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Page 1 of 54
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TITLE: SSFL Area IV Gamma Survey Procedures In Support of the Site Radiological Characterization Study.

APPROVALS

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REV. LTR.	REVISION	APPROVAL DATE
A	1. Change in walk-about survey procedure decreases walking speed to 4 sec/ft, and decreases width of area to be scanned by each surveyor to 5-ft, during each transit across the *survey block*. Also adds requirement for a "blind" test using a hidden QA check-source at least once in each survey block for each day of survey in that block. 2. Change in IQR form (fig. B1) to include spaces for entering initials of person taking data in each column, and to add a data line for Reuter-Stokes cumulative gamma exposure counter data. 3. Adds a general survey area schematic (fig. B5) for use by the team HPs in describing the location of features or conditions relative to, or impacting upon the survey. 4. Reduces survey flag types to one color (iridescent pink) to tag locations where the gamma activity is greater than 4200cpm at the surface, or 4040cpm at 1-meter height. 5. Adds additional administrative details for the survey crew to clarify issues about use of forms and flags.	9/21/94 9/21/94 9/21/94 9/21/94 9/22/94 9/22/94

DRC 25134 R2

CONTENTS

(indicates sections in which redline changes were required)

FIGURES

1.0 SCOPE

This document provides procedures for performing gamma surveys in support of the Radiological Characterization Study of Area IV, at the Santa Susana Field Laboratory (SSFL). These procedures are instructions for field survey teams and survey managers for conducting a walk-about scanning survey of near-surface gamma radiation levels to look for radioactive hot spots, and for performing a systematic survey of ambient gamma radiation levels at 1-meter above the ground surface to provide data for site characterization. Each survey team will consist of an HP (Health Physics) professional who will be responsible for data accuracy and quality, and one or more survey technicians, who will assist in performing the survey. More than one team may be working at the same time, and teams may work together or interchange members to meet the needs of the survey activity. The survey team(s) will be directed by two Survey Managers, who will be jointly responsible for the overall field survey activity. One (the Survey Activity Manager) will manage the activities of the survey team personnel, and the other (the Survey Data Control Manager) will manage the technical quality of the data being produced by the survey teams. The Survey Activity Manager will plan and coordinate crew activities, assemble materials and equipment needed for the survey, assure that documentation associated with the survey is completed and turned over to the Survey Data Control Manager at the end of the day, and will coordinate with the Survey Data Control Manager in establishing the survey location priorities. The Survey Data Control Manager will monitor the field data for measurement trends and instrument problems, monitor the instrument checks, and will regularly monitor the technical performance of the survey team during the data collection activity. The Survey Data Control Manager will evaluate the survey results, and will perform supplemental evaluation of locations having marginally high or anomalous gamma activity levels. Both survey managers will coordinate any changes to equipment or procedures which may be imposed by the HSO (Health & Safety Officer), by QA&T (Quality Assurance & Training), or by impediments to access from the physical circumstances of the facility.

This survey will focus on those areas within Area IV that are thought to be free of contaminants, that have not been previously identified as potentially or actually contaminated, and where no comparable radiological survey has either already been done, or is planned to be done as part of a separate survey or monitoring program, or D&D (decontamination & decommissioning) project.[ref 1,2,&3]

The design criteria which have structured the protocols for this survey were developed in the related Radiological Field Sampling Plan.[ref 4] Health and safety guidelines, and quality assurance provisions governing the data collection were structured by the respective Health & Safety[ref 5] and Quality Assurance[ref 6] plans for this project. The surveys will be accomplished in increments of smaller *survey blocks*, with each block encompassing an area of about .92 acres. For the systematic survey of ambient gamma, 64 measurement points will be surveyed in each survey block, so that approximately 20,000 measurement points will be visited over the whole of Area IV to complete this survey.

Procedures for a related onsite soil sampling survey, and for offsite collection of background soil samples, have been developed separately.[ref 7]

A description of Area IV, and a more comprehensive discussion of the Radiological Characterization Study are contained in reference 8. The location of Area IV within Santa Susana Field Laboratory (SSFL) is mapped in figure 1-1.

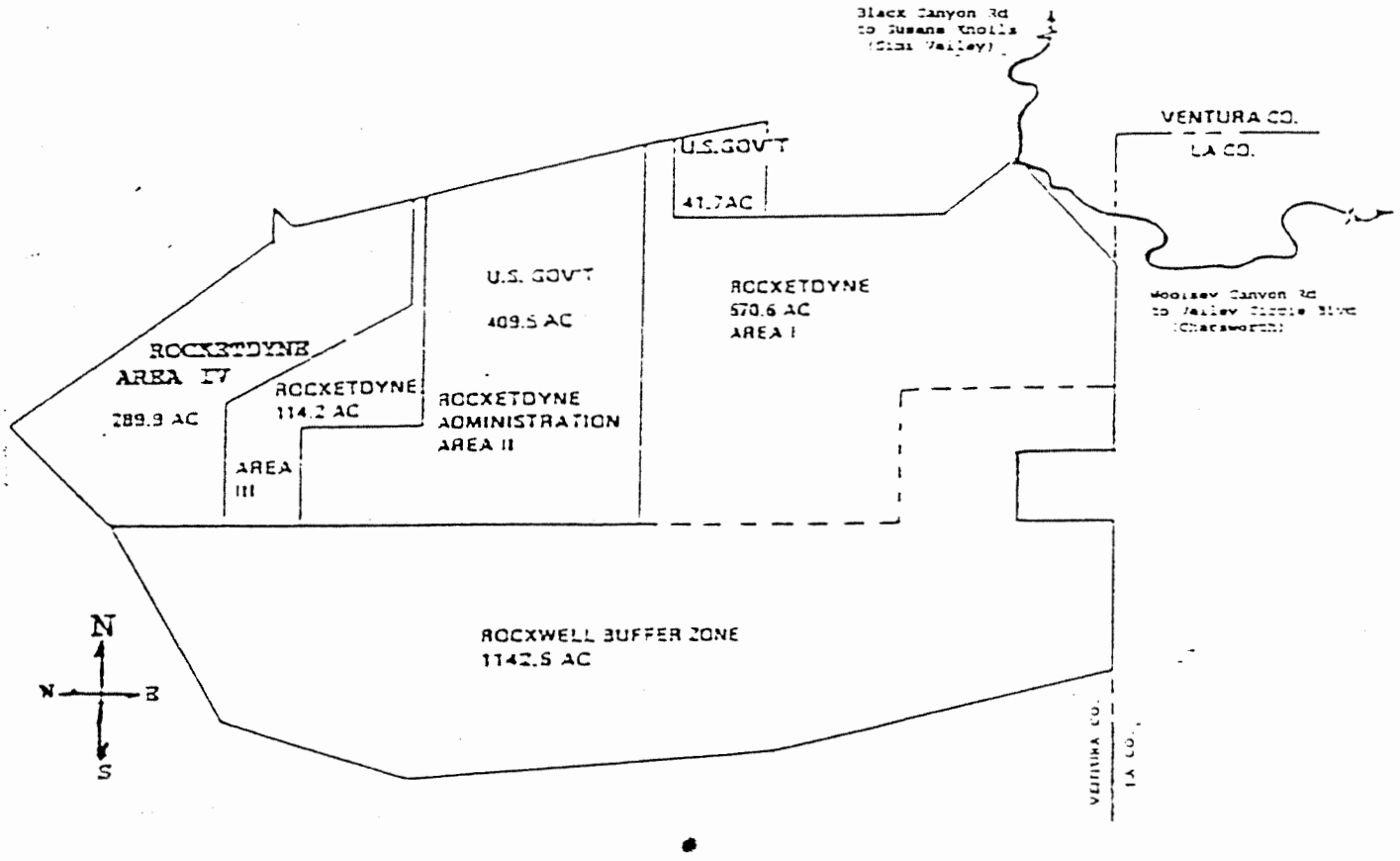

Figure 1-1. SSFL Facility Map Showing Location of Area IV.

1.1 PURPOSE OF THE SURVEY

The purpose of this radiological survey is to collect sufficient data to allow, in conjunction with prior data, an assessment of the current radiological status of the whole of Area IV.

1.2 EXPECTED OUTPUT

All onsite survey data will be identified and tabulated by their locations, in terms of rectangular distance coordinates [N/S axis, E/W axis] relative to the California State Plane Coordinate (CSPC) System, Zone 5. To assist the survey team in identifying survey locations, an outside contractor will install location marker stakes on a 200ft x 200ft grid throughout Area IV, before the radiological survey begins. Each stake in this 200ft interval grid will identify its location relative to the CSPC system, and the location of each survey measurement will be determined relative to the 200ft interval grid markers.

The end product of the work covered by this procedure will be a final report containing the peak radioactivity data from the findings (if any) of the walk-about survey, along with the ambient gamma radiation levels at 1-meter height that were recorded during the ambient gamma survey. All site data will be tabulated by their CSPC System location coordinates, and plotted on site location maps.

The results from the onsite ambient gamma survey, and the findings of the walk-about survey will be used to determine if there is any significant radiological indications that might distinguish any of the measurement data as being other than from the natural background.[ref 4]

If gamma measurements are noted which exceed the expected range of natural background radiation, those locations will be referred to the Survey Data Control Manager for additional evaluation. All of the results of any additional evaluations for any location in the survey will be detailed in the final report, regardless of the findings. If an additional evaluation reveals the presence of possible radiological contamination, those sites will be referred to the Project Manager, Manager of Radiation Protection & Health Physics Services (RP&HPS), and HSO for further action as appropriate.

All survey records, procedures, data, and related reports for this survey will be maintained in the Area IV Site Radiological History File by the RP&HPS group.

2.0 REFERENCES

1. Executive Summary of the DOE SSFL Site Radiological Survey, J.A.Chapman, RI/RD ETEC Doc No. GEN-ZR-0015, 10 Oct 1988.

2. Long Range Plan for Decommissioning Surplus Facilities at the Santa Susana Field Laboratories, W.D.Kittinger, RI/RD Doc No. N001TI00200, 30 Sept 1983.

3. ETEC Environmental Restoration Program Management Plan, R.D.Meyers, C.D.Richards, & P.D.Rutherford, RI/RD ETEC Doc No. ER-AN-0002, 25 Oct 1991.

4. SSFL Area IV Radiological Field Sampling, Analysis, and Data Management Plan, J.J.Collins, RI/RD ETEC No. A4CM-ZM-0004, (to be released March 1994).

5. Area IV Characterization, and Monitoring/Surveillance Program, Health and Safety Plan, Kathy Shane, ETEC Doc No. A4CM-AN-0002, 23 Nov 1993.

6. Quality Assurance Plan for Area IV Site Characterization, Monitoring, & Surveillance, S. Reeder, ETEC Doc No. A4CM-QN-0001, Nov 1993.

7. SSFL Area IV Radiological Soil Sampling Procedures, J.J.Collins, RI/RD ETEC Doc No. A4CM-SP-0002, (to be released March 1994).

8. SSFL Area IV Radiological Characterization Plan, L.A.Mountford, RI/RD ETEC Doc No. A4CM-AN-0003, 8 Oct 1993.

9. Rocketdyne Santa Susana Field Laboratory Coordinate Index (for a survey of site boundaries and existing internal surveyor's brass monuments), Don L. Day (PLS No. 6028), Azimuth Boundary Specialists, Simi Valley, CA, 2 pages, document not numbered (accompanies index of 30 page SSFL Aerial Topographic Exhibit Drawings]), 30 April 1993.

10. Operational Manual for the Reuter-Stokes RSS-111 Area Monitor System, Reuter-Stokes Inc, Twinsburg; Ohio.

3.0 EQUIPMENT AND MATERIALS

3.1 SURVEY EQUIPMENT AND MATERIALS LIST:†

4 ea Ludlum Model 2221 or Model 2220-ESG Scaler/Ratemeters
4 ea Ludlum Model 44-2 High-Energy NaI Gamma Detectors
1 ea Ambient Gamma Survey Detector Fixture (§3.2.2)
2 ea Walk-About Gamma Detector Fixtures (§3.2.3)
1 ea Field Check Source (low-level ^{137}Cs calibration source)
5 ea 200ft Fiberglass Field Survey Measuring Tapes
3 doz Wire stakes w/ iridescent pink flags (§3.2.4.1)
2 doz Wire stakes w/ {other than iridescent pink} flags (§3.2.4.2)
Survey LogBook (w/ bound and numbered pages)
2 ea Sighting Compasses (Silva Type 27, or equivalent)‡
2 ea 100ft measuring tapes‡

† most items listed in minimum quantity needed by each survey team
‡ item(s) shared by multiple survey teams

3.2 PRESURVEY HARDWARE PREPARATION

3.2.1 Reuter-Stokes RSS-111 Environmental Radiation Monitor

A Reuter-Stokes ambient gamma exposure monitor will be kept at the location (§B.4.1.2) where the daily instrument performance checks will be done (~30ft east of T425). Before the survey begins, the unit's mounting post will be set in concrete at the instrument check location. The monitor will be mounted on the post (which holds the unit at 1-meter height), and will remain in place throughout the Area IV survey.

3.2.2 Ambient Gamma Survey Detector Fixture

Two sodium-iodide gamma detectors will be mounted on a special fixture that holds the detectors side-by-side at 1-meter distance from the ground surface when measuring 1-meter ambient gamma. This fixture, the ***ambient gamma survey fixture*** is described in §A.1. At least two of these fixtures will be manufactured for this survey.

3.2.3 Walk-About Survey Fixture

A sodium-iodide gamma detector will be mounted at the end of a balanced boom that can be held at a few inches distance from the ground surface, and swept side to side during the walk-about survey. At least four of these special survey fixtures will be manufactured for the walk-about survey, so that multiple gamma detectors can be deployed by the team at the same time. The ***walk-about survey fixture*** is described in §A.2.

3.2.4 Marker Flag Coding

Wire stakes with colored flags, in at least two different colors, will be used as location markers in this survey.

3.2.4.2 {Iridescent pink} "Hot Spot" Location Flag

During the walk-about and 25ft interval grid surveys, iridescent pink "hot spot" location flags will be used to mark any location where a local peak in gamma activity occurs that is greater than 4200cpm, as measured at the surface, or is greater than 4040cpm, as measured at 1-meter above the surface. Locations where these flags are used will be considered radiologically suspect locations that require further investigation by the Survey Data Control Manager.

NOTE: "Suspect locations" may be flagged during the ambient gamma grid survey even though these locations may not necessarily be on the actual "hot spot" (a 25ft interval survey grid location may just be influenced by a nearby gamma source). For this reason, locations flagged during the ambient gamma survey will be better defined by the survey team in the follow-up walk-about survey. During the walk-about survey, the survey team may choose to reposition an iridescent pink flag that was placed in the ambient gamma survey so that the flag occurs at the actual site of the anomalous gamma activity; If this is done, the walk-about survey team HP will coordinate with the grid survey team HP to make sure that the location change is also noted on the original ambient gamma survey form.

Whenever "hot spot" location flags are used, they will be marked (using a permanent marker) with the letters "RSL" (Radiologically Suspect Location), followed by a consecutive counting number, starting with "001":

RSL001

NOTE: The fact that a location has been marked with a "Hot Spot" location flag does not mean that the location is in fact contaminated. It is expected that many naturally occurring radioactive soil and bedrock deposits will be flagged and investigated under the criteria established in this section.

3.2.4.3 {Other} Utility Marking Flags

Flags having colors different than the iridescent pink, as described above, will be used as temporary markers, wherever place keeping is needed in the field. These flags need not be numbered, or otherwise marked, and, in most cases will be removed when no longer needed.

4.0 SAFETY AND TRAINING

4.1 SPECIAL SAFETY PRECAUTIONS

SSFL Area IV is located in a remote area that is known to be home to rattlesnakes, scorpions, black widow spiders, ticks, and other biting creatures. The survey team is therefore cautioned to refrain from stepping into or near small animal holes, caves, cavities, or depressions under rocks or vegetative cover. Similarly, do not put hands or fingers in any place that has not been visually inspected. Crew members should wear high-top leather boots, and loose-fitting pants or coveralls while taking measurements in particularly shrubby or grassy areas where visibility may be impaired.

Thick stands of Poison Oak grow throughout the area, and people who have particular sensitivity to the oil produced by the leaf of this plant should avoid contact with it. Note that, on contact with the plant leaves and stems, the irritation-producing leaf-oils may by transferred to other surfaces, such as the survey detector fixture, shoes, and pants, which can then become secondary sources for skin contact. In the fall and winter, bare stems may be coated with the irritating oil at a time when the shrub has lost its familiar leaves. Tyvex coveralls will be available for the survey crew to use in areas heavily overgrown with poison oak.

Much of the area is comprised of uneven terrain, which presents a tripping and falling hazard to the crew. Since this risk is made worse when carrying bulky equipment (such as will be used during this survey), the team will always have at least two members present.

The weather in this area frequently includes periods of unseasonal hot days, creating conditions which may increase the crew's vulnerability to heat stress. As a precaution, the crew leader of each survey team will monitor the staff for heat stress related symptoms. The entire survey crew must be vigilant in making sure that everyone drinks sufficient fluids to replace fluids lost to perspiration, and that sun block ointments are used when needed.

No smoking is permitted in the field areas of SSFL except in designated areas.

4.2 PROJECT HEALTH AND SAFETY OFFICER (HSO)

A Health and Safety Officer (HSO) will be designated for the duration of the work described in this procedure, in accordance with the health and safety plan for this project.[ref 5] The HSO shall regularly examine the working conditions and note the presence of unsafe or unexpected conditions or substances relative to safety concerns. The HSO will notify the appropriate authority

of any such findings (e.g. Environmental Protection, for chemical materials; and Radiation Protection and Health Physics Services, for radioactivity). The HSO will determine what personnel or environmental monitoring is necessary, and will provide the equipment that is needed to accomplish the monitoring objectives. The HSO will insure the calibration of all H&S instruments used.

The HSO will develop safety instructions or special precautions appropriate for any conditions found, and will provide written recommendations for Personnel Protective Equipment (PPE) to the crew leader(s), with a copy to the Survey Manager. All such findings, precautionary instructions, procedures, and PPE recommendations will be written into the survey logbook, and properly indexed in the Health & Safety index at the front of the logbook.

4.3 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

Personnel Protective Equipment (PPE) shall be specified by the Health and Safety Officer (HSO) for this project. It is expected that only general work hazard protection will be needed during this survey: High-top workboots with reinforced toe protection, loose-fitting pants or overalls, and safety glasses should be worn in heavily vegetated and/or rocky terrain. Tyvex coveralls will be available for the survey crew to use in areas heavily overgrown with poison oak. The HSO may determine upon inspection of the working conditions that additional, or alternate PPE are required, and will direct the crew, in writing, accordingly.

4.4 HEALTH AND SAFETY LOG ENTRIES

The survey crew will maintain a survey logbook (as described in §B.7), which will include all crew instructions related to Health & Safety. An exclusive ***Health & Safety Index*** will be kept at the front of the survey logbook to note the date, time, logbook page location, and descriptive title of all Health & Safety entries.

If the HSO finds that new safety instructions or special precautions are required in response to changes in the work environment, the HSO will provide recommendations for additional precautionary instructions, or for changes to procedure, or PPE, as appropriate, in writing to the crew leader(s), and to the Survey Manager. All such findings and subsequent recommendations will be written into, or a copy posted in the survey logbook, and the date, time, descriptive title, and logbook page number where the entry is located will be listed in the *Health & Safety Index* at the front of the book.

4.5 SPECIAL PERSONNEL TRAINING REQUIREMENTS

The Survey Data Control Manager, and the designated Health Physicist (HP) of each survey team must be currently qualified Health Physics professionals, as demonstrated by having attained a passing score on the current USDOE Radworker II examination.

Other members of the survey team must have completed the Radiation Safety Training Course (RP&HPS Course No.4013) before starting the survey.

All survey team members must read and understand the survey procedures detailed in Section 5 of this document, and demonstrate competance in performing the procedures to the satisfaction of the Survey Manager.

All survey team members must also be knowledgable about, and comply with the contents of the Health and Safety Plan[ref 5] for this project.

All survey team members must be trained in, and possess current certification for CPR and First Aid, (H&S Course No.4044).

5.0 WORK INSTRUCTIONS

This section provides detailed working procedures for performing a comprehensive gamma survey of Area IV in support of the Area IV Radiological Characterization Study. After a brief description of the overall survey plan, detailed instructions are given for performing the survey.

Procedures for correct operation of the survey instruments; for survey instrument quality assurance; and for survey data identification and record keeping are given in Appendix B.

During performance of this work, a single designated working copy of this procedure will be maintained by the survey team at the worksite as a redline document. The face page of this document will have a banner above the document title stating that it is the "Master Field Redline Document". Up-to-date copies of this redline document will be maintained by the survey managers. Should procedure changes become necessary during the survey, the working copy will be redlined to reflect the changes, and the manager's copies will also be updated. All changes to procedures must have prior approval of the Survey Managers, who will keep other managing interests apprised of the changes. Any changes affecting radiological health and safety, or survey methodology, must be approved and initialed by the Manager of Radiation Protection and Health Physics Services (RP&HPS). The Project Manager must approve and initial any changes affecting cost or schedule. Quality Assurance must also approve and initial any changes. At the completion of the survey, all redlined changes will be incorporated into a revised version of this procedure, and released through ETEC document control.

5.1 SURVEY PLAN OVERVIEW

This section provides a brief description of the overall plan for the gamma survey of Area IV.

The Area IV onsite gamma survey will consist of two parts: A systematic survey of ambient gamma radiation levels at 1-meter above the ground surface, at locations defined by a 25ft interval measurement grid; and a walk-about survey of near-surface gamma radiation levels to locate any gamma "hot spots". This onsite survey will cover the whole of Area IV, excluding those areas previously surveyed, or scheduled to be surveyed in other comparable survey or monitoring programs, or after completion of already planned remediative actions. The specific locations, and planned sequencing of the regions to be surveyed are presented in the radiological field sampling plan[ref 4]. The data from this survey will be used to develop an accurate representation of the ambient radiological environment currently existing in Area IV.

The surveys will be performed by survey teams. Each survey team will consist of an HP (Health Physics) professional who will be responsible for data accuracy and quality, and one or more

survey technicians, who will assist in performing the survey. More than one team may be working at the same time, and teams may work together, or redistribute people in order to meet survey objectives.

The survey team(s) will be directed by two Survey Managers, who will be jointly responsible for meeting the overall gamma survey data collection objectives of the Area IV Radiological Characterization Study. One (the Survey Activity Manager) will manage the activities of the survey team personnel, and the other (the Survey Data Control Manager) will provide quality assurance monitoring over the survey data output.

The Survey Activity Manager will plan and coordinate crew activities, assemble materials and equipment needed for the survey, assure that documentation associated with the survey is completed and turned over to the Survey Data Control Manager at the end of the day, and will coordinate with the Survey Data Control Manager in establishing the survey location priorities. The Survey Activity Manager will also provide for crew training, when needed.

The Survey Data Control Manager will monitor the field data for measurement trends and instrument problems, monitor the instrument checks, and will regularly monitor the technical performance of the survey team during the data collection activity, and evaluate the need for additional crew training, or for possible procedural additions or changes. The Survey Data Control Manager will provide data management for the survey data, and will initiate data analysis as data is accumulated from the field. The Survey Data Contol Manager will also perform supplementary investigations of any locations having high or anomalous gamma activity levels, to determine the cause of the readings.

Throughout the course of the survey, the survey team will be visited periodically by the Health & Safety Officer (HSO), who will examine working conditions and, if needed, provide written recommendations for safety or health-related changes in working procedures and personnel protective equipment. The designate from ETEC Quality Assurance & Training (QA&T) will also make intermittent visits to the crew to provide an independent assurance of survey procedure adherence.

The two survey managers will coordinate any changes to equipment or procedures which may be imposed by the HSO (Health & Safety Officer), by QA&T (Quality Assurance & Training), or by impediments to access from the physical circumstances of the facility.

In preparation for this survey, location stakes on a grid of 200ft x 200ft intervals will be established throughout Area IV by an outside survey contractor. Each of these 200ft interval grid location stakes will indicate a location on the California State Plane Coordinate System, Zone 5 (CSPC System, or CSPCS), NAD1983 (as amended, 1991). In CSPCS notation, each location is identified by its distance (in feet) to a specific survey monument that was

established by the state government. The location coordinates are expressed in rectangular coordinate notation of ***northings*** (distance north of the reference monument), and ***eastings*** (distance east of the reference monument).

For example:

A brass surveyor's monument[note 1] that presently marks the northwest corner of the SSFL Buffer Zone at the point where it meets the southwest corner of Area IV (near the south water storage tanks) is located, in CSPCS (NAD1983/1991) notation, at:

[N264,249.16]/[E1,783,627.52]

To identify a survey location in terms of CSPCS rectangular coordinates, using the Area IV Site Location Grid, the survey team will lay a measuring tape line between the two 200ft grid markers that form a north/south line just west of, and (similarly, with a second measuring tape) just east of the location being surveyed. This action locates the west and east boundaries of a 200ft x 200ft ***survey block*** within which the survey location can be found. For purposes of defining location, the point of reference for each *survey block* will be at the 200ft grid marker stake that establishes the southwest corner of the block. The survey team will then lay a third measuring tape, running east/west (perpendicular) between the first two tapes, and through the survey location. The location of the survey point within the *survey block* is then described as a distance (in terms of N/S and E/W rectangular distance coordinates) between the survey location and the 200ft grid marker stake at the southwest corner of the block. The CSPCS coordinates of the survey location can then be determined by adding its measured distance (N/S and E/W) to the southwest corner post, in rectangular format, to the CSPCS *northing* and *easting* coordinates of the grid marker stake being used as the southwest corner post.

For the ambient gamma survey, a 200ft x 200ft *survey block* will be delineated as described above, as an area to be surveyed as a unit. Within this *survey block*, the radiological survey measurements will be made at the 25ft interval intersections of north/south, and east/west grid lines superimposed upon the 200ft site location grid. At each survey location, 1-minute measurements

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note 1: The referenced brass surveyors' monument was placed in 1953 to mark the location as 19,984.31ft north of, and 10,484.02ft east of a locally selected survey reference point. The relationship of the brass monument to its position on the California State Plane Coordinate System, Zone 5 (NAD1927), was established in the survey documented by reference 9. An additional survey was made following the January, 1994 Northridge Earthquake, and the location of the referenced brass surveyors' monument was established in relationship to the more currently used CSPCS, Zone 5 (NAD1983/1991).

of the ambient gamma activity at 1-meter above the ground surface will be made using paired, duplicate instruments. Making simultaneous survey measurements with paired, duplicate instruments provides a continuous check on instrument reliability to detect instrument instability, drift, intermittent excessive noise, or other failures. The availability of paired data also yields an improvement in measurement precision by a factor of 1.4. If the gamma activity at a survey location is high, or if it is anomalous in comparison to the immediate surrounds, then the location will be marked with a numbered, iridescent pink flag (§3.2.4.1) for follow-up attention during the walk-about survey. When the individual measurements are recorded, the survey location will be identified by its CSPCS *northing* and *easting* coordinates. All measurements will be recorded on an Ambient Gamma Survey Data Record (figure B2). Each *survey block* will have 81 ambient gamma measurement locations, except where obstructions (property boundary lines, buildings, regions already surveyed, etc) prevent access to all points on the grid.

The walk-about survey of near surface gamma activity will be an active search for "hot spots" (peaks in gamma countrate) as the survey team walks over the grounds of Area IV. The walk-about survey will usually be done in each *survey block* after the ambient gamma survey has been completed, and before the measuring tapes are removed from the east and west boundaries.

To assist in performing the walk-about survey, the gamma detector will be mounted on the end of a balanced boom, with which the surveyor can hold the detector close to the ground surface, sweeping it side-to-side, while listening for changes in gamma meter click rates, as the surveyor walks over the grounds.

At the start of the walk-about survey, the surveyor will first return to those locations flagged as "suspect" during the ambient gamma survey, and scan the areas around the flags to more precisely locate the source(s) of the high or anomalous gamma activity readings. If an increase in gamma activity is noticed during this scan, the surveyor will follow the direction of the increase until the specific location of the gamma activity peak is found (the actual location of the hot-spot source may be different than the grid point marked during the ambient gamma survey). The gamma activity of any gamma "hot spot" finds will then be measured at the ground surface, and at 1-meter above the ground. If the ambient gamma activity at the "hot spot" is more than 4040cpm (equivalent to 5μR/hr) over the normal background, as measured at 1-meter height, then the the location of the activity peak will be marked with a numbered, iridescent pink flag, and its CSPCS *northing* and *easting* coordinates determined using the measuring tape method described above. All "hot spot" data will be entered on a Walk-About Survey "Hot Spot" Data Record (fig B4). If it is clear that this "hot-spot" peak is the source of the activity that prompted a flag to be set during the ambient gamma survey, then the HP will note this fact on the "Hot-Spot" Data Record for this Survey Block.

After all of the "suspect" flag locations have been scanned, the walk-about surveyor will proceed to the SW corner of the *survey block*, and continue the survey, systematically, along parallel transit lines running east/west across the *survey block*. If other gamma peaks are encountered, the surveyor will again follow the direction of increasing gamma to determine the specific source location. The surveyor will monitor the gamma activity level at the surface, and, if the gamma countrate exceeds 4200cpm, as measured at the surface, mark it with a "hot spot" flag as described above, and determine the location coordinates. Again the Team HP will enter all "hot-spot" finds on the "Hot-Spot" Data Record. After completing each transit pass across the *survey block*, the surveyor will move the transit line northward at 5ft intervals until the *survey block* has been completely scanned. To document the progress of the walk-about survey, the start-time and end-time of each transit across the *survey block* will be recorded on a Walk-About Survey Transit Record (fig B3).

Any location flagged as a "hot spot" will be noted in the final report, even if it is later determined that the high gamma activity was due to some feature of local geology, or to other fluctuations in the natural radiological background. The Survey Data Control Manager will evaluate all "hot spot" findings -- taking additional measurements and soil samples for in-house gamma spectrum analysis -- to determine if the activity is related to the natural geology of the area. If the high measured activity at the flagged location is soil related, and is not clearly due to natural geology, the Survey Data Control Manager will notify the Manager of RP&HPS, and the Project Manager for further direction (e.g. taking soil samples for analysis by the contract lab).

Measurement integrity of the instruments will be monitored throughout all parts of these gamma surveys by periodic checks of the instrument's response to normal background radiation, and to a *Field Check Source*. A record of these instrument checks will be maintained by the daily completion of Instrument Qualification Reports (figure B1). Routine estimates of the detector efficiencies based upon their responses, as compared to a Reuter-Stokes ambient gamma exposure monitor (to be kept at the daily instrument check location), provides a means of monitoring for any changes in instrument accuracy during the test. It also provides data for determining the gamma conversion factor of each instrument so that counting data of different instruments can be logically compared.

If, during the walk-about survey, a surveyor discovers the presence of patches of ground having unusual or uncharacteristic vegetation die-back, discarded chemical containers, or debris which might indicate a suspected or potential hazardous chemical or material release, the find will be indicated on the NOTES column of the Walk-About Survey Transit Record. The entry about the find will include a brief description, the transit east distance from the *east boundary tape*, plus any other pertinent information. The back of the 'Transit Data Record page may be used if extra space is needed. The Survey Managers will be notified as soon as

practicable, and the Survey Managers will notify the Rocketdyne Environmental Protection Unit of the finding before the end of the next working day (or, immediately, if a chemical hazard is obviously present).

5.2 AREA IV GAMMA SURVEY INSTRUCTIONS

5.2.1 200ft INTERVAL AREA IV LOCATION GRID LAYOUT

A map of the facility showing a 200ft grid layout is given in Figure 5-1.

5.2.1.1 Prior to the start of the survey, an outside contractor will lay out marker stakes at the 200ft x 200ft interval grid locations of the Area IV location grid. Each 200ft intersect interval of the site location grid will be individually identified by a site location grid code (a site grid number), with a consecutive alphabet letter to represent location along the north/south axis, and a consecutive number to represent location along the east/west axis. Each marker stake will be stamped with the site grid number ("*Post ID No:*") for its intended location, even if the actual location of the marker stake was offset during placement to accommodate physical obstacles.

5.2.1.2 In addition to the site grid number, each grid marker stake will also have a tag that identifies its actual CSPCS (NAD1983/1991) location, in terms of *northing* and *easting* coordinates. With this information, the marker stakes can be used directly for defining the boundaries of a *survey block*, and then for determining the *northing* and *easting* coordinates of any point within that *survey block*. The *northing* and *easting* coordinates listed on each stake will always reflect the actual coordinates of the marker stake, not its intended location on the site grid.

5.2.1.3 The procedure for layout of a *survey block*, where access to the four marker stakes forming the corner posts of the *survey block* is unobstructed, is described in §5.2.2.

5.2.1.4 The location for some 200ft grid marker stakes may occur where there is no physical access (as might be caused by a sandstone formation, deep ravine, restricted facility fencing, etc.). In such cases, the grid survey contractor has been instructed to place the marker stake as close as possible to the designated point. Marker stakes with offset placements cannot be used directly to define the corners of a *survey block*, using the precedure given in §5.2.2, because the *survey block* would end up irregular in shape (meaning, other than 200ft square). Therefore:

5.2.1.4.1 Whenever marker stakes with offset placement are encountered by the survey team, the team will consult with the Survey Data Control Manager before proceeding with the *survey block* layout.

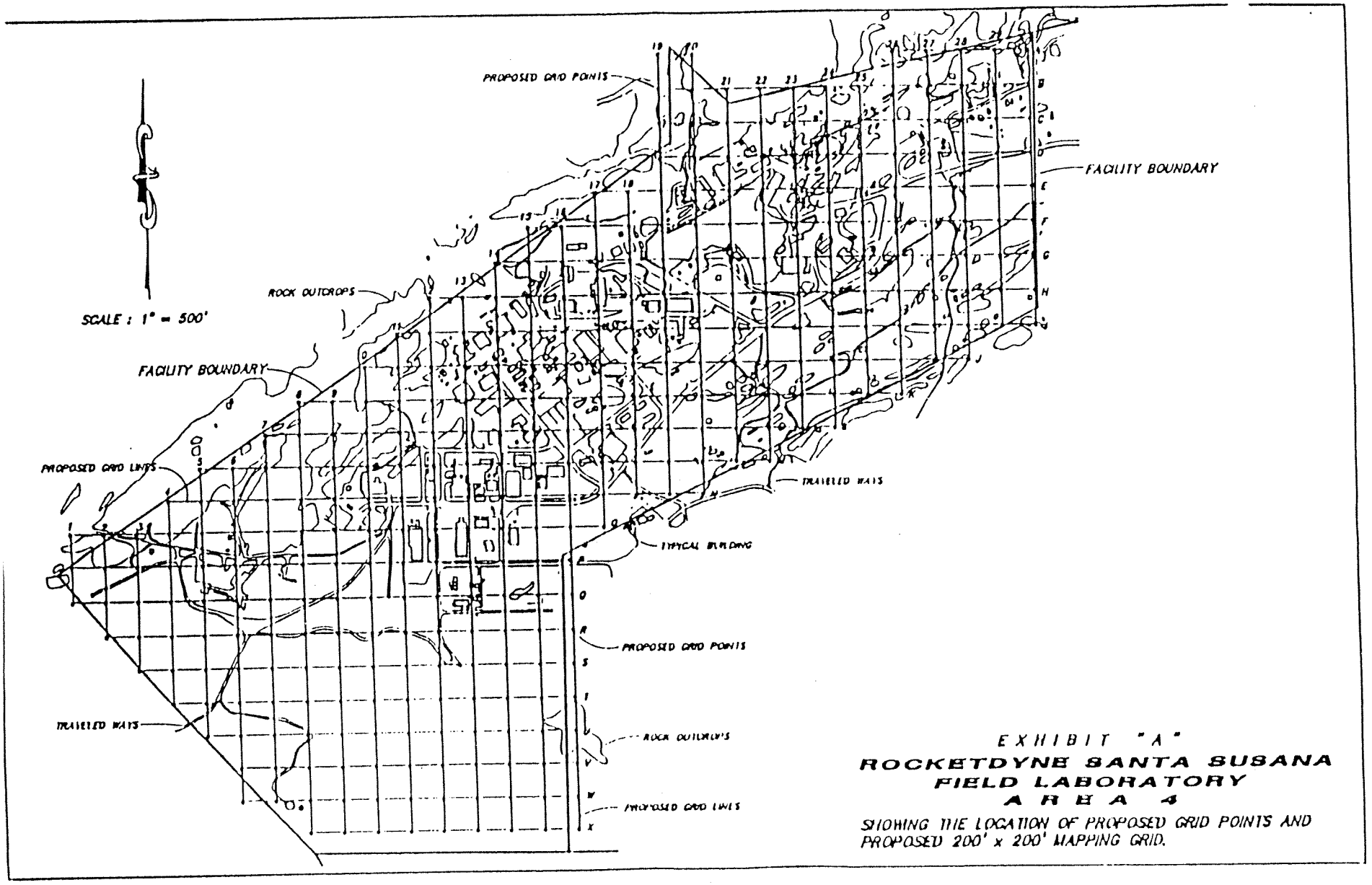


Figure 5-1. Area IV Schematic Showing The 200ftx200ft Site Location Grid Layout.

*Note: The actual locations of the marker stakes for the 200ft x 200ft Area IV Location Grid will be provided by the survey vendor.

5.2.1.4.2 The Survey Data Control Manager will specify a modification to the layout procedure to accommodate for the lack of true corner post placement(s). Such alterations to the procedure will be based upon the use of sighting compasses and additional measuring tapes to establish placements for the *west* and *east boundary tapes*, which may include rectangular coordinate steps around areas having impaired access. Any such alterations to the boundary layout procedure will be specifically described on the back of the Ambient Gamma Survey Data Record in use for that *survey block*. The alternate procedure developed will be formalized by the Survey Data Control Manager, and added to the redline copy of this working procedure.

5.2.1.4.3 Once the *west* and *east boundary tapes* have been appropriately placed to accommodate for the physical circumstances, the survey team may identify the *survey block* as described in §5.2.3, and proceed to find the individual survey locations as described in §5.2.4.

5.2.2 ESTABLISHING WEST AND EAST BOUNDARIES OF A SURVEY BLOCK

A ***survey block*** is a 200ft square enclosing an area to be surveyed as a unit. The corners of a *survey block* are defined by four adjacent 200ft location grid marker stakes. To define the boundaries of a particular *survey block*, within which survey locations are to be established, locate the four adjacent 200ft location grid marker stakes that will define the corners of the block.

> *NOTE*: Throughout §5.2.2 it is assumed that the 200ft grid marker stakes needed to define a *survey block* are in place, and that all stakes occur at exact 200ft interval intersect points on the site location grid. If the placement of any stake is found to be offset (due to impeded access at the intended point on the site location grid), refer to §5.2.1.4.

5.2.2.1 First, find the 200ft location grid marker stake at the southwest corner of the area being surveyed. The grid marker stake will have an internal site location code stamped on it, such as: "G5", as well as a tag identifying the CSPCS *northing* and *easting* coordinates of the location marked by that stake.

For example, for grid marker stake No. G5:
No. G5: [N1,906,000]/[E6,344,400]

VERIFY that the marker stake is placed at a 200ft interval grid point, by reading the *northing* and *easting* coordinates from the CSPCS coordinate tag. If the marker stake is not located at a 200ft interval point, refer to §5.2.1.4.

5.2.2.2 Starting at this first stake -- for example, at marker stake No."G5" -- lay a 200ft measuring tape along the line running due north, ending at the next marker stake northward of the starting point.

VERIFY that the second marker stake is placed at a 200ft interval grid point, by reading the *northing* and *easting* coordinates from the CSPCS coordinate tag. If the marker stake is not located at a 200ft interval point, refer to §5.2.1.4.

This second stake (in this example, marker stake No. "H5"), marks the northwest corner of the *survey block* being defined. The tape should be taut, but not stretched, and anchored to the ground by a large nail. This tape will be referred to as the ***west boundary tape***.

5.2.2.3 Leaving the first measuring tape in place, and returning to the southwest corner post, find the next 200ft grid marker stake directly east (in this example, marker stake No. "G6").

VERIFY that the marker stake is placed at a 200ft interval grid point, by reading the *northing* and *easting* coordinates from the CSPCS coordinate tag. If the marker stake is not located at a 200ft interval point, refer to §5.2.1.4.

This third stake marks the southeast corner of the *survey block* being defined.

5.2.2.4 Starting at this southeast corner post, lay a second 200ft measuring tape along the line running due north, ending at the next marker stake northward.

VERIFY that the marker stake is placed at a 200ft interval grid point, by reading the *northing* and *easting* coordinates from the CSPCS coordinate tag. If the marker stake is not located at a 200ft interval point, refer to §5.2.1.4.

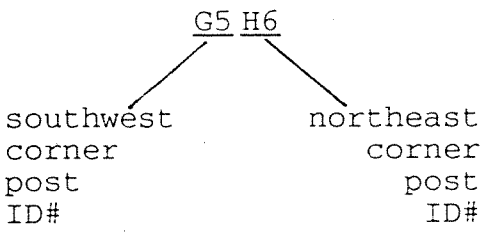
This fourth stake (in this example, marker stake No. "H6"), marks the northeast corner of the *survey block* being defined. This second tape should also be laid taut, but not stretched, and anchored to the ground with a large nail. This second tape will be referred to as the ***east boundary tape***.

5.2.3 DETERMINING THE SURVEY BLOCK IDENTIFICATION NUMBER

For data management, each *survey block* will be assigned a unique **survey block identification number** (**Srvy Blk ID No:**), which will be composed of the site grid number codes (marker stake No. code) from the marker stakes serving as the southwest and northeast corner posts of the *survey block*:

For example:

The *survey block* that was defined to illustrate the boundary tape layout procedure (§5.2.2) had its corners described by the four marker stakes identified as: "G5", "H5", "G6", and "H6". Since the southwest corner was at "G5", and the northeast corner was at "H6", the *survey block ID number* will be "**G5H6**".



5.2.4 IDENTIFYING A SURVEY LOCATION WITHIN A SURVEY BLOCK

For purposes of data recording on the survey Data Records, the HP shall enter the marker stake ID number of the southwest corner post of the *survey block*, and its *northing* and *easting* coordinates in the spaces provided in the upper left corner of each page of data. A specific survey location within the *survey block* will be identified by its rectangular distance coordinates, northward and eastward, (as determined with the measuring tapes) from the SW corner post. Thus, a location within G5H6 that is 175ft north of, and 150ft east of marker stake G5 would be correctly identified on a Data Record as: N175,E150; on a working note other than a Data Record (as, for example in a logbook entry) the location should be further linked to its reference corner post, so that this same point would be identified as: (G5)N175,E150.

For historical purposes, however, a survey location is more fully identified by its CSPCS *northing* and *easting* coordinates, usually in the following format:

[*northing coordinate*]/[*easting coordinate*]

For example:

[N1,906,175]/[E6,344,550]

After the corner stakes have been identified for the *survey block*, and the *west* and the *east boundary tapes* have been placed (§5.2.2, or §5.2.1.4), specific survey locations within the *survey block* can be identified by the procedures given in §5.2.4.1, and §5.2.4.2.

5.2.4.1 Determining CSPCS Northing Coordinate:

A specific location along either of the two boundary tape lines, in terms of the CSPCS *northing* coordinate, is found by adding the distance value (in "feet") along the measuring tape to the CSPCS *northing* coordinate associated with the southwest corner post of the *survey block*.

For example:

If the southwest corner post of the *survey block* is marker stake No. "G5", and the CSPCS *northing* cordinate for that location is listed as [N1,906,000], then a location along the first measuring tape at the 175ft mark (i.e., 175ft north of the tape starting point) would have a CSPCS *northing* coordinate of:

n175 + [N1,906,000] = [N1,906,175]

And:

A *survey transect tape* running from the 175ft mark of the *west boundary tape* to the 175ft mark of the *east boundary tape* would lie along the CSPCS [N1,906,175] *northing* axis.

5.2.4.2 Determining CSPCS Easting Coordinate:

Easting coordinates are distance coordinates along a *northing* axis. To find a specific location along any *northing* axis within the *survey block*:

5.2.4.2.1 Lay out a third 200ft measuring tape, starting at the *west boundary tape*, and running on an east/west line -- through the survey location -- to the *east boundary tape*. This third tape will be referred to as the ***survey transect tape***.

5.2.4.2.2 A specific location along any *northing* axis, in terms of the CSPCS *easting* coordinate, is found by adding the distance value (in "feet") along the *survey transect tape* to the CSPCS *easting* coordinate associated with the southwest corner post of the *survey block*.

For example:

If the southwest corner post of the *survey block* is marker stake No. "G5", and the CSPCS *easting* cordinate for that location is listed as [E6,344,400], then a location along the *survey transect tape* that is at the 150ft mark (i.e., 150ft east of the western edge of the *survey block*) would have a CSPCS *easting* coordinate of:

e150 + [E6,344,400] = [E6,344,550]

NOTE: This procedure assumes that there are no obstacles inside the *survey block* which would interfere with the placement of the *survey transect tape*. If obstacles <u>are</u> present which prevent a direct line across the *survey block*, refer to §5.2.4.3.

5.2.4.3 Impassable Obstacles In the *Survey Transect Tape* Path:

If impassable obstacles prevent the laying out of a straight boundary-to-boundary *survey transect tape*, and, if a suitable alternative procedure for stepping around the obstacle(s) has not already been developed and inserted into the redline document by the Survey Managers, the survey team will consult with the Survey Data Control Manager before proceding in this *survey block*.

5.2.4.3.1 The Survey Data Control Manager will specify an alternate layout procedure to accommodate for the obstacle. Such alterations to the procedure will be based upon the use of sighting compasses and additional measuring tapes to establish measured, rectangular coordinate steps around the obstacle(s). Any such alterations to the *survey transect tape* layout procedure will be specifically described on the back of the <u>Ambient Gamma Data Record</u> in use for that *survey block*. The alternate procedure that is developed will be formalized by the Survey Data Control Manager, and added to the redline copy of this working procedure.

5.2.4.3.2 Once a layout of measuring tapes has been appropriately placed to step around the physical obstacle(s), the east/west oriented portions of the tapes may be collectively used as a *survey transect tape*, and the survey team may proceed to find the individual survey locations as described in §5.2.4.2.2.

5.2.4.4 Full CSPCS Description Format:

Continuing the example from §5.2.4.2.2, the <u>full</u> CSPCS description of a survey point in *survey block* No. G5H6, that is located 175ft north, and 150ft east of the southwest corner post (Marker No. G5), would be:

[N1,906,175]/[E6,344,550]

5.2.5 AMBIENT GAMMA SURVEY PROCEDURES

The ambient gamma survey will be done at locations defined by the intersects of a 25ft x 25ft grid that is superimposed upon the site location grid. The survey team will use the 200ft interval marker stakes of the site location grid to define a 200ft x 200ft *survey block* within which to set up the 25ft interval survey grid. The survey team will normally perform the ambient gamma survey, visiting all of the survey locations, and completing all of the measurements in the *survey block* before starting the walk-about survey (§5.2.6) of the same *survey block*, or before starting an ambient gamma survey of a new *survey block*.

5.2.5.1 Find the positions of the 200ft grid marker stakes for each of the four corners of the selected *survey block*, and set up the *east and west boundary tapes* as described in §5.2.2. The boundary tapes, which must be securely anchored in place, will be used directly for establishing the gamma survey locations within the *survey block*.

5.2.5.2 Return to the southwest corner post of the *survey block*, and lay a third 200ft measuring tape (the *survey transect tape*) between the southwest and southeast corner posts, as described in §5.2.4.2. Secure the ends of the tape with large nails, and leave the tape in place.

RECORD the Southwest Corner Post ID data (§5.2.2.1) in the upper left hand corner of the Ambient Gamma Survey Data Record (figure B2, as described in §B.6.1). Include the post ID No., and the CSPCS *northing* and *easting* coordinates for that marker stake location, if that information is available at the marker stake.

RECORD the *Survey Block ID Number* (§5.2.3) in the upper right hand corner of the Ambient Gamma Survey Data Record.

5.2.5.3 The survey measurement locations for the ambient gamma survey are at the 25ft interval marks along the length of the *survey transect tape*, including the points located on the *west* and *east boundary tapes* of the *survey block*. Find the starting, or next, 25ft interval along the *survey transect tape* (§5.2.4.2.2).

5.2.5.4 For purposes of data recording on the Data Records, a specific survey location within a *survey block* will be identified by its rectangular distance coordinates, northward and eastward (as determined with the measuring tapes), from the southwest corner post (see §5.2.4).

RECORD the survey point location data in the columns provided on the Ambient Gamma Survey Data Record. The data to be recorded is the measured tape distances northward and eastward from the SW corner post.

5.2.5.5 Make sure that the instrument function switch settings are correct (§B.3), that the calibration date has been verified, that the instrument performance checks are current and satisfactory (§B.4), and that the RP&HPS Daily Instrument Qualification Report (figure B1, as described in §B.5) has been properly completed

5.2.5.6 Place the *Ambient Gamma Survey Detector Fixture* (§A.1), with its two mounted gamma detectors, at the survey location. The pole of this fixture will be held perpendicular to -- with the gamma detectors oriented towards -- the surface being measured. The gamma detectors must also have at least 1-meter distance from other nearby rocks or cliff faces.

NOTE: If the fixture cannot be positioned to provide this separation from rock surfaces:

5.2.5.6.1 The survey team will note this on the Ambient Gamma Survey Data Record, and move on to the next survey location:

RECORD the date and time on the Ambient Gamma Survey Data Record.

ENTER "No measurement" across the *AMBIENT GAMMA* columns, and, "rock face within (distance)ft" in the *NOTES* column.

REPORT the missed survey locations to the Survey Data Control Manager.

5.2.5.6.2 Upon notification of the missed location, the Survey Data Control Manager will evaluate the placement options and specify whether an alternate location is to be used as a substitute.

5.2.5.7 The survey data to be obtained at each location on the 25ft interval grid, will be a 1-minute count of ambient gamma activity at 1-meter distance above the ground surface, from each of two independent gamma survey instruments, simultaneously. Initiate a 1-minute count for the two instruments at the same time by pushing each of their respective **"COUNT"** buttons.

RECORD the results of the 1-minute count (for both instruments) on the Ambient Gamma Survey Data Record (fig B2, as described in §B.6.1), and the date and time, next to the survey point location data. In the "NOTES column, enter the meter numbers of the instruments used, and the initials of the person actually making the measurements; also enter any observations about the measurement environment (ie: proximity to large rocks, temperature, weather, etc.), or about unusual instrument behavior that might lend perspective to the data during later analysis. Continue notes on the back of the 'Data Record, if additional space is needed.

OBSERVE that the meter readings from the two duplicate instruments are consistent with previous experience.

NOTE: If unusual or anomalous meter behavior is observed, determine if the meters are functioning normally, and that the meter cables are free of defective connections. Enter observations in the *Survey Logbook*, and report observations to the Survey Data Control Manager at the end of the workshift. If instrument operation remains suspect, report the problem to the Radiological Instrumentation Laboratory, and/or one of the Survey Managers before making any survey measurements with the instrument(s). If anomalous instrument behavior is observed, or if cables or batteries are replaced, or if any adjustments are made on an instrument, enter a note about it on that instrument's IQR Data Sheet for that day.

OBSERVE that the measured gamma countrate does not exceed 4040cpm

NOTE: If high countrates are measured, mark the location with a numbered, iridescent pink flag, and enter the flag number in the "NOTES" column of the Ambient Gamma Survey Data Record.

ENTER Team HP initials in the space provided to record procedural adherence and data accuracy. Also sign and initial at the bottom of the data record page, if not previously done.

ENTER QA&T initials, if observer was present during the procedure, to provide a record of the observation. Also sign and initial at the bottom of the 'Data Record page, if not previously done.

5.2.5.8 When survey measurements are complete along the length of the *survey transect tape*, make sure that the *east* and *west boundary tapes* are still secured along their respective boundaries. Using the distance scales on both the *east* and the *west boundary tapes*, move the *survey transect tape* 25ft northward. Repeat §5.2.5.3 and §5.2.5.4 to find and record the next set of survey measurement locations.

5.2.5.9 Repeat §5.2.5.5 through §5.2.5.8 until the *survey transect tape* reaches the north boundary of the *survey block*, and all measurements in the survey block are complete. Leave the *east* and *west boundary tapes* in place, and proceed to the walk-about survey (§5.2.6).

5.2.6 WALK-ABOUT SURVEY PROCEDURES

The walk-about survey of near-surface gamma activity will be an active search for "hot spots" (peaks in gamma countrate), as the survey team walks over the *survey block*. The gamma detector will be mounted on the end of a balanced boom (the *Walk-About Survey Detector Fixture*, §A.2), with which the surveyor can hold the detector close to the ground surface while sweeping it side-to-side as he/she walks ahead. The walk-about survey of a *survey block* will usually be performed <u>after</u> the ambient gamma survey (§5.2.5) has been completed.

5.2.6.1 If any locations in the *survey block* were flagged as anomalous or "suspect" during the ambient gamma survey, go directly to (one of) the flag(s).

<u>*RECORD*</u> the *survey block ID number* (§5.2.3), and the *SW corner post ID* data on the <u>Walk-About Survey "Hot Spot" Data Record</u> (figure B4, as described in §B.6.3), if not previously done.

<u>*RECORD*</u> the flag number at the "suspect" location (RSLnnn) in the NOTES column of the first, or next, row of the <u>Walk-About Survey "Hot Spot" Data Record.</u>

5.2.6.2 Scan the area around the flag to more precisely locate the source(s) of the high or anomalous gamma activity readings that were observed in the ambient gamma survey. If an increase in gamma activity is noticed during this scan, the surveyor will follow the direction of the increase until the specific location of the gamma activity peak is found.

5.2.6.3 Using the indicator meter of the survey instrument, determine the approximate gamma activity at the new peak location at 1-meter height.

5.2.6.4 Place a numbered iridescent pink flag at the new "hot spot" location. If this new location is clearly the source of the high gamma activity reading at the nearby gamma survey grid point (ie: the starting point for this part of the survey), indicate so on the 'Hot-Spot Data Sheet for this *survey block*.

RECORD the "hot spot" location marker flag number in the left hand column of the Walk-About Survey "Hot Spot" Data Record.

5.2.6.5 Using the survey measuring tapes (§5.2.4), determine the location of the "hot spot" within the *survey block*.

RECORD the location coordinates of the "hot spot" in the columns provided in the Walk-About Survey "Hot Spot" Data Record.

5.2.6.6 Measure a 1-minute count of gamma activity at the contact surface of the "hot spot" location.

RECORD the result of the measurement in the Walk-About Survey "Hot Spot" Data Record.

5.2.6.7 With the same instrument used in step 5.2.6.6, measure a 1-minute count of gamma activity at 1-meter height at the same location.

RECORD the results of the measurement in the Walk-About Survey "Hot Spot" Data Record. Also record the meter number of the instrument used, and the initials of the person making the measurement.

ENTER Team HP Initial in the space provided to record procedural adherence and data accuracy. Also sign and initial at the bottom of the "hot spot" data record page, if not done previously.

ENTER QA&T initials, if observer was present during the procedure, to provide a record of the observation. Also sign and initial at the bottom of the "hot spot" data record page, if not done previously.

5.2.6.8 Move on to the next "suspect" location marker flag, and proceed as in step §5.2.6.1, until the areas around all "suspect" marker flags have been scanned.

RECORD the *survey block ID number* (§5.2.3), and the *SW corner post ID* data on a Walk-About Survey Transit Record (figure B3 as described in §B.6.2), if not previously done.

5.2.6.9 Move to the southwest corner post of the *survey block*. Starting at a point on the *west boundary tape* that is 5ft north of the southwest corner post, lay out the *survey transect tape* on a line running due east, to a point on the *east boundary tape* that is 5ft north of the southeast corner post. The *survey transect tape* will provide a guide for keeping the transit line straight, and parallel to the south boundary, as the surveyor walks the transit path across the *survey block*.

NOTE: One east/west *survey transect tape* can accommodate up to two walk-about surveyors: One on the south side of the tape, scanning to 5ft southward; and one on the north side of the tape, scanning to 5ft northward. Additional surveyors may be added by adding more east/west *survey transect tapes* at 5ft intervals.

RECORD the transit being surveyed (identified by its distance north of the south corner posts) on the Walk-About Survey Transit Record.

CHECK that the instrument being used is a Ludlum model 2221 Ratemeter/Scaler (or equivelent), that the instrument **SCALER/DIG RATE** switch is in the "**DIG RATE**" position, that the **AUDIO VOLUME** is loud enough that the surveyor can hear the clicking of the meter, that the **AUDIO DIVIDE** switch is set to its "normal" position (usually "**X1**"), that the meter **RANGE** switch is set to its "normal" position (usually "**X10**"), and that the **RESP F/S** switch is set to "**S**".

RECORD the date and starting time for the transit.

5.2.6.10 Starting with the survey detector at the southwest corner post, and the surveyor standing just outside the *survey block*, in line with the transit path, the surveyor will walk at a slow pace of about 4 sec/ft to the *eastern boundary tape* of the *survey block*, using the *survey transect tape* as a guide for keeping the walking path straight. As the surveyor walks the transit path, he/she will scan a 5ft-wide sweep of the ground surface with the gamma detector, while monitoring for changes in the gamma meter countrate. The surveyor will note the approximate maximum and

minimum countrate observed during the walk across the survey transit line, and will form a subjective opinion of the approximate average countrate value for the whole transit pass (ie: where the meter indicator spent most of its time during the transit pass). These subjective estimates need only be to the nearest approximate 100cpm.

NOTE: The side-to-side motion of the detector should be such that the detector traverses the 5ft-wide path from one side to the other in about 4 seconds, making sure that the detector comes within 1ft proximity of all points in the survey path.

5.2.6.11 If an increase in gamma activity is noticed, and it is not obviously leading to a nearby location that is already flagged as a "hot spot", the surveyor may leave the east/west transit line temporarily, marking the point of departure from the transit line, and follow the direction of the increase until the location (source) of the increased gamma activity is found. If the gamma countrate exceeds 4200cpm, as measured at the surface, the surveyor will place a numbered, iridescent pink flag at the "hot spot" location.

RECORD the "hot spot" flag number of the "hot spot" location in the Walk-About Survey "Hot Spot" Data Record (figure B4, §B.6.3).

5.2.6.12 Using the survey measuring tapes (§5.2.4), determine the location of the "hot spot" within the *survey block*.

RECORD the location coordinates of the "hot spot" in the columns provided in the Walk-About Survey "Hot Spot" Data Record.

5.2.6.13 Measure a 1-minute count of gamma activity at the contact surface of the "hot spot" location.

RECORD the result of the measurement in the Walk-About Survey "Hot Spot" Data Record. Also record the meter number of the gamma instrument used, the initials of the person making the measurement, as well as the date and time of the measurement.

5.2.6.14 With the same instrument used in step 5.2.6.13, measure a 1-minute count of gamma activity at 1-meter height.

RECORD the results of the measurements in the Walk-About Survey "Hot Spot" Data Record, the meter number of the gamma instrument used, the initials of the person making the measurement, and the date and time of the measurement.

ENTER Team HP Initials in the space provided to record procedural adherence and data accuracy. Also sign and initial at the bottom of the "hot spot" data record page, if not previously done.

ENTER QA&T initials, if observer was present during the procedure, to provide a record of the observation. Also sign and initial at the bottom of the "hot spot" data record page, if not previously done.

5.2.6.15 After the "hot spot" activity and location data is recorded, the surveyor will return to the east/west transit line (restoring the *survey transect tape* to its correct transit path location, if it was moved) at the point of departure, and continue the systematic scanning for more "hot spots".

5.2.6.16 Upon reaching the endpoint of the transit, at the *eastern boundary tape*:

RECORD the time of transit end in the Walk-About Survey Transit Record.

RECORD the surveyors subjective estimate of the approximate maximum, minimum, and average countrate values (cpm) observed during the transit pass.

ENTER Team HP Initials in the space provided to record procedural adherence and data accuracy. Also sign and initial at the bottom of the transit record page, if not previously done.

ENTER QA&T initials, if observer was present during the procedure, to provide a record of the observation. Also sign and initial at the bottom of the transit record page, if not previously done.

5.2.6.17 Move the *survey transect tape(s)* northward 5ft for each surveyor on the survey line, to the next transit line. Repeat the east/west transits (§5.2.6.9 through §5.2.6.16), moving the transit line(s) northward 5ft for each surveyor on the transit line(s) after each pass across the *survey block* until the gamma detector has been swept over the entire survey area.

5.2.6.18 At least once each day in each *survey block* surveyed, the Team HP will hide a low-level gamma source in the surveyors path for the walk-about surveyors to "discover". This will be a "blind" test, in that the surveyors may not know when or where the source has been hidden, nor which surveyor should be expected to find it. The Team HP may repeat this test as often as desired to keep the surveyors alert. This test shall be referred to as the "QA source

check". If the hidden "QA source" is found, the Team HP will indicate with the notation: "* found QA source" in the NOTES column of that transit pass entry of the Walk-About Survey Transit Record. If the hidden source is not found by the surveyors, the Team HP will also note this fact on the 'Transit Record, and the Team HP will call for a resurvey of as much of the *survey block* as is necessary to insure that the area was adequately covered by an alert survey team. The transit pass records of the transects that needed to be excluded and resurveyed will be submitted to the Survey Manager, along with the rest of the data for that *survey block*.

5.2.6.19 When the survey is complete for the *survey block*, proceed to the ambient gamma survey (§5.2.5) of the next assigned *survey block*. The walk-about survey of each *survey block* should be completed before starting a walk-about survey of another *survey block*.

5.2.7 OFFSITE BACKGROUND AMBIENT GAMMA SURVEY

Ambient gamma surveys of selected offsite locations will be performed under this working procedure, in support of offsite background soil sampling. The Survey Manager will coordinate with the RP&HPS Manager to fix the precise locations for the offsite ambient gamma surveys, and will assist the survey teams in identifying the locations in the field. The area of interest at each offsite location will be defined by a single *offsite survey block*, 100ft x 100ft square, that has already been identified for a soil sample survey. The offsite ambient gamma survey will consist of measurements of ambient gamma activity at 1-meter above the ground surface, taken at the intersects of a 25ft interval grid which will be superimposed upon the 100ft square. A total of 25 measurement locations will be visited in the survey. Procedures specific to the offsite ambient gamma survey are given in the following paragraphs.

5.2.7.1 Before leaving SSFL to find the offsite survey locations, make sure that the calibration dates of the gamma measurement instruments have been verified, that the instrument performance checks are current and satisfactory (§B.4), and that the RP&HPS Daily Instrument Qualification Report (figure B1, as described in §B.5) has been properly completed.

5.2.7.2 With the assistance of the Survey Manager, find the four corner posts of the *offsite survey block* at the selected offsite location, and determine which of the corner posts is to be designated as the southwest corner of the block.

NOTE: If the corner posts do not exist, the Survey Manager will assist the survey team in determining where the corner posts should be placed, and flags will be set at each corner post location.

ENTER "OFFSITE GAMMA SURVEY" in the upper left corner of the Ambient Gamma Survey Data Record.

RECORD the offsite location designation number (to be provided by the Survey Managers) at the top of an Ambient Gamma Survey Data Record.

5.2.7.3 Starting at the designated southwest corner post, lay a measuring tape between the designated southwest corner post, and the designated northwest corner post. This first tape will be the *designated west boundary tape* of the *offsite survey block*. Anchor the tape securely in place.

5.2.7.4 Starting at the designated southeast corner post, lay a measuring tape between the designated southeast corner post, and the designated northeast corner post. This second tape will be the *designated east boundary tape* of the *offsite survey block*. Anchor the tape securely in place.

5.2.7.5 Return to the southwest corner post of the *offsite survey block*, and lay a *survey transect tape* between the southwest and southeast corner posts. Anchor the tape securely in place.

5.2.7.6 The survey measurement locations for the offsite ambient gamma survey are at the 25ft interval marks along the length of the *survey transect tape*, including the points located on the *west* and *east boundary tapes* of the *survey block*, and also including the southern and northern boundaries of the *survey block*. Find the starting, or next, 25ft interval along the *survey transect tape*.

5.2.7.7 For the offsite ambient gamma survey, the location of each survey point will be identified by its measured distance, in terms of rectangular coordinates, from the designated southwest corner post.

RECORD the survey point location data (the measured tape distance "northward" and "eastward" from the southwest corner post) in the columns provided on the Ambient Gamma Survey Data Record.

5.2.7.8 Make sure that the instrument function switch settings are correct (§B.3), that the instrument performance checks are current and satisfactory (§B.4), and that the RP&HPS Daily Instrument Qualification Report has been properly completed.

5.2.7.9 Place the *Ambient Gamma Survey Detector Fixture* (§A.1), with its two mounted gamma detectors, at the survey location. The pole of this fixture will be held perpendicular to -- with the gamma detectors oriented towards -- the surface being measured. The gamma detectors must also have at least 1-meter distance from other nearby rocks or cliff faces.

NOTE: If the fixture cannot be positioned to provide this separation from rock surfaces, the Survey Manager will evaluate the placement options and specify whether an alternate location is to be used as a substitute.

5.2.7.10 The survey data to be obtained at each location on the 25ft interval grid, will be a 1-minute count of ambient gamma activity from each of two independent gamma survey instruments, simultaneously. Initiate a 1-minute count for the two instruments at the same time by pushing each of their respective **"COUNT"** buttons.

RECORD the results of the 1-minute count (for both instruments) on the Ambient Gamma Survey Data Record, next to the survey point location data. Enter the meter numbers of the instruments used, and the initials of the person making the measurement. Add the date and time, and any observations about the measurement environment (ie: proximity to large rocks, temperature, weather, etc.), or about unusual instrument behavior that might lend perspective to the data during later analysis. Continue notes on the back of the 'Survey Data Record, if additional space is needed.

OBSERVE that the meter readings from the two duplicate instruments are consistent with previous experience.

NOTE: If unusual or anomalous meter behavior is observed, determine if the meters are functioning normally, and that the meter cables are free of defective connections. Enter observations on the 'Survey Data Record. If instrument operation remains suspect, report the problem to the Radiological Instrumentation Laboratory before making any survey measurements with the suspect instrument(s). If cables or batteries are replaced, or if adjustments are made on the instrument, a note to that effect should be entered on the instrument's IQR Data Sheet.

ENTER Team HP Initials in the space provided to record procedural adherence and data accuracy. Also sign and initial at the bottom of the data record page.

ENTER QA&T initials, if observer was present during the procedure, to provide a record of the observation. Also sign and initial at the bottom of the data record page.

5.2.7.11 When survey measurements are complete along the length of the *survey transect tape*, make sure that the *east* and *west boundary tapes* are still secured along their respective boundaries. Using the distance scales on both the *east* and the *west boundary tapes*, move the *survey transect tape* 25ft northward. Repeat §5.2.7.6 through §5.2.7.7 to find and record the next set of survey measurement locations.

5.2.7.12 Repeat §5.2.7.8 through §5.2.7.11 until the *survey transect tape* reaches the designated north boundary of the *survey block*, and all measurements in the *offsite survey block* are complete.

APPENDIX A: SPECIAL HARDWARE PREPARATIONS

A.1 AMBIENT GAMMA SURVEY DETECTOR FIXTURE

In order to assure reproduceability of the survey measurements in the survey of ambient gamma at 1-meter, the sodium iodide detectors will be mounted on a lightweight PVC fixture. This fixture, shown in figure A1, holds two detectors side-by-side, oriented towards the ground at 1-meter height. Its use will facilitate quick placement of the detectors at each measurement location, while eliminating errors due to detector distance or orientation. The fixture has a removeable spike, at the ground contact end, that can be pushed into the soil to hold the pole erect; this allows one person to manage the detector placement and meter operation, while a second person manages the survey data entries and logbook notations.

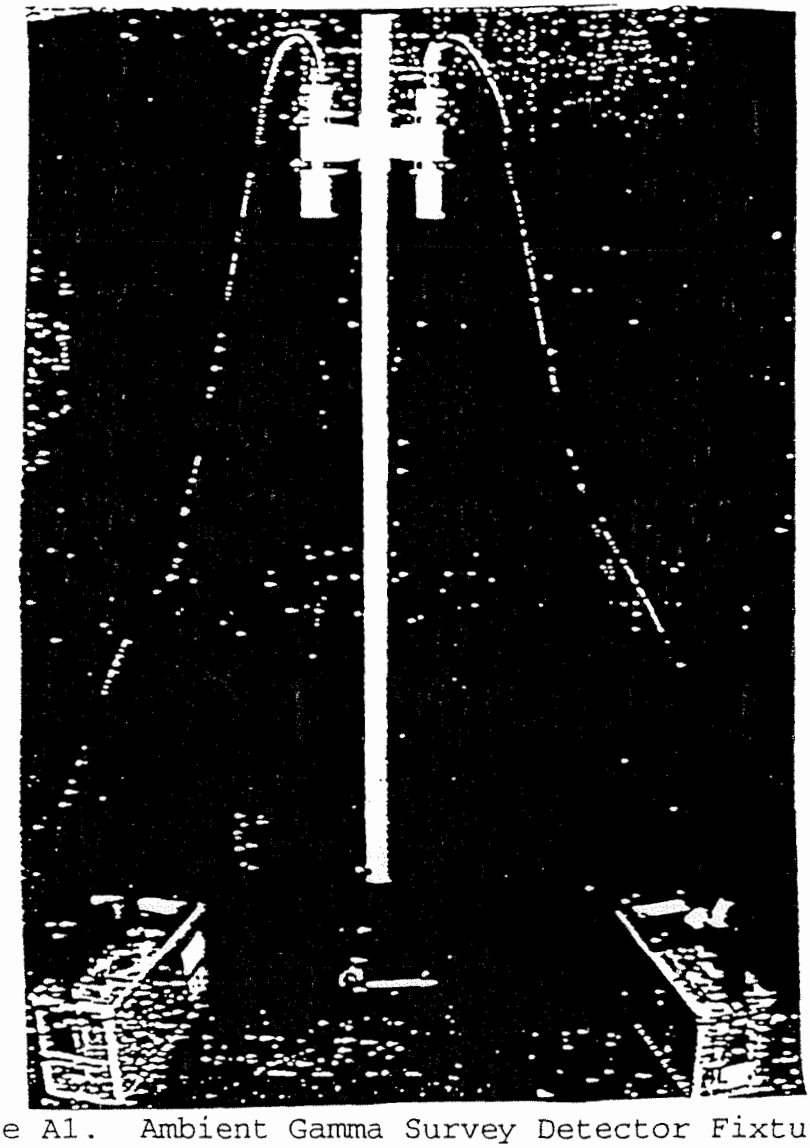


Figure A1. Ambient Gamma Survey Detector Fixture.

A.2 WALK-ABOUT SURVEY DETECTOR FIXTURES

During the walk-about survey, the sodium iodide detector will be mounted at the end of a balanced boom, so the surveyor can sweep the detector over a large area while walking along the survey path. The fixture for this survey, shown in figure A2, has a length of stainless steel tubing for the boom, with a bracket at one end to hold the detector upright with respect to the ground, and a counterbalance weight at the other end. A shoulder strap may be attached to the approximate balance point of the fixture, so the surveyor can shoulder the weight while walking forward. The arrangement allows the surveyor to sweep the detector over an area about 8 feet wide while standing in one place, or walking a straight line. At least four of these fixtures should be manufactured so that multiple gamma detectors can be in use at the same time.

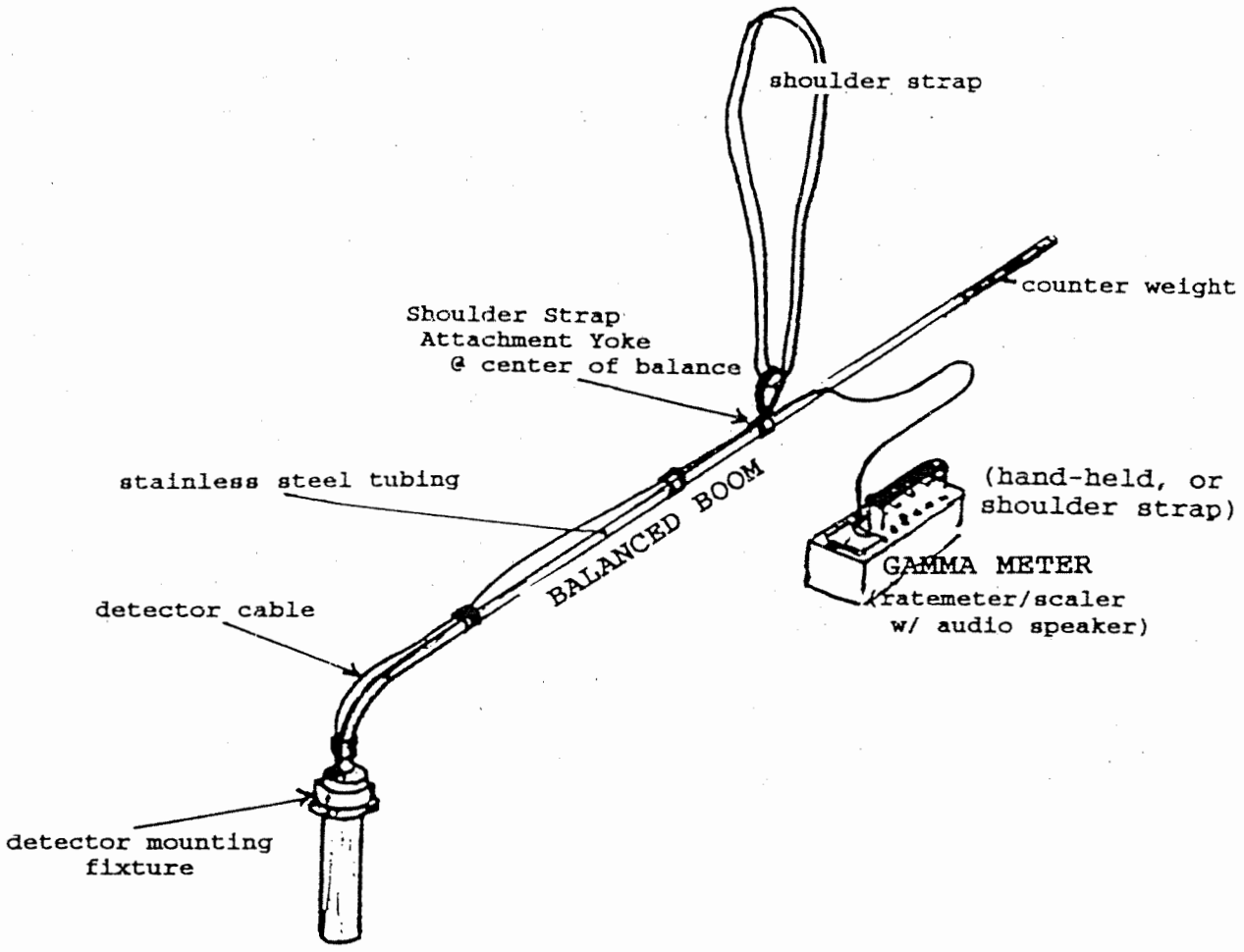


Figure A2. Walk-About Survey Detector Fixture.

APPENDIX B: INSTRUMENT OPERATION AND QUALITY ASSURANCE PROCEDURES

B.1 QUALITY ASSURANCE OVERSIGHT

ETEC Quality Assurance and Training department (QA&T) will provide independent quality assurance oversight during the performance of the gamma survey described by this document, in accordance with the Quality Assurance program plan.[ref 6] Although it is not necessary that QA&T provide continuous monitoring of the survey team throughout the survey, QA&T shall carry out sufficient surveillance to insure that the survey team properly executes and understands the importance of adhering to the details of the procedures detailed herein.

The QA&T representative will document this oversight activity by entering his/her initials in the space provided on the datasheet relevant to the procedure observed.

B.2 SURVEY INSTRUMENT QUARTERLY CALIBRATION

All survey instruments used in this study will be selected from among those maintained on a Quarterly Calibration cycle by the RP&HPS Instrument Lab. Further, the date of the last calibration for the selected instruments shall be no more than 45 days preceding the start-up date for this survey.

During the Quarterly Calibration, each NaI gamma survey meter (including the detector, ratemeter, and interconnecting cable) will be calibrated against a ^{137}Cs standard source, and verified against both ^{241}Am and ^{226}Ra standard sources.

A copy of the Calibration Lab's Instrument Calibration report for each instrument used in the survey will be included with the historical file for this project.

B.3 SURVEY INSTRUMENT OPERATING PROCEDURES

This section provides detailed instructions for field calibration and use of the survey instruments.

> *NOTE*: All non-normal observations and meter readings will be reported to the Radiological Instrumentation Laboratory, and/or Survey Manager before taking any survey measurements with the suspect instrument(s).

B.3.1 INSTRUMENT SETTINGS

For the Model 2220 and 2221 Ratemeter/Scalers:

WINDOW ..... "OUT"
RESP (F/S) ..... "S"
*** RANGE ..... "x10"**
*** COUNT TIME:**
MINUTES ... "1.0"
x1/x10 ... "x1"

* (Normal background settings are shown; set as needed.)

Additional settings for the model 2221:

SCALER/DIG RATE ..... "SCALER" (During 1-m ambient gamma surveys and Instrument Performance Checks)
..... "DIG RATE" (During walk-about surveys)

LAMP ON/OFF ..... "OFF"
AUDIO DIVIDE ..... "1"
MINUTES ..... "1"

B.3.2 INSTRUMENT TURN-ON PROCEDURE

The following procedure should be followed whenever the instrument has been left unused for more than an hour.

B.3.2.1 Set the **RANGE** switch to **"LOG"**; for the model 2221, also set the **POWER ON/OFF** switch to **"ON"**.

OBSERVE that the analog meter pointer goes to maximum off-scale, then drops back to some mid-scale location.

B.3.2.2 Set the **RANGE** switch to the *normal* background setting.

B.3.2.3 Check the **battery condition** by pushing the **"BAT"** button.

OBSERVE that the digital display reads 5.6 (volts) or greater.

B.3.2.4 Check the **high voltage** supply by pushing the **"HV"** button.

OBSERVE that the displayed reading is 900 volts +/- 50 (volts).

B.3.2.5 Check the **threshold** setting by pushing the **"THRESH"** button.

OBSERVE that the displayed reading is 400 +/- 25.

B.3.2.6 Check the instrument's response to normal background radiation. Remove the instrument from known radioactive sources, and initiate a 1-minute background radiation count by pushing the **"COUNT"** button.

VERIFY that the resulting meter reading is within normal bounds: (2200 to 3700 cpm for ambient outdoor gamma at 1-m height).

B.3.2.7 The instrument is now ready for use. If the current daily ***Instrument Performance Checks*** have not been completed, proceed to section §B.4 before performing survey measurements.

B.4 DAILY INSTRUMENT PERFORMANCE CHECKS

To ensure that data quality is sustained throughout the gamma surveys described in this procedure, checks on survey instrument functional operation will be performed and documented at the start of each shift, at the middle of the shift, and at the end of the shift. Additional performance checks may also be done whenever needed by the survey team.

B.4.1 DESIGNATED INSTRUMENT CHECK LOCATION

Daily ***Instrument Performance Checks*** will always be done at the designated instrument check location.

B.4.1.1 A location near Bldg 425 has been selected as the designated instrument check location during survey of the western half of Area IV. As the survey progresses into the eastern half of Area IV, alternate designated instrument check locations may be established in other parts of Area IV, to keep it closer to the survey work. The Survey Manager will monitor the need for alternate check locations, and implement changes as required. Changing the designated instrument check location requires relocation of the Reuter-Stokes ambient gamma exposure monitor, or installation of its equivalent (§B.4.1.2).

B.4.1.2 A Reuter-Stokes ambient gamma exposure monitoring system will be maintained at the designated instrument check location. This instrument is a High Pressure Ionization Chamber (HPIC) system, which will be used as a background radiation monitoring standard against which instrument responses can be compared during *instrument performance checks*. The Reuter-Stokes monitor also provides a continuous record of gamma exposure from ambient atmospheric and cosmic radiation, which may be useful in evaluating anomalous gamma survey measurements, if any occur during the survey. The Reuter-Stokes monitor is mounted on a specially designed post, which holds the unit at 1-meter height above the ground surface. The unit is a continuous monitor, and will remain powered on. Expanded details about instrument operation can be

found in the manufacturer's operating manual.[ref 10] Procedures for operating the monitor during *instrument performance checks* is included in the procedures for those checks. If an alternate designated instrument check location is established during the survey, the Reuter-Stokes monitor, or an equivalent unit, must be installed at the new location before it can be used for *instrument performance checks*.

B.4.1.3 Radioactive sources will be kept at least 100ft away from the designated instrument check location, except when the survey instruments' responses to the field check source are being checked.

B.4.1.4 Completion of the daily **Instrument Performance Checks** will be documented on the signed Instrument Qualification Report (**IQR**) shown in figure B1, and described in §B.5.

B.4.2 AMBIENT BACKGROUND LEVEL RESPONSE TEST

B.4.2.1 At the beginning of each work shift the survey team will check the **"calibration due"** date (on the calibration label affixed to the side of the instrument) to verify that the instrument calibration is still current.

RECORD the calibration due date on each respective Instrument Qualification Report (IQR).

B.4.2.2 Carry the survey instruments to the designated instrument check location (§B.4.1.1). The two gamma detectors used as an ambient gamma survey pair should be mounted in the *Ambient Gamma Survey Detector Fixture*, and the fixture placed next to the Reuter-Stokes HPIC sensor housing (§B.4.2). The fixture pole should be vertical, and the two gamma detectors oriented towards the ground, at 1-meter height. Hang the walk-about detector(s) -- still mounted in the *Walk-About Detector Fixture(s)* -- on the plywood bracket provided at the instrument check location. The walk-about gamma detectors should be next to the ambient gamma survey detectors, oriented towards the ground, at 1-meter height. Open the control housing on the Reuter-Stokes ambient gamma exposure rate monitor.

B.4.2.3 Turn on the gamma instruments, and check that the instrument voltage readings are within normal bounds (§B.3.2.1) through (§B.3.2.5).

RECORD the meter readings of each instrument on its respective IQR.

RECORD the clock time when the *instrument performance checks* were started on the top of the column on each IQR.

B.4.2.4 Read the cumulative exposure value indicated on the cumulative exposure counter of the Reuter-Stokes monitor.

RECORD the cumulative exposure value in the space labled **RS Cum Cnt** on each IQR.

B.4.2.5 Initiate a 1-minute count for all of the gamma instruments at the same time by pushing each of their respective **"COUNT"** buttons. Observe the chart recorder and the digital display meter of the Reuter-Stokes monitor during the 1-minute count, and form a subjective opinion about the average background radiation exposure rate value during the instrument count time (e.g. the meter value "where the digital readout spent most of its time").

RECORD the background radiation exposure rate value noted on the Reuter-Stokes monitor in the space labeled **RS (μR/hr)** on each IQR.

RECORD the results of the 1-minute count (for all gamma instruments) on their respective IQRs.

VERIFY that the resulting meter readings are within normal bounds: (2200 to 3700 counts/min for ambient gamma at 1-m).

B.4.2.6 If proceeding to the *field check source response test*, go to (§B.4.3.1). Otherwise, close and reseal the control housing on the Reuter-Stokes ambient gamma exposure rate monitor before leaving the area.

B.4.3 FIELD CHECK-SOURCE RESPONSE TEST

Normal instrument responses to ambient background should have been verified before proceeding (§B.4.2). Check source response of the two gamma detectors should be checked together while still mounted on the *Ambient Gamma Survey Detector Fixture*, and the fixture placed next to the Reuter-Stokes HPIC sensor housing (§B.4.1.2) at 1-meter height, oriented towards the ground. Check source response of the walk-about survey detector(s) may also be accomplished at the same time by hanging the detector(s) -- still mounted in (their) *Walk-About Survey Fixture(s)* -- on the plywood bracket provided at the instrument check location. The walk-about gamma detectors should be next to the ambient gamma survey detectors, oriented towards the ground, at 1-meter height. Open the control housing on the Reuter-Stokes ambient gamma exposure rate monitor.

B.4.3.1 A ^{137}Cs calibration source will be used as the field check source. The source ID number and gamma activity will be entered on each IQR. Place the check source on the ground at the base of the *Ambient Gamma Survey Fixture* and Reuter-Stokes monitor.

B.4.3.2 Initiate a 1-minute count for all of the gamma instruments at the same time by pushing each of their respective **"COUNT"** buttons. Observe the chart recorder and the digital display meter of the Reuter-Stokes monitor during the 1-minute count, and form a subjective opinion about the average [background + check source] radiation exposure rate value during the instrument count time (e.g. the meter value "where the digital readout spent most of its time").

RECORD the combined gamma exposure rate value from the check source and ambient background radiation in the space labeled **RS (μR/hr)** on each IQR.

RECORD the results of the 1-minute count (for all gamma instruments) on their respective IQRs.

B.4.3.3 Close and reseal the control housing on the Reuter-Stokes ambient gamma exposure rate monitor before leaving the area.

B.5 INSTRUMENT QUALIFICATION REPORT (IQR)

The **Instrument Qualification Report (IQR)** is the document that is used to record the results of *instrument performance checks*. As such, it is the central quality assurance thread that traces the performance of the survey instruments, in quantitative terms, throughout the entire survey.

The IQR form is shown in Figure B1. One IQR form will be completed for each instrument used during each day of the survey. The results of performance checks will be entered on the IQR forms at least three times each shift: at the beginning of the work shift; at mid-shift; and at the end of each work shift. The performance checks will always be made at the designated instrument check location (§B.4.1.1).

B.5.1 SPECIAL INSTRUCTIONS FOR COMPLETING THE IQR

B.5.1.1 At the start of each work shift, the survey team HP will verify that a correct form has been provided for each instrument used in the survey. Identification data for the instrument electronics and detector hardware will be completely entered. Copies of the forms with completed manufacturer and **RI/RD asset** ID data, **Scaler Diagnostic CAL** values, and **Field Check Source** ID data may be prepared in advance.

Figure B1. Daily Instrument Qualification Report

RADIATION PROTECTION & HEALTH PHYSICS SERVICES
GAMMA INSTRUMENT QUALIFICATION REPORT

INSTRUMENT ELECTRONICS

RI#: _____ S/N: _____

MFR: _____ Mdl: _____

RADIATION DETECTOR

RI#: _____ S/N: _____

MFR: _____ Mdl: _____

GAMMA INSTRUMENT CALIBRATION

Last Calibrated: Next Cal Due:

FIELD CHECK SOURCE

Source ID: Isotope: Activity:

_____ _____ _____

BKGD GAMMA EXPOSURE STANDARD

RI#: _____ S/N: _____

MFR: _____ Mdl: _____

INSTRUMENT QUALIFICATION DATA

	@Shift Start:	@Mid-Shift:	@Mid-Shift:	@Shift End:
Check Time:				
QA&T:				
SCALER DIAGNOSTICS				
(CAL) ( ) BAT:				
( ) HV:				
( ) THRSH:				
RS CUM CNT:				
BACKGROUND RESPONSE	Expected 1-Min Count: (RS): _____ uR/hr (Instr): _____ cpm Measured 1-Min Count:			
RS (uR/hr):				
Instr (cpm):				
CHECK-SOURCE RESPONSE	Expected 1-Min Count: (RS): _____ uR/hr (Instr): _____ cpm Measured 1-Min Count:			
RS (uR/hr):				
Instr (cpm):				
HP INIT'L:	:	:	:	

DAILY IQR AVERAGES

CHECK SOURCE RESPONSE:	AMBIENT BACKGROUND RESPONSE:
Avg Msrd (Chk Src+Bkgd) Expsr Rate:	Avg Msrd Bkgd Exposure Rate:
RS: _____ +/- _____ uR/hr	RS: _____ +/- _____ uR/hr
Avg (Chk Src+Bkgd) Count:	Avg Bkgd Count:
Instr: _____ +/- _____ cpm	Instr: _____ +/- _____ cpm
x (0.00465 uR/hr/cpm) =	x (0.00465 uR/hr/cpm) =
= _____ +/- _____ uR/hr	= _____ +/- _____ uR/hr

SIGNATURE: INIT'L:

HP: _____ _____ Date: _____

_____ _____

QA&T: _____ _____

SSFL Area IV Radiological Characterization Study

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B.5.1.2 A designated team technician may perform the daily *instrument performance checks*, but the team HP is responsible for reviewing the results (and evaluating the suitability of the instrument performance). The team HP will document this review by initialing at the bottom of the data column on the IQR, and by entering signature, initials, and date at the bottom of the page. The technician performing the actual test will signify such by entering initials at the bottom of the data column, next to the team HP's initials. If the IQR checks were observed by QA&T, the observer will document the observation by initialing the space provided below the time entry (to signify which set of measurements were observed, and enter their signature and initials at the bottom of the form.

B.5.2 INSTRUCTIONS FOR DAILY EVALUATION OF THE IQR DATA

B.5.2.1 After each work shift, the Survey Manager will inspect the data from that day's *Instrument Qualification Reports* to determine that there are no anomalous entries.

B.5.2.2 After the data has been entered into the analysis spreadsheet, the daily mean and standard deviation for all of the IQR data for the day will be calculated for:

the Reuter-Stokes Gamma Exposure Readings for:

- Ambient Background Radiation
- [Combined Check Source + Ambient Background] Radiation

and, for each instrument:

- 1-minute Ambient Background Response Checks
- 1-minute Check Source Response Checks

and, the gamma countrate/exposure rate conversion factors (cpm/uR/hr) for each instrument will also be computed.

B.5.2.3 The results will be plotted against elapsed days on survey management control charts, (DAILY MEANS control charts), throughout the duration of the survey. These charts will be monitored by the Survey Manager to watch for trends in instrument performance, as evidenced by trends in the IQR data.

B.6 SURVEY DATA CONTROL RECORDS

B.6.1 AMBIENT GAMMA SURVEY DATA RECORD

The Ambient Gamma Survey Data Record, figure B2, will be used for recording the 1-m ambient gamma activity data during the ambient gamma surveys. All of the measurements at an individual survey location in this gridded survey will occupy one row of the Ambient Gamma Survey Data Record. The data record has spaces for entering specific location data for identifying the *survey block*, as well as the 200ft grid marker stake defining the southwest corner post of the *survey block*. The data record also has columns for entering the the actual measured tape distances from the southwest corner stake of the *survey block*, to the survey location (defined by the 25ft interval grid), as well as for the calculated CSPCS *northing* and *easting* coordinates of the survey location. Columns are also provided for recording 1-meter gamma activity measurements from each of the two gamma survey instruments, respective meter numbers of the instruments used, initials of the person making the measurement, date, and time of day. Notes about the measurement environment at the location, and about any anomalous instrument behavior can also be entered, if pertinent. The team HP will acknowledge adherence to the procedures in this document by initialing the space at the right of each line of data. If the data measurement procedure has been observed by QA&T, the quality assurance monitor will record the observation by initialing next to the survey team HP initials.

The team HP will sign and initial the bottom block of the data record, and the date on which this page of the data record was filled up will also be entered. If more than HP records data on page, each HP will sign and initial at the bottom of the page. Each QA monitor whose initials appear on a data entry line will also sign and initial at the bottom of the data record.

B.6.2 WALK-ABOUT SURVEY TRANSIT RECORD

The Walk-About Survey Transit Record (figure B3) will be used for recording the progress of the walk-about survey of a *survey block*. The Walk-About Survey Transit Record has spaces for identifying the *survey block* being surveyed, and for recording specific identification data about the 200ft grid marker stake defining the southwest corner post of that *survey block*. Each row of the *survey transit record* has spaces for recording start-time and end-time of a transit across the *survey block*, and for entering the approximate average, and range (maximum and minimum) gamma activity countrates observed on the meter during the transit. A column is provided for recording the flag number of any "hot spot" finds that might be discovered during the scan; this provides a link to a matching entry on an associated Walk-About Survey "Hot Spot" Data Record. The team HP will acknowledge adherence to the procedures in this document by initialing the space at the right of each line of data. If the survey has been observed by QA&T, the

AMBIENT GAMMA SURVEY DATA RECORD

SRVY BLK ID No: _____

Page: _____ of _____

SURVEY BLOCK/SW CORNER POST ID		
CSPCS NORTHING COORDINATE:	CSPCS EASTING COORDINATE:	Post ID No.

SURVEY POINT LOCATION						AMBIENT GAMMA at 1-meter height				
distance frm SW corner NORTH:	EAST:	CSPCS Location NORTHING:	EASTING:	DATE	TIME	G1	G2	METER/LOCATION NOTES	HP INIT'L	QA&T INIT'L

(signatures) HP: _____ (Init'l): _____ DATE: _____

QA&T: _____

SSFL Area IV Radiological Characterization Study

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Figure B2. Ambient Gamma Survey Data Record

SURVEY BLOCK/SW CORNER POST ID

CSPCS NORTHING COORDINATE:	CSPCS EASTING COORDINATE:	Post ID No.

WALK ABOUT SURVEY TRANSIT RECORD

SRVY BLK ID No: _____

Page: _____ of _____

TRANSIT ID distance from south boundary	TRANSIT PASS DATA START TIME:	END TIME:	DATE:	(meter observation) MAX GAMMA	MIN GAMMA	AVG GAMMA	HOT SPOT FINDS? FLAG No:	INSTRUMENT/LOCATION NOTES	HP INIT'L	QA INIT'L

(signatures) HP: _____ (init'l): _____ DATE: _____

_____ _____

QA&T: _____ _____

SSFL Area IV Radiological Characterization Study

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A4CM-SP-0001 REV A
Page 49

Figure B3 Area IV Walk-About Survey Transit Record

quality assurance monitor will record the observation by initialing next to the survey team HP initials.

The team HP will sign and initial the bottom block of the Walk-About Survey Transit Data Record, and the date on which this page was completed will also be entered. If more than one HP records data on a page, then each HP will sign and initial at the bottom of the page. Each QA monitor whose initials appear on a data entry line will also sign and initial at the bottom of the data record.

B.6.3 WALK-ABOUT SURVEY "HOT SPOT" DATA RECORD

The Walk-About Survey "Hot Spot" Data Record (figure B4) will be used for recording the location and gamma activity data of any "hot spots" that are found during the walk-about survey of a *survey block*. "Hot spots" are radiologically suspect locations where a local peak in gamma activity occurs, that exceeds a countrate of 4200 cpm, as measured at the surface, or that exceeds 4040cpm, as measured at 1-meter height.

All of the measurements at an individual "hot spot" location will occupy one row of the Walk-About Survey "Hot Spot" Data Record. The *"hot spot" data record* has spaces for entering specific location data for identifying the *survey block* in which the "hot spot" was found, along with data about the 200ft grid marker stake defining the southwest corner post of that *survey block*. The *"hot spot" data record* has columns for recording the "hot spot" marker flag number, for recording actual measured tape distances from the southwest corner post to the "hot spot" location, and for entering the calculated CSPCS *northing* and *easting* coordinates of the "hot spot". Columns are also provided for recording ambient gamma activity at 1-meter height from one or two gamma survey instruments, as well as for a single gamma measurement at the ground surface. The team HP will record the meter numbers of the instrument used, the initials of the persom making the measurements, the date, and time. Notes about the measurement environment or anomalous instrument behavior that might be relevant to later evaluation by the Survey Data Control Manager may also be recorded. If additional space is needed, the entry may be continued on the back of the page. The team HP will acknowledge adherence to the procedures in this document by initialing the space at the right of each line of data. If the survey and data measurement procedure has been observed by QA&T, the quality assurance monitor will record the observation by initialing next to the survey team HP initials.

The team HP will sign and initial the bottom block of the Walk-About Survey "Hot Spot" Data Record, and the date on which this page was completed will also be entered. If more than one HP records data on a page, then each HP will sign and initial at the bottom of the page. Each QA monitor whose initials appear on a data entry line will also sign and initial at the bottom of the data record.

SURVEY BLOCK/SW CORNER POST ID

CSPCS NORTHING COORDINATE:	CSPCS EASTING COORDINATE:	Post ID No:

WALK-ABOUT SURVEY "HOT SPOT" DATA RECORD

SRVY BLK ID No: _____

Page: _____ of _____

HOTSPOT FLAG No:	SURVEY POINT LOCATION distance frm SW corner NORTH:	EAST:	CSPCS Location NORTHING:	EASTING:	DATE	TIME	SURFACE GAMMA	METR No:	AMBIENT GAMMA @1-meter height G1	G2	METER/LOCATION NOTES	HP INIT'L	QA&T INIT'L

(signatures) HP: _____ (init'l): _____ DATE: _____

QA&T: _____

SSFL Area IV Radiological Characterization Study

jjc:a4hsDATA.(14feb94)

Figure B4 Area IV Walk-About Survey "Hot Spot" Data Record

B.6.4 SUPPLEMENTAL NOTES MAP FOR *SURVEY BLOCKS*

The Supplemental Notes Map for *Survey Blocks* (figure B5) is a generalized grid map of a *survey block* to be used as needed by the team HPs for identifying locations of stored materials, structures, dense vegetation, swamps, rock formations, or other ground conditions that may impact upon the survey. This form is provided as a convenience to the survey team HPs, to use as an aid in recording relevant details about the *survey block* being surveyed.

B.7 SURVEY LOGBOOK

A survey logbook with bound, numbered pages will be maintained throughout the duration of the Area IV radiological survey (including the soil sample survey to be done under the procedures in reference 7). Pertinent notes and explanatory comments about the survey will be entered in the logbook to aid in later interpretation of the survey results.

All written recommendations from the Health & Safety Officer will either be written into the logbook, or a copy will be posted in the logbook (see §B.7.1).

B.7.1 SURVEY LOGBOOK ENTRIES

A member of the survey team will be appointed to maintain the log, and a backup person will be designated in case of absence of the appointee. These persons should be ETEC employees, rather than contract personnel.

Log entries will be made each working day. The log should contain the date and time of shift start, the individual names of team members present, the work plan for the day (ID numbers of the *survey blocks* to be surveyed), reference to the procedures in use (a copy of the current redline procedures should be immediately available with the logbook), and notes on special instructions received, unusual observations, occurance of accidents or injuries, and instrument problems or breakage. References to instructions from the Health & Safety Officer (HSO) should also be entered by the HSO's representative.

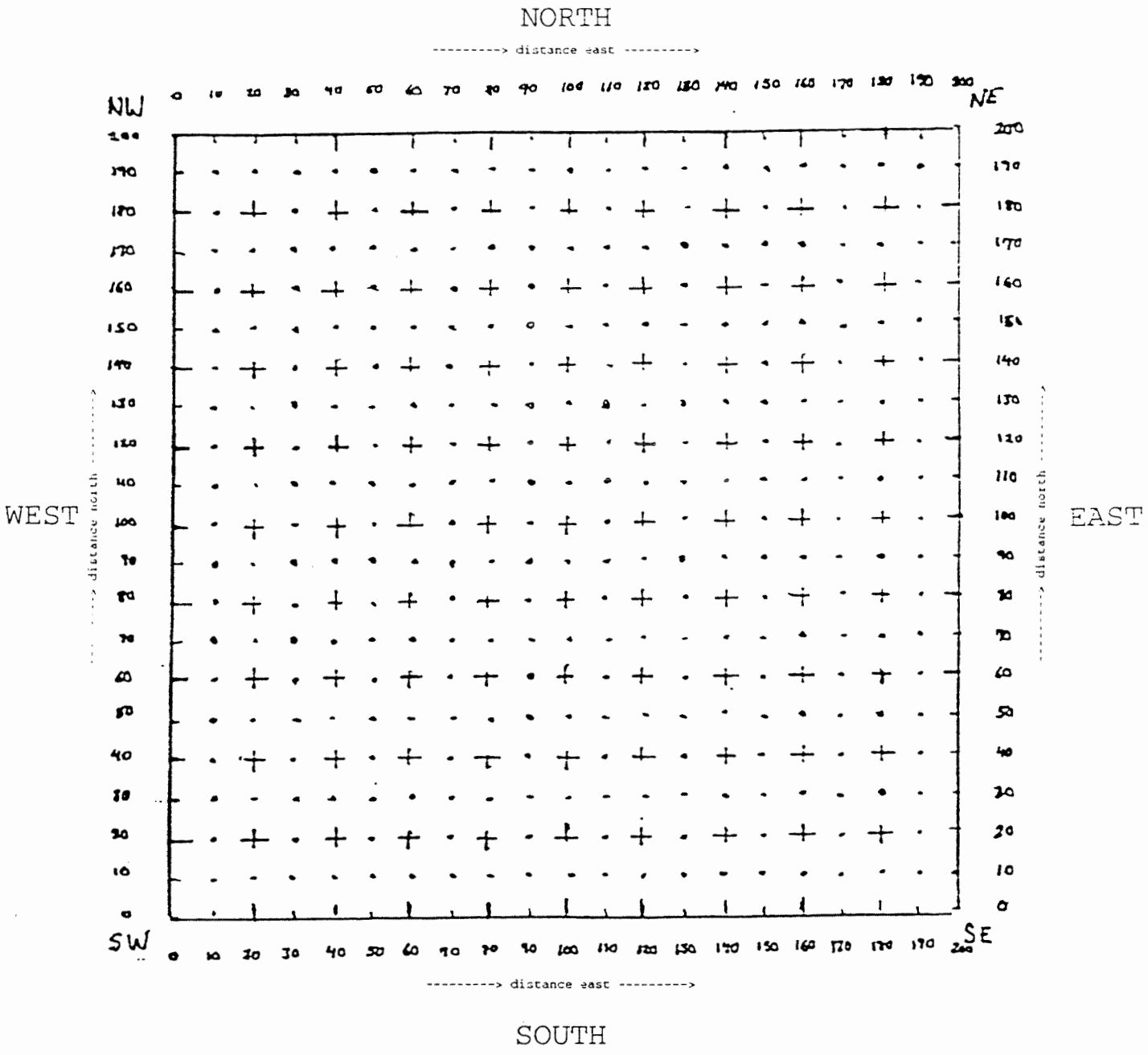
Do not include details that are recorded elsewhere (e.g data sheets). The logbook should be in the hands of the field crew, available for making log entries as needed.

B.7.2 INDEX TO HEALTH & SAFETY INSTRUCTIONS

The survey crew will maintain a *Health & Safety Index* at the front of the logbook, in which all of the Health & Safety Officer safety instructions, recommendations for changes to PPE or survey procedures, or other written comments, will be listed in the order of occurrence.

Figure B5. Supplemental Notes Map for *Survey Blocks*.

(supplemental survey area schematic for *Survey Block* No._____)



HP Signature: Init'l: Date:

_____ _____ _____

_____ _____ _____

Any such directives from the HSO will be entered in the survey logbook at the time of occurrence, at whatever page of the logbook the survey crew is currently using. Each such HSO directive will be given a descriptive title, and the date and time of the directive, along with the descriptive title, and the page number within the logbook where the HSO entry occurs, will be listed in the *Health & Safety Index* for ready reference.

<end>