are for total alpha and beta contamination, so these measurements are mandatory. These limits are summarized in Table 6. The term total is used because a direct probe reading will measure both contamination that can be easily removed (This background (0.2 pCi/g, upper 95percentile) was determined in the off-site sampling program conducted by McLaren/Hart Environmental Engineering Corporation in 1994 (Reference 2). (i.e. "removable") and contamination that cannot be easily removed (i.e. "fixed"). Alpha and beta emitters were surveyed for in the manner explained in section 3.5. Randomly located stationary 1-minute cumulative counts for total alpha and beta surface contamination were performed in 76 locations using a digital Ludlum 2221 with alpha and beta probes in scaler mode (see Appendices A, and D for locations of measurements). The results were reported on a custom report called a "Final Survey Data Sheet (FSDS)". An example of a completed FSDS report can be found in Appendix C, Figure C2. The instruments used, along with calibration information was recorded on a 732-A cover sheet (Figure C1). Results from these surveys are summarized in Section 5.2.2.

3.6.3 Quantitative Removable Alpha and Beta Counts

Two of the other regulatory release limits are for removable alpha and beta contamination, so these survey methods are employed to determine if any of the total that may have been found is removable. These limits are summarized in Table 6. Non-fixed or removable radioactive

contamination, which can be easily removed from surfaces, was tested for using cloth pieces to wipe the surface being tested, otherwise known as smears. The smears for removable alpha and beta surface contamination were taken in 76 randomly located areas. The cloth pieces are then placed in a counter and were counted for 1 minute on a low background Tennelec laboratory counter. Smear locations were the same as total count locations found in Section 3.6.2 and in Appendix B. Results are summarized in Section 5.2.3.

Table 2. Selected Radiation Surveys for Each Survey Unit

CLASS	SU *	LOCATION	AREA ft^2	QUALITATIVE SCAN α/β	QUANTITATIVE TOTAL + REMOVABLE α/β	SURFACE EXPOSURE γ	AMBIENT EXPOSURE γ (1 meter)	SOIL/ASPHALT SAMPLES
II	1	Treatment Room (inside)	1,200	100% to 2m, 10% ceiling	20	-	3 locations	-
II	2	Outside surface of building (and equipment)	1,500	100% TO 2m (β only)	20	-	-	-
II	3	T1 tank, pipechase, rain water sumps	200	100%	16	-	-	-
II	4	Inside Building (office area & restroom)	1,400	100% to 2m, 10% ceiling	20	-	3 locations	-
III	5	Inside fenced area	6,200	-	-	100%	13 locations, one every 25'	3 Soil 3 Asphalt

* SU is an acronym for Survey Unit

3.6.4 Ambient Gamma Radiation Exposure for Structures

A fifth type of regulatory release limit for buildings is the ambient gamma exposure rate at 1 meter above the floor. This limit can be found in Table 6. At the same 9 floor locations identified above for contamination measurements, a 1-minute, 1-meter cumulative stationary count for gamma radiation exposure was taken using a digital Ludlum 2221 with a 1" by 1" NaI probe. The results were recorded on a Final Survey Data Sheet (Figure C1). These results are summarized in Section 5.2.4. One-meter ambient gamma readings were not taken in SU-2 and SU-3 because the survey was conducted on the system components themselves (i.e. scrubber, tanks, and pumps). The limits apply to facility floors, not to equipment. Alpha and beta surveys suffice for equipment surveys.

Table 3. Summary of Surveys Performed

Sample Type	Number of Samples
Qualitative Alpha and Beta Scan	Not Applicable (NA)
Quantitative Total Alpha Counts	76
Quantitative Total Beta Counts	76
Quantitative Removable Alpha Counts	76
Quantitative Removable Beta Counts	76
Ambient Gamma Radiation Exposure for Structures	9
Surface Gamma Radiation Exposure for Yard	NA
Ambient Gamma Radiation Exposure for Yard	13
Soil and Asphalt Samples	6

3.7 Asphalt Yard Surveys

3.7.1 Qualitative Surface Gamma Radiation Exposure for the Yard

Gamma radiation exposure at 2 inches above the ground level was measured using a digital Ludlum 2221 with a 1" by 1" NaI probe in count-rate mode (real-time counts per minute). The surveyor slowly swings a pole-mounted probe from left to right, across a 5-foot wide strip of land, at a speed of one foot per second. The surveyor then steps forward one foot and repeats the swing from left to right.

While doing this he is observing the instrument reading. If an area with elevated exposure rate above the limit is observed, the location is marked for further investigation and or remediation. This process is repeated step by step until a strip of land between the fence-line, 5 foot wide, has been surveyed. The process is repeated for the next 5-foot wide strip. The results are recorded on a Walkabout Survey Transit Record. Figure C3 in Appendix C shows an example of this record. Results of these surveys are presented in Section 5.3.1.

3.7.2 Ambient Gamma Radiation Exposure for the Yard

Although this survey is not required by the MARSSIM protocols, it is useful in further demonstrating the cleanliness of land areas. A one meter above the surface, one minute cumulative stationary count for gamma radiation exposure was taken at 13 locations using a digital Ludlum 2221 with a 1" by 1" NaI probe in scaler mode. These measurements were taken in a square grid every 25 feet (see Appendix A). The results were recorded on an Ambient Survey data sheet. Figure C4 in Appendix C shows an example of this form. Results of these surveys are presented in Section 5.3.2.

3.7.3 Soil Sampling

At 3 locations, asphalt and the soil underneath were sampled and analyzed by gamma spectroscopy.

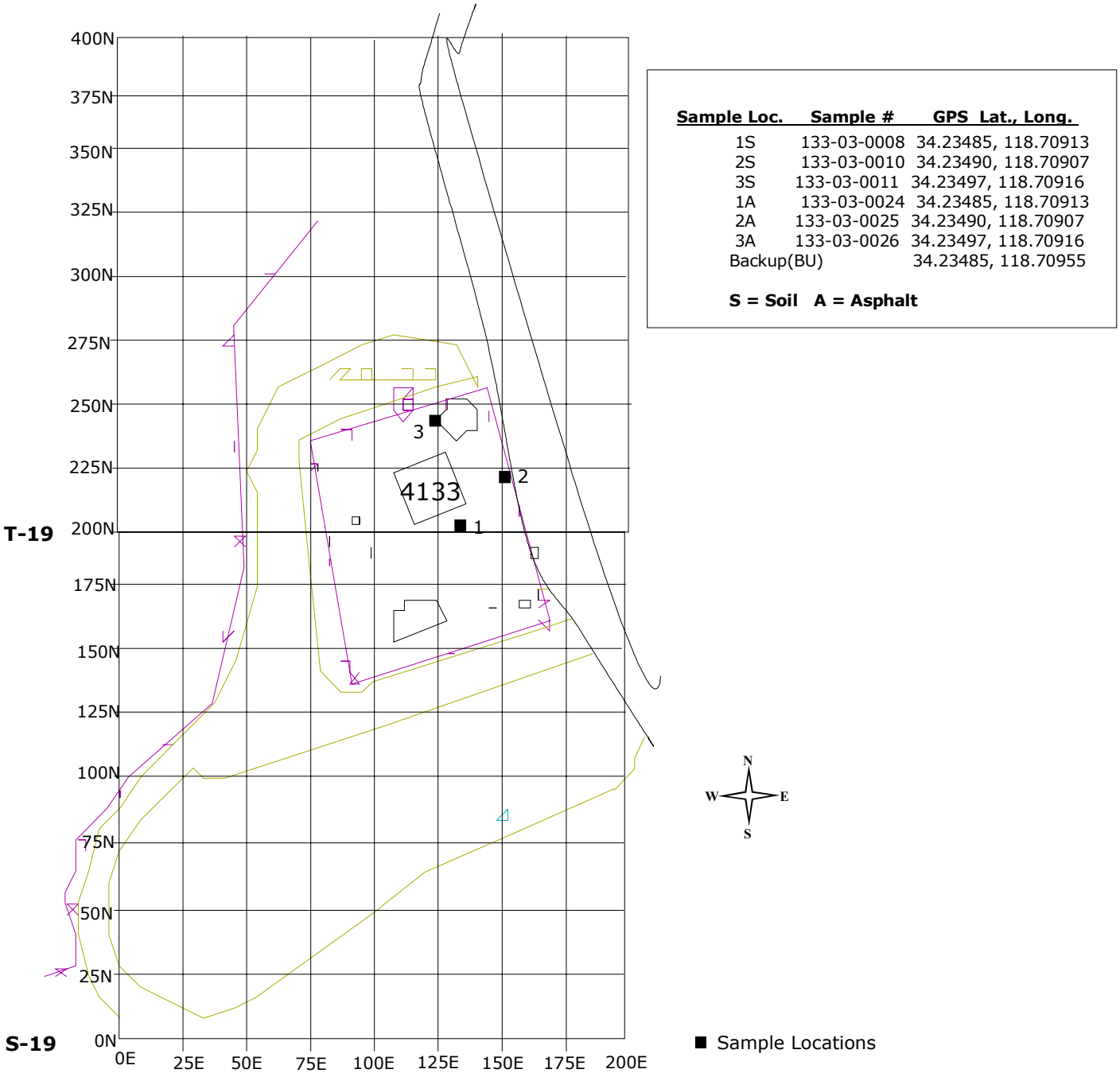
The samples were taken from the surface to 6 inches deep. The highest care was taken to assure that there was no cross contamination between samples from the sampling tools. After

each sample, the tools were thoroughly washed and distilled water was used to rinse them off. This rinseate was collected and analyzed. The rinseate from one of the samples was analyzed separately and the composite rinseate was analyzed from all of the samples. All rinseate analyses were less than minimum detectable activity (MDA).

3.8 Sample Locations

MARSSIM recommends establishment of random grid spacing for Class II areas by taking the square root of the area divided by the number of survey points for each survey unit. A square grid would then be established using a random starting point. MARSSIM assumes that that the room being surveyed is large and empty. The grid process, however, is cumbersome for small three-dimensional rooms and unworkable for complex pipe/equipment/tank configurations. MARSSIM also is flexible and allows for deviation from the protocol for cases like Building 4133. Therefore, the facility structures were uniformly yet randomly sampled based on the judgment of the surveyor. The focus for selection was on areas most likely to be contaminated, if contamination were to be present, such as low spots, cracks in the structure, etc. The structure survey points were chosen from floor, wall and ceiling locations.

For Class III areas, MARSSIM recommends generating random locations for selecting sample locations. For choosing the sample locations a computer program called “Random Number Generator Pro” was utilized. Three number sets were generating using the Area IV grid coordinate system for sample locations. Figure 3 shows the sample locations relative to Building 4133 and grid blocks S-19 and T-19.



Sample Loc.	Sample #	GPS Lat., Long.
1S	133-03-0008	34.23485, 118.70913
2S	133-03-0010	34.23490, 118.70907
3S	133-03-0011	34.23497, 118.70916
1A	133-03-0024	34.23485, 118.70913
2A	133-03-0025	34.23490, 118.70907
3A	133-03-0026	34.23497, 118.70916
Backup(BU)		34.23485, 118.70955

S = Soil A = Asphalt

Figure 3. Soil Sample Locations

4.0 PROCEDURES

Specific step-by-step instructions for performing survey measurements are identical to those used in recent radiological status reports [e.g. References 6, 7 and 8]. These instructions are based on Rocketdyne procedures and protocols specified in RS-00012, "Methods and Procedures for Radiological Monitoring", Rev. A (Reference 9). This procedure has detailed guidelines for selection of appropriate instrumentation, calibration verification, calculating minimum detectable activity (MDA), performance testing instrumentation and how to perform a survey. It includes such details as appropriate scanning speed and what to do if suspect contamination is found.

5.0 SURVEY RESULTS

5.1 Background Levels

Background levels for this survey are shown in Table 4. The alpha and beta backgrounds were taken in a non-radioactive office, away from Building 4133. They were measured values, taken by using the scaler mode of the instruments for a stationary 5-minute count and dividing the value observed by 5, yielding counts per minute. The gamma backgrounds were taken at a low background location, away from Building 4133. 5-minute stationary counts were taken and the observed value was divided by 5 to obtain cpm. These values were subtracted from the gross cpm of each survey location to obtain net cpm. The values are within the typical range normally observed for each instrument type used.

Table 4. Background Levels

Location	Total Alpha (cpm)	Total Beta (cpm)	Surface Gamma Exposure (cpm)	Ambient 1-meter Gamma Exposure (cpm)
SU-1	2	51	N/A	2,400
SU-2	2	51	N/A	N/A
SU-3	2	51	N/A	N/A
SU-4	2	51	N/A	2,400
SU-5	N/A	N/A	2,788	2,875

5.2 Facility Structural Surfaces

5.2.1 Qualitative Alpha and Beta Scan Counts

As reported in section 3.6.1, a qualitative measurement of total alpha and beta contamination was performed on all surfaces. This survey was performed with a calibrated count-rate instrument, with alpha and beta detector probes. Surfaces of floors, sumps, equipment and walls up to 2 meters were surveyed 100%, and 10% of ceiling and walls above 2 meters were surveyed in a selective, but randomized manner. Surveys were performed at a half-inch from the surface, at a speed of about 2 inches per second.

During the hand scanning process no elevated readings were noted. All qualitative scans indicated no detectable activity above background (NDA). An example survey report is shown in Appendix C, Figure C1.

5.2.2 Quantitative Total Alpha and Beta Counts for Survey Units 1 to 4

For survey units 1 through 4, the total alpha and beta measurements were taken inside Building 4133 offices, rest rooms, and the Treatment Room on the walls, ceilings, floors and outside surfaces of the building. Survey unit 5 was the surrounding land and parking lot areas, both inside and outside the fenced area and contained no structures to survey. Table 6 shows a comparison of the ranges of those surveys to the regulatory limits (Reference 1). With the exception of 2 total beta measurements in Survey Unit # 4, all total alpha and beta measurements were non-detect, i.e., measurements are less than the respective minimum detectable activity (MDA). The two detectable measurements were well below release limits and were in the range of typical background variability. Survey methods are presented in section 3.6.2. Detailed results are presented in Appendix A.

5.2.3 Quantitative Removable Alpha and Beta Counts

For survey units 1 through 4, the removable alpha and beta measurements were taken inside Building 4133 offices, rest rooms, and the Treatment Room on the walls, ceilings, floors and outside surfaces of the building. Table 6 shows a comparison of the ranges of those surveys to the regulatory limits (Reference 1). All removable alpha and beta measurements were non-detect, i.e., measurements are less than the respective minimum detectable activity (MDA). Survey methods are presented in section 3.6.3. Detailed results are presented in Appendix A.

5.2.4 Ambient Gamma Radiation Exposure for Structures

For survey units 1 through 4, the ambient gamma measurements were taken inside Building 4133 offices, rest rooms and Treatment room at 1 meter from the floor. Table 6 shows a comparison of the ranges of those surveys to the regulatory limits (Reference 1). All measurements were less than the 5 μR/hr above background limit and were within typical background variation from natural radioactivity in soil and rocks. Survey methods are presented in section 3.6.4. Detailed results are presented in Appendix A.

5.3 Yard Surveys

5.3.1 Qualitative Surface Gamma Radiation Exposure for the Yard

The average, gross (before background subtraction) surface exposure level observed for SU-5, the outside surrounding yard, was 3,100 cpm (14.4 μR/hr). The maximum surface exposure level observed was 3,800 cpm (17.7 μR/hr). When the background level of 2788 cpm (13.0 μR/hr) was subtracted from these values, the net average and maximum surface exposure levels were 312 cpm (1.5 μR/hr) and 1012 cpm (4.7 μR/hr) respectively. All measurements were below the action level of 5 μR/hr and were within typical background variation from natural radioactivity in soil and rocks.

5.3.2 Ambient Gamma Radiation Exposure for the Yard

The average, gross, 1-meter ambient exposure level observed for SU-5, the outside surrounding areas, was 2,914 cpm (13.6 µR/hr). The maximum 1-meter ambient exposure level for all survey units was 3,495 cpm (16.3 µR/hr). When the background level of 2,875 cpm (13.4 µR/hr) was subtracted from these numbers, the net average and maximum 1-meter ambient exposure levels were 39 cpm (0.2 µR/hr) and 620 cpm (2.9 µR/hr) respectively (see Appendix A). All measurements were below the action level of 5 µR/hr.

Table 5 summarizes the surface contamination and exposure level measurement results discussed in Sections 5.2 and 5.3.

Table 5. Comparison of Surface Contamination and Exposure Level Ranges to Regulatory Limits

Survey Type	Regulatory Limit (Average)	MDA*	Survey Unit 1	Survey Unit 2	Survey Unit 3	Survey Unit 4	Survey Unit 5
Quantitative Total Alpha (dpm/100cm^2)	5,000	35	-9 to 9 Average 1.8	-9 to 9 Average –0.5	-5 to 36 Average 6	-9 to 9 Average -1	N/A
Quantitative Removable Alpha (dpm/100cm^2)	1,000	13	-0.4 to 6 Average 0.9	-0.3 to 6 Average 0.2	-0.5 to 6 Average 0.9	-1 to 5 Average 0.2	N/A
Quantitative Total Beta (dpm/100cm^2)	5,000	870	-662 to 630 Average 117	-600 to 500 Average -225	-500 to 600 Average -102	-400 to 1,300 Average 190	N/A
Quantitative Removable Beta (dpm/100cm^2)	1,000	22	-1 to 15 Average 5	-1 to 12 Average 4	-4 to 24 Average 5	-4 to 18 Average 4	N/A
Ambient Gamma Radiation Exposure (Net) (µR/hr)	5	0.9	-4.9 to –3.4 Average -4.1	N/A	N/A	-3 to –2 Average –2.7	-4 to 2.9 Average 0.2

***MDA = minimum detectable activity**

5.3.3 Soil and Asphalt Sampling

All soil and asphalt samples were less than minimum detectable activity (MDA) for man-made isotopes except for one. That sample indicated 0.1 pCi/g of Cs-137, slightly above the MDA of 0.03 pCi/g. The 0.1 pCi/g level is typical of background levels from global fallout generated by above ground testing of nuclear weapons. This background (0.2 pCi/g, upper 95 percentile) was determined in the off-site sampling program conducted by McLaren/Hart Environmental Engineering Corporation in 1994 (Reference 2).

6.0 CONCLUSION

The 4133 area was designed and constructed in 1977 for the treatment of non-radioactive alkali metals. This area includes the treatment building, the office building, two sodium hydroxide storage tanks (referred to as tanks T-1 and T-3) and a NaK (sodium-potassium liquid metal) feed tank (referred to as tank T-2). It was never a radiological facility.

The survey for radiological contaminants was designed according to the MARSSIM protocol. The number of survey locations chosen was conservative by the protocols standards. Because the facility was small and still contained plant equipment, survey locations were selected in the most likely areas to be contaminated had it been a radiological facility. The appropriate survey equipment was used for each survey type. Minimum detectable activities for the instrumentation were all well below the applicable release limits.

Seventy six facility structure locations were surveyed for removable and total alpha and beta radioactivity. Six soil and asphalt samples were taken within the fenced area and analyzed by gamma spectroscopy.

Subsequent to the Rocketdyne survey, the Oak Ridge Institute for Science and Education (ORISE) and the California Department of Health Services (DHS) also surveyed the facility in October 1999. The ORISE survey results verified the Rocketdyne conclusion that Building 4133 satisfies the criteria for release for unrestricted use had the HWMF had been a licensed facility or a radiological facility (Reference 3).

The highest total alpha surface contamination measured at the facility was 36 dpm/100cm^2, and the highest removable alpha surface contamination measured at the facility was 6 dpm/100cm^2. The highest total beta surface contamination measured at the facility was 1292[a] dpm/100cm^2 and the highest removable beta surface contamination measured at the facility was 24[a] dpm/100cm^2 (see Appendix A). 302 of the 304 surface contamination measurements were at or below the minimum detectable activity of the instrumentation, and all 304 were well below the surface contamination release criteria (Reference 1). The survey demonstrated that Building 4133 is not radiologically contaminated.

The highest observed net ambient gamma reading found inside the fenced facility was 2.9 µR/h which is below the action level of 5 µR/hr. Gamma backgrounds vary with proximity to soil, rocks and concrete, all which contain natural gamma emitters in varying quantities. The 2.9 µR/h is within the typical range of natural background variability.

The results of soil and asphalt sampling indicated one soil sample at 0.1 pCi/g Cs-137 and all others with no detectable man-made activity. The activity of the one detectable sample is

[a] Backgrounds were taken in a fixed location. Background levels are variable depending on the types of material being surveyed. The two beta measurements that exceeded MDA were due to this background variability and were most likely due to natural radioactivity in concrete.

typical of local background levels of Cs-137 from global fallout. This background (0.2 pCi/g, upper 95 percentile) was determined in the off-site sampling program conducted by McLaren/Hart Environmental Engineering Corporation in 1994 (Reference 2). This coupled with the fact that all of the scans and smears of the building and equipment were well below release limits therefore indicated that the facility and yard would be suitable for “release for unrestricted use” if Building 4133 had been a licensed facility or a radiological facility.

7.0 REFERENCES

1. N001SRR140131, "Approved Site wide Release Criteria for Remediation of Radiological Facilities at the Santa Susana Field Laboratory", February 18, 1999.

2. "Additional Soil and Water Sampling at the Brandeis-Barden Institute and Santa Monica Mountains Conservancy," McLaren / Hart Environmental Engineering Corporation, January 19, 1995

3. ORISE 00-0577, "Verification Survey of Building 4133, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California." April 2000.

4. 133-SOP-0005, "Receipt Preparation for Treatment, and Disposal of Alkali Metal Components", April 20, 1993.

5. NUREG 1575, EPA 402-R-97-016, "Multi Agency Radiation Survey and Site Investigation Manual (MARSSIM)", Rev.1, August 2000

6. RS-00001, "Building 4059, Phase I Final Status Survey Procedure", April 29, 1999.

7. RS-00006, "Area 4020, Final Status Survey Procedure", August 6, 1999.

8. RS-00005, "17th Street Drainage Area, Final Status Survey Procedure", July 21, 1999.

9. RS-00012, "Methods and Procedures for Radiological Monitoring", Rev. A, January 10, 2002

APPENDIX A

Alpha, Beta and Gamma Survey Data

Appendix Summary

This appendix contains tables and graphs that represent the data from the total surface contamination and removable surface contamination surveys. The tables contain the raw counts and the calibration data for the instruments that were used to calculate the derived values in disintegrations per minute per 100 cm^2 (dpm/100cm^2) and microR/hr (µR/hr). The graphs are a statistical plot of the values. The nature of the calculations is rather complex, but a simple interpretation of the data can be given. The Y-axis represents the value of the data and the X-axis represents probability. The release limits are given in text boxes on the graphs. If one were to see a data point at 5 dpm/100cm^2, and it fell at 95% cumulative probability, it could be said that there is a 95% probability that the survey area is less than 5 dpm/100cm^2. If that release limit were 5000 dpm/100cm^2, then it could be said that there is a 95% probability that the area is less than one thousandth of the release limit. The line is a best-fit statistical equation line to the data. There is no significance to data not being on the line.

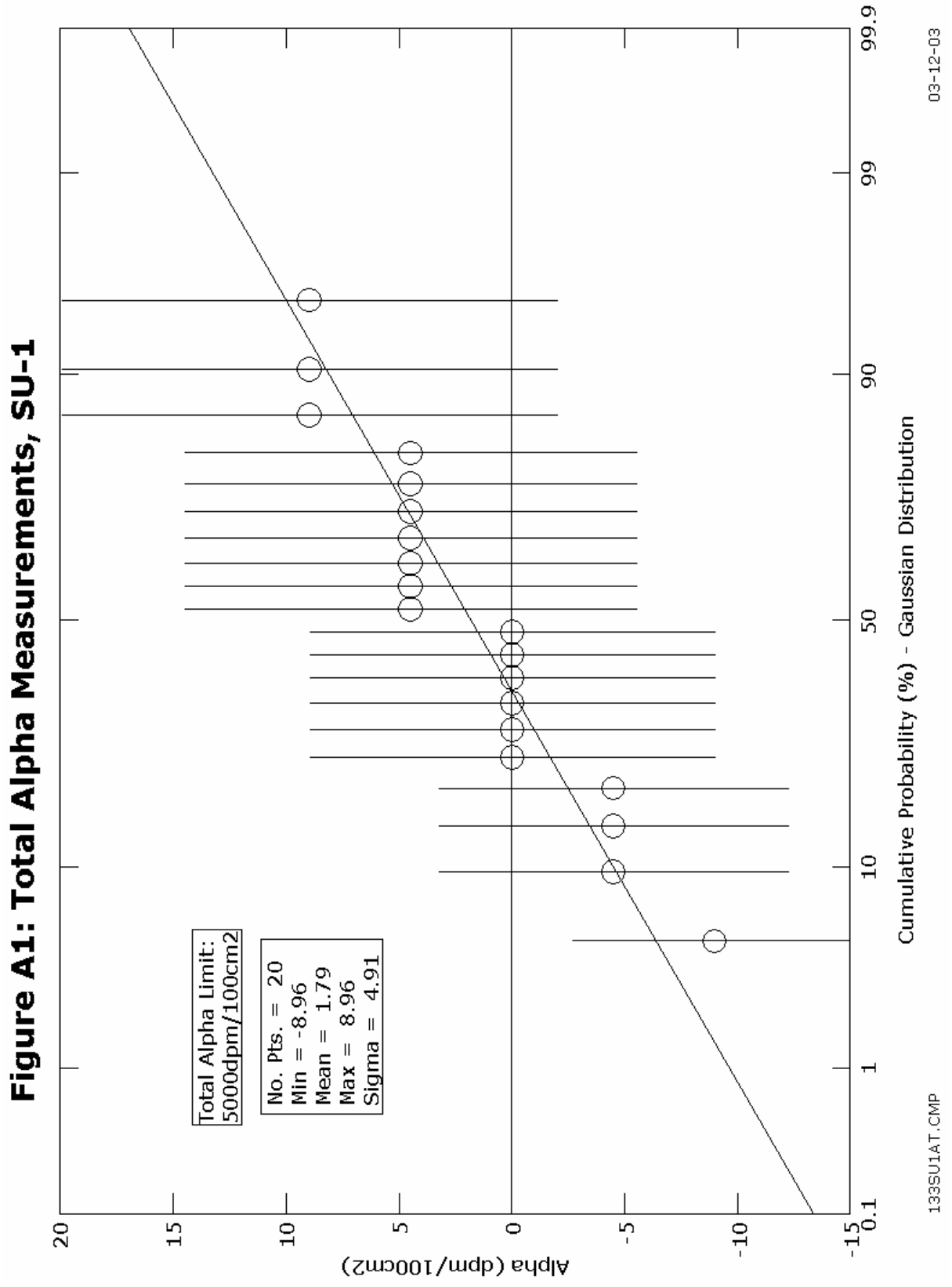


Figure A1: Total Alpha Measurements, SU-1
Total Alpha Limit:
5000dpm/100cm2
No. Pts. = 20
Min = -8.96
Mean = 1.79
Max = 8.96
Sigma = 4.91
Alpha (dpm/100cm2)
20
15
10
5
0
-5
-10
-15
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU1AT.CMP

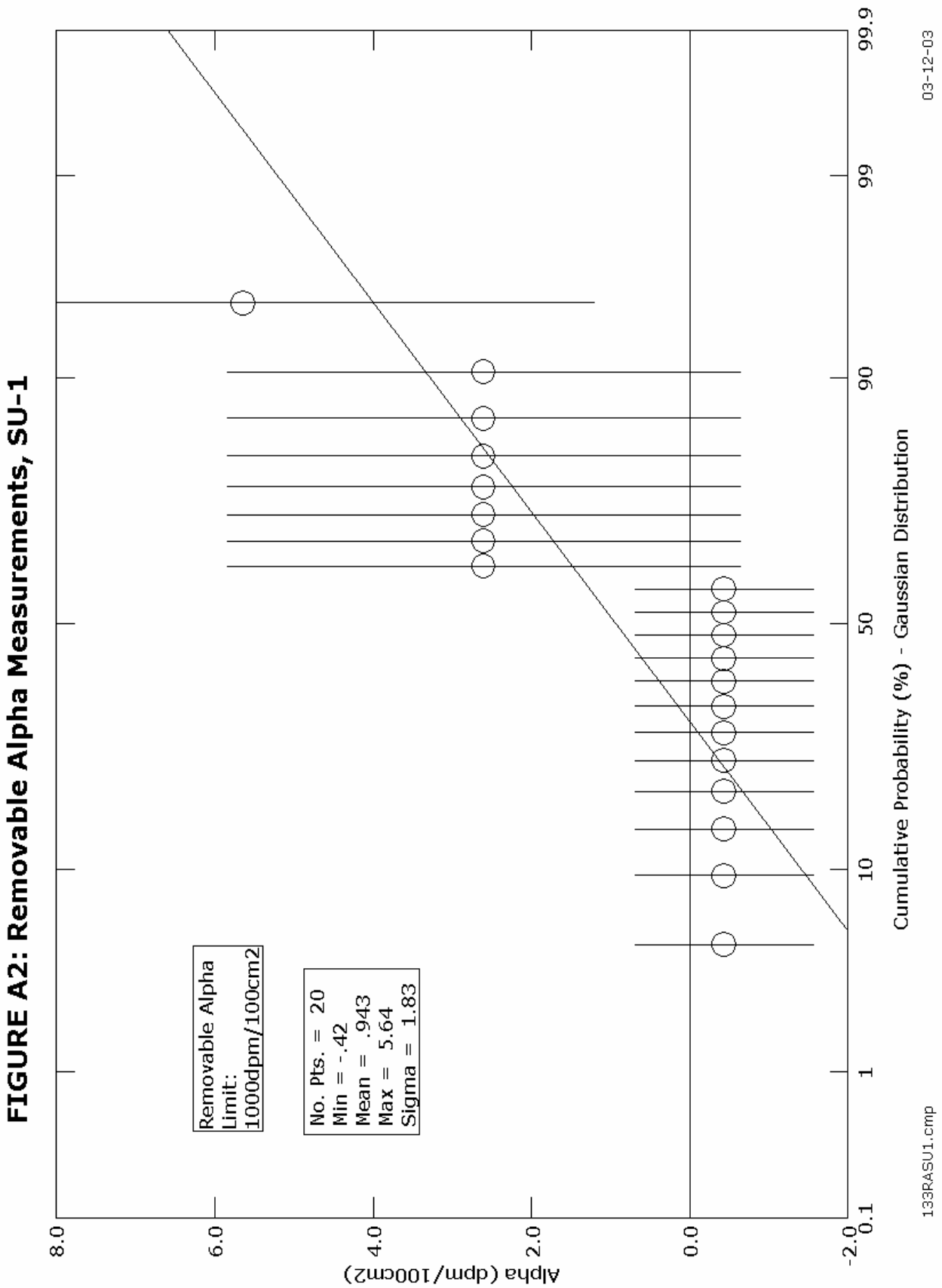


FIGURE A2: Removable Alpha Measurements, SU-1
Removable Alpha Limit: 1000dpm/100cm2
No. Pts. = 20
Min = -.42
Mean = .943
Max = 5.64
Sigma = 1.83
Alpha (dpm/100cm2)
8.0
6.0
4.0
2.0
0.0
-2.0
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133RASU1.cmp

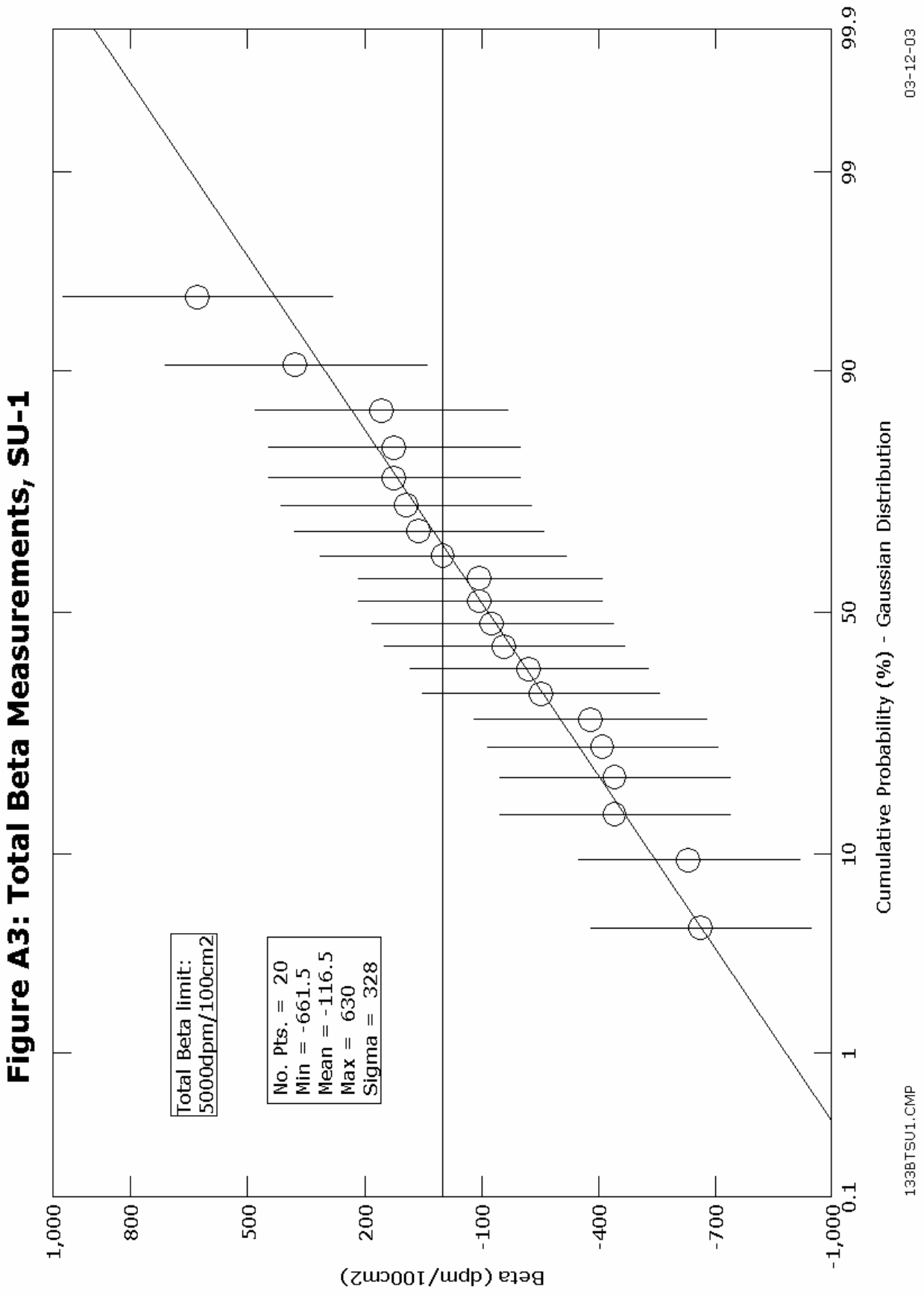


Figure A3: Total Beta Measurements, SU-1
Total Beta limit:
5000dpm/100cm2
No. Pts. = 20
Min = -661.5
Mean = -116.5
Max = 630
Sigma = 328
Beta (dpm/100cm2)
1,000
800
500
200
-100
-400
-700
-1,000
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133BTSU1.CMP

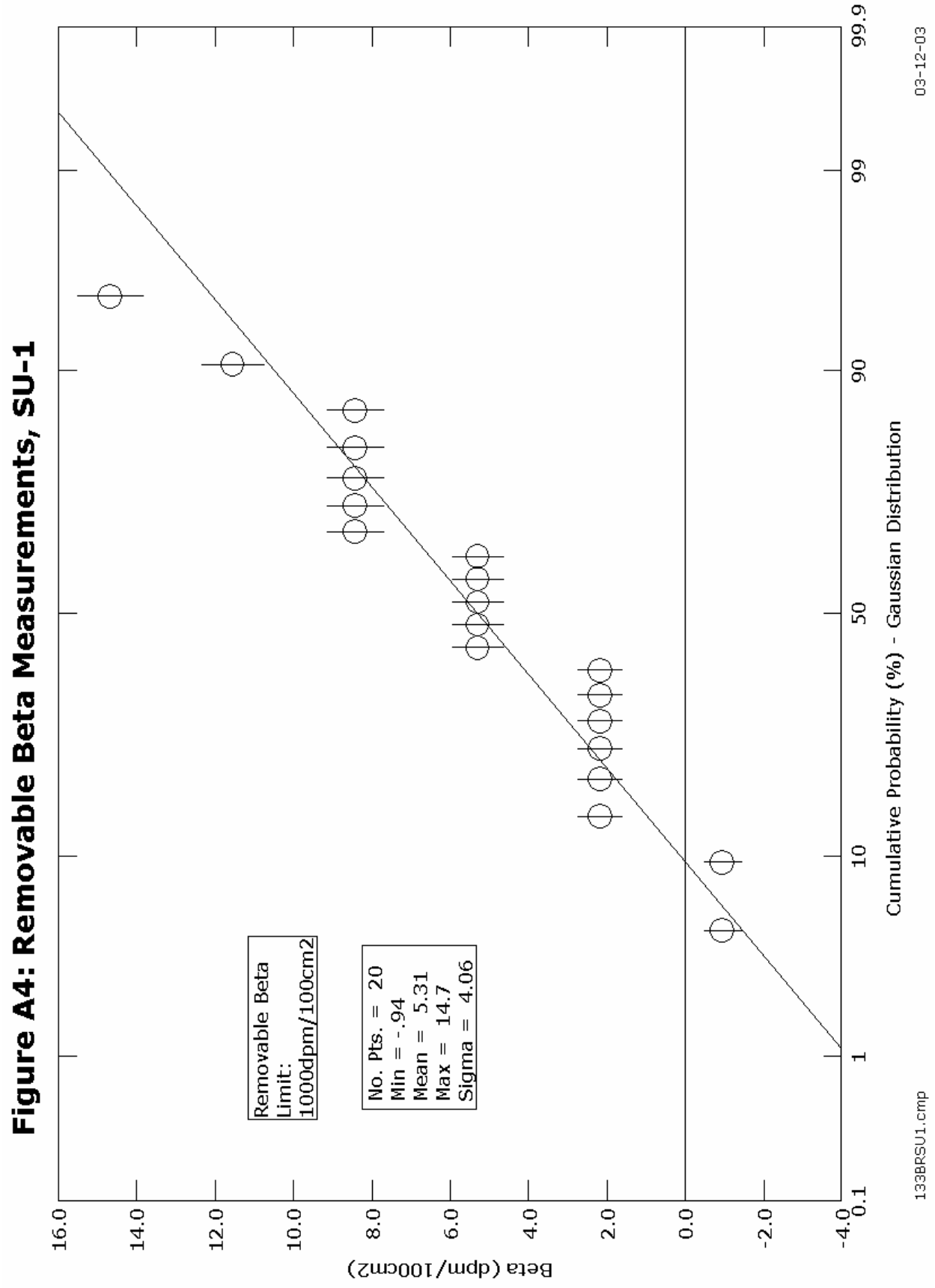


Figure A4: Removable Beta Measurements, SU-1
Removable Beta
Limit:
1000dpm/100cm2
No. Pts. = 20
Min = -.94
Mean = 5.31
Max = 14.7
Sigma = 4.06
Beta (dpm/100cm2)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133BRSU1.cmp

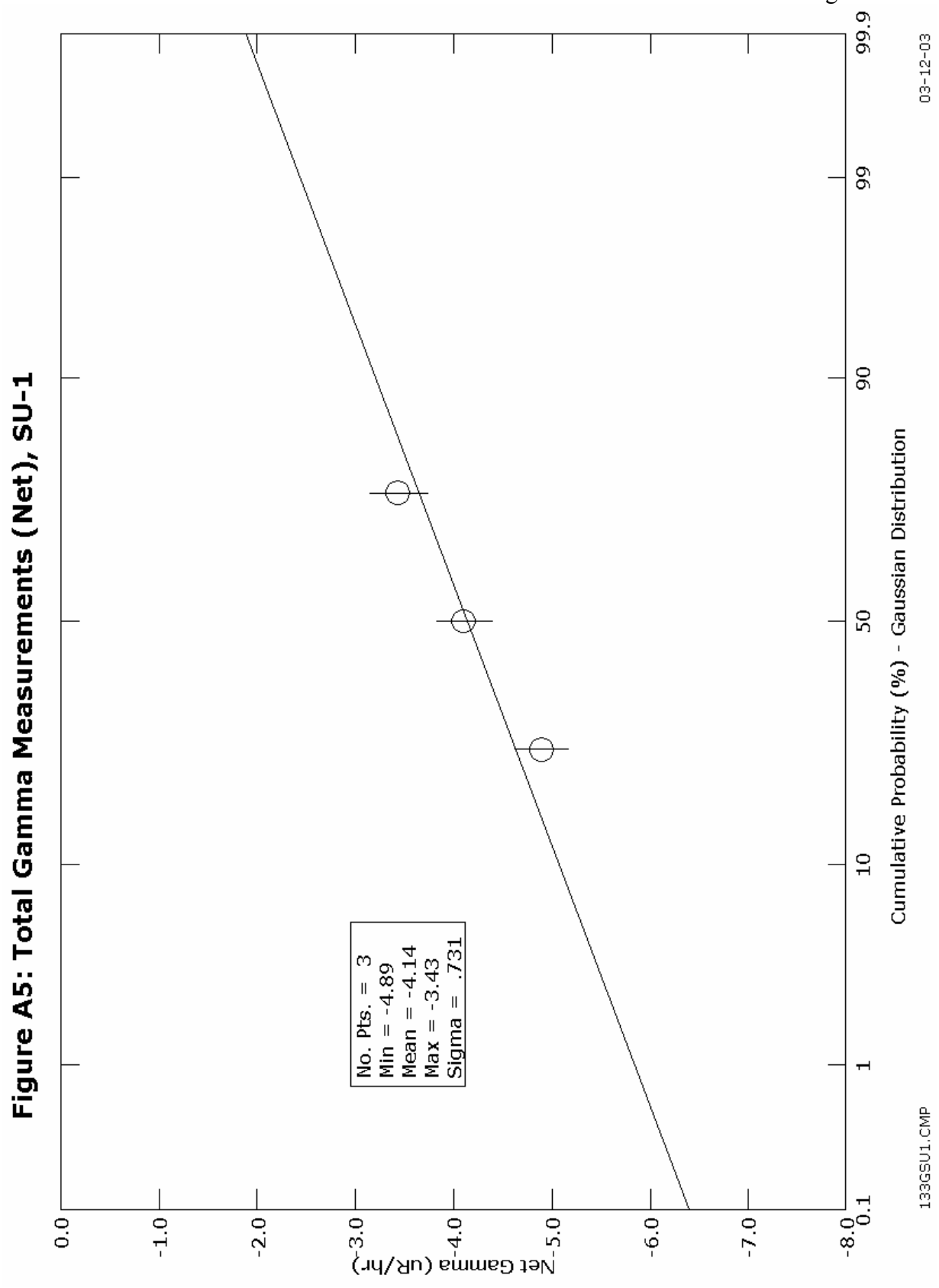


Figure A5: Total Gamma Measurements (Net), SU-1
No. Pts. = 3
Min = -4.89
Mean = -4.14
Max = -3.43
Sigma = .731
Net Gamma (uR/hr)
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
133GSU1.CMP
03-12-03

TABLE A1: BUILDING AREA 4133
SURVEY UNIT 1

		1 MIN	1 MIN	1 MIN	1 MIN	1 MIN	ALPHA					BETA					GAMMA	
SAMPLE NAME	SAMPLE NO.	Alpha		Beta		GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
		TOTAL	REM	TOTAL	REM	TOTAL	BKGD	EFACT	AFACT	BKGD	EFACT	BKGD	EFACT	AFACT	BKGD	EFACT	BKGD	EFACT
Treatment Room	T-1	2	1	53	2	1663	2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32	2400	215
Treatment Room	T-2	1	1	63	3	1519	2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32	2400	215
Treatment Room	T-3	0	1	71	4	1349	2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32	2400	215
Treatment Room	T-4	2	1	51	6		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-5	3	1	56	2		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-6	2	0	47	3		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-7	2	0	55	2		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-8	4	0	48	3		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-9	3	1	43	4		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T10	4	2	38	5		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-11	3	0	39	1		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-12	3	0	54	3		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-13	1	0	30	2		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-14	3	0	31	4		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-15	3	0	48	2		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-16	2	0	37	4		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-17	4	0	55	2		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-18	3	1	37	4		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-19	2	0	44	1		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215
Treatment Room	T-20	1	0	46	3		2	3.2	1.4	0.14	0.33	51	6.3	5	1.3	0.32		215

TABLE A1: BUILDING AREA 4133
SURVEY UNIT 1

SAMPLE NAME	SAMPLE NO.	ALPHA (DPM/100CM2)				BETA (DPM/100CM2)				GAMMA (uR/hr)	
		TOTAL	STD DEV	REM	STD DEV	TOTAL	STD DEV	REM	STD DEV	TOTAL	STD DEV
Treatment Room	T-1	0.00	8.96	2.61	3.24	63.0	321.24	2.19	0.58	-3.43	0.30
Treatment Room	T-2	-4.48	7.76	2.61	3.24	378.0	336.33	5.31	0.66	-4.10	0.29
Treatment Room	T-3	-8.96	6.34	2.61	3.24	630.0	347.93	8.44	0.74	-4.89	0.28
Treatment Room	T-4	0.00	8.96	2.61	3.24	0.0	318.13	14.69	0.86		
Treatment Room	T-5	4.48	10.02	2.61	3.24	157.5	325.84	2.19	0.58		
Treatment Room	T-6	0.00	8.96	-0.42	1.13	-126.0	311.83	5.31	0.66		
Treatment Room	T-7	0.00	8.96	-0.42	1.13	126.0	324.31	2.19	0.58		
Treatment Room	T-8	8.96	10.97	-0.42	1.13	-94.5	313.42	5.31	0.66		
Treatment Room	T-9	4.48	10.02	2.61	3.24	-252.0	305.40	8.44	0.74		
Treatment Room	T10	8.96	10.97	5.64	4.43	-409.5	297.17	11.56	0.80		
Treatment Room	T-11	4.48	10.02	-0.42	1.13	-378.0	298.84	-0.94	0.49		
Treatment Room	T-12	4.48	10.02	-0.42	1.13	94.5	322.78	5.31	0.66		
Treatment Room	T-13	-4.48	7.76	-0.42	1.13	-661.5	283.50	2.19	0.58		
Treatment Room	T-14	4.48	10.02	-0.42	1.13	-630.0	285.24	8.44	0.74		
Treatment Room	T-15	4.48	10.02	-0.42	1.13	-94.5	313.42	2.19	0.58		
Treatment Room	T-16	0.00	8.96	-0.42	1.13	-441.0	295.50	8.44	0.74		
Treatment Room	T-17	8.96	10.97	-0.42	1.13	126.0	324.31	2.19	0.58		
Treatment Room	T-18	4.48	10.02	2.61	3.24	-441.0	295.50	8.44	0.74		
Treatment Room	T-19	0.00	8.96	-0.42	1.13	-220.5	307.02	-0.94	0.49		
Treatment Room	T-20	-4.48	7.76	-0.42	1.13	-157.5	310.24	5.31	0.66		

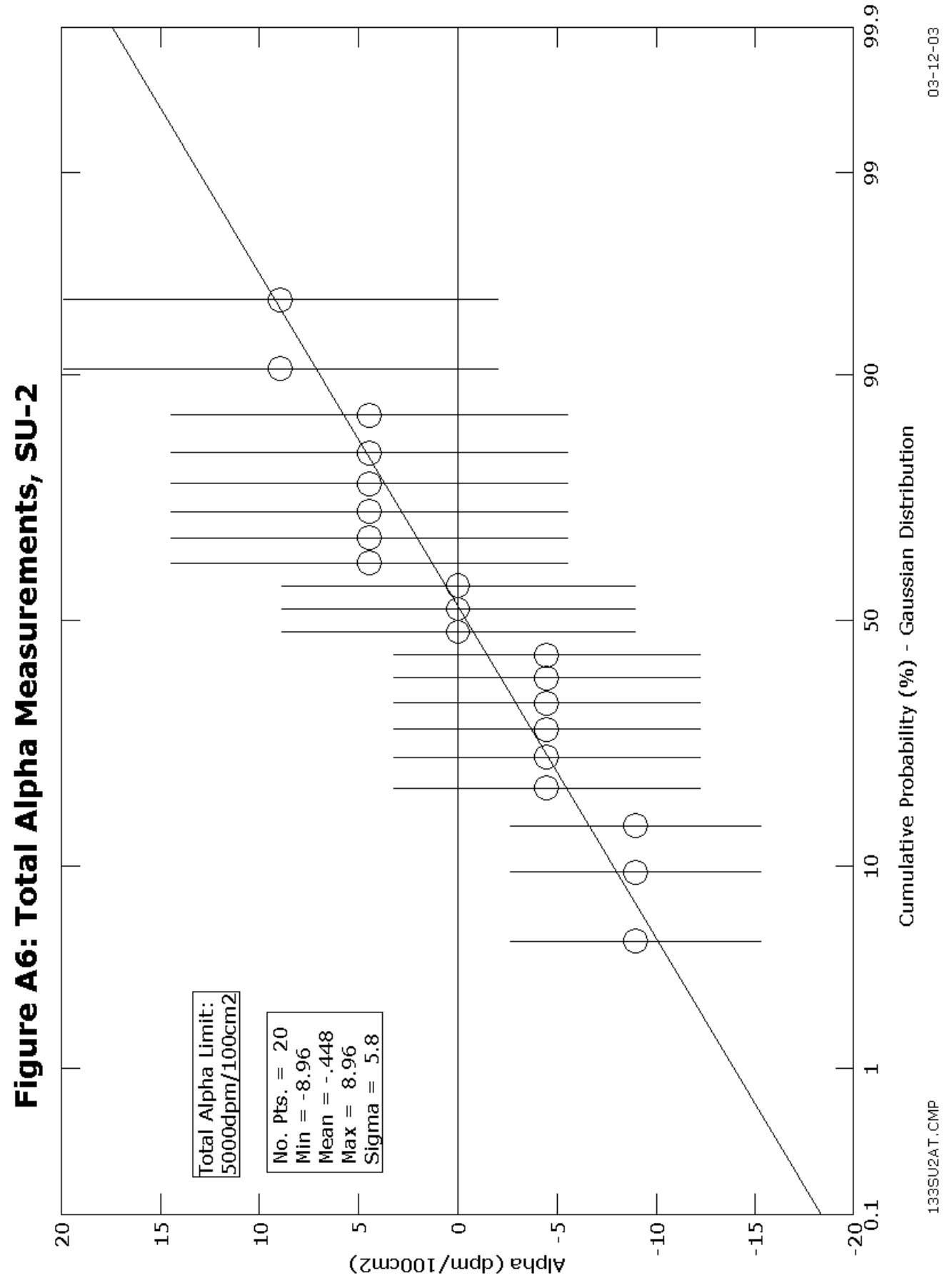


Figure A6: Total Alpha Measurements, SU-2
Total Alpha Limit:
5000dpm/100cm2
No. Pts. = 20
Min = -8.96
Mean = -.448
Max = 8.96
Sigma = 5.8
Alpha (dpm/100cm2)
20
15
10
5
0
-5
-10
-15
-20
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU2AT.CMP

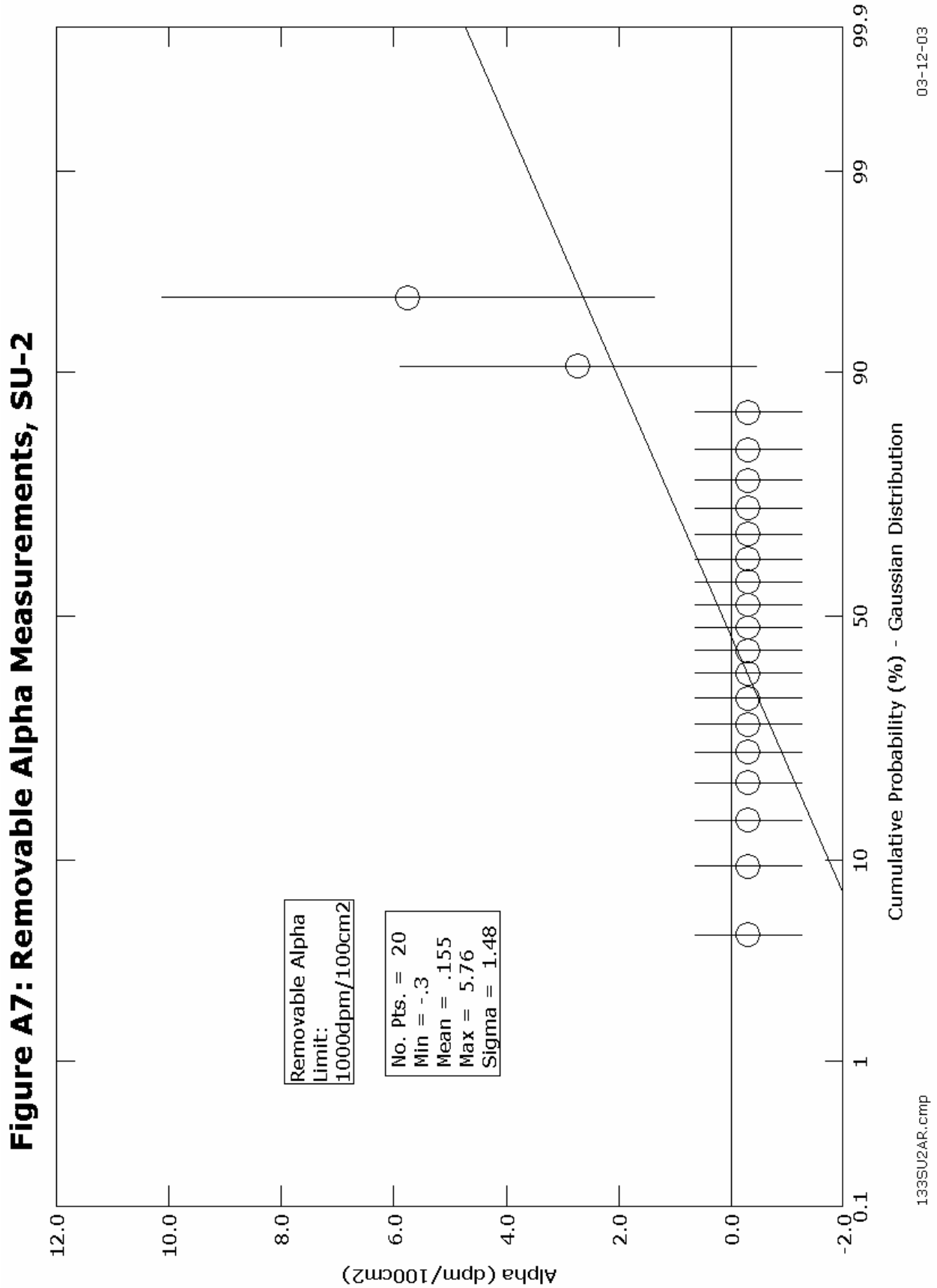


Figure A7: Removable Alpha Measurements, SU-2
Removable Alpha Limit: 1000dpm/100cm2
No. Pts. = 20
Min = -.3
Mean = .155
Max = 5.76
Sigma = 1.48
Alpha (dpm/100cm2)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Cumulative Probability (%) - Gaussian Distribution
0.1
1
10
50
90
99
99.9
03-12-03
133SU2AR.cmp

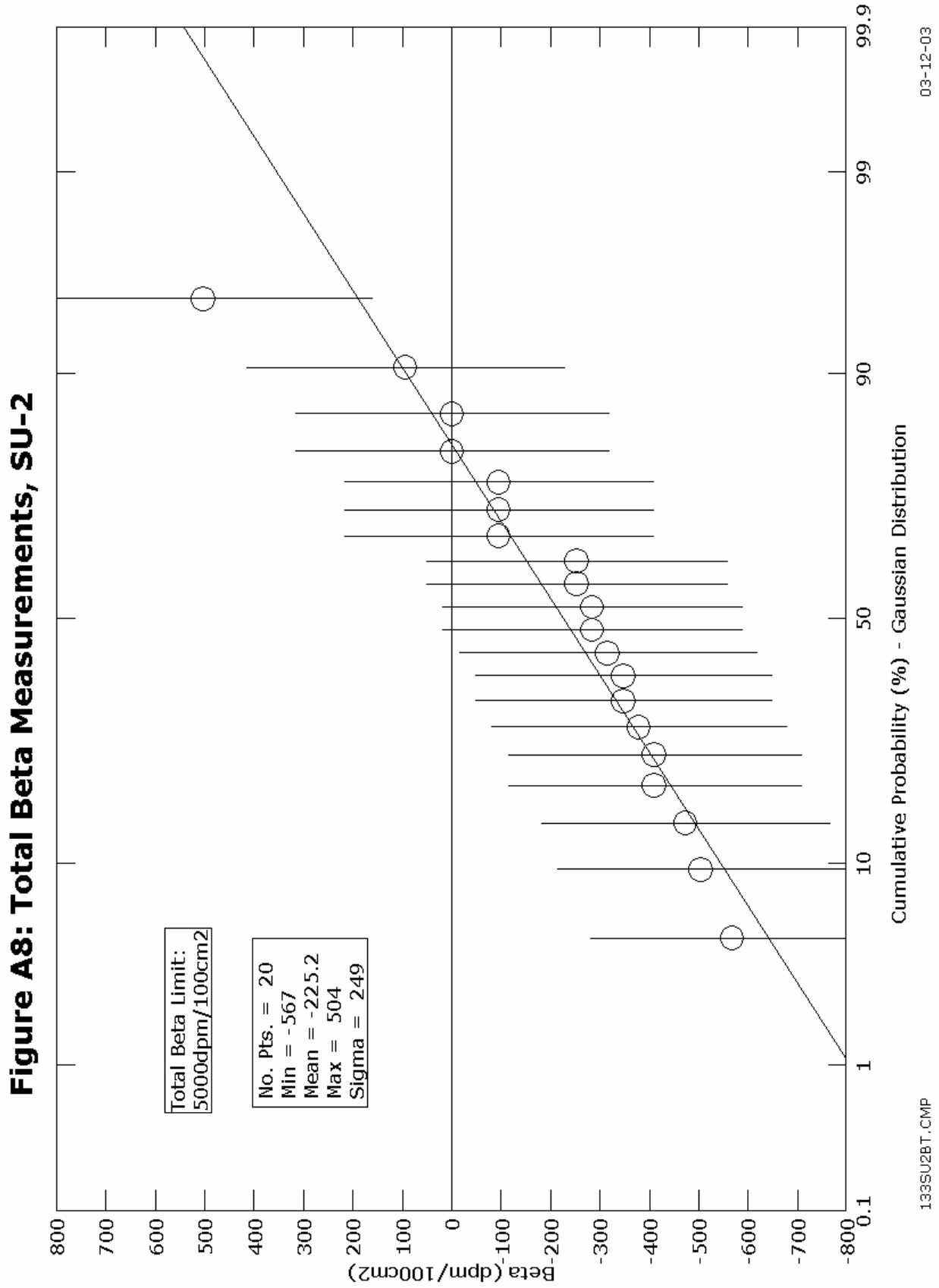


Figure A8: Total Beta Measurements, SU-2
Total Beta Limit:
5000dpm/100cm2
No. Pts. = 20
Min = -567
Mean = -225.2
Max = 504
Sigma = 249
Beta (dpm/100cm2)
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU2BT.CMP

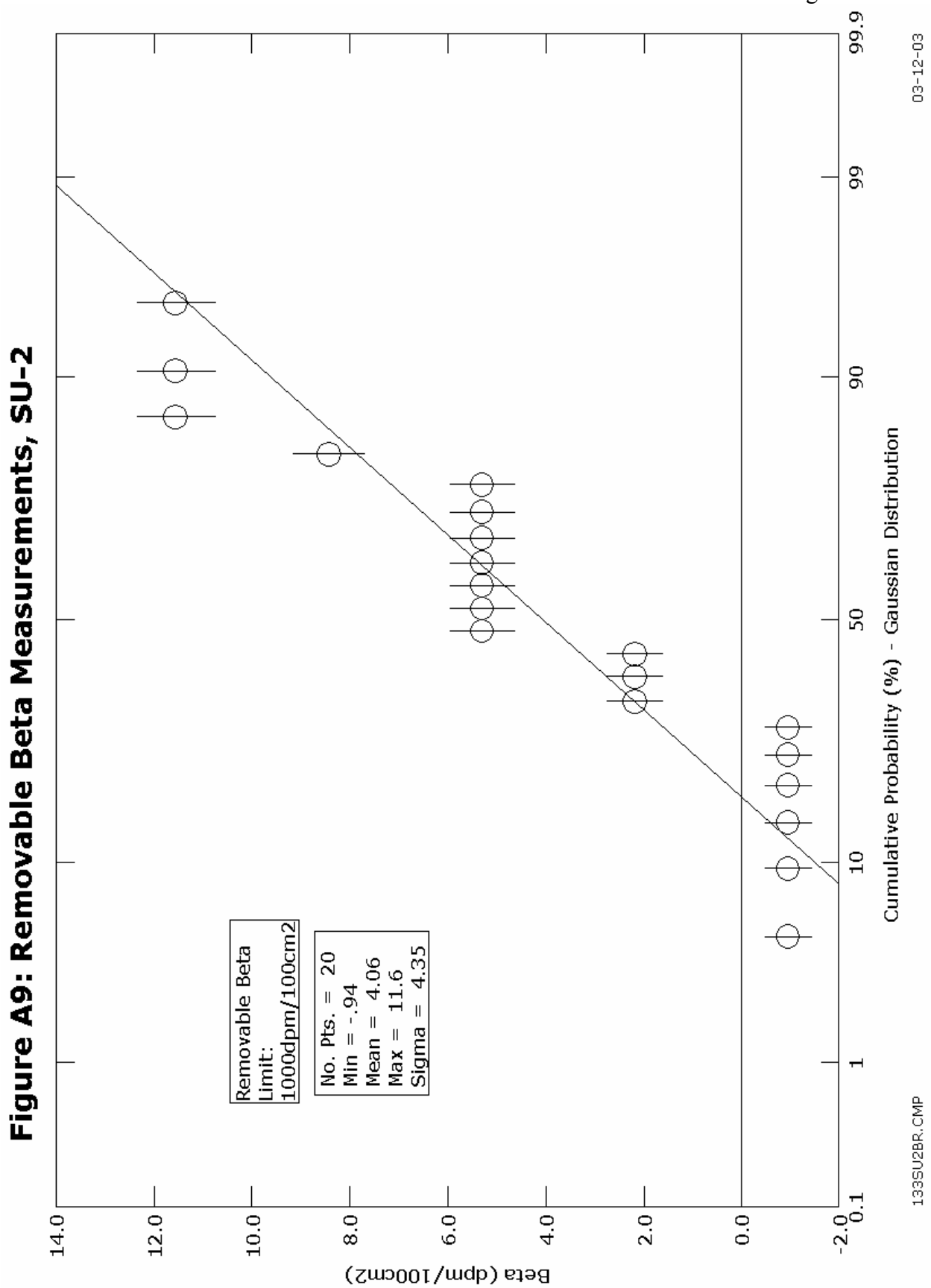


Figure A9: Removable Beta Measurements, SU-2
Removable Beta Limit: 1000dpm/100cm2
No. Pts. = 20
Min = -.94
Mean = 4.06
Max = 11.6
Sigma = 4.35
Beta (dpm/100cm2)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU2BR.CMP

TABLE A2: BUILDING / AREA 4133
SURVEY UNIT 2

		1 MIN	1 MIN	1 MIN	1 MIN	ALPHA					BETA					GAMMA	
SAMPLE	SAMPLE	ALPHA		BETA		INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NO.	TOTAL	REM	TOTAL	REM	BKGD	EFACT	AFACT	BKGD	EFACT	BKGD	EFACT	AFACT	BKGD	EFACT	BKGD	EFACT
Perimeter	1	2	0	43	2	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	2	3	0	38	1	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	3	3	0	39	2	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	4	3	0	67	3	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	5	0	0	43	1	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	6	1	0	40	2	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	7	4	0	51	1	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	8	4	1	54	3	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	9	2	0	48	1	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	10	1	0	48	5	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	11	3	0	33	1	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	12	1	0	42	3	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	13	1	0	51	3	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	14	2	0	42	3	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	15	0	0	40	4	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	16	3	0	48	3	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	17	0	0	36	5	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	18	3	0	38	1	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	19	1	0	35	5	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		
Perimeter	20	1	2	41	3	2	3.2	1.4	0.1	0.33	51	6.3	5	1.3	0.32		

TABLE A2: BUILDING / AREA 4133
SURVEY UNIT 2

SAMPLE NAME	SAMPLE NO.	ALPHA (DPM/100CM2)				BETA (DPM/100CM2)			
		TOTAL	STD DEV	REM	STD DEV	TOTAL	STD DEV	REM	STD DEV
Perimeter	1	0.00	8.96	-0.30	0.96	-252.0	305.40	2.19	0.58
Perimeter	2	4.48	10.02	-0.30	0.96	-409.5	297.17	-0.94	0.49
Perimeter	3	4.48	10.02	-0.30	0.96	-378.0	298.84	2.19	0.58
Perimeter	4	4.48	10.02	-0.30	0.96	504.0	342.18	5.31	0.66
Perimeter	5	-8.96	6.34	-0.30	0.96	-252.0	305.40	-0.94	0.49
Perimeter	6	-4.48	7.76	-0.30	0.96	-346.5	300.49	2.19	0.58
Perimeter	7	8.96	10.97	-0.30	0.96	0.0	318.13	-0.94	0.49
Perimeter	8	8.96	10.97	2.73	3.18	94.5	322.78	5.31	0.66
Perimeter	9	0.00	8.96	-0.30	0.96	-94.5	313.42	-0.94	0.49
Perimeter	10	-4.48	7.76	-0.30	0.96	-94.5	313.42	11.56	0.80
Perimeter	11	4.48	10.02	-0.30	0.96	-567.0	288.70	-0.94	0.49
Perimeter	12	-4.48	7.76	-0.30	0.96	-283.5	303.77	5.31	0.66
Perimeter	13	-4.48	7.76	-0.30	0.96	0.0	318.13	5.31	0.66
Perimeter	14	0.00	8.96	-0.30	0.96	-283.5	303.77	5.31	0.66
Perimeter	15	-8.96	6.34	-0.30	0.96	-346.5	300.49	8.44	0.74
Perimeter	16	4.48	10.02	-0.30	0.96	-94.5	313.42	5.31	0.66
Perimeter	17	-8.96	6.34	-0.30	0.96	-472.5	293.81	11.56	0.80
Perimeter	18	4.48	10.02	-0.30	0.96	-409.5	297.17	-0.94	0.49
Perimeter	19	-4.48	7.76	-0.30	0.96	-504.0	292.12	11.56	0.80
Perimeter	20	-4.48	7.76	5.76	4.39	-315.0	302.14	5.31	0.66

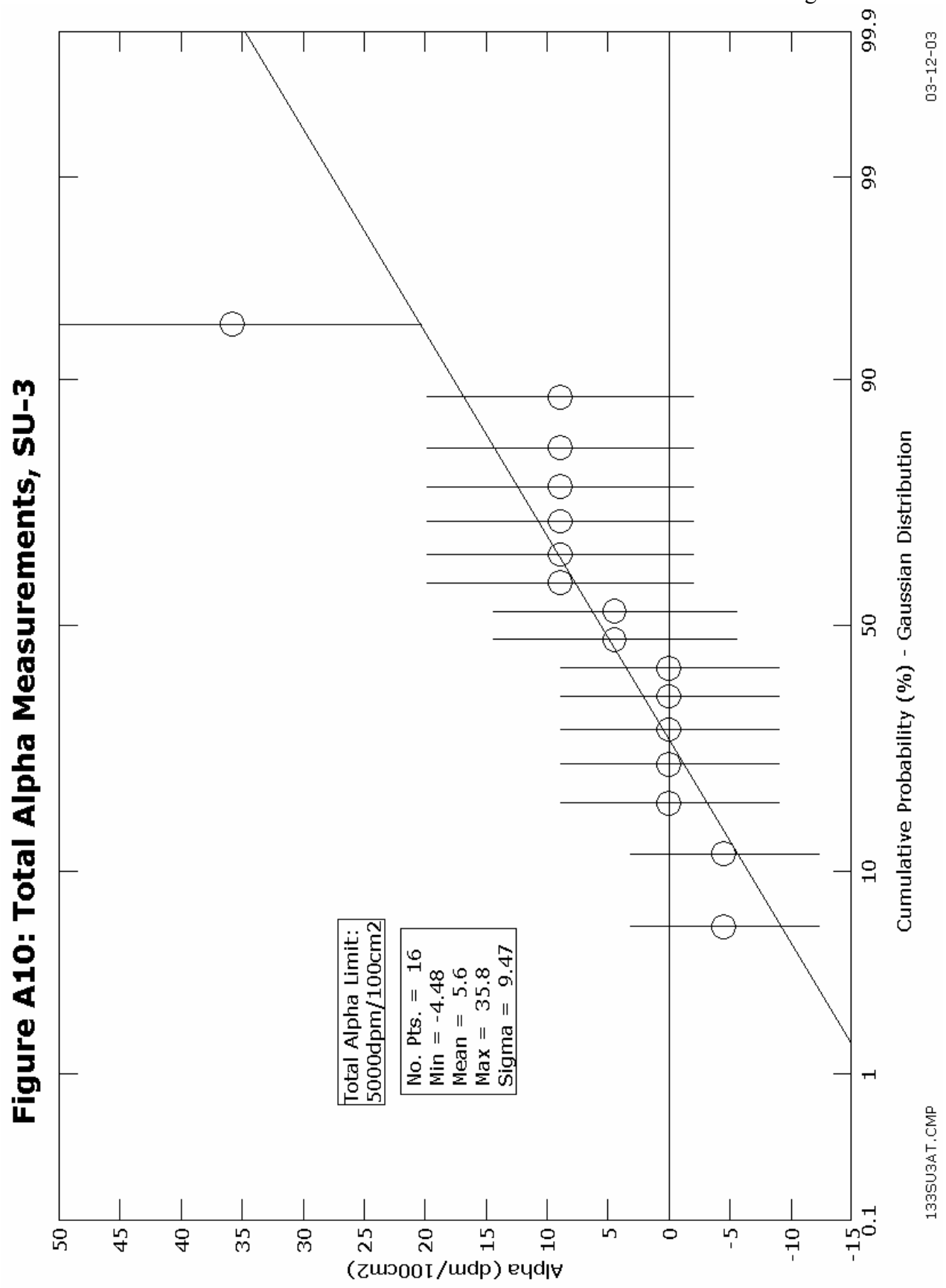
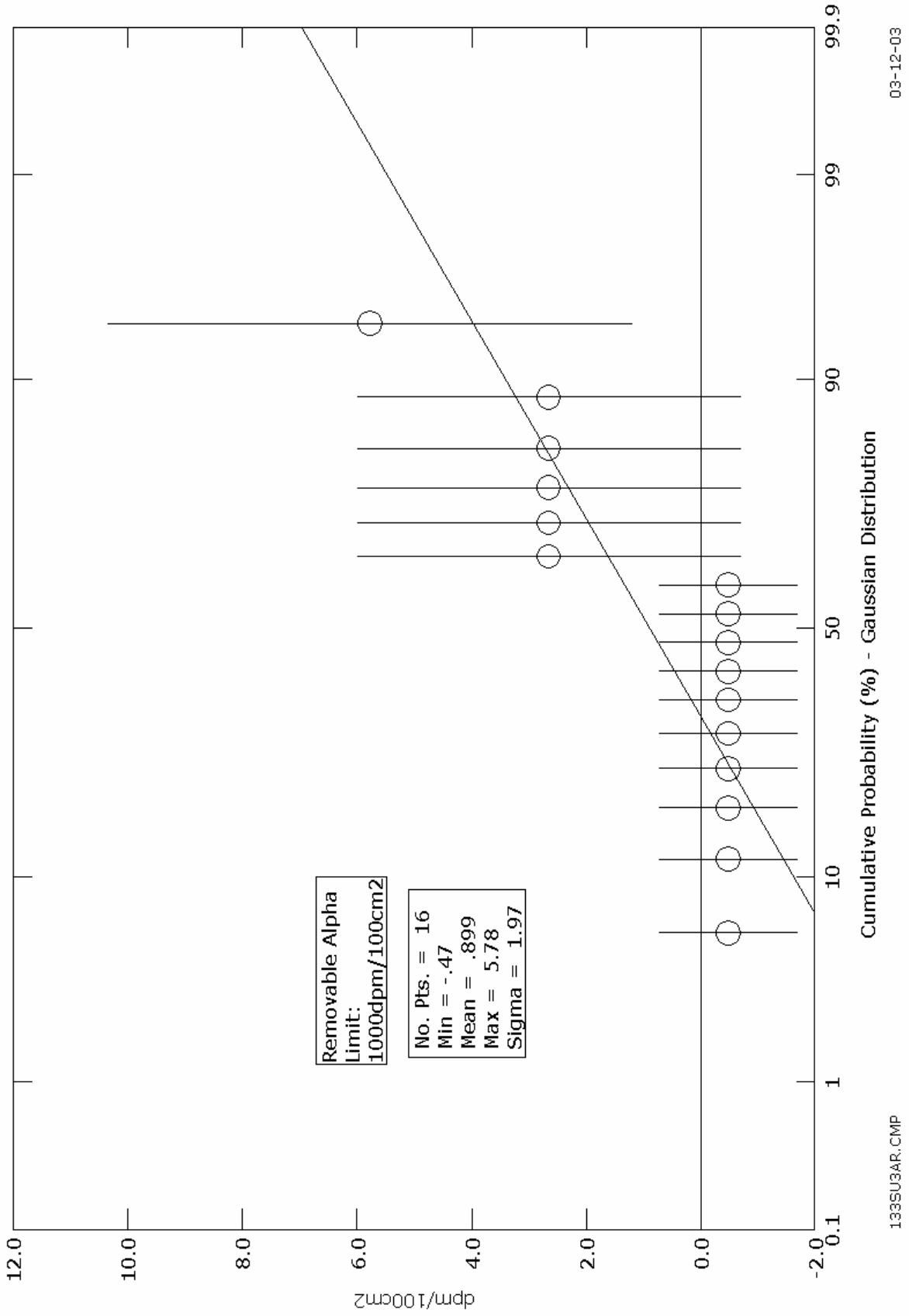


Figure A10: Total Alpha Measurements, SU-3
Alpha (dpm/100cm2)
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
Total Alpha Limit:
5000dpm/100cm2
No. Pts. = 16
Min = -4.48
Mean = 5.6
Max = 35.8
Sigma = 9.47
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU3AT.CMP

Figure A11: Removable Alpha Measurements, SU-3



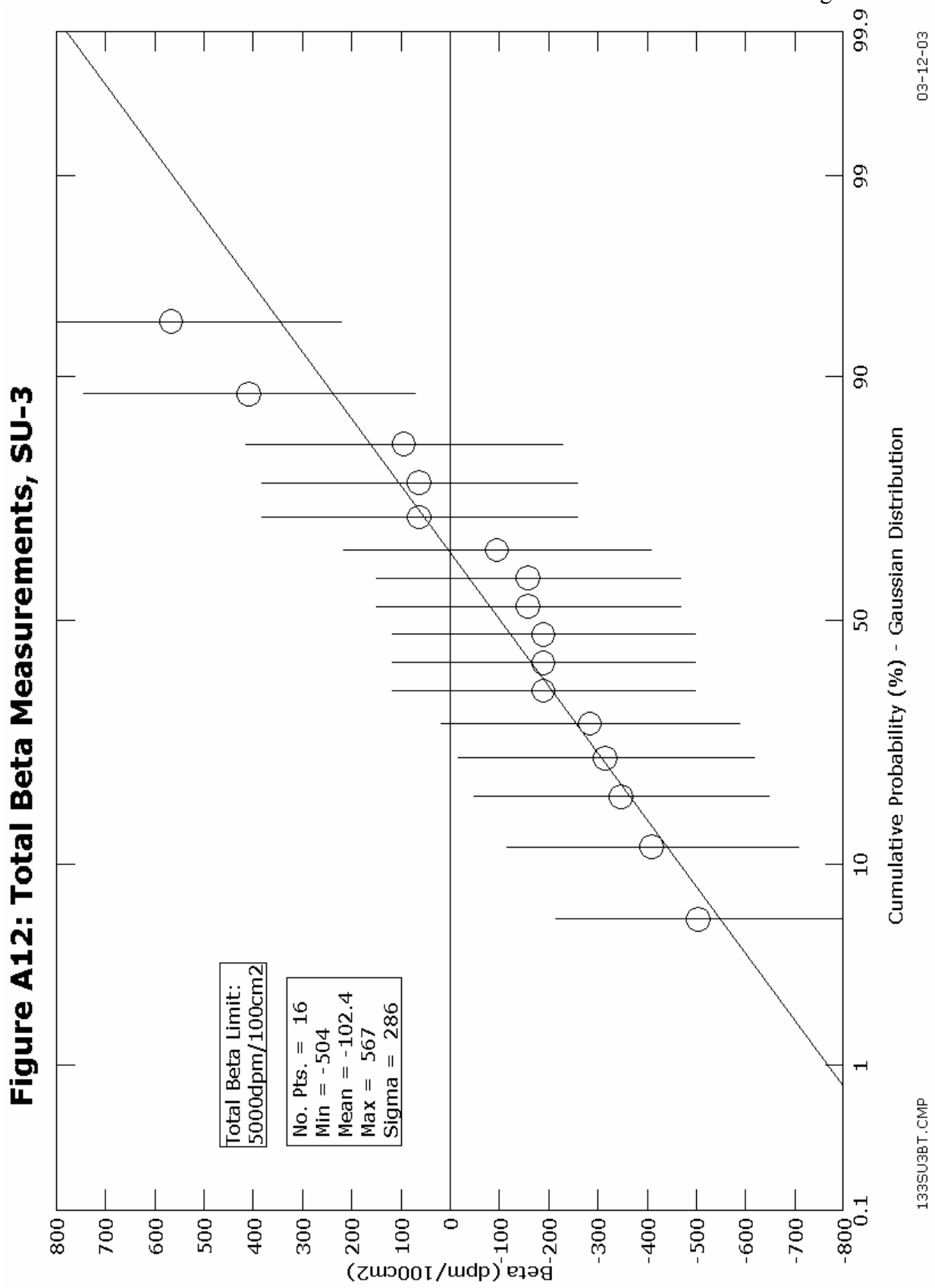


Figure A12: Total Beta Measurements, SU-3
Total Beta Limit:
5000dpm/100cm2
No. Pts. = 16
Min = -504
Mean = -102.4
Max = 567
Sigma = 286
Beta (dpm/100cm2)
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU3BT.CMP

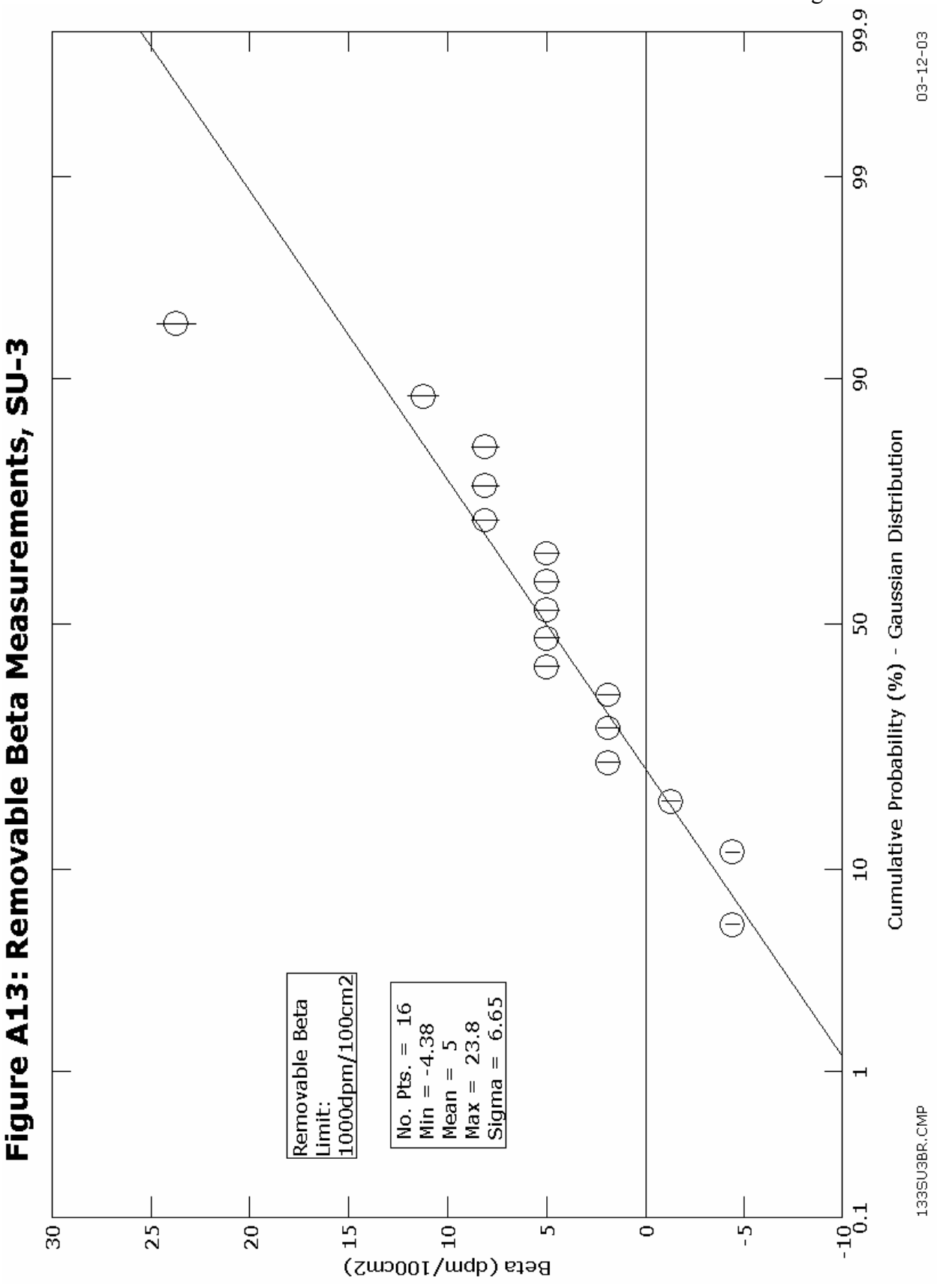


Figure A13: Removable Beta Measurements, SU-3
Beta (dpm/100cm2)
30
25
20
15
10
5
0
-5
-10
Removable Beta
Limit:
1000dpm/100cm2
No. Pts. = 16
Min = -4.38
Mean = 5
Max = 23.8
Sigma = 6.65
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU3BR.CMP

TABLE A3: BUILDING/AREA 4133
SURVEY UNIT 3

SAMPLE NAME	SAMPLE NO.	1 MIN ALPHA TOTAL	1 MIN ALPHA REM	1 MIN BETA TOTAL	1 MIN BETA REM	1 MIN GAM TOTAL	ALPHA INSTRUMENT BKGD	ALPHA INSTRUMENT EFACT	ALPHA INSTRUMENT AFACT	ALPHA SMEAR BKGD	ALPHA SMEAR EFACT	BETA INSTRUMENT BKGD	BETA INSTRUMENT EFACT	BETA INSTRUMENT AFACT	BETA SMEAR BKGD	BETA SMEAR EFACT	GAMMA BKGD
Tank & Sump Area	1	4	0	48	5		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	2	2	0	38	3		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	3	4	0	46	0		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	4	1	0	42	4		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	5	2	0	40	2		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	6	2	0	45	0		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	7	3	1	54	1		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	8	1	1	46	3		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	9	2	0	69	3		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	10	10	2	64	9		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	11	4	0	41	2		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	12	3	0	45	3		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	13	4	1	53	4		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	14	4	0	35	2		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	15	4	1	53	4		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	
Tank & Sump Area	16	2	1	45	3		2	3.2	1.4	0.15	0.33	51	6.3	5	1.4	0.32	

TABLE A3: BUILDING/AREA 4133
SURVEY UNIT 3

SAMPLE NAME	SAMPLE NO.	ALPHA (DPM/100CM2)				BETA (DPM/100CM2)			
		TOTAL	STD DEV	REM	STD DEV	TOTAL	STD DEV	REM	STD DEV
Tank & Sump Area	1	8.96	10.97	-0.45	1.17	-94.5	313.42	11.25	0.81
Tank & Sump Area	2	0.00	8.96	-0.45	1.17	-409.5	297.17	5.00	0.67
Tank & Sump Area	3	8.96	10.97	-0.45	1.17	-157.5	310.24	-4.38	0.38
Tank & Sump Area	4	-4.48	7.76	-0.45	1.17	-283.5	303.77	8.13	0.74
Tank & Sump Area	5	0.00	8.96	-0.45	1.17	-346.5	300.49	1.88	0.59
Tank & Sump Area	6	0.00	8.96	-0.45	1.17	-189.0	308.64	-4.38	0.38
Tank & Sump Area	7	4.48	10.02	2.58	3.25	94.5	322.78	-1.25	0.50
Tank & Sump Area	8	-4.48	7.76	2.58	3.25	-157.5	310.24	5.00	0.67
Tank & Sump Area	9	0.00	8.96	-0.45	1.17	567.0	345.07	5.00	0.67
Tank & Sump Area	10	35.84	15.52	5.61	4.44	409.5	337.80	23.75	1.03
Tank & Sump Area	11	8.96	10.97	-0.45	1.17	-315.0	302.14	1.88	0.59
Tank & Sump Area	12	4.48	10.02	-0.45	1.17	-189.0	308.64	5.00	0.67
Tank & Sump Area	13	8.96	10.97	2.58	3.25	63.0	321.24	8.13	0.74
Tank & Sump Area	14	8.96	10.97	-0.45	1.17	-504.0	292.12	1.88	0.59
Tank & Sump Area	15	8.96	10.97	2.58	3.25	63.0	321.24	8.13	0.74
Tank & Sump Area	16	0.00	8.96	2.58	3.25	-189.0	308.64	5.00	0.67
		35.84		5.61		567.0		23.75	
		-4.48		-0.45		-504.0		-4.38	

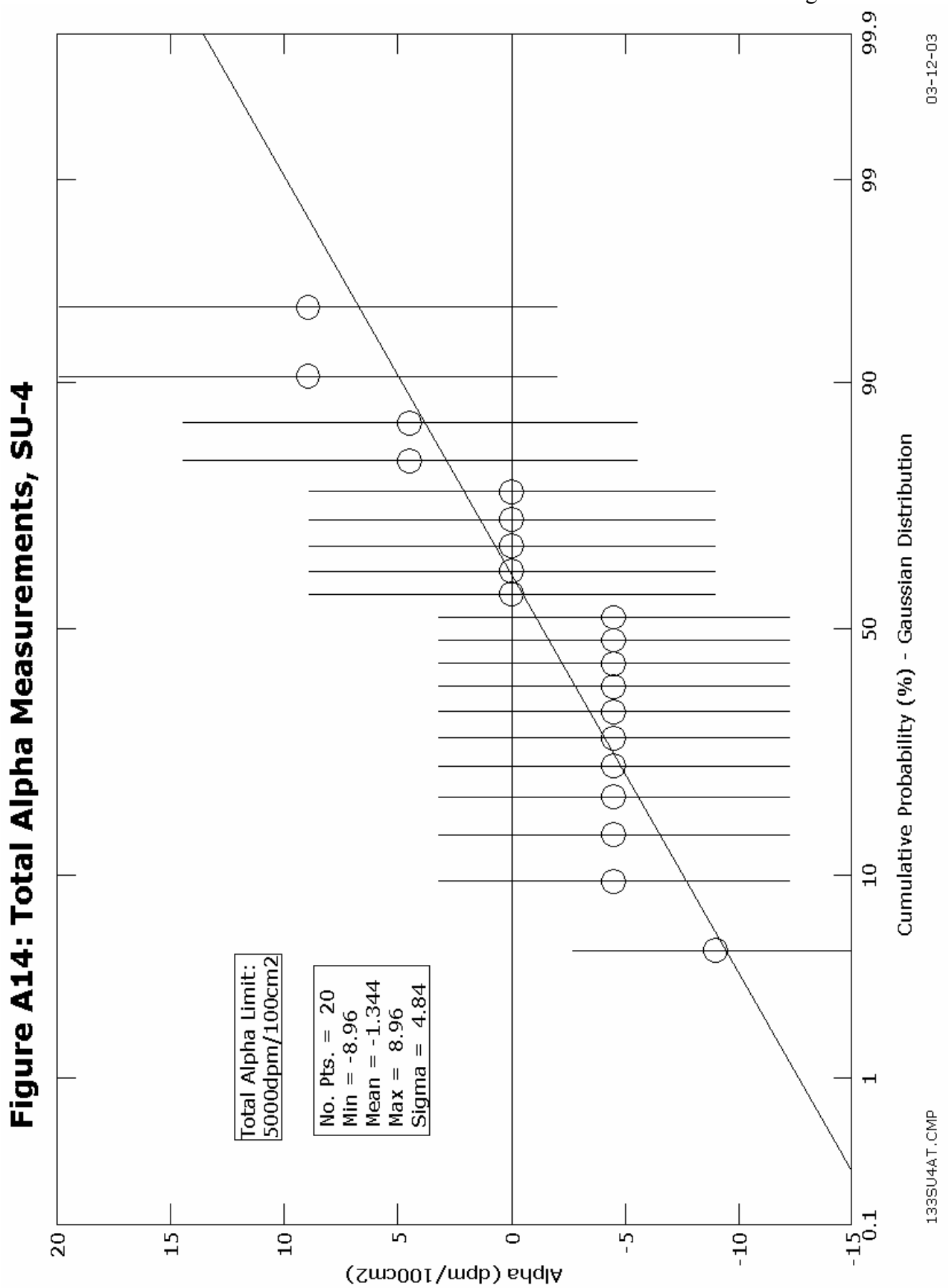


Figure A14: Total Alpha Measurements, SU-4
Total Alpha Limit:
5000dpm/100cm2
No. Pts. = 20
Min = -8.96
Mean = -1.344
Max = 8.96
Sigma = 4.84
Alpha (dpm/100cm2)
20
15
10
5
0
-5
-10
-15
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-12-03
133SU4AT.CMP

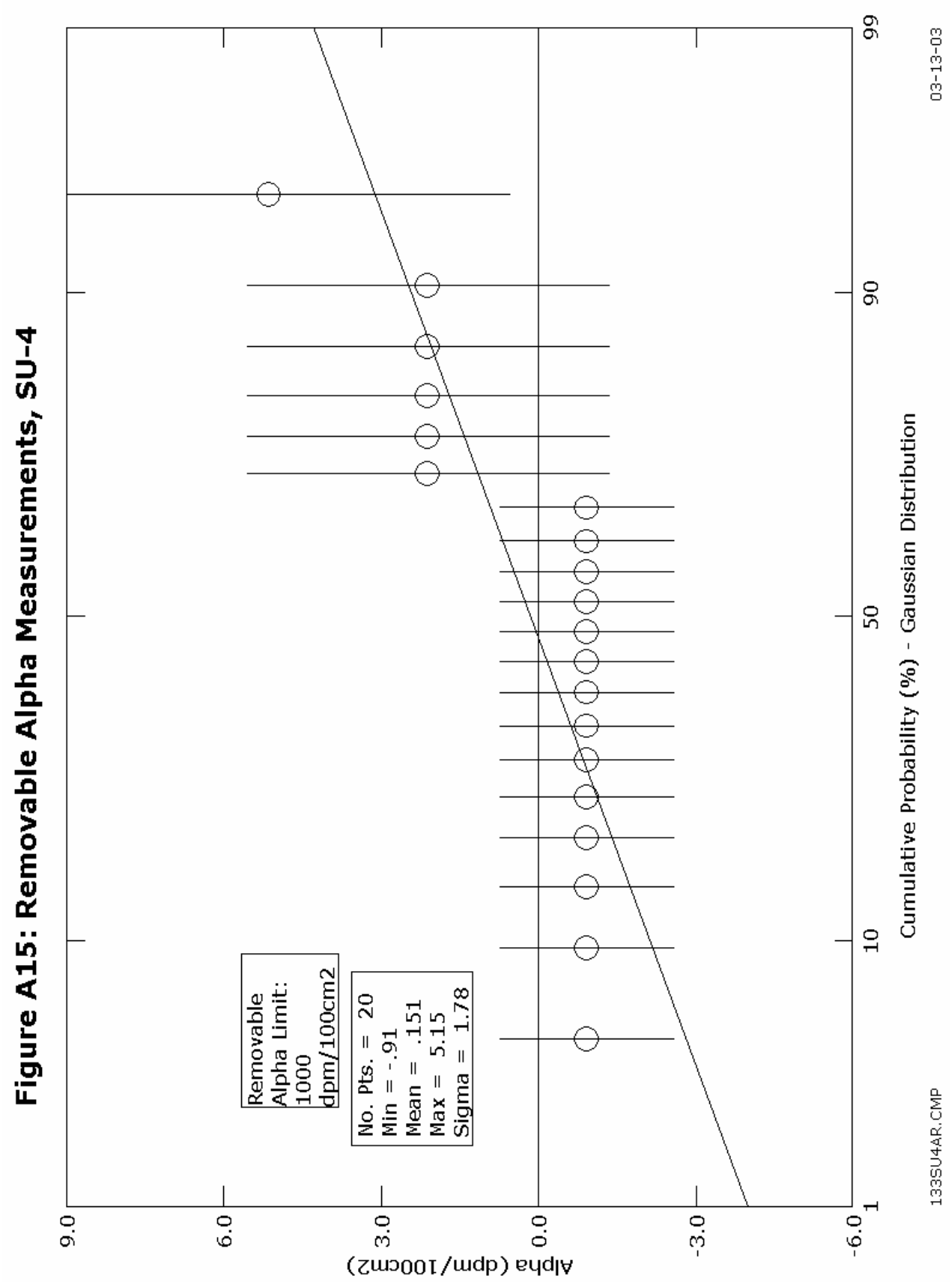


Figure A15: Removable Alpha Measurements, SU-4
Alpha (dpm/100cm2)
9.0
6.0
3.0
0.0
-3.0
-6.0
1
10
50
90
99
Cumulative Probability (%) - Gaussian Distribution
Removable
Alpha Limit:
1000
dpm/100cm2
No. Pts. = 20
Min = -.91
Mean = .151
Max = 5.15
Sigma = 1.78
03-13-03
133SU4AR.CMP

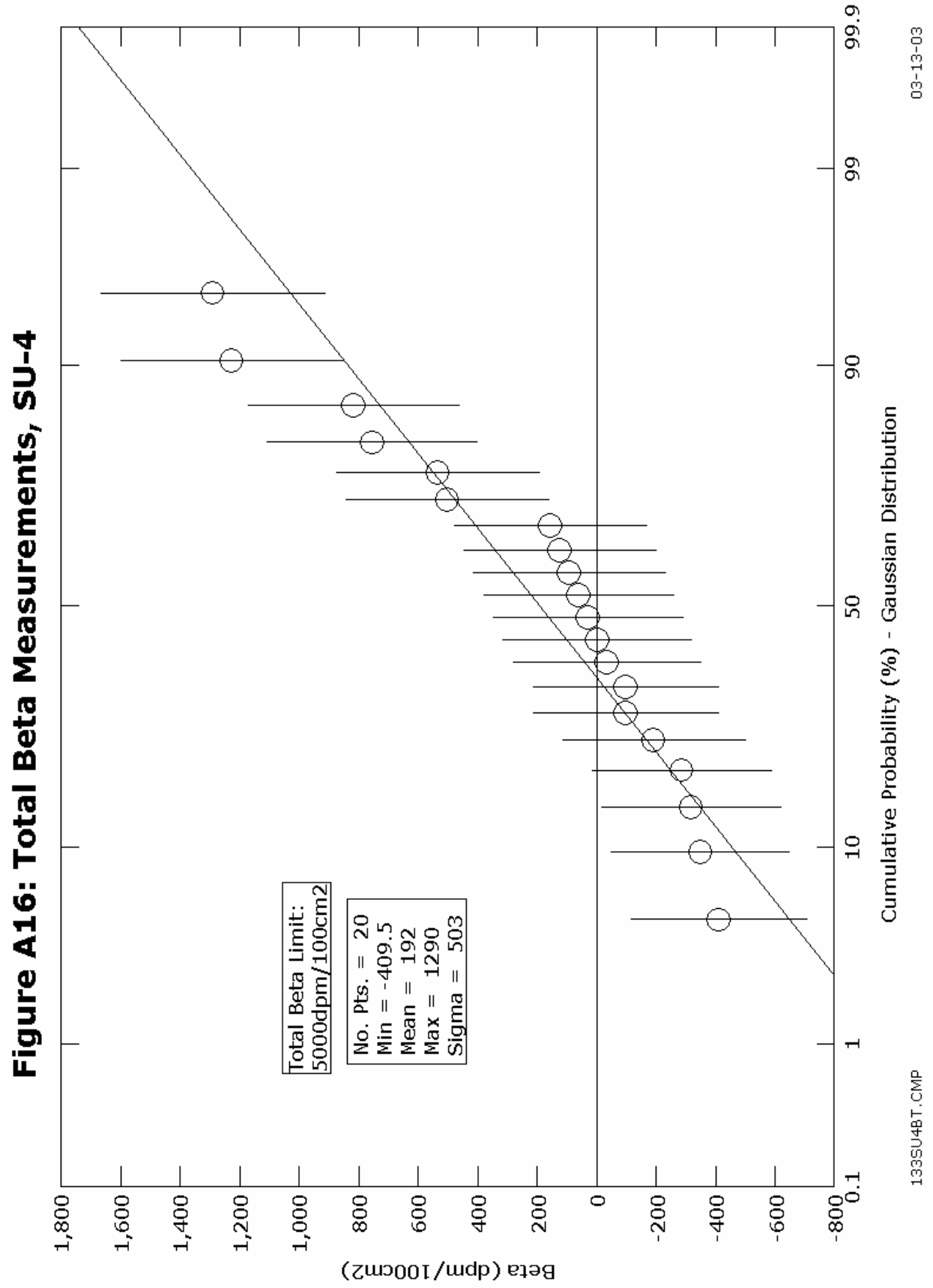


Figure A16: Total Beta Measurements, SU-4
Beta (dpm/100cm2)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
-200
-400
-600
-800
Total Beta Limit:
5000dpm/100cm2
No. Pts. = 20
Min = -409.5
Mean = 192
Max = 1290
Sigma = 503
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-13-03
133SU4BT.CMP

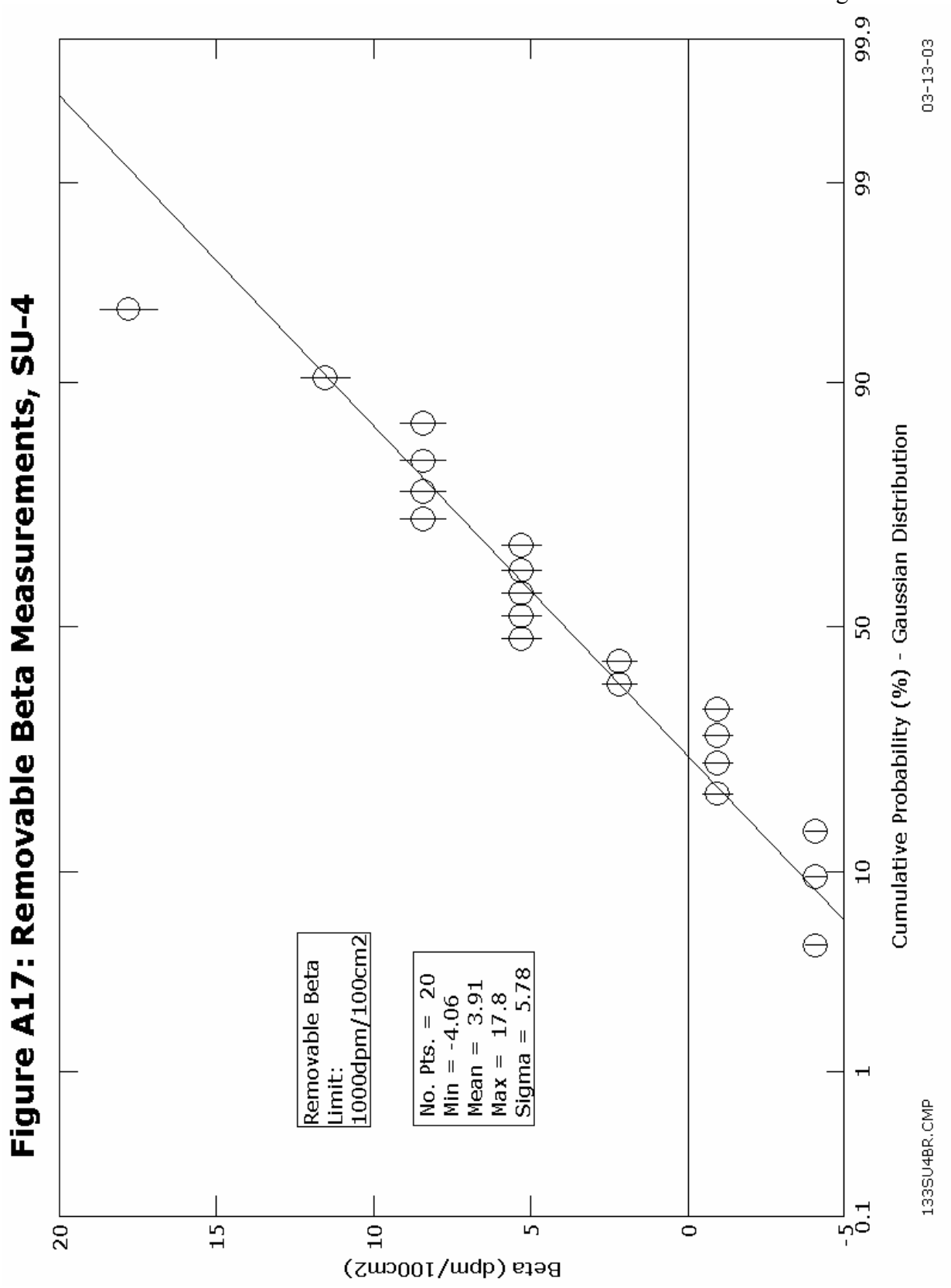


Figure A17: Removable Beta Measurements, SU-4
Beta (dpm/100cm2)
20
15
10
5
0
-5
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
Removable Beta
Limit:
1000dpm/100cm2
No. Pts. = 20
Min = -4.06
Mean = 3.91
Max = 17.8
Sigma = 5.78
03-13-03
133SU4BR.CMP

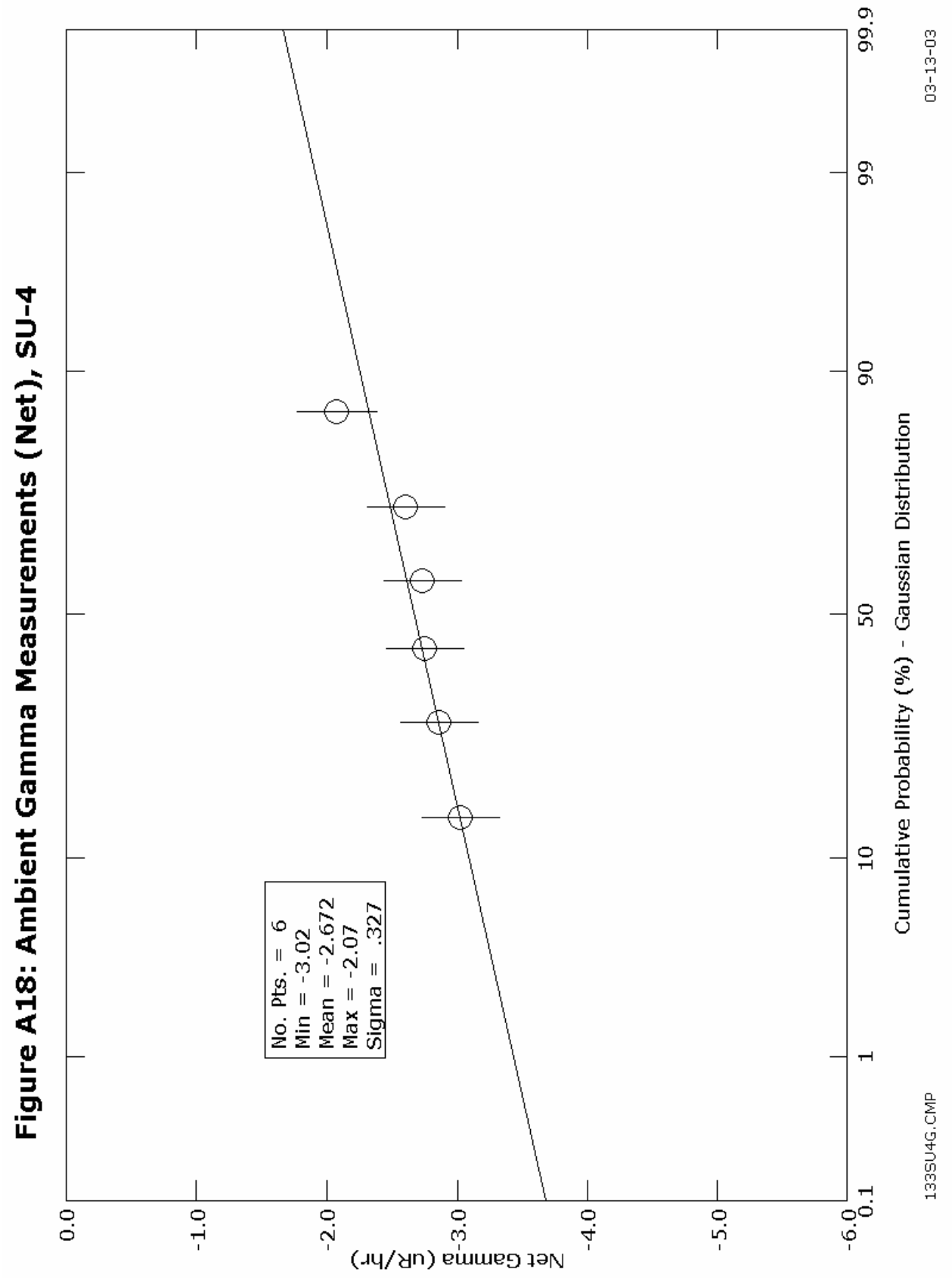


Figure A18: Ambient Gamma Measurements (Net), SU-4
No. Pts. = 6
Min = -3.02
Mean = -2.672
Max = -2.07
Sigma = .327
Net Gamma (uR/hr)
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
0.1
1
10
50
90
99
99.9
Cumulative Probability (%) - Gaussian Distribution
03-13-03
133SU4G.CMP

TABLE A4: BUILDING / AREA 4133
SURVEY UNIT 4

		1 MIN	1 MIN	1 MIN	1 MIN	1 MIN	ALPHA					BETA					GAMMA	
SAMPLE	SAMPLE	ALPHA		BETA		GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NO.	TOTAL	REM	TOTAL	REM	TOTAL	BKGD	EFACT	AFACT	BKGD	EFACT	BKGD	EFACT	AFACT	BKGD	EFACT	BKGD	EFACT
Offices	OR-1	1	1	92	3	1809	2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32	2400	215
Offices	OR-2	1	1	90	0	1751	2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32	2400	215
Offices	OR-3	2	0	75	1	1785	2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32	2400	215
Offices	OR-4	0	1	68	1	1840	2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32	2400	215
Offices	OR-5	1	0	77	7	1814	2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32	2400	215
Offices	OR-6	3	0	67	4	1955	2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32	2400	215
Offices	OR-7	1	1	56	3		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR-8	1	0	38	3		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR-9	1	0	42	2		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR10	3	0	45	4		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR-11	2	0	40	4		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR-12	2	0	54	0		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR-13	4	0	41	4		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR-14	2	0	53	5		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Offices	OR-15	1	0	50	0		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Rest Room	OR-16	4	0	52	3		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Rest Room	OR-17	1	0	48	1		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Rest Room	OR-18	1	1	55	2		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Rest Room	OR-19	2	0	48	3		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		
Rest Room	OR-20	1	2	51	1		2	3.2	1.4	0.3	0.33	51	6.3	5	1.3	0.32		

TABLE A4: BUILDING / AREA 4133
SURVEY UNIT 4

SAMPLE NAME	SAMPLE NO.	ALPHA (DPM/100CM2)				BETA (DPM/100CM2)				GAMMA (uR/hr)	
		TOTAL	STD DEV	REM	STD DEV	TOTAL	STD DEV	REM	STD DEV	TOTAL	STD DEV
Offices	OR-1	-4.48	7.76	2.12	3.46	1291.5	376.69	5.31	0.66	-2.75	0.30
Offices	OR-2	-4.48	7.76	2.12	3.46	1228.5	374.04	-4.06	0.36	-3.02	0.30
Offices	OR-3	0.00	8.96	-0.91	1.66	756.0	353.59	-0.94	0.49	-2.86	0.30
Offices	OR-4	-8.96	6.34	2.12	3.46	535.5	343.62	-0.94	0.49	-2.60	0.30
Offices	OR-5	-4.48	7.76	-0.91	1.66	819.0	356.38	17.81	0.92	-2.73	0.30
Offices	OR-6	4.48	10.02	-0.91	1.66	504.0	342.18	8.44	0.74	-2.07	0.31
Offices	OR-7	-4.48	7.76	2.12	3.46	157.5	325.84	5.31	0.66		
Offices	OR-8	-4.48	7.76	-0.91	1.66	-409.5	297.17	5.31	0.66		
Offices	OR-9	-4.48	7.76	-0.91	1.66	-283.5	303.77	2.19	0.58		
Offices	OR10	4.48	10.02	-0.91	1.66	-189.0	308.64	8.44	0.74		
Offices	OR-11	0.00	8.96	-0.91	1.66	-346.5	300.49	8.44	0.74		
Offices	OR-12	0.00	8.96	-0.91	1.66	94.5	322.78	-4.06	0.36		
Offices	OR-13	8.96	10.97	-0.91	1.66	-315.0	302.14	8.44	0.74		
Offices	OR-14	0.00	8.96	-0.91	1.66	63.0	321.24	11.56	0.80		
Offices	OR-15	-4.48	7.76	-0.91	1.66	-31.5	316.57	-4.06	0.36		
Rest Room	OR-16	8.96	10.97	-0.91	1.66	31.5	319.69	5.31	0.66		
Rest Room	OR-17	-4.48	7.76	-0.91	1.66	-94.5	313.42	-0.94	0.49		
Rest Room	OR-18	-4.48	7.76	2.12	3.46	126.0	324.31	2.19	0.58		
Rest Room	OR-19	0.00	8.96	-0.91	1.66	-94.5	313.42	5.31	0.66		
Rest Room	OR-20	-4.48	7.76	5.15	4.60	0.0	318.13	-0.94	0.49		

Figure A-19: Ambient Gamma Readings (Gross), SU 5

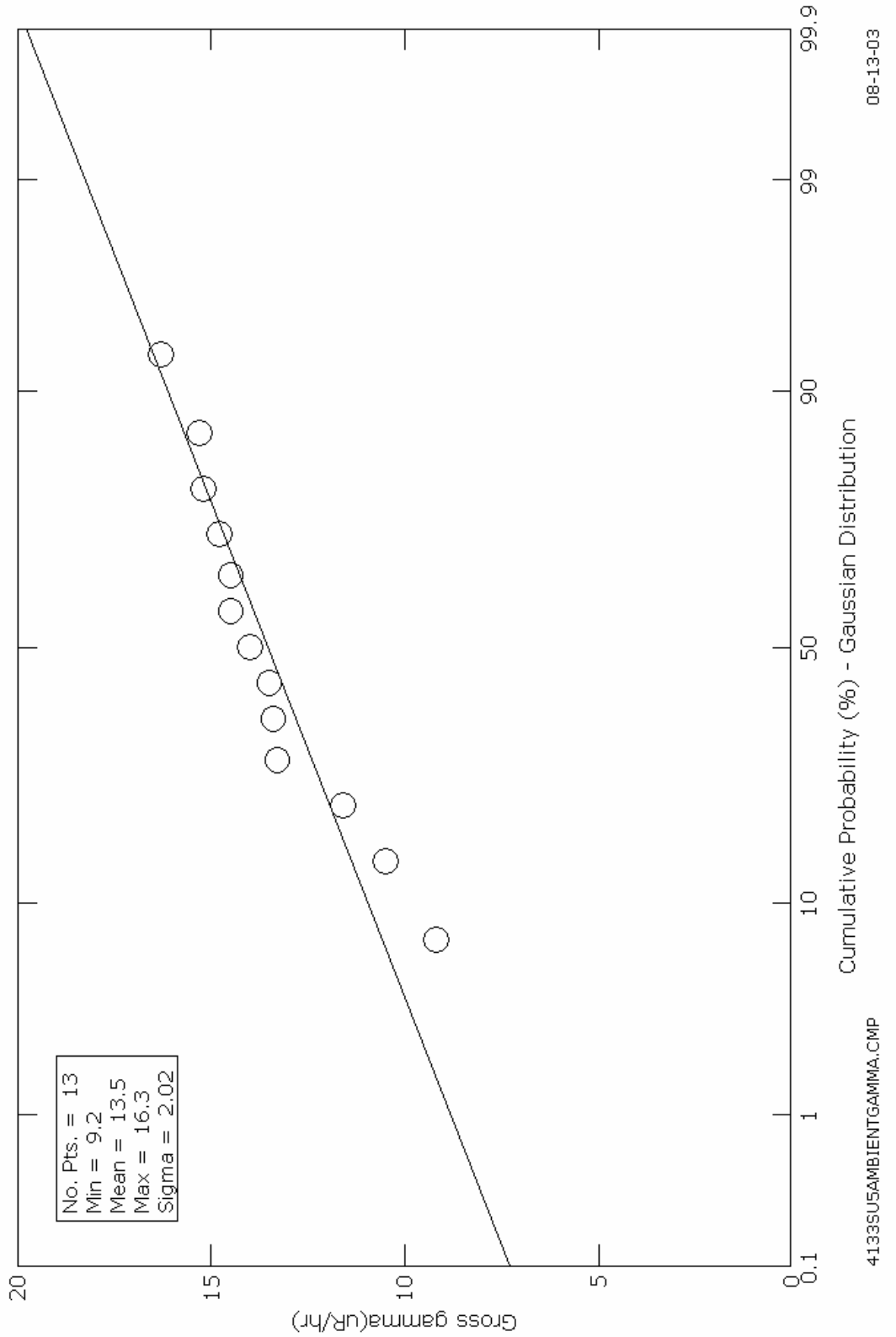


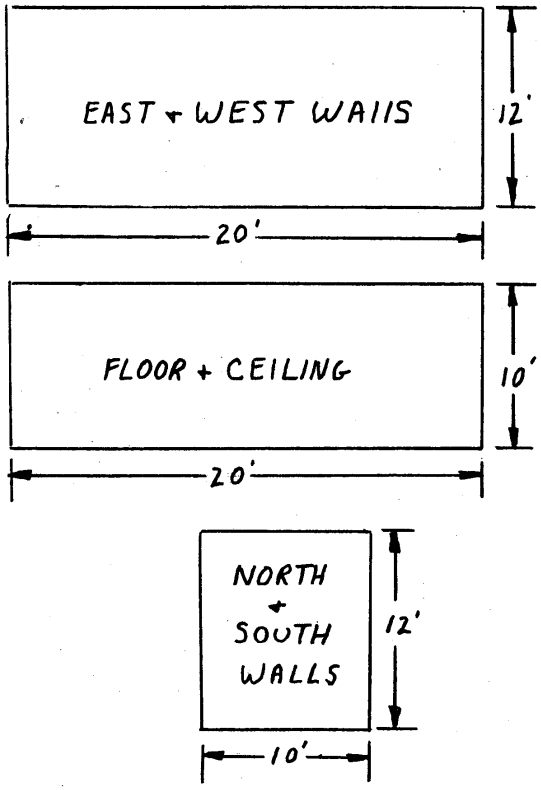
Table A5: Building 4133 Yard Ambient Gamma Results

Grid	Location	Date	γ cpm (Gross)	µR/hr (Gross)
S-19	N150E125	9/27/1999	3124	14.5
S-19	N150E150	9/27/1999	3260	15.2
S-19	N150E100	9/1/1999	3299	15.3
S-19	N175E100	9/1/1999	3184	14.8
S-19	N175E125	9/1/1999	2908	13.5
S-19	N175E150	9/1/1999	3002	14.0
T-19	N0E100	9/1/1999	3127	14.5
T-19	N0E125	9/1/1999	1975	9.2
T-19	N0E150	9/1/1999	2870	13.3
T-19	N25E100	9/1/1999	2492	11.6
T-19	N25E125	9/1/1999	2265	10.5
T-19	N25E150	9/1/1999	2885	13.4
T-19	N48E120	9/27/1999	3495	16.3

APPENDIX B

Maps

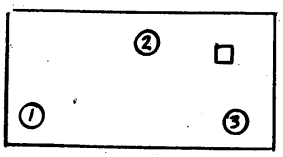
B4133 SURVEY
Treatment Room
Diagram Of Areas Surveyed
Class 2, Survey Unit - 1



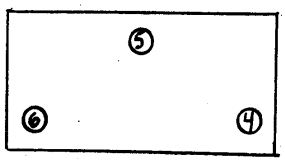
Techn.: K.Darcy _____ **Date:** 8/16/99

Reviewed By: _____ **Date:** 10/13/99

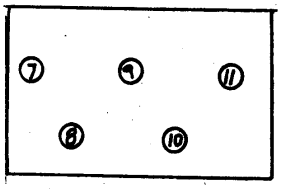
B4133 SURVEY
Treatment Room
Location Of Smears and Sample Points
Class 2, Survey Unit - 1



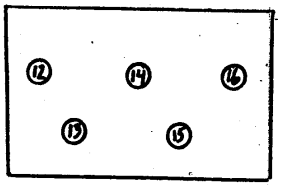
FLOOR



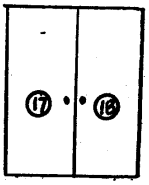
CEILING



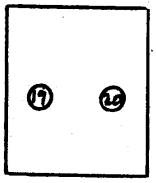
WEST WALL



EAST WALL



SOUTH WALL



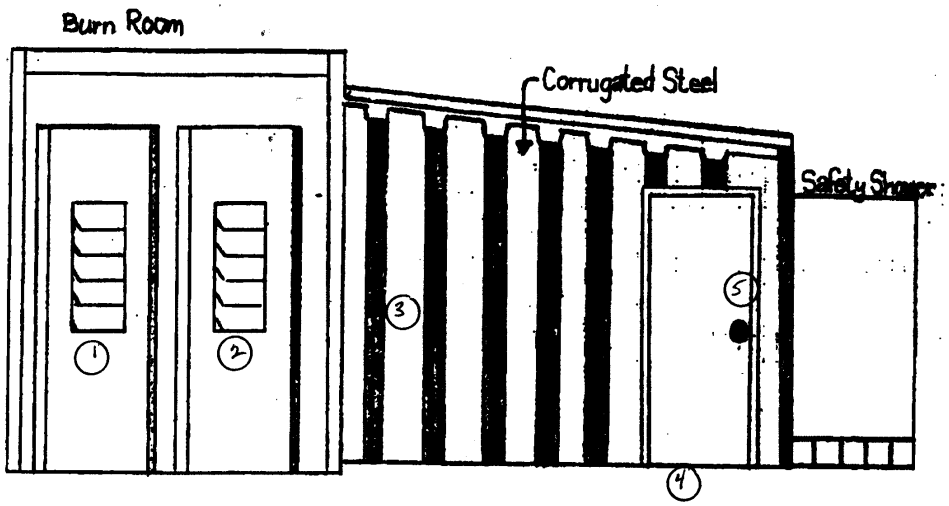
NORTH WALL

Techn.: K.Darcy K Darcy Date: 9/17/99

Reviewed By: Rue Ruck Date: 10/13/99

B4133 MARSSIM FINAL SURVEY
Building Outside Surfaces
Diagram Of Areas Surveyed
Class 2, Survey Unit - 2

SOUTH END



Techn.: Richard Arechiga — Date: 9/24/99

Techn.: NA — Date: NA

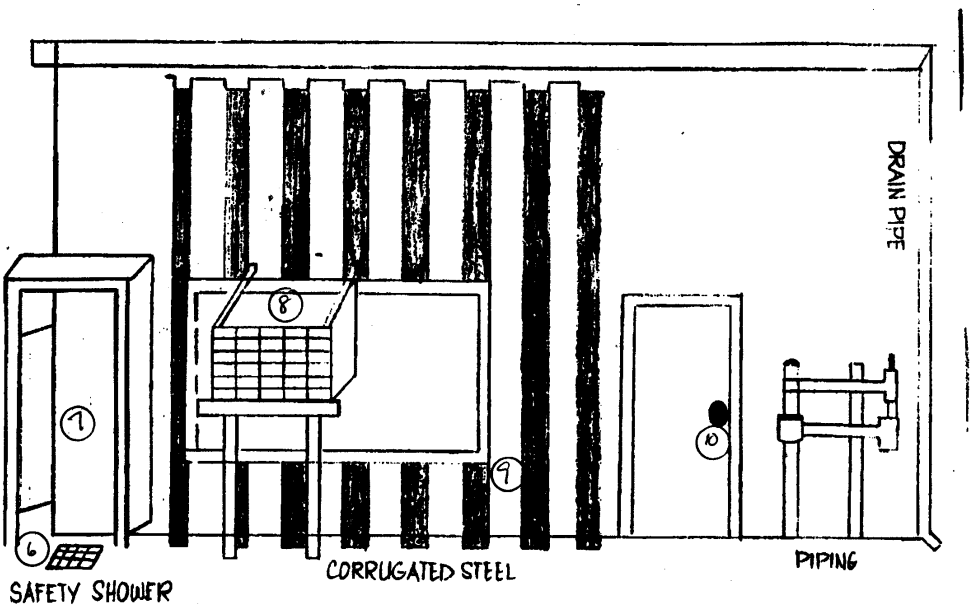
Reviewed By: Phil Luetz — Date: 10/13/99

Instru. Model / ID: Ludlum3/EXO54115 — Cal. Due Date: 11/11/99

Instru. Model / ID: Tennelec / 842489 — Cal. Due Date: Daily

○ Smear locations

B4133 AREA IV SURVEY
Building Outside Surfaces
Diagram Of Areas Surveyed
Class 2, Survey Unit - 2
East



Techn.: Richard Deschamps **Date:** 9/24/99

Reviewed By: Phil Curtis **Date:** 10/13/99

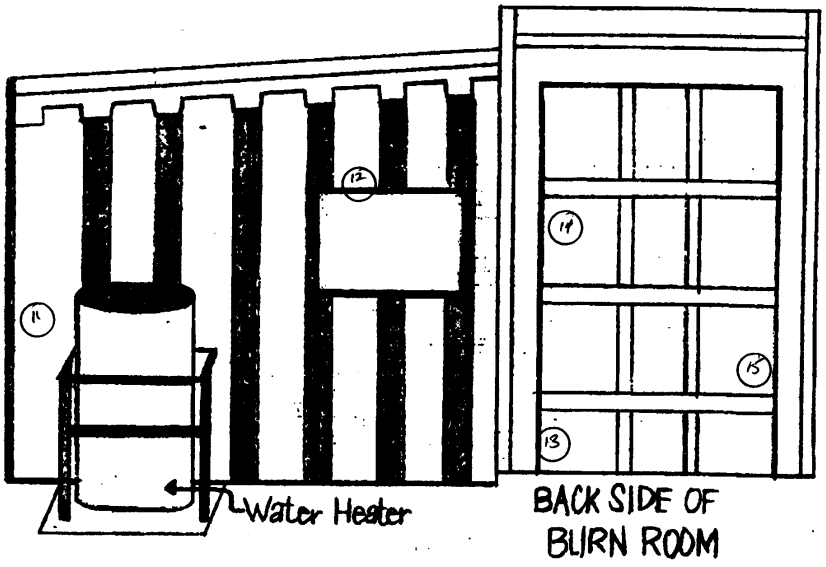
Instru. Model / ID: Ludlum 3 / 6X054115 **Cal. Due Date:** 11/11/99

Instru. Model / ID: Tennelec / 142489 **Cal. Due Date:** Daily

○ Smear locations

B4133 MARSSIM FINAL SURVEY
Building Outside Surfaces
Diagram Of Areas Surveyed
Class 2, Survey Unit - 2

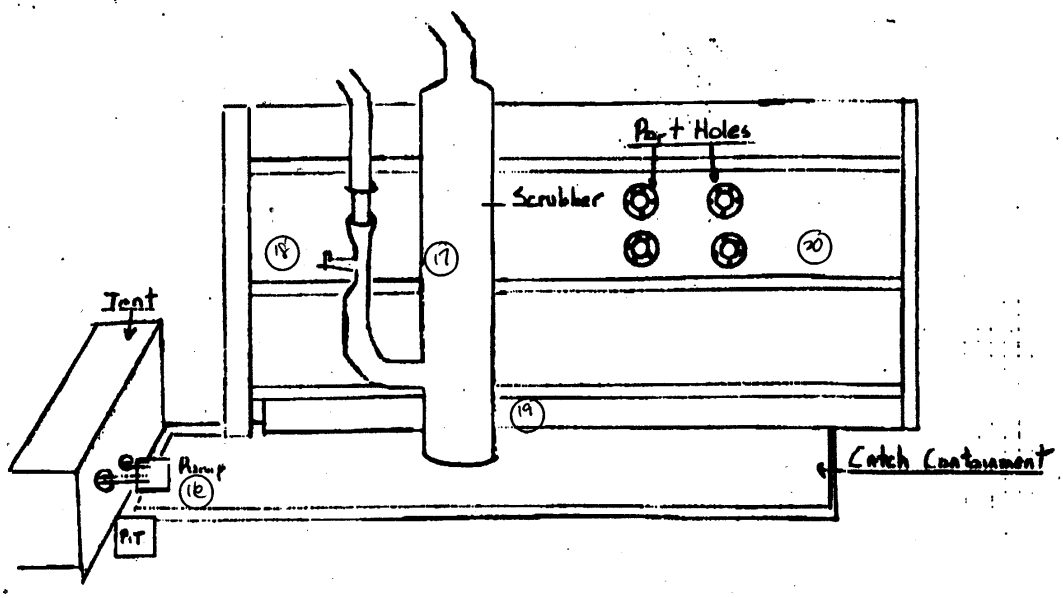
NORTH END



Techn.: Richard Sechamp — Date: 9/24/99
Reviewed By: Phil Rutter — Date: 10/13/99
Instru. Model / ID: Ludlum 3 / EX054115 — Cal. Due Date: 11/11/99
Instru. Model / ID: Tennelec / 842489 — Cal. Due Date: Daily

○ Smear locations

B4133 AREA IV SURVEY
Building Outside Surfaces
Diagram Of Areas Surveyed
Class 2, Survey Unit - 2
West



Techn.: Richard Sanchez Date: 9/24/99

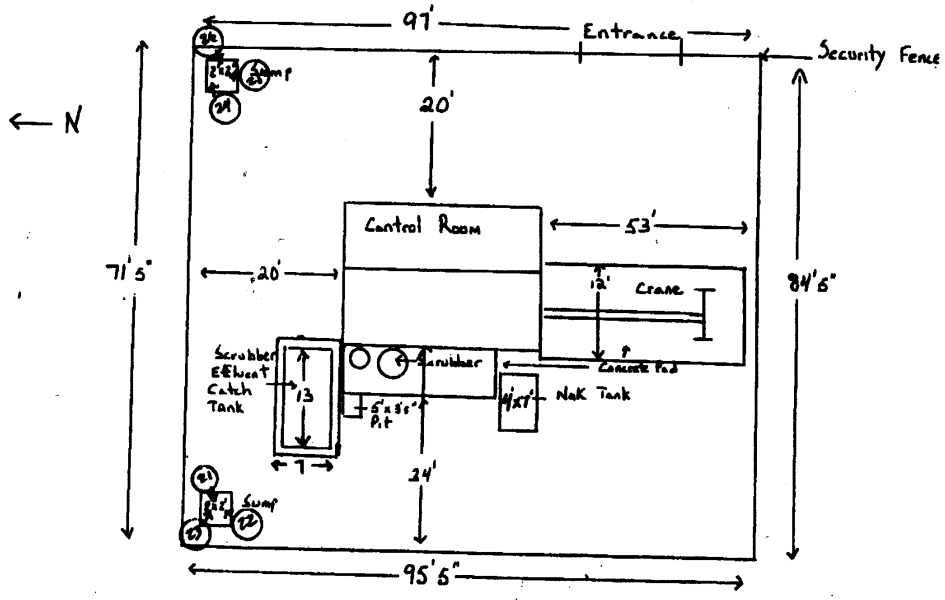
Reviewed By: [signature] Date: 10/13/99

Instru. Model / ID: Ludlum 3 / 6X054115 Cal. Due Date: 11/11/99

Instru. Model / ID: Tennelec / 842489 Cal. Due Date: Daily

○ Smear Locations

B4133 AREA IV SURVEY
Building Outside Surfaces
Diagram Of Areas Surveyed



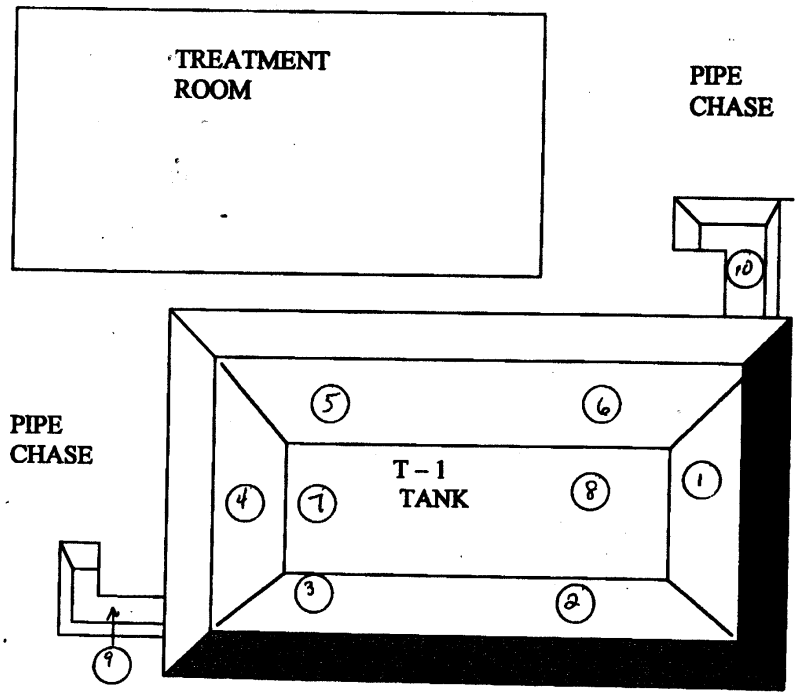
Techn.: R. Deschamps R. Deschamps **Date:** 10/21/99

Reviewed By: [signature] **Date:** 10/25/99

Instru. Model / ID: Ludlum 2221 / 6X053927 **Cal. Due Date:** 12/14/99

Instru. Model / ID: Ludlum 2221 / 6X053928 **Cal. Due Date:** 12/14/99

B4133 AREA IV SURVEY
Building Outside Surfaces
Diagram Of Areas Surveyed



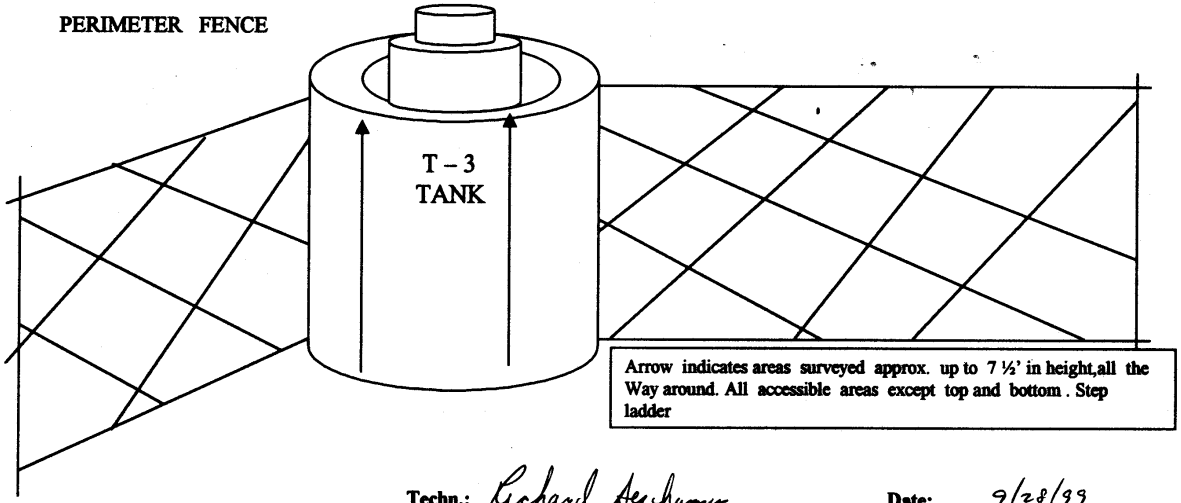
Techn.: R. Deschamps R. Deschamps Date: 10/21/99

Reviewed By: Date: 10/25/99

Instru. Model / ID: LuJlum 2221 / 6X053927 Cal. Due Date: 12/14/99

Instru. Model / ID: LuJlum 2221 / 6X053928 B Cal. Due Date: 12/14/99

B4133 AREA IV SURVEY
Building Outside Surfaces



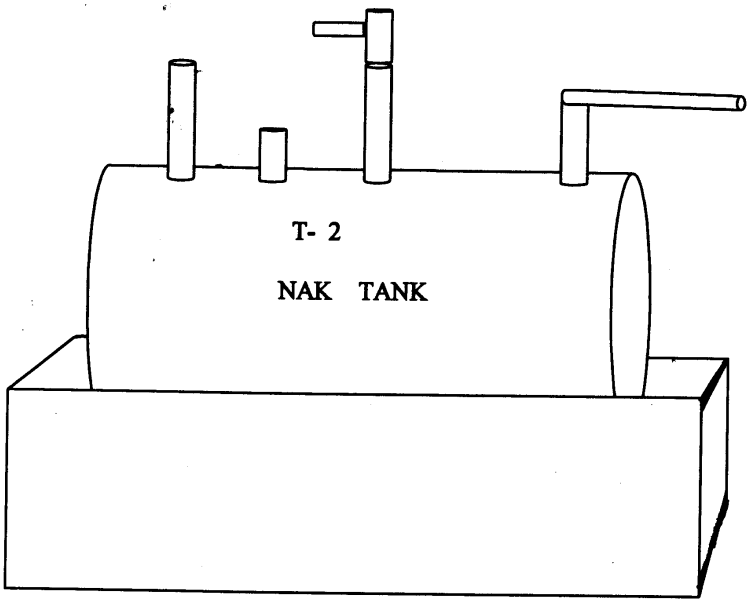
Techn.: Richard Hershberger **Date:** 9/28/99

Reviewed By: Phil Ludlum **Date:** 10/13/99

Instru. Model / ID: Ludlum 3/GM054115 **Cal. Due Date:** 11/11/99

Instru. Model / ID: NA **Cal. Due Date:** NA

B4133 AREA IV SURVEY
Building Outside Surfaces
Diagram Of Areas Surveyed

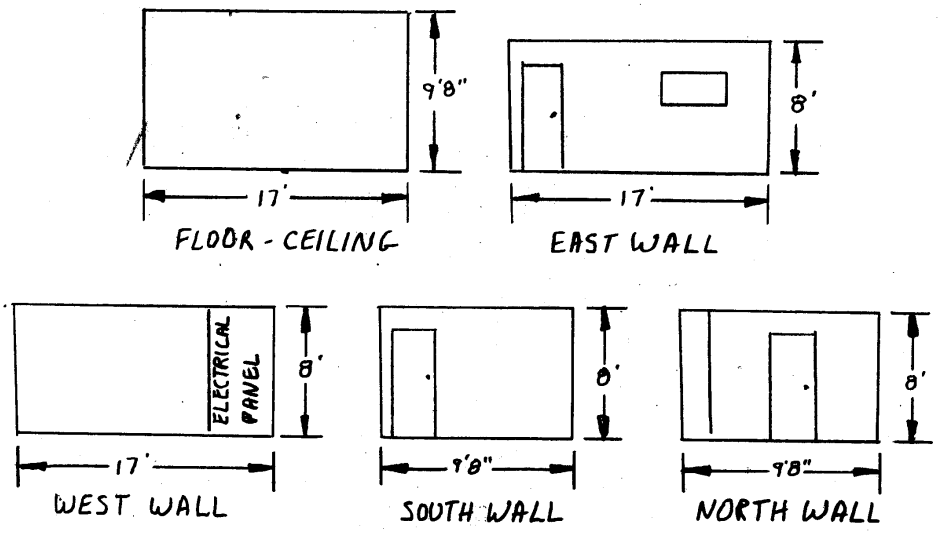


Techn.: Richard Deschaine **Date:** 9/21/99

Reviewed By: Phil Hutton **Date:** 10/18/99

Instru. Model / ID: Ludlum 3 / EXO54115 **Cal. Due Date:** 11/11/99

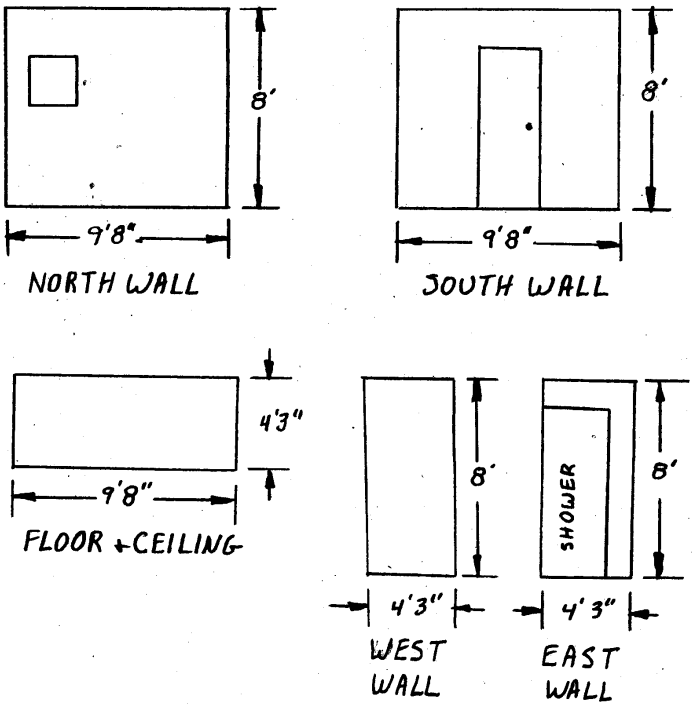
B4133 SURVEY
Office Survey
Diagram Of Areas Surveyed
Class 2, Survey Unit - 4



Techn.: K.Darcy J. Darcy **Date:** 8/16/99

Reviewed By: [signature] **Date:** 10/13/99

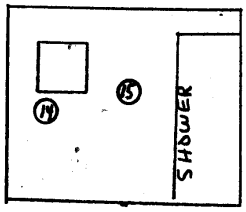
B4133 SURVEY
Restroom Survey
Diagram Of Areas Surveyed
Class 2, Survey Unit - 4



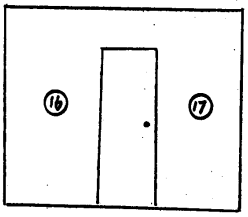
Techn.: K.Darcy K Darcy **Date:** 8/16/99

Reviewed By: Paul Russo **Date:** 10/13/99

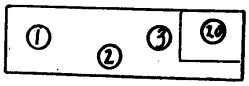
B4133 SURVEY
Restroom Survey
Location Of Smears and Sample Points
Class 2, Survey Unit - 4



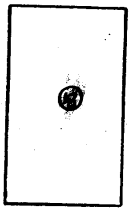
NORTH WALL



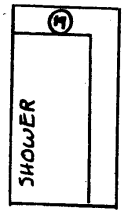
SOUTH WALL



FLOOR



WEST WALL

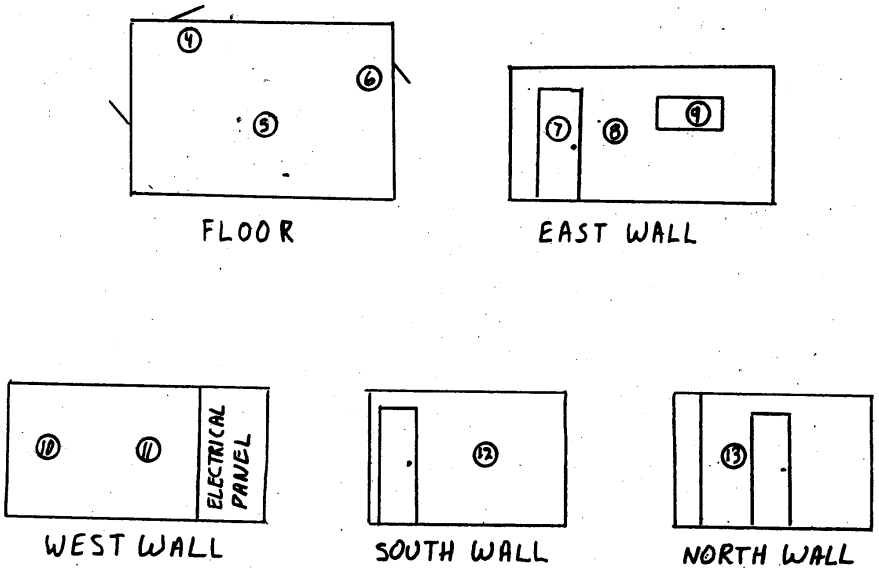


EAST WALL

Techn.: K.Darcy K Darcy Date: 9/17/99

Reviewed By: [signature] Date: 10/12/99

B4133 SURVEY
Office Survey
Location Of Smears and Sample Points.
Class 2, Survey Unit - 4

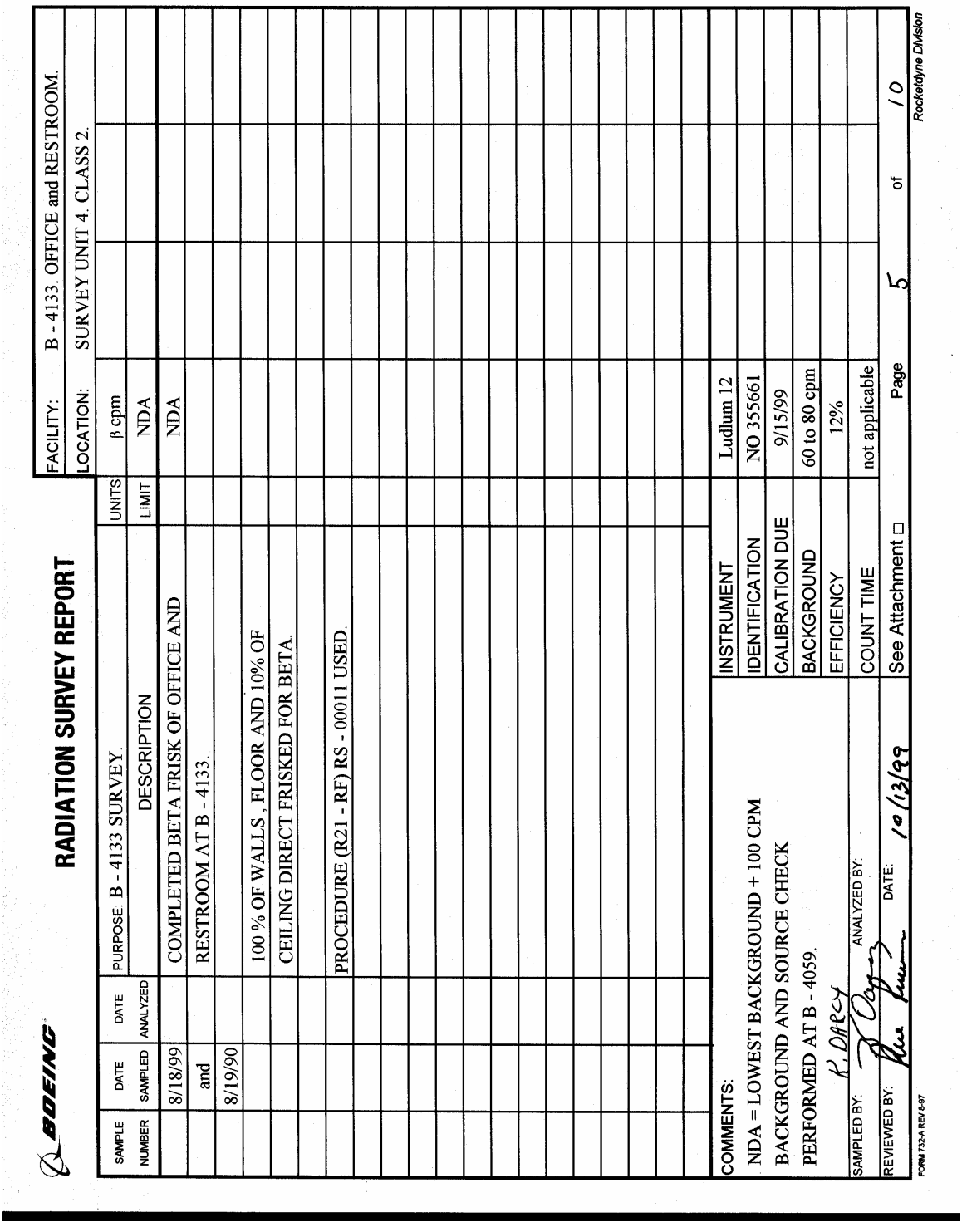


Techn.: K.Darcy _____ **Date:** 9/17/99

Reviewed By: _____ **Date:** 10/13/99

APPENDIX C

Field Survey Report Examples



BOEING

RADIATION SURVEY REPORT

FACILITY: B - 4133. OFFICE and RESTROOM.

LOCATION: SURVEY UNIT 4. CLASS 2.

SAMPLE NUMBER	DATE SAMPLED	DATE ANALYZED	PURPOSE: B - 4133 SURVEY. DESCRIPTION	UNITS LIMIT	β cpm NDA		
	8/18/99		COMPLETED BETA FRISK OF OFFICE AND		NDA		
	and		RESTROOM AT B - 4133.				
	8/19/90						
			100 % OF WALLS , FLOOR AND 10% OF				
			CEILING DIRECT FRISKED FOR BETA.				
			PROCEDURE (R21 - RF) RS - 00011 USED.				

COMMENTS:

NDA = LOWEST BACKGROUND + 100 CPM

BACKGROUND AND SOURCE CHECK

PERFORMED AT B - 4059.

R. DiRey

INSTRUMENT	Ludlum 12
IDENTIFICATION	NO 355661
CALIBRATION DUE	9/15/99
BACKGROUND	60 to 80 cpm
EFFICIENCY	12%
COUNT TIME	not applicable

SAMPLED BY: ANALYZED BY:

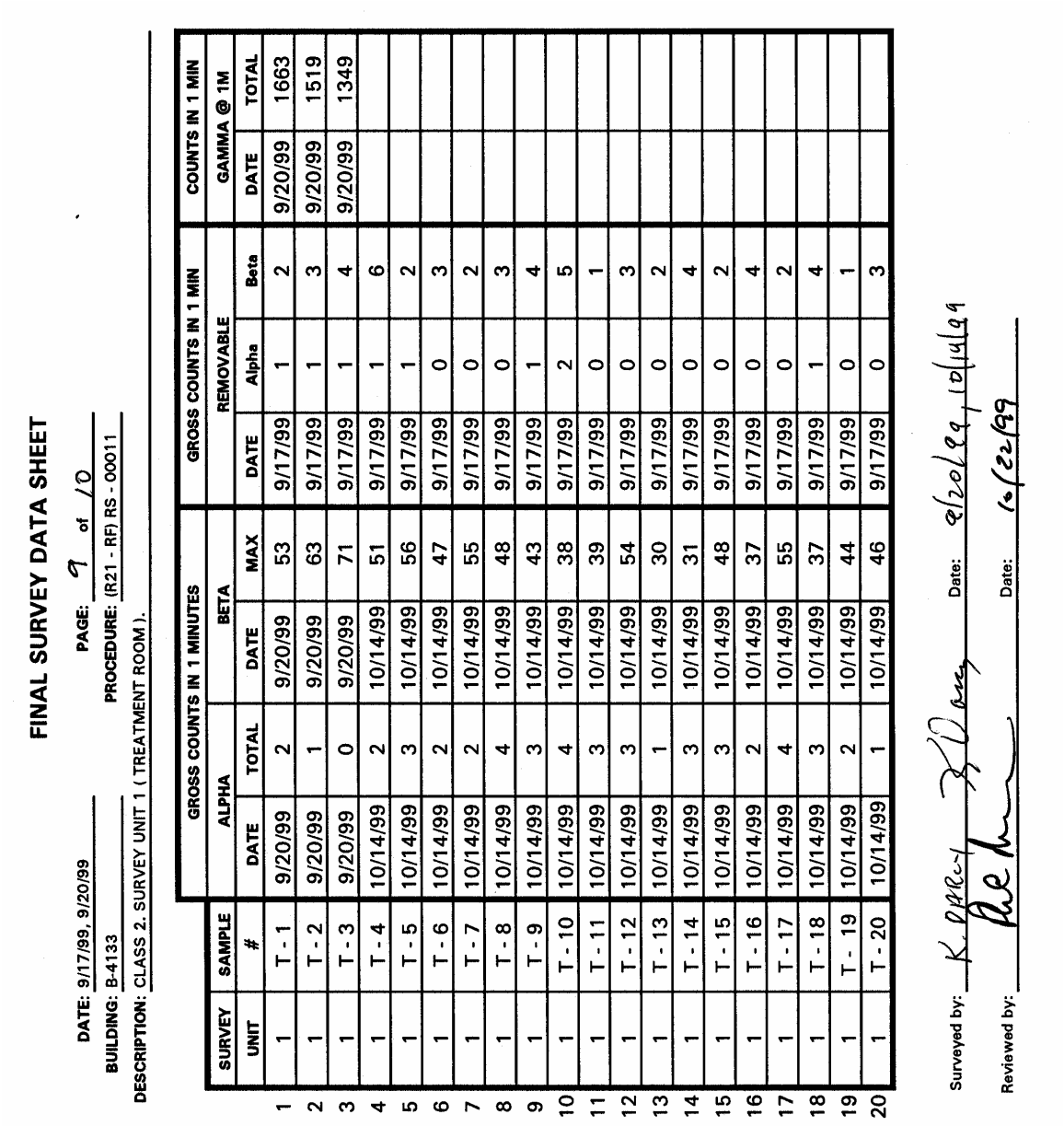
REVIEWED BY: DATE: 10/13/99

See Attachment □ Page 5 of 10

FORM 732-A REV 8-97

Rocketdyne Division

Figure C1: Form 732-A, "Radiation Survey Report" Example



FINAL SURVEY DATA SHEET

DATE: 9/17/99, 9/20/99 PAGE: 9 of 10

BUILDING: B-4133 PROCEDURE: (R21 - RF) RS - 00011

DESCRIPTION: CLASS 2. SURVEY UNIT 1 (TREATMENT ROOM).

	SURVEY	SAMPLE	GROSS COUNTS IN 1 MINUTES				GROSS COUNTS IN 1 MIN			COUNTS IN 1 MIN	
			ALPHA		BETA		REMOVABLE			GAMMA @ 1M	
	UNIT	#	DATE	TOTAL	DATE	MAX	DATE	Alpha	Beta	DATE	TOTAL
1	1	T - 1	9/20/99	2	9/20/99	53	9/17/99	1	2	9/20/99	1663
2	1	T - 2	9/20/99	1	9/20/99	63	9/17/99	1	3	9/20/99	1519
3	1	T - 3	9/20/99	0	9/20/99	71	9/17/99	1	4	9/20/99	1349
4	1	T - 4	10/14/99	2	10/14/99	51	9/17/99	1	6		
5	1	T - 5	10/14/99	3	10/14/99	56	9/17/99	1	2		
6	1	T - 6	10/14/99	2	10/14/99	47	9/17/99	0	3		
7	1	T - 7	10/14/99	2	10/14/99	55	9/17/99	0	2		
8	1	T - 8	10/14/99	4	10/14/99	48	9/17/99	0	3		
9	1	T - 9	10/14/99	3	10/14/99	43	9/17/99	1	4		
10	1	T - 10	10/14/99	4	10/14/99	38	9/17/99	2	5		
11	1	T - 11	10/14/99	3	10/14/99	39	9/17/99	0	1		
12	1	T - 12	10/14/99	3	10/14/99	54	9/17/99	0	3		
13	1	T - 13	10/14/99	1	10/14/99	30	9/17/99	0	2		
14	1	T - 14	10/14/99	3	10/14/99	31	9/17/99	0	4		
15	1	T - 15	10/14/99	3	10/14/99	48	9/17/99	0	2		
16	1	T - 16	10/14/99	2	10/14/99	37	9/17/99	0	4		
17	1	T - 17	10/14/99	4	10/14/99	55	9/17/99	0	2		
18	1	T - 18	10/14/99	3	10/14/99	37	9/17/99	1	4		
19	1	T - 19	10/14/99	2	10/14/99	44	9/17/99	0	1		
20	1	T - 20	10/14/99	1	10/14/99	46	9/17/99	0	3		

Surveyed by: K. Parry Date: 9/20/99, 10/14/99

Reviewed by: Date: 10/22/99

Figure C2: Final Survey Data Sheet Example

Building B/4133
Survey Unit 5B, Class II

WALKABOUT SURVEY TRANSIT RECORD

Page 3 of 14

SURVEY BLOCK/SW CORNER POST ID: S - 19

Procedure: (R21-RF) RS-00011

TRANSIT ID		TRANSIT PASS DATA			METER OBSERVATION			HOT SPOT			
DIST. FROM SOUTH In Feet	EAST-WEST DIST. In Feet	START TIME	END TIME	DATE	MAX GAMMA	MIN GAMMA	AVG GAMMA	FINDS? FLAG#	INSTRUMENT/ LOCATION NOTES	HP INIT'L	QA&T INIT'L
50 to 55	0 to 25	1008	1012	9/8/99	4700	4400	4500		γ - 1	RD	PDR
50 to 55	25 to 65	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
50 to 55	65 to 190	1015	1027	9/8/99	4600	3600	4200		γ - 1	RD	
50 to 55	190 to 200	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
55 to 60	0 to 25	1008	1012	9/8/99	4700	4100	4300		γ - 1A	RD	
55 to 60	25 to 75	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
55 to 60	75 to 95	1015	1027	9/8/99	4500	3700	3900		γ - 1A	RD	
55 to 60	95 to 200	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
60 to 65	0 to 20	1035	1039	9/8/99	4400	4000	4200		γ - 1	RD	
60 to 65	20 to 100	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
60 to 65	100 to 200	1040	1049	9/8/99	4400	3600	4100		γ - 1	RD	
65 to 70	0 to 10	1035	1039	9/8/99	4600	4200	4300		γ - 1A	RD	
65 to 70	10 to 110	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
65 to 70	110 to 200	1040	1049	9/8/99	4300	3700	3900		γ - 1A	RD	
70 to 75	0 to 5	1045	1049	9/8/99	3800	3600	3700		γ - 1	RD	
70 to 75	5 to 125	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
70 to 75	125 to 200	1052	1102	9/8/99	4100	3300	3800		γ - 1	RD	
75 to 80	0 to 15	1105	1108	9/8/99	4000	3700	3900		γ - 1	RD	
75 to 80	15 to 125	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
75 to 80	125 to 200	1114	1129	9/8/99	4500	2900	3800		γ - 1	RD	
80 to 85	0 to 50	1209	1215	9/8/99	4300	3900	4000		γ - 1	RD	
80 to 85	50 to 60	NA	NA	9/8/99	NA	NA	NA		Pile of tree cuttings.		
80 to 85	60 to 80	1219	1225	9/8/99	4300	3900	4000		γ - 1	RD	
80 to 85	80 to 125	NA	NA	9/8/99	NA	NA	NA		Area not accessible. Refer to maps.		
80 to 85	125 to 200	1227	1237	9/8/99	4100	3700	4000		γ - 1	RD	PDR

HP: Richard Deschamps (INIT'L): RD DATE: 09/8/99

RND

HP: Beverly Hill (INIT'L): BAH DATE: 09/8/99

BAH

QA&T: (INIT'L): PDR DATE: 10/13/99

SSFL, AREA IV
RADIOLOGICAL
CHARACTERIZATION

Figure C3: Walkabout Survey Transit Record

B/4133
AMBIENT SURVEY

Date: September 1, 1999.
Location: Inside Fenced Compound
Starting Point S-19, 150 ft. North, 100 ft East

Survey Unit: 5A
Class: II

Procedure: (R21-RF) RS-00011

IN FEET		Gamma 1 in cpm		IN FEET		Gamma 1 in cpm	
S-19		AMBIENT READING		T-19		AMBIENT READING	
North	East	Date	1 Meter	North	East	Date	1 Meter
150	100	9/1/99	3299	0	100	9/1/99	3127
175	100	9/1/99	3184	0	125	9/1/99	1975
175	125	9/1/99	2908	0	150	9/1/99	2870
175	150	9/1/99	3002	25	100	9/1/99	2492
200	100	9/1/99	3127	25	125	9/1/99	2265
200	125	9/1/99	1975	25	150	9/1/99	2885
200	150	9/1/99	2870				

Note: Approximate sample locations listed.

Surveyed By: Richard N. Deschamps — Date: 9/1/99

Surveyed By: Beverly A. Hill — Date: 9/1/99

Reviewed By: — Date: 6/13/99

Figure C4: Ambient Survey Data Sheet