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VIA EXPRESS DELIVERY SERVICE

Ms. Mary Adams
Licensing Section 1/Licensing Branch
Division of Fuel Cycle Safety
and Safeguards, NMSS
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Docket No. 70-734; SNM-696: Request to Release "TRIGA® Trailer Land Area" to Unrestricted Use and Delete it from GA's License
and

Ms. Sudana Kwok (in Duplicate)
State of California
Department of Health Services
Radiologic Health Branch Mail Stop 178
601 North 7th Street
Sacramento, CA 95814-0208

Subject: Radioactive Materials License No. 0145-37; Request to Release "TRIGA® Trailer Land Area" to Unrestricted Use and Delete it from GA's License

Dear Ms. Adams and Ms. Kwok:

As you are aware, General Atomics (GA) is continuing its efforts to decommission and decontaminate, as appropriate, selected facilities and land areas on its site in support of obtaining their release to unrestricted use. GA recently completed its final radiological surveys of a land area referred to as the "TRIGA® Trailer Land Area." This relatively small land area (~ 3,034 ft²) is situated on GA's Main Site and is located just southwest of the former Hot Cell Site and southeast of the site of GA's TRIGA® Reactors facility.

The TRIGA® Trailer land area is bounded on the north by the TRIGA® Reactors Facility site and on the east, south and west by a previously defined land area referred to as the TRIGA® Fuel-Fabrication Facility Utility Corridor (a.k.a. TFF Utility Corridor). The TRIGA® Trailer land area was excluded from the earlier TFF Utility Corridor release request because at the time of that request, this small land area was occupied by a Decommissioning Project Trailer. That trailer was first used in support of the Hot Cell site decommissioning project and then in support of TRIGA® Reactors facility decommissioning activities. The trailer has since been relocated so as to make the "TRIGA® Trailer land area"

available for survey and release. This land area is nearly entirely paved with asphalt or concrete; there are no sewer systems within its boundaries.

GA hereby requests both the U.S. Nuclear Regulatory Commission (NRC) and the State of California Department of Health Services' Radiologic Health Branch (State) to release the TRIGA® Trailer Land Area, as described in the enclosed final survey report, to unrestricted use and to delete it from GA's NRC and State radioactive material licenses, respectively.

In support of this request, enclosed is GA's report titled "General Atomics' Final Radiological Survey Report For TRIGA® Trailer Land Area," dated September 2002. This report documents the results of GA's radiological measurements, surveys, and soil sampling and analyses which demonstrate that this land area meets the State- and NRC- approved criteria for release to unrestricted use.

The TRIGA® Trailer land area borders on, and was used to support decommissioning activities for, land areas for which the NRC has, or had, the lead role in coordinating the release requests, e.g., the TRIGA® Reactors Facility site and the Hot Cell site. It is, therefore, GA's understanding that the NRC is the lead agency for coordinating this release request, including conducting regulatory agency confirmatory surveys, as are deemed appropriate; the results of which will be made available to the State.

If you should have any questions regarding this request or the enclosed report, please contact Ms. Laura Q. Gonzales at (858) 455-2758, or me at (858) 455-2823. Your assistance in responding to this request is very much appreciated.

Very truly yours,



Keith E. Asmussen, Ph.D., Director
Licensing, Safety and Nuclear Compliance

Enclosure: GA report titled: "General Atomics' Final Radiological Survey Report For TRIGA® Trailer Land Area," dated September 2002.

cc: Dr. D. Blair Spitzberg, Chief, NMSS Branch 3, Region IV
Mr. Wayne L. Britz, Fuel Cycle Inspector, NRC Region IV
Ms. Kathleen Henner, State of CA, Brea, CA
Dr. Mina Goeders, State of CA, Sacramento

GENERAL ATOMICS'

FINAL RADIOLOGICAL SURVEY REPORT

For

TRIGA® Trailer Land Area

Prepared By: William LaBonte, Joseph Sullivan and Laura Gonzales

September 2002

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Introduction

General Atomics (GA) is continuing its efforts directed at decontaminating, as appropriate, and obtaining the release to unrestricted use of selected facilities and land areas at General Atomics. GA has recently completed the Final Radiological Survey of the TRIGA® Trailer Land Area located on GA's Main Site. The TRIGA® Trailer Land Area is a small parcel of land that was excluded from the TRIGA® Fuel Fabrication Facility Utility Corridor (aka TFF Utility Corridor) release request, dated February 23, 2001, because it was occupied by the TRIGA® Administration trailer at that time. The total land area to be released to unrestricted use is approximately 3,034 ft² (~28 m²).

GA is requesting both the Nuclear Regulatory Commission (NRC) and the State of California (DOHS/RHB) to release this parcel of land to unrestricted use.

This report documents the results of GA's radiological measurements completed on the TRIGA® Trailer Land Area. The results of these surveys demonstrate that this land area meets the NRC- and State- approved criteria for release to unrestricted use.

Site Description

The TRIGA® Trailer Land Area is located on General Atomics' Main Site; See Figure 1. The location of the TRIGA® Trailer Land Area in relation to other facilities at GA's Main Site and a diagram of the open TRIGA® Trailer Land Area to be released to unrestricted use are shown in Figure 2.

The TRIGA® Trailer Land Area is a small parcel of land that was excluded from the TFF Utility Corridor release request because it was, at that time, occupied by the TRIGA® Decommissioning project administrative trailer.

This land area is nearly entirely paved with asphalt or concrete and there are no sewer systems within it's boundaries.

History of Use

During the Hot Cell Facility Decommissioning project, the administrative trailer for that project was moved to allow final radiological surveying of the entire Hot Cell Site boundary. This trailer was moved to the roadway adjacent to both the Hot Cell Site and the TRIGA® Reactor Facility site. When this trailer was moved to the new location, the Health Physics soil preparation



laboratory, decontamination sink, and personnel decontamination shower (along with supporting holding tank and HEPA exhaust system) were installed in it.

Following the completion of the Hot Cell Facility Decommissioning activities, this trailer was renamed the TRIGA® Administrative Trailer.

In the release request submitted for the TFF Utility Corridor, the portion of land occupied by this trailer and support equipment was excluded from that request.

In June 2002, the Holding tank supporting the decontamination sink and shower was disconnected and moved to the TRIGA® facility. The Health Physics soil preparation laboratory, along with the HEPA exhaust system, was moved to a soil preparation laboratory established within the TRIGA® facility. The trailer was surveyed for radioactive contamination. No radioactivity above background was found either in the trailer or on the land surrounding it. The trailer was released as a piece of clean equipment for re-use on the GA site.

Classification

The only radioactive material stored on the TRIGA® Trailer land area was the activity contained in the waste water holding tank used to support the decontamination facilities inside the trailer. There is no history of radioactive material leaks or spills in this area. Sealed radioactive check sources and soil samples with low levels of radioactive material were processed, used, and/or stored inside of the TRIGA® trailer, but not on the land adjacent to the trailer.

This land area is therefore classified as a **Non-Suspect Affected Area** for final survey purposes.

Criteria for Release to Unrestricted Use

As Low As Reasonably Achievable (ALARA)

During decommissioning efforts, GA always attempts to decontaminate to levels as close to "background" as possible and as far below the approved Soil Release Criteria as reasonably achievable.

Release Criteria for Soils

The primary radionuclides found at other nearby GA facilities, on occasion, are enriched uranium and mixed fission and activation products (mainly Cs-137 and Co-60). The approved release criteria, for the predominant radionuclides found in the soil at GA (above natural background concentrations), as identified in the GA Site Decommissioning Plan, is provided as follows:



| | |
|----------------------------------|----------|
| Enriched Uranium (U-234 + U-235) | 30 pCi/g |
| Thorium (Th-228 + Th-232) | 10 pCi/g |
| Depleted Uranium | 35 pCi/g |
| Cs-137 | 15 pCi/g |
| Cs-134 | 10 pCi/g |
| Co-60 | 8 pCi/g |
| Eu-152 | 11 pCi/g |

If more than one radionuclide exists, the sum of the fractions of the concentrations is calculated as follows:

$$\sum_{i=1}^n \frac{C_i}{L_i} = <1$$

C_i = The average concentration levels of radionuclide i in the sample (above background).

L_i = The release criteria for radionuclide i .

The sum of the fractions must be less than or equal to one (1).

Facilities and Equipment (and Asphalt or Concrete Surfaces)

The U.S. NRC's and the State of California's criteria for releasing facilities and equipment to unrestricted use are shown in Tables 1 and 2, respectively. The applicable guidelines for enriched uranium (and beta/gamma emitters including Cs-137 and Co-60) are as follows:

5,000 dpm/100 cm², averaged over a 1 m² area
15,000 dpm/100 cm², maximum in a 100 cm² area if the average over 1 m² is met
1,000 dpm/100 cm², removable activity

Exposure Rate Guideline

Exposure rates measured at 1 m above the surface are not to exceed 10 µR/hr above natural background levels.



Instrumentation and Background Measurements

A list of instruments used during the radiological surveys is shown in Table 3. The table includes: (1) a description of the instrument, model number and its serial number, (2) a description of the detector (if applicable) and its serial number, (3) instrument ranges, (4) calibration due dates, (5) typical background readings and (6) calibration efficiencies (if applicable). All of the instruments used were calibrated semiannually and after repair, except for exposure rate meters which were calibrated quarterly.

Background Measurements for Instruments/Detectors

Building 13 on GA's main site was used for conducting background measurements with instruments used for the final survey because: (1) there is no history involving the use or storage of radioactive materials in Building 13, and (2) the various surfaces and construction materials found at the TRIGA® Trailer Land Area could also be found within and outside of Building 13. Background information, where appropriate, is included in Table 3.

Minimum detectable activities (MDA's) for instruments used for fixed measurements, for each type of surface (see Table 3), were calculated using equation (5-2) from the NUREG/CR-5849 as shown below:

Equation (5-2)

$$MDA = \frac{2.71 + 4.65\sqrt{B_R \times t}}{t \times E \times \frac{A}{100}} \text{ (dpm/100cm}^2\text{)}$$

Where:

B_R = background rate (cpm)

t = count time (min)

E = efficiency

A = area of the detector (cm^2)

Background Soil Concentrations of Concern

Typical background concentrations measured by gamma spectroscopy in soil near the GA site are provided in Table 4 along with a description of the locations where these samples were taken.



Exposure Rate Background

Typical exposure rate background for GA's site using a Ludlum Model 19 micro R meter is 12-18 $\mu\text{R}/\text{hr}$ measured at 1 m from the surface of soil. This range of exposure rates can be measured south of Building 15 (an office building on the eastern portion of the GA site). Measurements taken offsite in 10 different locations (9 offsite and 1 onsite at a non-impacted area near Building 15) over a period of 15 months also averaged $\sim 15 \mu\text{R}/\text{hr}$ (measured at 1 m from the surface). The range of 12-18 $\mu\text{R}/\text{hr}$ is typical at the GA site for the external dose rates measured at 1 meter from the surface. Background measurements @ 1 m above an asphalt surface are generally higher due to the higher concentrations of naturally occurring radioactive material (NORM). This background fluctuates depending upon the asphalt batch used and the date applied. This background, (measured at 1 m from the surface) ranges from 22-30 $\mu\text{R}/\text{hr}$.

Final Surveys Performed

Objectives and Responsibilities

The objectives of the final survey plans were: (1) to demonstrate that the average surface contamination levels for each survey unit were below the approved release criteria, (2) to show that the maximum residual activity did not exceed three times the approved release criteria for average surface contamination value in an area up to 100 cm^2 , (3) to demonstrate the results of analyses of soil samples were well below GA's approved release criteria for unrestricted use, and, (4) that the exposure rate measurements taken in these areas, measured at 1 meter above the surface, were less than 10 $\mu\text{R}/\text{hr}$ above background.

Survey Plans

A Final Survey Plan was developed based on the previous history of the trailer and the facilities it supported, the history of use for the TRIGA® Trailer Land Area, the radionuclides of concern for this area, the potential for contamination, the various types of surfaces encountered and the classification of the various areas. See Appendix A for the Final Survey Plan for the TRIGA® Trailer Land Area.

Surveys were taken in accordance with an approved survey plan(s) by qualified Health Physics Technicians having a minimum of three years health physics experience.

Every survey taken was documented on a daily basis to a worksheet/drawing showing the approximate locations surveyed/sampled. The documentation included the results of the measurements (including units), the technician's signature, date, instrument(s) used (including the model and serial number of both the ratemeter and detector), calibration due date, % efficiency, background readings (if applicable) and any other pertinent information.



Soil Sampling

Soil samples were collected in approximate locations as indicated on Figure 5. Each of the soil samples taken was approximately 1 kilogram in mass. The samples were properly logged, labeled, tracked and packaged into plastic bags. The sampling locations were documented on a drawing. All debris (i.e., grass, rocks, sticks, asphalt and foreign objects) was removed from each sample. Each soil sample was individually crushed to reduce large lumps, dried, placed into tared marinelli beakers (filled to the top), weighed, sealed and transported to GA's Health Physics Laboratory.

Soil samples were analyzed in GA's Health Physics Laboratory with a Canberra Low Sensitivity Gamma Spectroscopy MCA System using a high purity germanium detector. The system is calibrated using NIST traceable standards and performance checked daily. Soil samples were counted for a minimum of 30 minutes each. A 30 minute count was sufficient to detect the radionuclides of concern at levels below GA's approved soil release criteria.

Survey Summary

Comparisons of the Site Decommissioning Plan requirements with the Final Surveys performed in relation to the percentage of surface area scanned, number of measurements (i.e., number of fixed radiation measurements), exposure rate measurements ($\mu\text{R}/\text{hr}$) and soil samples taken are provided as follows:

| Comparisons of Site Decommissioning Plan Requirements with Final Surveys Performed on the TRIGA® Trailer Land Area | | | | | |
|--|---------------------|---|---|--|---|
| Survey Area** | Gridding Required ? | # of Direct Measurements Fixed α , β , or Wipes on concrete or asphalt | # of Exposure Rate Measurements ($\mu\text{R}/\text{hr}$) | Surface Scans on asphalt or concrete | # of Soil Samples Taken and Analyzed |
| D-Plan* Non-Suspect Affected Area (required) → | No | 1 per 50 m ² or 1 every ~ 7 m. | 1 per 10 m ² or 1 per ~ 3 m Total ≈ 3 | 10% of Surface Areas (asphalt and concrete) | 4 per 10 m x 10 m grid in open land/soil areas |
| Final Surveys Non-Suspect Affected Areas (performed) → | No | Fixed $\alpha = 16$, Fixed $\beta = 15$, Wipes=20, for a total of 51 (~2 per m ²) measurements. | Total=50 readings plus 100% surface scan | 100% of accessible concrete and asphalt surfaces | 3 surface (0-6") samples taken in 2 small open land areas |

* D-Plan = GA Site Decommissioning Plan

** The total surface area to be released is approximately 28 m².



Results of the Final Surveys

The results for the TRIGA® Trailer Land Area Final Surveys are provided in figures and tables as noted below:

Scanning

100% of the surface was scanned for α and β activity with large area (434 cm^2) gas flow proportional detectors held within approximately 1" of the asphalt/concrete surface. The highest α activity measured was less than the background range of 0 to 40 counts per minute (cpm) for the instrument used. See Figure 3 for locations and results. The range of β activity measured was 2400 to 3163 cpm. The background for this instrument was 2900 to 3300 cpm. See Figure 4 for locations and results.

Fixed Measurements (α and β)

Sixteen (16) fixed α and fifteen (15) fixed β measurements were taken. The highest α activity measured was <20 cpm. The highest β activity measured was less than the minimum detectable activity (MDA) for the instrument used (<255 dpm/100cm 2). All of these measurements are not discernable from natural background activity levels. See Figure 5 for survey locations and results.

Removable Activity

Twenty (20) wipe samples were taken. All samples were analyzed for α and β activity. The highest α activity measured was <20 dpm/100 cm 2 , and the highest β activity measured was <20 dpm/100 cm 2 . These results are far below the approved release criteria. See Figure 5 for locations and Table 6 for results.

Soil Samples

A total of three (3) surface (0-6") soil samples were taken. See Figure 5 for locations, and Table 5 for results. The results presented in Table 5 are summarized below:



Final Radiological Survey Report For TRIGA® Trailer Land Area

| | ^{238}U in pCi/g | ^{235}U in pCi/g | ^{137}Cs in pCi/g | ^{228}Th in pCi/g | ^{232}Th in pCi/g | ^{60}Co in pCi/g |
|-----------------|------------------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|
| High | 0.34 ± 1.00 | 0.18 ± 0.08 | 0.07 ± 0.06 | 1.56 ± 0.19 | 1.89 ± 0.36 | ND |
| Low | ND | 0.10 ± 0.05 | 0.04 ± 0.06 | 1.10 ± 0.14 | 1.15 ± 0.25 | ND |
| Average (N = 3) | 1.17 | 0.13 | 0.08 | 1.37 | 1.56 | 0.14 |

Notes:

1. ND means not detected or less than the average minimum detectable activity (MDA) for the geometry and counting times used.
2. Average Minimum Detectable Activities (MDAs):
 $\text{U-238} = 1.58 \text{ pCi/g}$ (63 keV peak)
 $\text{U-235} = 0.15 \text{ pCi/g}$ (186 keV peak)
 $\text{Cs-137} = 0.13 \text{ pCi/g}$ (662 keV peak)
 $\text{Co-60} = 0.14 \text{ pCi/g}$ (average of 1173 + 1332 keV peaks)
 $\text{Th-228} = 0.21 \text{ pCi/g}$ (238 keV peak)
 $\text{Th-232} = 0.43 \text{ pCi/g}$ (911 keV peak)
3. The High concentrations for each isotope did not occur in the same sample. No sample had a sum of fractions greater than 1.0.
4. Background is not subtracted from results See Table 4 for Background soil concentrations.
5. The average MDA was used to determine the average activity when the results were ND.
6. Radioactive material concentrations were not discernable from natural background levels.

Thorium contamination was not present (as determined by process knowledge and gamma spectroscopy analyses of soil samples). All thorium results were at, or near, background levels and well below the release limit of 10 pCi/g.

Uranium (U-238 and U-235) was at, or near, nominal background levels and well below the approved release limits.

Cs-137 was not discernable from natural background activity levels. The highest activity level detected was $0.07 \pm 0.06 \text{ pCi/g}$, which is far below the approved release limit of 15 pCi/g and similar to normal background Cs-137 concentrations.

Co-60 was not detected in any soil sample.

Fixed Exposure Rate Measurements

A total of 50 fixed measurements were taken at 1m from the surface. The highest exposure rate measured was $18 \mu\text{R}/\text{hr}$ at 1m from the surface. See Figures 6 for locations and results. These measurements are at or below the natural background range of $15\text{-}18 \mu\text{R}/\text{hr}$ at GA when the detector is held at 1 m from the surface.



Exposure Rate Scans

100% of the Non-Suspect Affected Area was scanned with a NaI(Tl) detector held approximately 1" from the surface. The exposure rate ranged from 14 to 20 $\mu\text{R}/\text{hr}$. See Figures 7 for locations and results.

Exposure Rate Measurements at Soil Sampling Locations

Exposure rate measurements were taken at each sample location at 1 meter from the surface, after the soil sample was collected. The maximum measurement was 18 $\mu\text{R}/\text{hr}$. See Figure 5 for soil sample locations and Table 5 for soil sample and exposure rate measurement results.

Confirmatory Survey

No activity distinguishable from natural background was detected during the Final survey. This factor, combined with the fact that this land area is very small, lead to the decision that an internal confirmatory survey was not needed.

Conclusion

Final contamination and radiation surveys, as well as the results of analyses of soil samples, as documented in this report, demonstrate that the TRIGA® Trailer Land Area meets the approved criteria for release to unrestricted use.

Table 1: USNRC'S ACCEPTABLE SURFACE CONTAMINATION LEVELS

| Nuclides | Average ^{b,c,f} (dpm/100cm ²) | Maximum ^{b,d,f} (dpm/100 cm ²) | Removable ^{b,e,f} (dpm/100cm ²) |
|--|---|--|---|
| U-nat, ²³⁵ U, ²³⁸ U, & associated decay products | 5,000 α | 15,000 α | 1,000 α |
| Transuramics, ²²⁶ Ra, ²²⁸ Ra, ²³⁰ Th, ²²⁸ Th, ²³¹ Pa, ²²⁷ Ac, ¹²⁵ I, ¹²⁹ I | 100 | 300 | 20 |
| Th-nat, ²³² Th, ⁹⁰ Sr, ²²³ Ra, ²²⁴ Ra, ²³² U, ¹²⁶ I, ¹³³ I, ¹³¹ I | 1,000 | 3,000 | 200 |
| Beta/gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except ⁹⁰ Sr and other noted above. | 5,000 | 15,000 | 1,000 |

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 cm².
 e The amount of removable radioactive material per 100 cm² 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, then 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 cm² and 1.0 mRad/hr at 1 cm², respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Table 2: STATE OF CA ACCEPTABLE SURFACE CONTAMINATION LEVELS ¹

| Nuclides ^a | Average ^{b,c,f} (dpm/100cm ²) | Maximum ^{b,d,f} (dpm/100cm ²) | Removable ^{b,e,f} (dpm/100cm ²) |
|--|---|---|---|
| U-nat, ²³⁵ U, ²³⁸ U, & associated decay products | 5,000 | 15,000 | 1,000 |
| Transuranics, ²²⁶ Ra, ²²⁸ Ra, ²³⁰ Th, ²²⁸ Th, ²³¹ Pa, ²²⁷ Ac, ¹²⁵ I, ¹²⁹ I | 100 | 300 | 20 |
| Th-nat, ²³² Th, ⁹⁰ Sr, ²²³ Ra, ²²⁴ Ra, ²³² U, ¹²⁶ I, ¹³³ I, ¹³¹ I | 1,000 | 3,000 | 200 |
| Beta/gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except ⁹⁰ Sr and other noted above | 5,000 | 15,000 | 1,000 |

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 cm².
 e The amount of removable radioactive material per 100 cm² 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, then 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 cm² and 1.0 mrad/hr at 1 cm², respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Guidelines For Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For byproduct, Source, or Special Nuclear Material, also known as "Decon-1" incorporated into GA's State of CA Radioactive Materials License.

TABLE 3: LIST OF INSTRUMENTS

| Instrument | Detector | Range (cpm, μ R/hr or mr/hr) | Calibration Due Date | Efficiency | Background | Description |
|---|--|---|-------------------------|-----------------------|---|--|
| Ludlum Model 2221 S/N 148425 | Ludlum Model 43-37 gas (434cm^2) proportional Alpha detector S/N 086236 | Four Linear Ranges 0-500,000 & one Log 50-500,000 (CPM) | 11/12/02 | 21.09% | MDA (100cm^2 β & 50cm^2 α (detectors only)) 10 - 40 cpm (Concrete & Asphalt) | Active Probe Area = 434 cm^2 . The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance. |
| Ludlum Model 2221 S/N 154202 | Ludlum Model 43-37 gas (434cm^2) proportional Beta detector S/N 149017 | Four Linear Ranges 0-500,000 & one Log 50-500,000 (CPM) | 11/03/02 | 28.34% | 1600 - 1995 cpm (Concrete) 2900 - 3300 cpm (Asphalt) | Active Probe Area = 434 cm^2 . The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance. |
| Ludlum Model 2221 S/N 86302 | Ludlum Model 43-68 100 cm^2 proportional Beta detector S/N 142547 | Four Linear Ranges 0-500,000 & one Log 50- 500,000 (CPM) | 01/23/03 | 34.95% | $1428 \pm 45 \text{ cp2m}$ (Asphalt) MDA = $255\text{dpm}/100\text{cm}^2$ $991 \pm 137 \text{ cp2m}$ (Concrete) MDA = $213\text{dpm}/100\text{cm}^2$ | 100 cm^2 gas flow proportional counter |
| Ludlum Model 3 S/N 153551 | Ludlum Model 44-10 Nal (TI) Scintillator Gamma Detector S/N 155594 | Four Ranges 0-500 μ R/hr | 09/13/02 | NA | 10 - 18 μ R/hr (Concrete & Asphalt) | 2 inch x 2 inch Nal (TI) scintillator. Used for measuring external dose rates on the surface and at one meter. |
| Ludlum Model 12 S/N 91103 | Ludlum Model 43-64 Alpha Scintillator ZnS (Ag) S/N 092192 | Four Ranges 0-500,000cpm | 09/17/02 | 22.14% | 0 - 20 cp2m MDA = $106\text{dpm}/100\text{cm}^2$ | Active Probe Area = 50cm^2 Used for Alpha surveying |
| Canberra Low Level α / β Counter Model 2404 | Gas Flow Proportional Detector | N/A | As needed | ~26-30% | Varies with Sample | Canberra Model 2404 Low Level / gas proportional counting system used to count wipes for removable contamination. Results are usually reported as $\text{dpm}/100\text{cm}^2$. |
| Canberra Gamma Spectroscopy System | High Purity Germanium Detector | N/A | As needed | Varies with Sample | Varies with Sample | Gamma Spectroscopy MCA system using a high purity Germanium detector. |

Table 4: Gamma Spectroscopy Results of Background Soil (Surface) Samples

| Sample ID | <i>Radionuclide Concentrations ($\mu\text{Ci/gm}$) - Results $\pm 2\sigma$ - 30 Minute Counts</i> | | | | | | |
|-----------|---|--------------------------------------|--------------------------------------|---|---|---|---|
| | ^{137}Cs 661.6 keV peak | ^{60}Co 1173 keV peak | ^{228}Th 238 keV peak | ^{228}Ra (^{232}Th) 911 keV peak | Total $^{228}\text{Th} +$ ^{232}Th | ^{238}U 63.3 (92.7) keV peak | ^{235}U 144 (186) keV peak |
| X-1 | ND | ND | 0.71 ± 0.07 | 0.97 ± 0.25 | 1.68 | 1.17 ± 0.77 | (0.13 ± 0.06) |
| X-2 | ND | ND | 0.90 ± 0.13 | 1.49 ± 0.31 | 2.39 | 1.91 ± 1.18 | (0.13 ± 0.08) |
| X-3 | 0.06 ± 0.04 | ND | 1.49 ± 0.10 | 1.56 ± 0.25 | 3.05 | 1.45 ± 0.80 | (0.23 ± 0.09) |
| X-4 | ND | ND | 1.52 ± 0.23 | 3.22 ± 0.61 | 4.74 | 3.74 ± 2.18 | (0.28 ± 0.17) |
| X-5 | ND | ND | 1.92 ± 0.17 | 2.41 ± 0.53 | 4.33 | (4.49 ± 1.64) | (0.32 ± 0.16) |
| X-6 | ND | ND | 1.02 ± 0.08 | 0.96 ± 0.23 | 1.98 | 1.31 ± 0.80 | (0.14 ± 0.06) |
| X-7 | 0.13 ± 0.08 | ND | 1.59 ± 0.14 | 2.40 ± 0.38 | 3.99 | 2.16 ± 1.48 | (0.18 ± 0.10) |
| X-8 | ND | ND | 1.44 ± 0.28 | 1.40 ± 0.28 | 2.84 | 2.30 ± 1.16 | (0.14 ± 0.09) |
| X-9 | 0.09 ± 0.08 | ND | 0.89 ± 0.10 | 1.27 ± 0.31 | 2.16 | 1.59 ± 1.05 | (0.10 ± 0.08) |
| X-10 | ND | ND | 1.29 ± 0.11 | 1.52 ± 0.36 | 2.81 | 1.10 ± 0.96 | (0.16 ± 0.08) |

Notes:

1. Surface (0-6") soil samples were collected on 06/05/00 and 06/06/00 by Ed Rutgers off GA's site but close to GA.
2. Samples were counted 7/20/00 through 7/24/00 for 30 minutes (same count as the soil samples).
3. ND means: < 0.1 pCi/g for Cs-137
< 0.1 pCi/g for Co-60
4. The numbers in parenthesis indicate that the peak in parenthesis was used rather than the preferred peak shown because the preferred peak was not identified

Sample Locations:

- X1 Sorrento Valley Road near sample location ST65 on the hillside ~1 mile from Building 37.
- X2 Sorrento Valley Road near Carmel Mountain Road junction on steep cliff.
- X3 Sorrento Valley Road in Los Penasquitos Preserve ~2 miles from Building 37.
- X4 Sorrento Valley Court at the end of the road in the field.
- X5 Roselle Street, East of sample location ST64 ~ ½ mile from Building 37 (collected on the hillside)
- X6 Roselle Street, East of sample location ST64 ~ 1 ½ miles from Building 37 (collected on hillside).
- X7 Lusk Boulevard, from the hillside ~ 1 ½ miles from Building 37 (collected on the hillside).
- X8 Vista Sorrento Parkway, ~ ½ mile from Building 37 (collected on the hillside).
- X9 Callahan Road, ~ ½ mile from Building 37 (collected on the hillside).
- X10 Eastgate Mall road, ~3 miles from Building 37 (collected in a field).

Table 5: TRIGA® Trailer Land Area Soil Sample Results

| # | Sample ID | Radionuclide Concentrations (pCi/g) Background Not Subtracted, 30 min. count | | | | | | Exposure Rate in $\mu\text{R}/\text{hr}$ at 1 meter from surface |
|---|---------------------|---|---|---------------------|-------------------------------------|-----------------------------|-----------------------------|---|
| | | U-238 (Th-234: 63Kev, 93 Kev used when 63 not present) | U-235 (144Kev,186 Kev used when 144 not present) | Cs-137 (662 Kev) | Co-60 {(1170 Kev+1330 Kev)/2} | Th-228 (Pb-214: 238 Kev) | Th-232 (Ac-228: 911 Kev) | |
| | | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | pCi/g | |
| 1 | TRIGA Trailer #1 | 0.34 ± 1.00 | 0.18 ± 0.08 | 0.07 ± 0.06 | ND | 1.56 ± 0.19 | 1.65 ± 0.28 | 17 |
| 2 | TRIGA Trailer #2 | ND | 0.10 ± 0.05 | ND | ND | 1.10 ± 0.14 | 1.15 ± 0.25 | 18 |
| 3 | TRIGA Trailer #3 | ND | 0.11 ± 0.06 | 0.04 ± 0.06 | ND | 1.45 ± 0.28 | 1.89 ± 0.36 | 17 |

- Notes:
1. ND means not detected, which means the energy peak was not identified or the value was less than the average MDA for the geometry and counting time used.
 2. Average Minimum Detectable Activities (MDAs):

U-238 = 1.58 pCi/g (63 keV peak)

U-235 = 0.15 pCi/g (186 keV peak)

Cs-137= 0.13 pCi/g (662 keV peak)

Co-60 = 0.14 pCi/g (average of 1173 + 1332 keV peaks)

Th-228 = 0.21 pCi/g (238 keV peak)

Th-232 = 0.43 pCi/g (911 keV peak)

3. Background is not subtracted from results. See Table 4 for Background soil concentrations.

Table 6:TRIGA® Trailer Land Area Wipe Survey Results

| Sample Number | α Activity in dpm/100cm ² | β Activity in dpm/100cm ² | Sample Number | α Activity in dpm/100cm ² | β Activity in dpm/100cm ² |
|---------------|--------------------------------------|--------------------------------------|---------------|--------------------------------------|--------------------------------------|
| 1 | <20 | <20 | 11 | <20 | <20 |
| 2 | <20 | <20 | 12 | <20 | <20 |
| 3 | <20 | <20 | 13 | <20 | <20 |
| 4 | <20 | <20 | 14 | <20 | <20 |
| 5 | <20 | <20 | 15 | <20 | <20 |
| 6 | <20 | <20 | 16 | <20 | <20 |
| 7 | <20 | <20 | 17 | <20 | <20 |
| 8 | <20 | <20 | 18 | <20 | <20 |
| 9 | <20 | <20 | 19 | <20 | <20 |
| 10 | <20 | <20 | 20 | <20 | <20 |

Figure 1: Main Site and Sorrento Valley Site

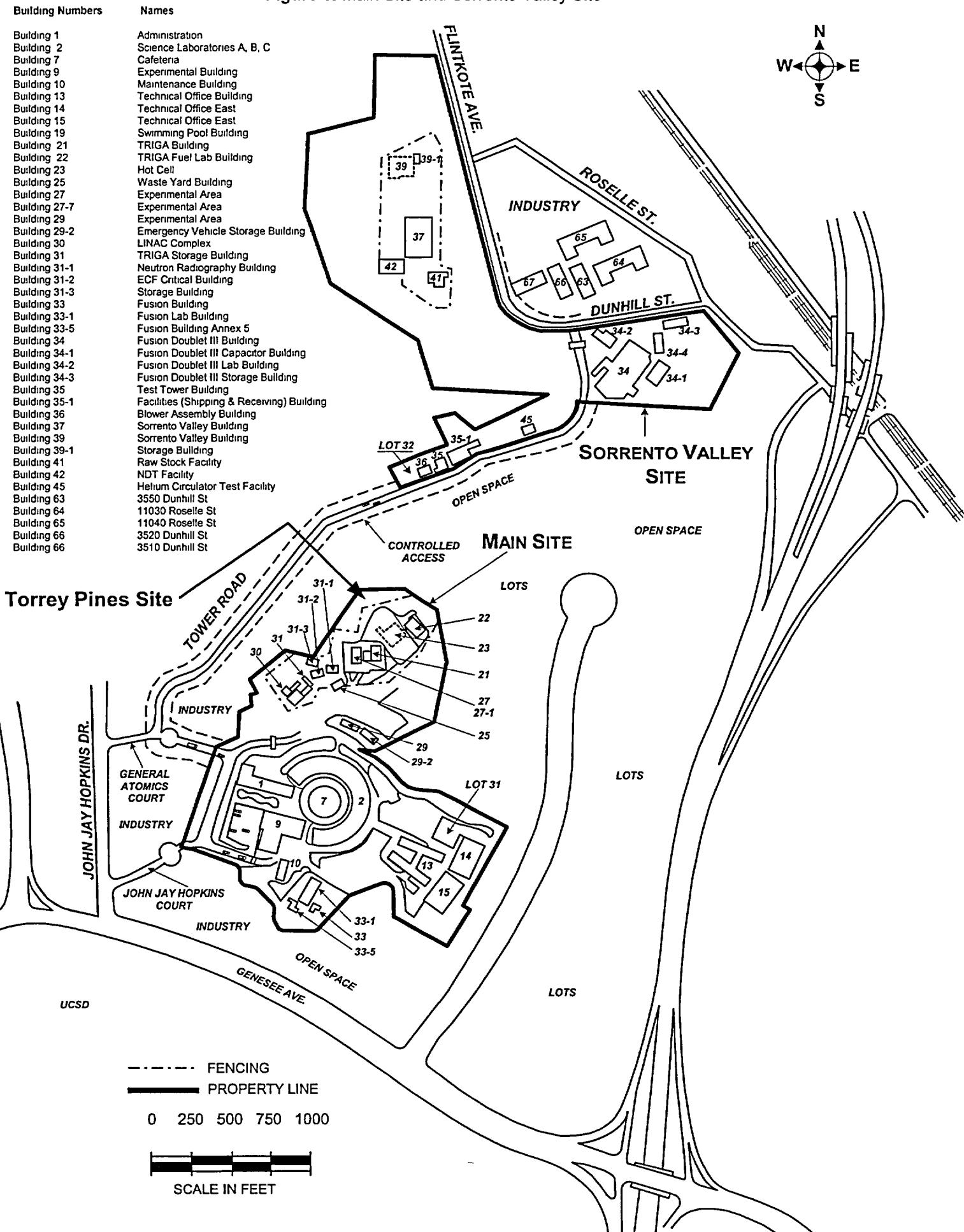


Figure 2: TRIGA Trailer Land Area, in Relation to Other GA Facilities

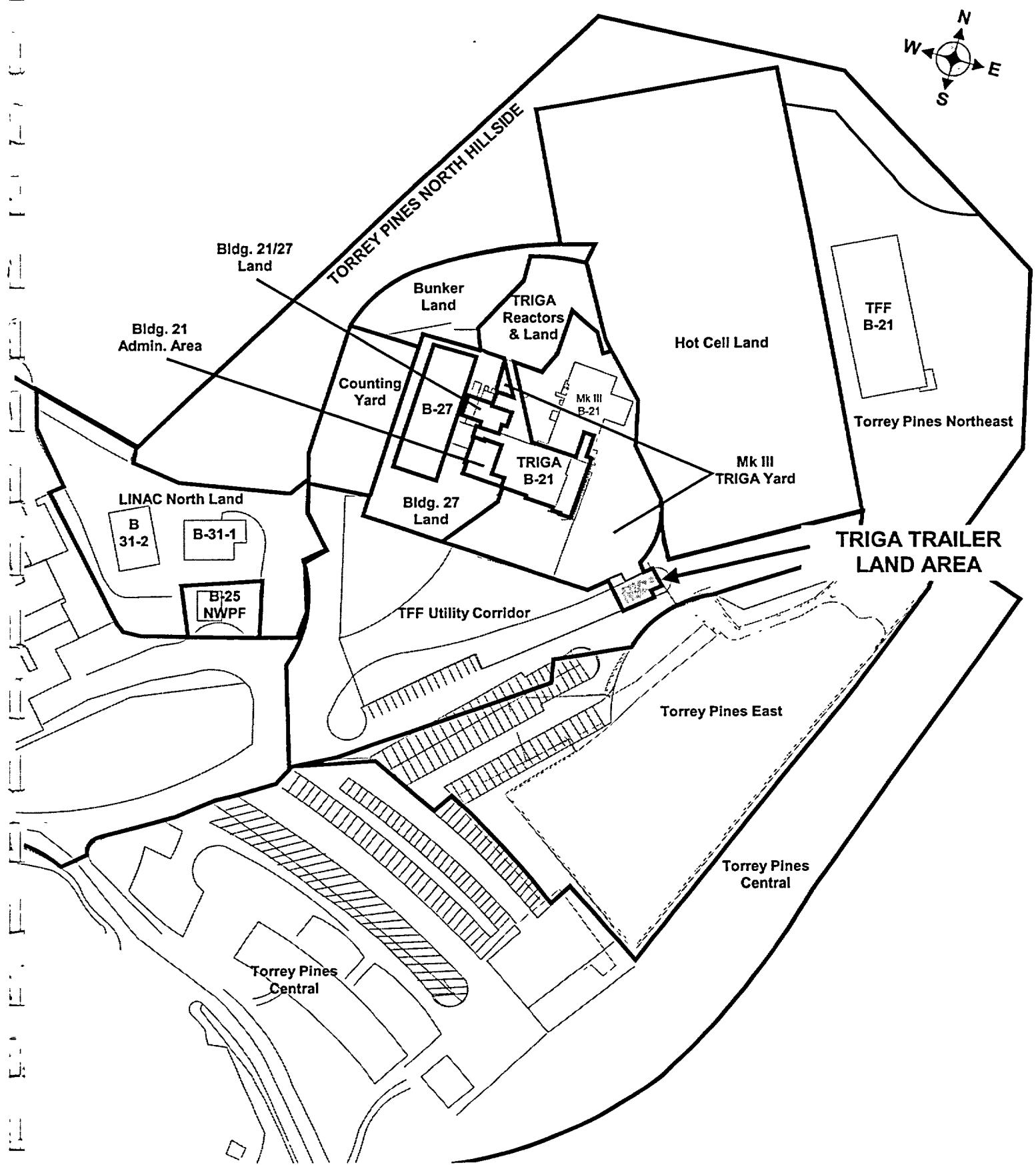




FIGURE 3: TRIGA TRAILER LAND AREA, ALPHA SCAN

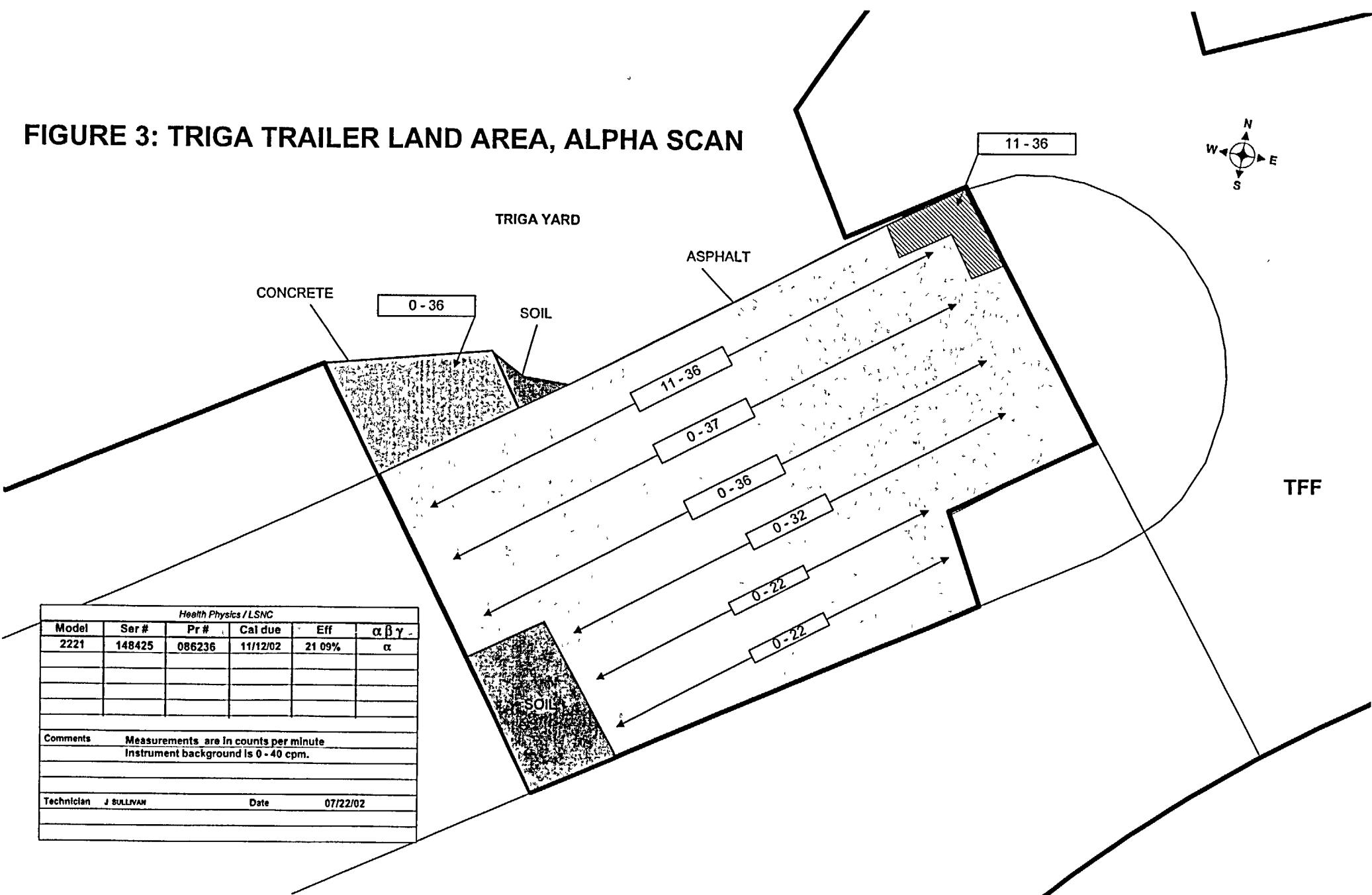


FIGURE 4: TRIGA TRAILER LAND AREA, BETA SCAN

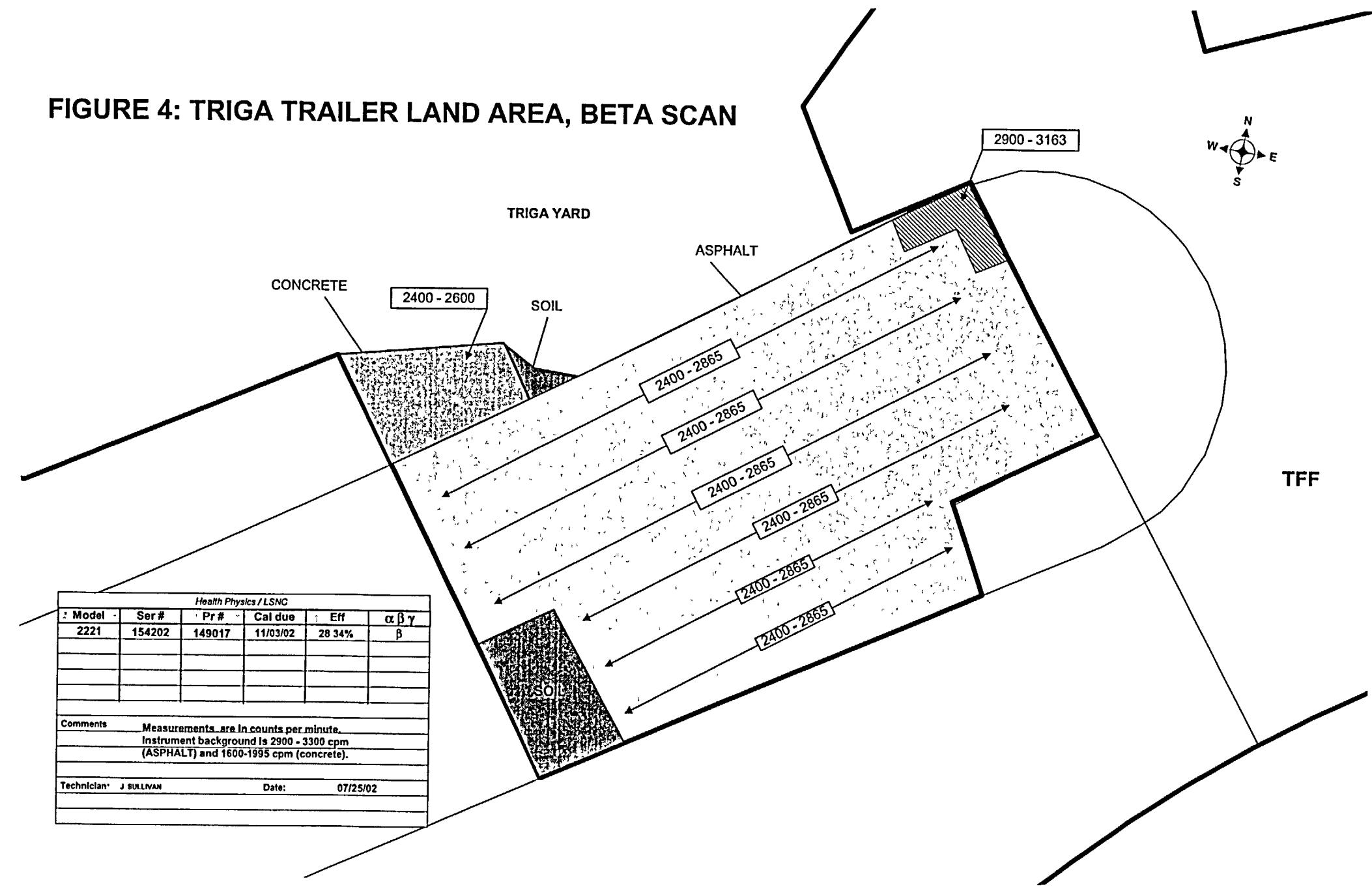


FIGURE 5: TRIGA TRAILER LAND AREA, FIXED ALPHA AND BETA MEASUREMENTS, WIPE AND SOIL SAMPLE LOCATIONS

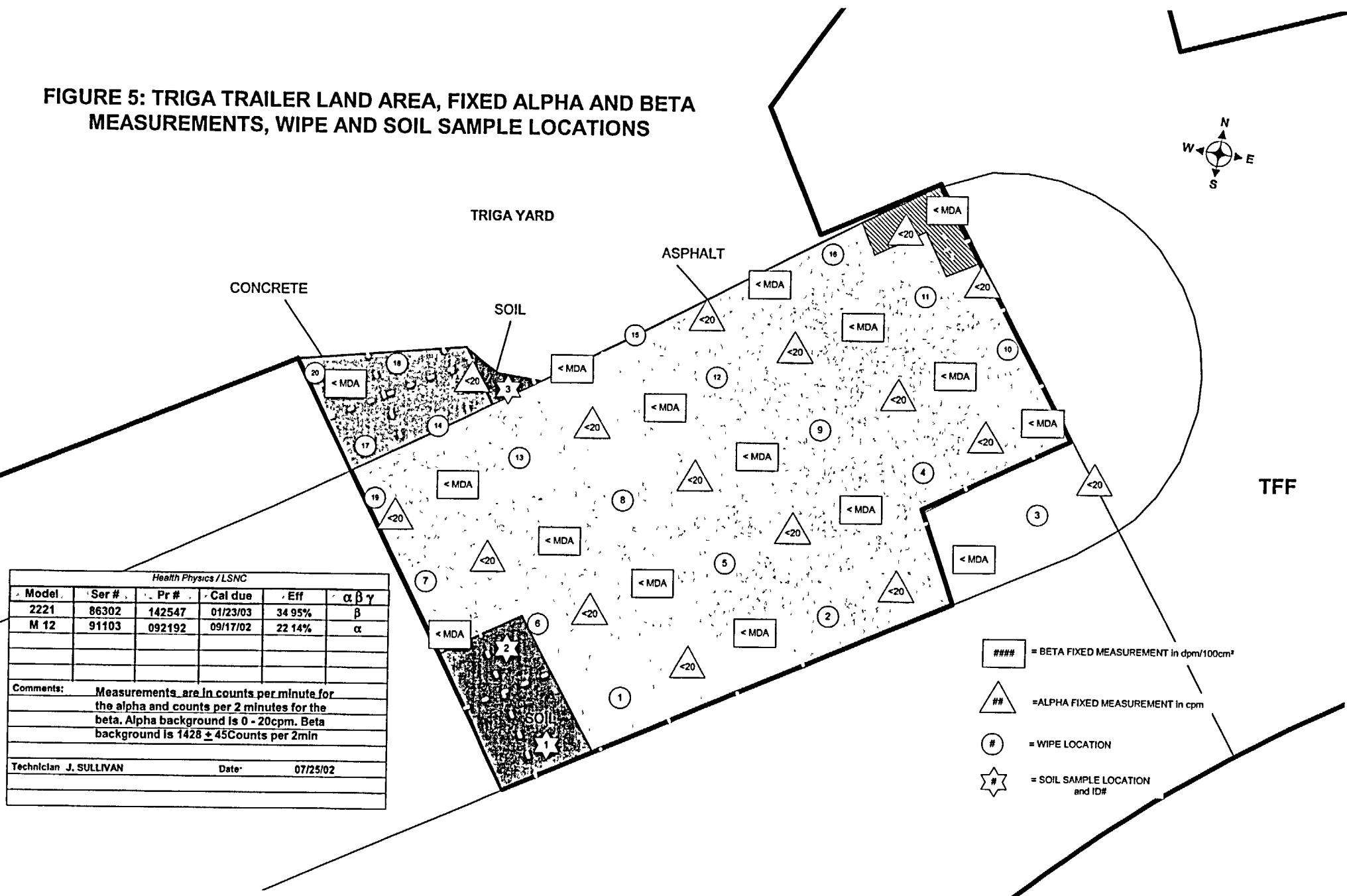
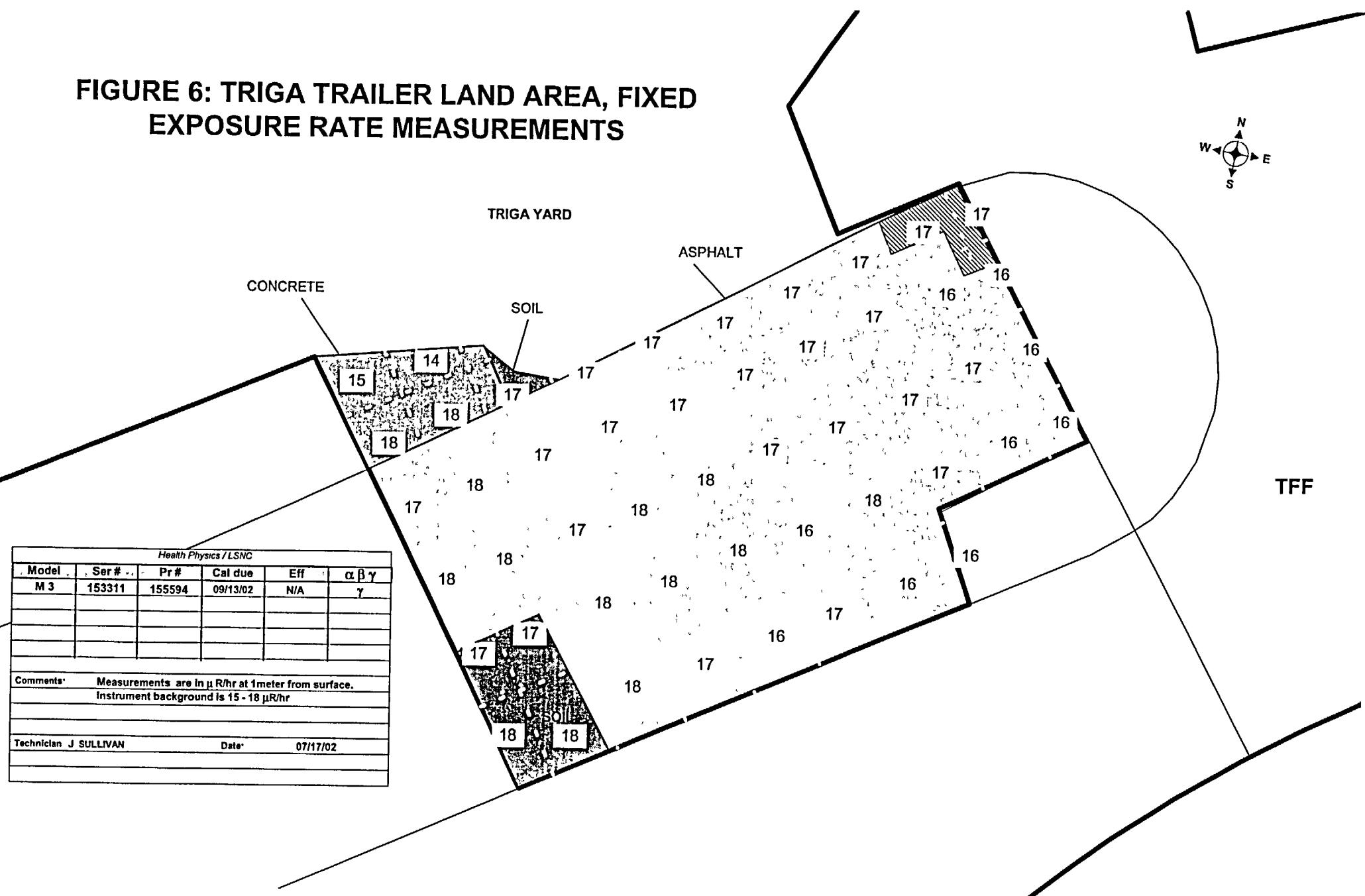
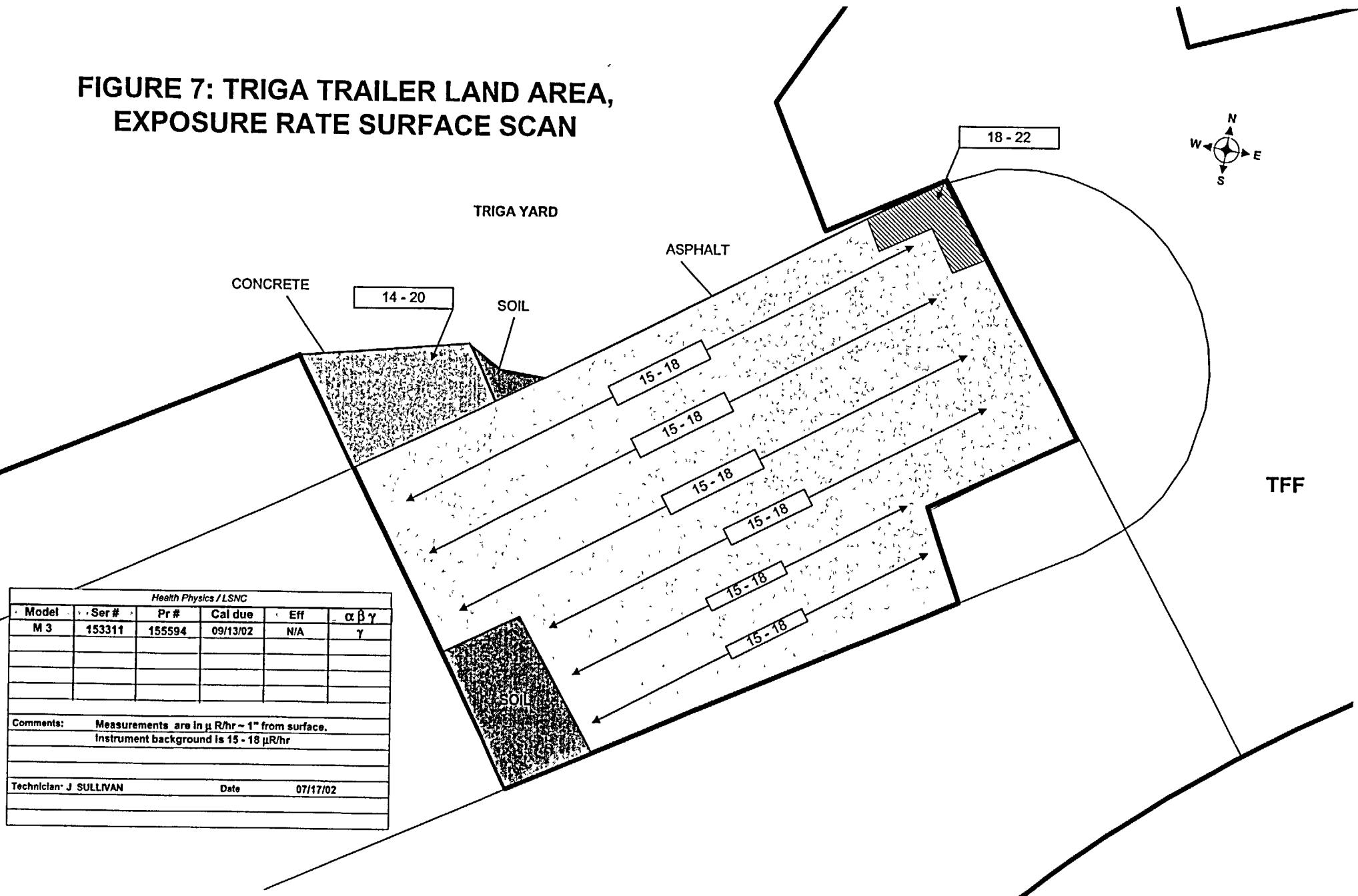


FIGURE 6: TRIGA TRAILER LAND AREA, FIXED EXPOSURE RATE MEASUREMENTS



**FIGURE 7: TRIGA TRAILER LAND AREA,
EXPOSURE RATE SURFACE SCAN**



General Atomics'
Final Radiological Survey Report
For
TRIGA® Trailer Land Area

Appendix A
Final Survey Plan

June 24, 2002

Prepared by: W. LaBonte

Approved by:

L. Q. Gonzales

W. LaBonte

Laura Gonzales

6/24/02

Final Survey Plan for TRIGA® Trailer Land Area

Asphalt and soil surfaces ONLY

This survey plan is for a strip of land excluded from the TFF Utility Corridor Land area because it was occupied by the TRIGA® Administrative Trailer. This survey plan is for the land areas that surrounded and was beneath the TRIGA® Administrative Trailer prior to removal. This land area, which is almost exclusively paved with asphalt, is ~ 3,034 ft² (~ 28 m²). See Figure 1 for location and Figure 2 for TRIGA® Trailer Land Area boundary and measurements.

Background and Classification

Background Information

Prior to placing the TRIGA® Administrative Trailer, (which was previously the Hot Cell Administrative Trailer), in this area, this land area was an access road in front of the TRIGA® facility which lead to the Hot Cell facility. When the trailer was moved to this location, a personnel decontamination shower and respirator cleaning sink were installed in the trailer, and, a holding tank for waste water from these facilities was installed outside of the trailer. In addition, the soil sample processing lab was moved to this trailer and it's support HEPA ventilation unit was installed outside of the trailer. The area where the HEPA Unit, waste water holding tank, and the entrance to the soil processing lab was enclosed with a fence and posted as a radioactive material area.

Classification

There is no known releases or contamination with radioactive material in this area. However, due to the HEPA unit and Waste Water Holding Tank being previously located in this area, and due to it's small size, the entire area is classified as a Non-Suspect Affected Area for final survey purposes. The predominate isotopes expected, if present, would likely be mixed fission and activation products, primarily Cs-137 with lesser amounts of Co-60.

Survey Objectives and Responsibility

The purpose of performing a final survey is to demonstrate that the radiological conditions satisfy

the NRC and State of California guidelines for release to unrestricted use. The objectives include (1) to show that the average surface contamination levels for each survey unit are within the authorized value, (2) to show that the maximum residual activity ("hot spot" area) does not exceed three times the average value in an area up to 100 cm², (3) that a reasonable effort has been made to clean removable contamination and fixed contamination and (4) that the exposure rates in occupiable locations are less than 10 µR/hr above background measured at 1 meter above the surface. Samples will be taken by qualified Health Physics technicians having a minimum of 3 years Health Physics Technician experience following approved Health Physics procedures and this plan. The survey and final report documenting the survey will be performed by GA's Health Physics group.

Release Criteria (per GA Site Decommissioning Plan)

Direct Surface Scans

The applicable release criteria, based on mixed fission and activation products, is:

**5,000 dpm/100 cm², averaged over 1 m² area
15,000 dpm/100 cm², maximum in a 100 cm² area
1,000 dpm/100 cm², removable contamination**

Exposure Rate Measurements

The guideline value for exposure rates measured at 1 m above the surface is 10 µR/hr above background.

Soil Criteria (soil limits apply to roof gravel, concrete rubble and asphalt rubble)

The release criteria for soil are specified in the Site Decommissioning Plan and summarized below. The values presented below are above background levels. **Note: Soil, asphalt and concrete rubble must remain on-site until specific approval to move it off-site is granted by the NRC and the State of California.**

| | |
|-------------------------------------|------------|
| Cs-137 | 15 pCi/g |
| Co-60 | 8 pCi/g |
| Enriched Uranium (U-234 plus U-235) | 30 pCi/g |
| Thorium (Th-232 plus Th-228) | 10 pCi/g |
| Sr-90 | 1800 pCi/g |

If multiple nuclides are present, the sum of the ratios of the concentration of each Radionuclide to its respective guideline must not exceed 1. **If other nuclides are encountered, notify HP Management for release criteria.**

Alert Levels

If the following "alert levels" are exceeded, notify HP Management so an evaluation can be performed to determine if increased survey coverage or decontamination is required.

On Concrete or Asphalt Surfaces

Note: The Alert levels provided below are based on the background cpm plus the meter cpm value taking into account the instrument efficiency and probe surface area. The alert level for each instrument used must be determined prior to performing surveys. The background determination must be performed in building 13 or other HP management approved area.

Alpha Monitoring

>100 cpm alpha using the large area (434 cm^2) probe. If >100 cpm, check with a hand held alpha meter.

>60 cpm using a hand held alpha probe, notify Health Physics Management.

Beta Scanning using 434 cm^2 probe

> ~ 500 cpm above background using any other 434 cm^2 probe

Beta Scanning using a 100 cm^2 detector

> ~ 200 cpm above background

Beta Scanning using a 15 cm^2 pancake GM detector

> ~ 80 cpm above background.

Exposure Rate Measurement

Exposure rate measurements at contact (1-2" above the surface) and at 1m above the surface: 20 $\mu\text{R}/\text{hr}$.

Soil, Gravel, Asphalt Rubble, Concrete Rubble Samples

Any Radionuclide above natural background levels (see HP-40 for background levels). All soil sample results must be reviewed by Laura Gonzales, Paul Maschka, or Bill LaBonte.

Site Conditions at Time of Final Survey

The following must be performed prior to conducting this survey:

1. The HEPA unit must be disconnected and removed from this land area,
2. The Waste Water Holding Tank must be disconnected and removed from this land area,
3. The TRIGA® Administrative Trailer must be moved from this land area, and,
4. This land area must be swept clean of surface debris and dirt to allow proper alpha activity surveying.

Final Survey Requirements

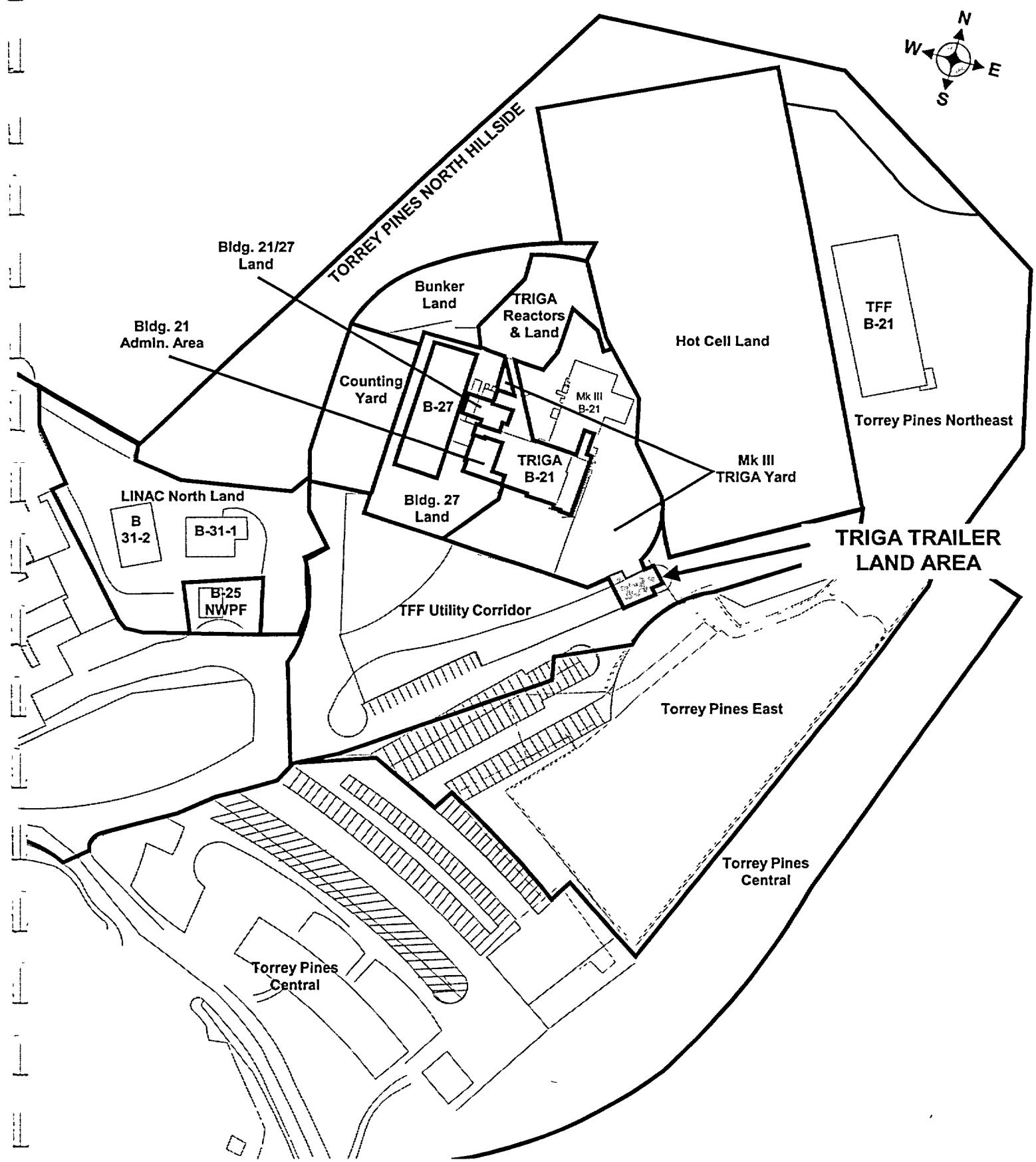
The minimum survey requirements for this final survey are outlined in Table-1, Planned Surveys for the TRIGA® Administrative Trailer Land Area.

Documentation

Every survey conducted must be documented on a **daily basis** on a drawing showing the approximate locations surveyed. Include the results (including units), the technicians' signature, date, instrument(s) used, efficiency, background readings (if applicable) and any other applicable information.

| Type of Survey/Activity | Non-Suspect Affected Area |
|---|---|
| Gridding Required? | No |
| Asphalt or Concrete Surfaces ⁽¹⁾ (Scan w/ 434 cm ² alpha probe). | 100% |
| Asphalt or Concrete Surfaces ⁽¹⁾ (Scan w/ 434 cm ² beta probe) | 100% |
| Minimum number of Measurements ^{(2) (3)} | 1 measurement per 20 m ² , or, 1 measurement every ~4.5 m Alternate between (1) a wipe, (2) an alpha fixed measurement and (3) a beta fixed measurement on all asphalt or concrete surfaces. |
| Asphalt/core samples | Locations and number of samples to be determined by HP Management based on survey results. |
| µR/hr Readings (Scan Survey) | 100% scan on all surfaces, detector held ~1" from surface |
| µR/hr Readings (Fixed Measurements @ 1m from surface) | 1 every 10m ² , or 1 every ~ 3m. |

Figure 1: TRIGA Trailer Land Area, in relation to other sites



**FIGURE 2:TRIGA TRAILER
SURVEY AREA**

