ZONE III
EPA REGION 9

RCRA ENFORCEMENT, PERMITTING, AND ASSISTANCE CONTRACT

FINAL
OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY REPORT FOR BUILDINGS T-011, T-019, T-055, AND T-100

DECEMBER 20, 2002

Prepared for:

U.S. Environmental Protection Agency
Office of Compliance
Washington, DC 20460

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EPA Contract No. 68-W-02-021
Work Assignment No. R09107

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CONTENTS

Section **Page**

ABBREVIATIONS AND ACRONYMS iv

EXECUTIVE SUMMARY ES-1

1.0 INTRODUCTION 1

1.1 PURPOSE 1

1.2 GENERAL SURVEY OBJECTIVES 2

2.0 PROJECT SCOPE 2

3.0 SITE BACKGROUND AND HISTORY 2

3.1 SITE BACKGROUND 2

3.2 CONTAMINANTS OF CONCERN 7

3.2.1 Tritium 7

3.2.2 Mixed Fission Products 7

3.2.3 Activation Products 7

3.2.4 Radium 8

3.2.5 Uranium 8

3.2.6 Transuranic Compounds 8

3.3 BACKGROUND RADIATION IN SOILS AND CONSTRUCTION MATERIALS 8

3.4 OPERATIONAL HISTORY AND BASIS FOR SURVEY 9

3.4.1 Building T-011 History 9

3.4.2 Building T-019 History 10

3.4.3 Building T-055 History 10

3.4.4 Building T-100 History 11

4.0 RADIOLOGICAL SURVEY METHODS 12

4.1 INITIAL INSPECTION AND SURVEY GRIDS 12

4.2 RADIATION DETECTION METHODS 12

4.3 SYSTEMATIC SAMPLING PLAN 13

4.4 FIELD MEASUREMENT IDENTIFICATION 13

5.0 MEASUREMENT METHODS 14

5.1 ESTABLISH GRID SYSTEMS 14

5.2 CALIBRATE SURFACE RADIATION DETECTORS 14

CONTENTS (Continued)

Section **Page**

5.3 SURVEY BY SCANNING AND FIXED-CONTAMINATION MEASUREMENTS 15

5.3.1 Scanning Surveys 15

5.3.2 Fixed-Point Measurements 17

5.4 SAMPLE AREAS FOR REMOVABLE CONTAMINATION 18

5.5 COLLECT SAMPLES OF CONSTRUCTION MATERIALS 18

5.6 GAMMA RADIATION LEVEL MEASUREMENTS 18

5.7 DETERMINING DETECTION LIMITS 18

5.8 LABORATORY QUALITY CONTROL/QUALITY ASSURANCE AND DATA VALIDATION 19

6.0 SURVEY RESULTS 20

6.1 DATA REPORTING REQUIREMENTS 20

6.2 SCAN AND FIXED-POINT SURVEY RESULTS 20

6.3 ALPHA AND BETA MEASUREMENT COMPARABILITY 22

6.4 REMOVABLE CONTAMINATION AND SOLID SAMPLING RESULTS 23

6.5 SUMMARY OF GAMMA RADIATION MEASUREMENTS 24

7.0 SUMMARY AND CONCLUSIONS 26

8.0 REFERENCES 27

Appendix

A SITE SURVEY GRID MAPS

B SURVEY DATA

C FORMULAS AND EQUATIONS

FIGURES

Figure		Page
1	SITE LOCATION MAP	5
2	OVERSIGHT VERIFICATION SURVEY SITES	6

TABLES

Table		Page
1	ACCEPTABLE SURFACE CONTAMINATION LEVELS	3
2	SCOPE OF RADIOLOGICAL SURVEYS	4
3	SURVEY INSTRUMENTS	16
4	SUMMARY OF MEASUREMENT LOCATIONS	21
5	BUILDING MAXIMUM ACTIVITY MEASUREMENTS	21
6	SCAN SURVEY MEASUREMENT COMPARISONS…	23
7	MAXIMUM GAMMA RADIATION LEVELS IN MICROROENTGENS PER HOUR	25

ABBREVIATIONS AND ACRONYMS

±	Plus or minus
cm^2	Square centimeter
COC	Contaminant of concern
cpm	Counts per minute
DHS	California Department of Health Services
DOE	U.S. Department of Energy
dpm/100 cm^2	Disintegrations per minute per 100 square centimeters
EPA	U.S. Environmental Protection Agency
ESSAP	Environmental Site Survey and Assessment Program
ETEC	Energy Technology and Engineering Center
L_C	Critical level
L_D	Detection limit
Ludlum	Ludlum Measurements, Inc.
m	Meter
m^2	Square meter
µRem/hr	MicroRoentgens per hour
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
MFP	Mixed fission products
NRC	U.S. Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
OV	Oversight verification
Paragon	Paragon Analytics, Inc.
pCi/g	PicoCuries per gram
RHB	Radiologic Health Branch
RICL	Radiation Instrument Calibration Laboratory
Rocketdyne	Rocketdyne Division of Boeing Corporation
RPD	Relative percent difference
SNAP	Systems for Nuclear and Auxiliary Power
SOP	Standard operating procedure
SSFL	Santa Susana Field Laboratory
Tetra Tech	Tetra Tech EM Inc.

EXECUTIVE SUMMARY

On January 15, 1999, Tetra Tech EM Inc. (Tetra Tech) received Work Assignment No. R09805 from U.S. Environmental Protection Agency (EPA) Region 9, under Contract No. 68-W-99-008, Resource Conservation and Recovery Act Enforcement, Permitting, and Assistance Zone III. As of April 1, 2002, this work assignment expired and ongoing tasks have been continued under Work Assignment No. R09107, Contract No. 68-W-02-021. Under this work assignment, Tetra Tech provides oversight, sampling, and technical review of documents pertaining to the U.S. Department of Energy's (DOE) Energy Technology and Engineering Center (ETEC), which is presently operated by the Rocketdyne Division of Boeing Corporation (Rocketdyne) (formerly Rockwell Corporation) and is located at the Santa Susana Field Laboratory (SSFL). The work assignment currently includes review of decontamination and decommissioning reports, development of oversight verification (OV) survey and sampling work plans, and conduct of OV radiation surveys.

From October 1 to 5, 2001, Tetra Tech conducted radiological survey tasks at DOE's ETEC in Area IV of the SSFL. This document presents the results of the OV radiological survey tasks. Tetra Tech performed OV radiation surveys for alpha and beta-gamma radiation in four buildings (T-011, T-019, T-055, and T-100). During the surveys, Tetra Tech performed a total of 150 direct alpha and 150 beta-gamma measurements. In addition, 157 swipes were collected to assess removable alpha or beta-gamma contamination in the survey areas. Gamma radiation levels also were measured in each building. Fifteen concrete core samples were collected to assess near-surface contamination using gamma spectrometry analysis. All field measurements were performed in accordance with a quality assurance program developed for this survey. All laboratory analyses were performed by Paragon Analytics, Inc., a State of California-certified laboratory, and the laboratory data were independently validated.

None of the field measurements performed by Tetra Tech indicated the presence of surface alpha or beta contamination above U.S. Nuclear Regulatory Commission (NRC) guidelines for a 1-square-meter area. Also, none of the swipe samples indicated the presence of removable alpha or beta activity greater than criteria established in the NRC Regulatory Guide 1.86 (1974). Similarly, none of the measurements exceeded the limits contained in Proposed Sitewide Release Criteria (Rocketdyne 1996). Fifteen solid samples were analyzed for gamma emitters and contained only naturally occurring radioisotopes (potassium-40 and the daughter products of naturally occurring uranium and thorium).

At the time of the survey, three rooms in Building T-100 (Rooms 112, 113, and 114) were in use for storage or use of radioactive materials. These three rooms were not surveyed and are not covered under this survey report.

The independent data collected by Tetra Tech during the OV survey are of sufficient quality and quantity to: (1) assess the radiological status of each building, (2) supplement and confirm other documentation of facility conditions, and (3) be used by EPA to develop recommendations and conclusions. The data show: (1) good agreement with prior surveys, (2) that surfaces monitored by Tetra Tech are within NRC-established radiological limits, and (3) that exposure rates measured by Tetra Tech do not exceed NRC-established radiological limits.

Tetra Tech's field measurements were compared with the radiological closeout surveys conducted by Rocketdyne and, where applicable, with the confirmation survey by DOE's contractor, Oak Ridge Institute for Science and Education (ORISE) Environmental Site Survey and Assessment Program. Although field measurement techniques and data reporting methods differed, Tetra Tech's field measurements confirm the conclusions reached by both Rocketdyne and ORISE.

1.0 INTRODUCTION

On January 15, 1999, Tetra Tech EM Inc. (Tetra Tech) received Work Assignment No. R09805 from U.S. Environmental Protection Agency (EPA) Region 9, under Contract No. 68-W-99-008, Resource Conservation and Recovery Act Enforcement, Permitting, and Assistance, Zone III. As of April 1, 2002, this work assignment expired and ongoing tasks have been continued under Work Assignment No. R09107, Contract No. 68-W-02-021. Under this work assignment, Tetra Tech provides oversight, sampling, and technical review of documents pertaining to the U.S. Department of Energy's (DOE) Energy Technology and Engineering Center (ETEC), presently operated by the Rocketdyne Division of Boeing Corporation (Rocketdyne) (formerly Rockwell Corporation), located at the Santa Susana Field Laboratory (SSFL). The work assignment currently includes review of decontamination and decommissioning reports, development of oversight verification (OV) survey and sampling work plans, and conduct of OV radiation surveys.

From October 1 to 5, 2001, Tetra Tech performed OV radiological survey tasks in Buildings T-011, T-019, T-055, and T-100 at the DOE's ETEC in Area IV of the SSFL. This survey report summarizes the results of the survey tasks.

1.1 PURPOSE

The purpose of this report is to summarize the results of the OV survey conducted by Tetra Tech. This report also compares OV survey data with data from the radiological closeout survey conducted by Rocketdyne and data from the confirmation survey performed by DOE's contractor, Oak Ridge Institute for Science and Education (ORISE) Environmental Site Survey and Assessment Program (ESSAP).

The OV survey conducted by Tetra Tech was developed to supplement and confirm other data used to document the final radiological status of the buildings. The OV survey included sampling of areas surveyed previously by other parties, as well as areas not previously surveyed in Buildings T-011, T-019, T-055, and T-100.

The project scope and detailed technical procedures are described in the Rocketdyne Technical Support and Field OV and Confirmation Radiological Survey Final Work Plan Addendum for Buildings T-011, T-019, T-055, and T-100 (Tetra Tech 2001) and the Oversight Verification (OV) and Confirmation Radiological Survey Work Plan (Revision 1) (Tetra Tech 1999). The work plan includes detailed standard operating procedures (SOP) for performing indoor and outdoor radiological surveys and instrument calibrations and the quality assurance project plan.

1.2 GENERAL SURVEY OBJECTIVES

General survey objectives under this task were to: (1) perform independent measurements of areas not previously surveyed, (2) measure areas previously surveyed to establish comparability of survey results, and (3) sample surfaces and areas that could retain radioactivity. Surveys were performed to a quality level equal to a final status survey, as defined by the Multi-Agency Radiation Survey and Site Investigation Manual Revision 1 (MARSSIM) (EPA 2000). However, because an OV survey does not require the same level of detail as a final status survey, the extent of the OV survey and sampling and selection of sampling locations were intentionally reduced in scope from that of a MARSSIM final status survey.

2.0 PROJECT SCOPE

The OV survey work plan covered accessible building surfaces that could be surveyed to establish total and removable surface radioactivity, in accordance with standard guidance provided by the U.S. Nuclear Regulatory Commission (NRC). Table 1 lists standard release criteria reproduced from the NRC Regulatory Guide 1.86 (1974). Table 2 presents the scope of surveys for Buildings T-11, T-019, T-055, and T-100; the surveys were performed in accordance with the OV survey work plan (Tetra Tech 1999).

3.0 SITE BACKGROUND AND HISTORY

This section briefly discusses site background information, contaminants of concern (COC), and general and specific site history for Buildings T-011, T-019, T-055, and T-100.

3.1 SITE BACKGROUND

Rocketdyne established the SSFL, located in Ventura County, California, in 1946 as a rocket engine test site. Rocketdyne divided the 2,700-acre site into four administrative areas (Areas I, II, III, and IV) and a buffer zone. During the 1950s, Rocketdyne expanded site operations to include nuclear energy research and nuclear reactor development for DOE. Nuclear operations were conducted in Area IV and included fabrication of nuclear fuels, testing of nuclear reactors, and disassembly and analysis of used fuel elements. Nuclear research has not been conducted at the site since 1988.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

Nuclide[a]	Average[b,c]	Maximum[b,d]	Removable[b,e]
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, and I-129	100 dpm/ 100 cm^2	300 dpm/ 100 cm^2	20 dpm/ 100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, and I-133	1,000 dpm/ 100 cm^2	3,000 dpm/ 100 cm^2	200 dpm/ 100 cm^2
U-nat, U-235, U-238, and Associated Decay Products	5,000 dpm α/ 100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission), except Sr-90 and Others Noted Above	5,000 dpm $\beta\gamma$/ 100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2

Source: U.S. Nuclear Regulatory Commission. 1974. Regulatory Guide 1.86.

Notes:

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

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

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

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

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

Ac	Actinium	Pa	Protactinium
α	alpha	Ra	Radium
β	beta	Sr	Strontium
cm^2	Centimeters squared	Th	Thorium
dpm	Disintegrations per minute	Th-nat	Thorium natural
dpm/100 cm^2	Disintegrations per minute per 100 centimeters squared	U	Uranium
γ	gamma	U-nat	Uranium natural
I	Iodine		

TABLE 2

SCOPE OF RADIOLOGICAL SURVEYS
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

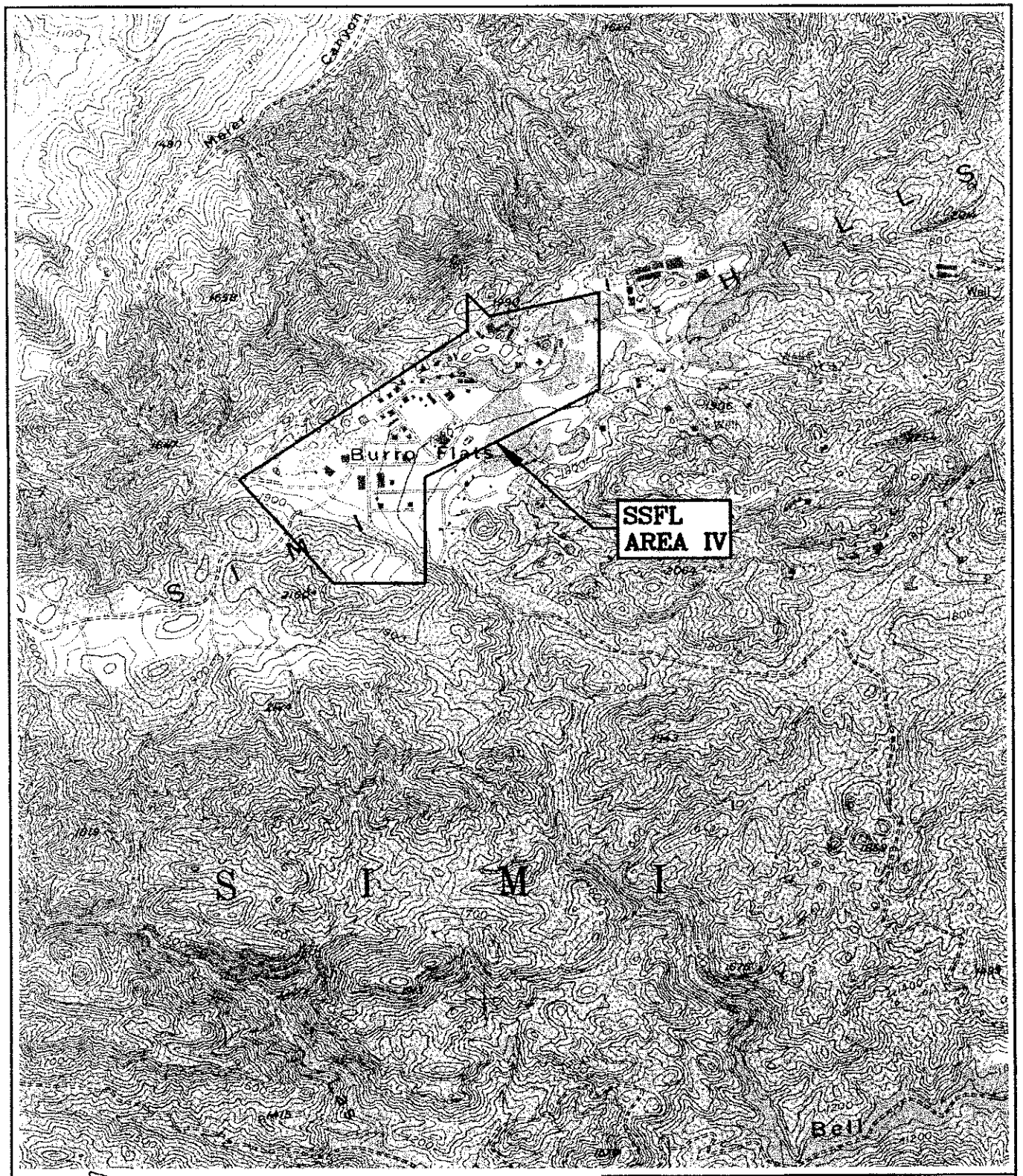
Building	Description	Facility Status	Contaminants of Concern [a]	Target Areas
T-011	Radiation Instrument Calibration Laboratory	Closed. Released for unrestricted use by DHS.	MFP, U, TRU, and ACP	Floors and walls
T-019	Systems for Nuclear and Auxiliary Power Qualification Facility	Closed. DHS has been requested to release for unrestricted use.	MFP, U, TRU, and ACP	Floors, walls, and ceilings
T-055	Nuclear Materials Development Facility	Currently in use. Available for Survey. Released for unrestricted use by NRC.	TRU	Floors, walls, and ceilings
T-100	Fast Critical Experiment Reactor	Currently in use. Partially Available for Survey. Released for unrestricted use by NRC.	MFP, U, TRU, and ACP	Floors, walls, and ceilings

Notes:

a Contaminants of concern are discussed in Section 3.2.
ACP Activation and corrosion products
MFP Mixed fission products
TRU Transuranic compounds
U Uranium
DHS Department of Health Services
NRC Nuclear Regulatory Commission

Figure 1 shows the location of the SSFL and Area IV. About 25 buildings within Area IV used radioactive material. This OV survey addresses four buildings (T-011, T-019, T-055, and T-100), as shown in Figure 2.

A detailed operational history of the facility is found in Nuclear Operations at Rockwell's SSFL – A Factual Perspective (Rocketdyne 1989). The Radiological Survey Plan for SSFL (Rocketdyne 1985) presents a concise summary of radiological issues at the site and a discussion of the environmental setting of SSFL.



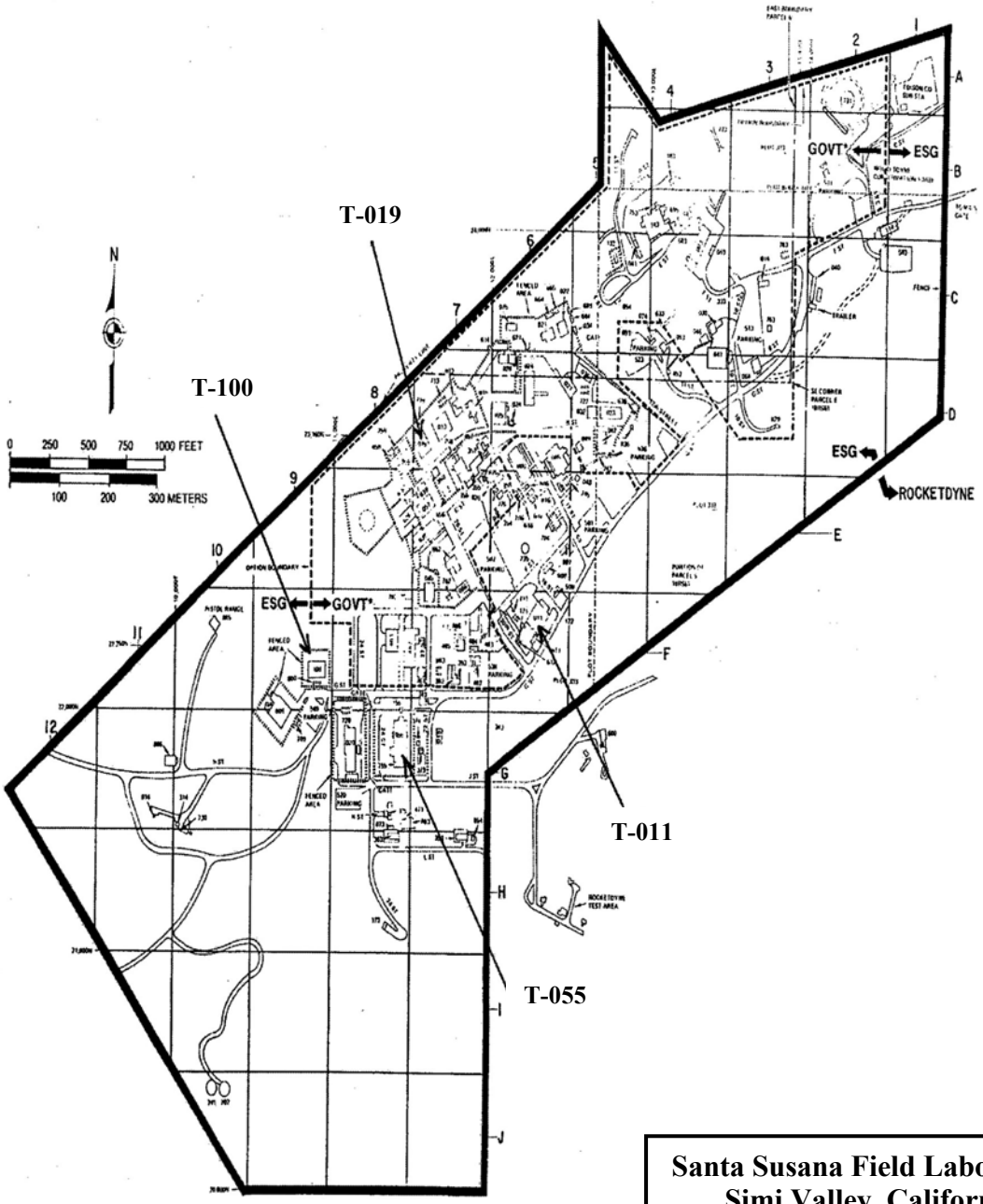
0 1000 2000
SCALE IN FEET

SOURCE: MODIFIED FROM USGS, CALABASAS, CALIFORNIA, 1952, PHOTOREVISED, 1967.

SANTA SUSANA FIELD LABORATORY
SIMI VALLEY, CALIFORNIA

FIGURE 1
SITE LOCATION MAP

Tetra Tech EM Inc.



Santa Susana Field Laboratory
Simi Valley, California

FIGURE 2
OVERSIGHT VERIFICATION SURVEY SITES

Tetra Tech EM Inc.

3.2 CONTAMINANTS OF CONCERN

The history of the Rocketdyne facility indicates the potential for contamination by tritium, mixed fission products (MFP), activation products, radium, uranium, and transuranic compounds. The sections below briefly discuss which COCs were targeted for the OV survey and the methods used to assess the presence of the target COCs in each facility. The field surveys are not designed to identify specific radionuclides, but rather gross alpha or beta-gamma radioactivity. Similarly, swipe surveys are taken to identify the presence of removable gross alpha or beta-gamma radioactivity and are not capable of identifying specific radionuclides.

3.2.1 Tritium

The OV survey was not designed for the detection of tritium, and no surface samples were collected for the purpose of assessing possible tritium contamination. Although tritium is a COC for the ETEC, based on past practices, tritium is not considered to be a COC for the four buildings discussed in this report (Rocketdyne 1991).

3.2.2 Mixed Fission Products

OV survey methods and survey instruments were capable of detecting beta-gamma radiation from MFPs below the release criteria set forth in Table 1 (beta-gamma emitters, except strontium-90) by detecting total beta-gamma surface activity and gamma dose rates. Swipe samples were collected to determine the presence of removable gross beta-gamma activity. Concrete samples were collected to determine the presence of photon-emitting MFPs through gamma spectrum analysis. MFP activity limits in Table 1 are appropriate for evaluating beta-gamma surface activity measurements for Buildings T-011, T-019, T-055, and T-100.

3.2.3 Activation Products

The presence of activation products resulting in volumetric contamination was assessed by measuring external beta-gamma dose rates and gamma spectrum analysis of concrete samples.

MFP activity limits in Table 1 (beta-gamma emitters, except strontium-90) are appropriate for evaluating activation product surface activity measurements for the four buildings discussed in this report.

3.2.4 Radium

OV survey methods and survey instruments were capable of detecting radium below the release criteria set forth in Table 1 for transuranics and radium-226 by detecting total alpha surface activity. Swipe samples were collected to determine the presence of removable gross alpha activity. Transuranics and radium-226 activity limits in Table 1 are appropriate for evaluating radium alpha surface activity measurements for the four buildings discussed in this report.

3.2.5 Uranium

OV survey methods and survey instruments were capable of detecting uranium below the release criteria set forth in Table 1 by detecting total alpha and beta-gamma surface activity. Swipe samples were collected to determine the presence of removable gross alpha and beta-gamma activity.

The uranium (uranium-natural, uranium-235, uranium-238, and associated decay products) limits in Table 1 are appropriate for evaluating uranium alpha and uranium beta-gamma surface activity for the four buildings discussed in this report.

3.2.6 Transuranic Compounds

OV survey methods and survey instruments were capable of detecting transuranic radionuclides below the release criteria set forth in Table 1 by detecting total alpha surface activity. Swipe samples were collected to determine the presence of removable gross alpha activity. Table 1 lists the surface activity limits for transuranic isotopes. Based on the history of Building T-055, application of the transuranic free-release limit was appropriate for this building.

3.3 BACKGROUND RADIATION IN SOILS AND CONSTRUCTION MATERIALS

Naturally occurring radiation is present in soils and common building materials. The naturally occurring isotopes include, but are not limited to, uranium and thorium as well as their progeny and potassium-40. The soils at the ETEC site are discussed in the Radiological Survey Plan for SSFL (Rocketdyne 1985). Arkosic sandstone, with interbeds of marine siltstone, claystone, and shale, underlie much of the site. Arkosic sand is the predominant source of naturally occurring radioactive isotopes in these soils. Arkose is a type of sandstone that contains feldspars. The feldspar fraction is a natural source of gamma-emitting potassium-40. The arkosic sand fraction also may contain some granitic rock.

Granitic rock contains small amounts of natural uranium that decays in a natural series into other radioisotopes, including radium-226 and radon-222. Granitic rock also is commonly integrated into masonry and ceramic building materials. All numerical release criteria for surface radioactivity are intended to be interpreted as "in addition to" the background concentration.

3.4 OPERATIONAL HISTORY AND BASIS FOR SURVEY

The following sections describe the operational history of Buildings T-011, T-019, T-055, and T-100, where the OV surveys were performed, and provide brief descriptions of the four buildings and the technical basis for conducting the survey. Appendix A includes all figures and reference drawings for the buildings.

3.4.1 Building T-011 History

Building T-011 housed the Radiation Instrument Calibration Laboratory (RICL). From 1984 to 1996, this building was used for calibration and repair of radiation detection instrumentation. After 1996, laboratory activities were transferred to Building T-100. Instrument calibration and repair could have involved handling instruments containing radioactive contaminants from any of the Area IV nuclear facilities. In addition, the building was used for repair of contaminated air pumps and other equipment that may have contained low levels of radioactive contamination. Both sealed and unsealed radioactive material sources were likely to have been handled in Building T-011. Rocketdyne documents report that the only known contamination in this building was in the janitor's sink drain line. The sink and drain line have been removed.

The RICL was in the northern side of this building. The southern side is a material warehouse, which stores nonradiological materials. Surveys were only performed in the northern side of the building.

Calibration facilities typically contain radioactive materials in special form[1] and only small quantities of radioactive material in normal form. These normal form materials typically are very small quantities of single radioisotopes plated onto a metal backing.

Building T-011 was surveyed by Rocketdyne in the 1996 to 1998 timeframe. In June 1998, the Radiologic Health Branch (RHB) of the California Department of Health Services (DHS) performed a confirmation survey. Rocketdyne then performed some modifications to the building, creating some

[1] "Special form" refers to encapsulated radioactive materials highly resistant to leakage and strictly regulated in manufacture and design.

structural and building material waste. The waste subsequently was surveyed by RHB and disposed of off site. Building T-011 was released from radiological controls by DHS in December 1998.

3.4.2 Building T-019 History

Building T-019 was used to house a Systems for Nuclear Auxiliary Power (SNAP) reactor test facility, which operated until 1970. The facility was used to test assembled SNAP reactor systems at zero power. The facility contained a high bay with a test chamber in the high bay floor, a fuel storage vault, and associated support rooms and office areas. The high bay floor contains equipment trenches. Enriched uranium fuel was used in the SNAP reactor. No contamination incidents were reported for this facility.

The overhead crane, piping, and ventilation ductwork remain in the building. In 1996, ORISE conducted surveys documenting the presence of residual beta-gamma surface contamination on the high bay floor at levels exceeding DOE guidelines. ORISE was unable to gain access to the reactor test chamber at that time. In 1999, Rocketdyne completed decontamination of the floor area identified by ORISE, dismantled the reactor test chamber, and conducted a detailed radiological survey of the affected areas in Building T-019. Subsequently, ORISE resurveyed the floor area previously identified as contaminated and performed a verification survey of the reactor test chamber. The reactor test chamber also was surveyed by DHS. Because the test chamber was dismantled and surveyed three times since 1999, no further surveys of the area were considered to be necessary.

3.4.3 Building T-055 History

Building T-055 housed the Nuclear Materials Development Facility, which operated until about 1987 under NRC License No. SNM-21. The facility operated for 16 years and was used to perform research and development as well as production of plutonium-containing nuclear fuel. During the period of operations, at least three contamination incidents were reported that resulted in the release of radioactive materials from containment systems. Two of the contamination incidents resulted in the spread of contamination to the ceiling of the glove box room. A liquid spill also occurred in the building's process laboratory. Plutonium and uranium in a variety of chemical and physical forms and isotopic mixtures were handled in this facility. Rocketdyne surveys of Building T-055 revealed contamination above acceptance limits for transuranic and uranium on the floor of the process laboratory (Room 126), on the eastern wall of the glovebox room (Room 127), and on the floor of the storage vault (Room 131). In 1986, Rocketdyne decontaminated and resurveyed these areas. The confirmation survey conducted by ORISE revealed one additional localized area of contamination on the southern wall of the glovebox room (Room 127). This area also was decontaminated and resurveyed. The Rocketdyne decommissioning report states, "Except

for the boiler located in Room 128, the emergency diesel generator located in Room 132, and the associated compressors and air conditioning units located outside of the building . . . , the building has been gutted."

Building T-055 subsequently has been refurbished, remodeled, and returned to service in another capacity. Some internal walls have been removed, some new internal walls have been added, new dropped ceilings have been added, new linoleum tile floors have been laid down in most of the building, and walls and ceilings have been painted. Because alpha particles are stopped by a sheet of paper and beta particles typically are stopped by a layer of clothing, surface activity surveys for alpha and beta activity were not capable of detecting whether alpha or beta activity was present under the new paint and tile.

3.4.4 Building T-100 History

Building T-100 contained the Fast Critical Experimental Laboratory, which operated until about 1974 under NRC License No. CX-17.

The facility consisted of an experimental critical assembly located within a high bay (Room 110), special nuclear material stored within a vault (Room 112), supporting rooms, and a control room (Room 109). The facility included a ventilation system with filtered exhaust for the high bay area, storage vault, and laboratories. A pit adjacent to the facility contained a liquid holdup tank system for any liquid wastes. As part of decommissioning, the critical assembly and appurtenances were removed. The facility also was cleaned prior to the decommissioning survey. The building has been used for other purposes subsequent to decontamination. It has been reported that most of the floor of the critical assembly room has been replaced at least twice since being used for reactor experiments. The new floor is reported to be about 6 feet thick and has a thick layer of epoxy and a new coat of paint. A new room (walls only) has been installed in the northeastern end of the critical assembly room. The utility trenches around the perimeter of two sides of the critical assembly room are accessible, and the floors between the trenches and the walls are accessible. Several of the rooms in the building have new floor tile and new paint on the walls. Currently, a portion of the building is being used as a radiation counting and calibration facility; therefore, Rooms 112, 113, and 114 were not surveyed. As with Building T-055, surface activity surveys for alpha or beta activity were not capable of detecting alpha or beta contamination under the new paint or tile surfaces.

4.0 RADIOLOGICAL SURVEY METHODS

This section describes the overall approach used to perform the OV survey for this project, including initial inspection and survey grids, radiation detection methods, systematic sampling plan, and field measurement identification.

4.1 INITIAL INSPECTION AND SURVEY GRIDS

Tetra Tech and Rocketdyne staff performed a walk-through inspection of the four buildings to be surveyed. Tetra Tech also performed a review of original survey data, locations surveyed, and coverage frequency. Based on the results of previous surveys, the survey team identified some specific locations to be included in the OV survey. In addition, members of a community interest group observed performance of OV surveys in Buildings T-019 and T-100 and requested some additional swipe and solid samples to be collected for analysis by Tetra Tech.

The survey team also determined some survey locations using professional judgment. Emphasis was placed on locations judged likely to trap residual radioactivity such as wall penetrations, ventilation ducts, and low points. Several pipes, ducts, cracks, and vents identified by the team were surveyed and swiped for assessment of removable activity. Measurements also were taken at random locations.

Previous survey grids were not visible; therefore, new grids were established to survey Buildings T-011, T-055, and T-100. A new grid system also was established for Building T-019; however, the grids previously used by Rocketdyne and ORISE were still visible and were noted on the survey form to allow for comparison of data.

4.2 RADIATION DETECTION METHODS

Several radiation detection methods and field activities were used during radiological surveys, including: (1) measurement of fixed and removable beta-gamma activity, (2) measurement of fixed and removable alpha activity, (3) measurement of gamma radiation levels, and (4) collection of concrete samples for off-site laboratory analysis. Field survey methodology, techniques, and terminology were performed in accordance with the MARSSIM[2] (EPA 2000). Surveys and data evaluation were performed in accordance with the work plan (Tetra Tech 1999).

[2] MARSSIM was jointly developed by EPA, NRC, the U.S. Department of Defense, and DOE.

For alpha and beta-gamma measurements of surface radioactivity and gamma radiation level measurements, background radiation levels were measured at appropriate, unaffected locations identified within the same survey area.

4.3 SYSTEMATIC SAMPLING PLAN

OV survey locations were selected based on previous survey data, facility history, accessibility, and professional judgment to: (1) establish comparability with previous surveys, (2) provide coverage of data gaps in the original survey, and (3) provide additional data for areas previously surveyed. Rooms that had received 100 percent area scans by ESSAP were not completely resurveyed; however, small areas within each room were rescanned to establish comparability of data. Survey coverage consisted of surface area scans, with fixed-point surveys of areas selected by Tetra Tech and swipe surveys and solid samples areas selected by the community. Several gamma radiation level measurements were taken in each building. Because each independent measurement process has an associated uncertainty, consisting of systematic and random uncertainty, results do differ on comparison. The initial criterion established in the work plan to evaluate data comparability is a relative percent difference of plus or minus (±) 50 percent. If comparability was not established within this value, reasons for discrepancies are discussed.

4.4 FIELD MEASUREMENT IDENTIFICATION

All field measurements are clearly traceable to a calibrated detector. Field measurements are entered into a computer database (spreadsheet) designed specifically for collecting data, performing necessary calculations, and presenting field measurement data in several ways to aid analysis.

Data typically were recorded directly on survey forms. For scanning measurements, the average alpha and beta-gamma count rates (in counts per minute [cpm]) were recorded. After completion of scan measurements, locations with the highest readings were identified and fixed-point measurements were recorded on the survey data sheet. Detector serial numbers were noted on survey forms.

Gamma radiation levels in counts per minute and in microRoentgens per hour (μRem/hr) also were recorded.

Raw field data were transferred to the database for conversion to activity units (disintegrations per minute per 100 square centimeters [dpm/100 cm^2]), uncertainty calculations, and reportable concentrations. Data tables from the database for all of the alpha and beta-gamma field measurements are presented in Table B-1, Appendix B.

5.0 MEASUREMENT METHODS

The methods used by Tetra Tech to set up, calibrate, and operate radiation detectors, as well as record data and perform measurement quality control, are described in the SOPs appended to the survey work plan (Tetra Tech 1999).

The radiological OV survey was divided into the following tasks:

- Establish grid systems for each of the four buildings (Section 5.1).
- Calibrate (determine the efficiency of) surface radiation detectors (Section 5.2).
- Survey specified areas by scanning and assessing fixed-contamination (Section 5.3).
- Sample areas for removable alpha and beta-gamma contamination (collect swipes) (Section 5.4).
- Collect samples of construction materials (concrete) in each building (Section 5.5).
- Measure gamma radiation levels at several locations in each building (Section 5.6).
- Determine detection limits (Section 5.7).

The sections below describe how each of these tasks was performed.

5.1 ESTABLISH GRID SYSTEMS

The existing Rocketdyne and ORISE survey maps were used as a reference. Tetra Tech established a separate numbering system for grid identification for all four buildings. Survey maps provided in Appendix A show the grid systems used for the surveys. In the case of Building T-019, the survey grids used by Rocketdyne and subsequently by ORISE were still visible. Table B-1 in Appendix B shows the Tetra Tech and Rocketdyne grid numbers surveyed by Tetra Tech.

5.2 CALIBRATE SURFACE RADIATION DETECTORS

Large-area phoswich[3] dual alpha and beta-gamma detectors (Ludlum Measurements, Inc. [Ludlum] Model 43-89 and Model 43-93), coupled to a rate/scalar meter (Ludlum Model 2360 or 2224), were used for surface scans. The large-area detectors (100 square centimeters [cm^2] for the Model 43-89 and 111 cm^2 for the Model 43-93) provide a proportionate increase in sensitivity over pancake-style

[3] A phoswich detector contains one alpha-sensitive layer and one beta-sensitive layer; therefore, alpha and beta emissions may be counted simultaneously.

Geiger-Mueller detectors. The survey team determined actual detector efficiencies during calibration, using methods described in the survey work plan (Tetra Tech 1999). Field efficiency determinations reflect the appropriate source energy and detector distance actually used. These factors can account for significant effects on measurement results. Detectors selected were suitable for site conditions.

Survey instruments were rented for the OV survey. The instrument supplier calibrated the detectors before shipment. Prior to using the alpha/beta detectors, the survey team determined the efficiency of each detector (probe and rate meter) pair using National Institute of Standards and Technology-traceable sources, in accordance with the procedures provided in the survey work plan (Tetra Tech 1999). The efficiencies were calculated to convert detector counts in counts per minute to alpha or beta-gamma activity in disintegrations per minute. Efficiencies also were used to determine scan rates and counting times that would provide sufficient detection limits to ensure that residual contamination less than one-half of the release criteria is detectable within a 95 percent confidence limit. Appendix C provides the equations used to calculate detector efficiency. A response check was performed each day to verify that the instruments properly responded to a known source of radioactivity. A background measurement was performed each day. After determining the detection efficiency of the detector pair, the pair was not changed for the duration of the surveys at Rocketdyne. Table 3 lists detectors and readout meters used, calibration dates, and detection efficiencies for alpha and beta surveys.

5.3 SURVEY BY SCANNING AND FIXED-CONTAMINATION MEASUREMENTS

Surveys for total alpha and beta-gamma surface activity were performed by scanning selected 1 square meter grids with the alpha/beta detectors. Fixed-point surface activity measurements were then taken in the grids with the highest scan readings.

5.3.1 Scanning Surveys

Floor and wall surfaces were scanned with phoswich detectors sensitive to both alpha and beta-gamma activity. The detector probe was held no more than 1 centimeter from the surface being scanned, and the scan rate was no more than one probe width per 4 seconds. The phoswich detector is unique in that it produces two different tones (clicks) for alpha and beta-gamma detections, thereby allowing an experienced surveyor to scan simultaneously for both alpha and beta-gamma radiation. Most of the surfaces were clean, flat, and relatively smooth. Surface conditions generally are not considered to have affected detector sensitivity.

TABLE 3

SURVEY INSTRUMENTS
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

Detector and Meter	Calibration Date[1]	Instrument Type	Alpha Efficiency	Beta Efficiency	Notes
Model 43-89 Serial 143875 Probe Model 2224 Serial 168594 Meter	9/25/01 3/19/01	alpha/beta	12.7%	7.4%	
Model 43-89 Serial 148500 Probe Model 2224 Serial 143031 Meter	9/20/01 9/20/01	alpha/beta	13.5%	7.6%	
Model 43-93 Serial 179869 Probe Model 2360 Serial 170544 Meter	9/20/01 9/20/01	alpha/beta	17.2%	15.9%	
Model 44-10 Serial 150784 Probe Model 2221 Serial 115157 Meter	9/20/01 9/20/01	gamma Scintillation	NA	NA	Gamma levels in cpm
Model 44-10 Serial 119805 Probe Model 2221 Serial 117328 Meter	9/20/01 9/20/01	gamma Scintillation	NA	NA	Gamma levels in cpm
Model 44-2 Serial 130739 Probe Model 3 Serial 124304 Meter	7/6/01 7/6/01	gamma Scintillation	NA	NA	Gamma levels in microRoentgens per hour

Note: 1. All instruments must be calibrated within 1 year of use.

cpm counts per minute
NA Not applicable
% percent

For optimum detection sensitivity, changes in the instrument response were monitored by visual and audible outputs. Alpha and beta-gamma count rates, as read from the digital output display on the rate meters, were recorded for each grid scanned.

The scan minimum detectable concentration (MDC) was calculated before the survey, using the method described in MARSSIM (EPA 2000). The detection sensitivity for this type of detection system, which is calibrated to a moderate energy beta source (technicium-99), ranged from 3,408 to 4,343 dpm/100 cm^2 for scanning measurements for this project. Because of the extremely low background rates associated with alpha scintillation detectors, MARSSIM indicates that it is not appropriate to calculate the scan MDC for alpha in the same manner as for beta-gamma detection. As an alternate, MARSSIM provides a family of probability curves used to estimate the probability of detecting alpha activity while scanning. The MARSSIM estimated probability of detecting 300 dpm/100 cm^2 alpha activity, while scanning ranged between 70 and 90 percent.

The alpha and beta-gamma scan data are recorded in Table B-1 in Appendix B.

5.3.2 Fixed-Point Measurements

Tetra Tech selected locations for fixed-point measurements to further assess those locations with highest readings during the scan surveys. Fixed-point activity measurements were taken on floors and walls.

Tetra Tech measured beta-gamma activity using 100- or 111-cm^2 phoswich probes (Ludlum Models 43-89 and 43-93) coupled to a rate/scalar meter. For this survey, the detection sensitivity calibrated for this type of detection system to a moderate energy beta source (technicium-99) ranged from 273 to 472 dpm/100 cm^2 for stationary, 2-minute counts. Counting times of 2 minutes were chosen to meet detection limit requirements of one-half of the maximum allowable average beta-gamma surface activity (see Table 1). For the purpose of these measurements, the beta-gamma activity expressed in disintegrations per minute per 100 centimeters squared was calculated using the equations presented in Appendix C.

Tetra Tech measured alpha activity on the interior surfaces of the rooms while measuring beta-gamma activity simultaneously. A 100- or 111-cm^2 phoswich probe (Ludlum Models 43-89 or 43-93) coupled to a rate/scalar meter was used for these measurements. For this survey, the detection sensitivity for this type of detector system, calibrated to a moderate energy source (thorium-230), ranged from 10.8 to 35.2 dpm/100 cm^2 for static, 2-minute counts. Counting times of 2 minutes were chosen to meet detection limit requirements of one-half of the maximum allowable average alpha surface activity (see Table 1).

The alpha and beta-gamma fixed point surface activity measurement data are recorded in Table B-1 in Appendix B.

5.4 SAMPLE AREAS FOR REMOVABLE CONTAMINATION

Removable contamination was measured by taking surface swipes at each grid location scheduled to be scan surveyed. Additional swipes were taken in areas that were considered likely to have trapped or pooled contaminated liquids, such as cracks and floor-wall joints. In addition, areas were selected randomly for collection of surface swipes. Swipes for assessment of removable surface activity were obtained by using a dry filter paper to wipe an area of about 100 cm^2, while applying moderate pressure.

On October 8, 2001, 157 swipes were sent to Paragon Analytics, Inc. (Paragon), in Fort Collins, Colorado, for gross alpha and gross beta analysis. Table B-2 in Appendix B presents the removable surface activity data.

5.5 COLLECT SAMPLES OF CONSTRUCTION MATERIALS

Fifteen concrete samples collected from the floors and walls of the four buildings also were sent to Paragon for gamma spectroscopy analysis. All samples were sent under chain-of-custody control. Table B-3 in Appendix B presents the results of the gamma spectroscopy analysis.

5.6 GAMMA RADIATION LEVEL MEASUREMENTS

A representative number of gamma radiation measurements were taken in each of the four buildings surveyed. Field measurements of gamma radiation levels typically are taken using a gamma scintillation detector, which reads out in counts per minute. Alternatively, these measurements sometimes are taken using a gamma scintillation detector calibrated to read in microRoentgens per hour. For the purpose of this survey, gamma radiation levels were recorded in both counts per minute and in microRoentgens per hour. Table B-4 in Appendix B lists gamma radiation levels.

5.7 DETERMINING DETECTION LIMITS

Detection limits (L_D) specify the capability of a measurement system to detect a signal in the presence of a background/noise signal. Because all low-level radioactivity measurements are associated with a physical error characteristic of the measurement process, statistical analysis is required for all measurements. Detection limits must be calculated at the field location where the survey is performed to account for background and to attain sufficient data quality of the intended purpose. Detection limits are based on counting statistics using the 95th percentile confidence interval for both Type I and II errors.

Type I and II errors are detailed in MARSSIM (EPA 2000). Adjustments of counting times allow required or specific L_Ds to be met.

Detection limits are reported in terms of the critical level (L_C), the a posteriori statement of detection that protects from the false positive or Type I error. The L_C activity is the concentration at which the analyst has a 50 percent chance of determining that a measurement is part of background, when in fact it is not. That is, at the L_C, a measurement is equally likely to be from the background or not. All activity measurements less than L_C are reported as less-than values. The L_C is a statistical function of the sample and background counting times and the background count rate. Appendix C presents the equations used to calculate L_C and the reported less-than value.

The detection limit is the a priori limit that protects from the false negative or Type II error and represents the measurement system sensitivity. That is, a measurement with a true activity equal to L_D will be identified correctly as different from background for a predetermined percentage of the time. For the OV survey, the L_D was calculated to represent a 95 percent confidence level. Activities determined to be greater than L_D are reported with a ± error. The L_D is a statistical function of the sample and background counting times and the background count rate. Appendix C presents the equations for calculating L_D and the reportable activity error.

The minimum detectable activity (MDA) is an a priori measure of the smallest quantity of activity that could be present and still be detected with a specified level of confidence. The MDA is equal to the L_D converted from raw data units (counts per minute) to activity units (disintegrations per minute).

5.8 LABORATORY QUALITY CONTROL/QUALITY ASSURANCE AND DATA VALIDATION

Solid and swipe samples were shipped to Paragon Analytics, under chain-of-custody control. Trained laboratory personnel received and verified the inventory of the samples and entered them into the laboratory control system. Samples were analyzed using instruments calibrated against National Institute of Standards traceable standards, in accordance with verified procedures. Laboratory control sample (LCS) analysis, method blank analysis, and duplicate sample analysis as applicable, were used to verify the accuracy of the sample analyses. No discrepancies requiring action were reported. All laboratory data were reviewed for completeness and correctness.

All laboratory data were validated by an independent validator. Approximately 10 percent of the samples received full validation, while the remainder received cursory validation. No swipe sample results or solid sample results were rejected.

6.0 SURVEY RESULTS

The sections below summarize data reporting requirements, as outlined in the survey work plan (Tetra Tech 2000), results of the scan and fixed-point surveys, measurement comparability, and results of removable contamination and solid sampling results. Appendix B presents all of the survey data for this survey report.

6.1 DATA REPORTING REQUIREMENTS

When reporting field survey results, levels of radioactivity will be reported to be "less than L_D" if the value in disintegrations per minute per 100 square centimeters is less than the limit of detection. If the value is greater than the calculated activity L_D, it is assigned an uncertainty estimate.[4] The L_D is the smallest quantity of radioactivity that can be reliably distinguished from background 95 percent of the time, based on counting statistics (for a laboratory detection system, the L_D is equal to the laboratory MDA when the units are converted from counts to activity). The L_C is the level at which a 5 percent chance exists of calling a background sample value "greater than background" (that is, the probability of a false positive). Alternatively, the L_C is the smallest quantity of radioactivity that can be distinguished reliably from background 50 percent of the time, based on counting statistics and other matters. For the purpose of reporting individual measurement results, any response above the instrument L_C will be considered to be above background (or a net positive result). For a detailed explanation of how L_C, L_D, and MDA limits are determined, see Appendix A of the survey work plan (Tetra Tech 1999) and MARSSIM (EPA 2000).

6.2 SCAN AND FIXED-POINT SURVEY RESULTS

This section provides summary statistics for the OV survey. Table 4 presents the number of grids scanned and the number of fixed-point measurements taken in each of the four buildings surveyed. Of the 116 individual grids scanned for total alpha activity and total beta-gamma activity, none were found to contain radioactivity above the most restrictive alpha surface activity limits or the applicable beta surface activity limits (see Table 1). Similarly, none of the 34 fixed-point measurements showed alpha or beta surface radioactivity above activity limits (see Table 1). Table 5 shows the locations of the highest alpha and beta-gamma measurements in each of the four buildings.

[4] A 95th percentile confidence interval, based on counting statistics

TABLE 4

SUMMARY OF MEASUREMENT LOCATIONS
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

Building	Number of Scanned Grids	Number of Fixed-point Measurements
T-011	21	6
T-019	29	8
T-055	42	12
T-100	24	8

TABLE 5

BUILDING MAXIMUM ACTIVITY MEASUREMENTS
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

Building	Room	Tetra Tech EMI Inc. Grid Number	Activity (dpm/100 cm^2)
Maximum Alpha Measurements			
T-011	Former Rooms 100 to 106, 108, and 111	N30	15.75
T-019	High Bay	U28	23.26
T-055	127	W29	15.75
T-100	110 South Wall	B5	19.26
Maximum Beta-gamma Measurements			
T-011	Former Rooms 100 to 106, 108, and 111	H11	2,736
T-019	High Bay	U28	2,428
T-055	127	W29	1,662
T-100	Any	Any	< minimum detectable activity

Notes:
< less than
dpm/100 cm^2 Disintegrations per minute per 100 square centimeters

6.3 ALPHA AND BETA MEASUREMENT COMPARABILITY

Tetra Tech performed alpha and beta-gamma surface activity measurements in some of the same grid locations previously surveyed by Rocketdyne. These measurements were taken to obtain a direct comparison of the Rocketdyne measured value with the Tetra Tech measured value. Specifically, 14 grids in the high bay area and fuel storage vault area of Building T-019 were scan surveyed for alpha and beta-gamma activity by both Rocketdyne and Tetra Tech. The data from both surveys are shown in Table 6. For the 14 grid measurements, the highest alpha activity result of the Rocketdyne survey was 13 dpm/100 cm^2. Tetra Tech results for the same 14 grids resulted in a high alpha reading of 7.4 dpm/100 cm^2. For beta activity, the highest Rocketdyne result for the 14 grids was 875 dpm/100 cm^2. The Tetra Tech results for the same 14 grids resulted in a high beta reading of 2,063 dpm/100 cm^2. The comparability of alpha measurements between Tetra Tech surveys and the previous Rocketdyne surveys is excellent because the highest reading from either survey was less than 0.5 percent of the alpha activity limit of Table 1. For the beta measurement comparison, the highest reading Tetra Tech grid was in the floor trench of the high bay, while the highest Rocketdyne reading was in the fuel storage vault. Only 5 of the 14 Rocketdyne beta activity measurements were positive values, with the highest (875 dpm/100 cm^2) being less than 20 percent of the beta surface activity limit of Table 1. All 14 of the Tetra Tech beta activity measurements were positive values, with the highest (2,063 dpm/100 cm^2) being just over 40 percent of the beta surface activity limit. The most likely reason for the differences between the Rocketdyne measurements and the Tetra Tech measurements is that Rocketdyne used a beta-gamma pancake probe, while Tetra Tech used a phoswich scintillation detector. Because all 14 of the beta surface activity measurements by both Rocketdyne and Tetra Tech are well below 50 percent of the Table 1 surface activity limit, comparability is satisfactory.

TABLE 6

SCAN SURVEY MEASUREMENT COMPARISONS
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

Building T019 Room	Grid Number		Tetra Tech		Rocketdyne	
	Tetra Tech	Rocketdyne	alpha (dpm/100 cm^2)	beta (dpm/100 cm^2)	alpha (dpm/100 cm^2)	beta (dpm/100 cm^2)
High Bay	N12	563	7.4	1,355	0.65	-303
High Bay	L22	420	0	671	-2.0	-98
High Bay	U31	302	5.8	1,069	4.6	-211
High Bay	Q24	397	5.8	1,201	0.65	798
High Bay	N30	310	5.81	1,031	-2.0	-170
High Bay	C27	436	5.8	509	-2.4	-1,111
High Bay	D23	455	0	679	-2.4	-1,198
High bay	AC24	233	0	1,635	-1	-703
High Bay	AB32	250	5.8	1,415	0.34	-771
High Bay	P28	353	0	2,063	-2.0	-756
Room 109	I5	F77	5.8	1,541	8.9	875
Room 109	E6	F66	0	1,352	11.5	680
Room 109	G7	19	5.8	1,390	3.7	454
Room 109	I8	14	5.8	1,308	5.0	583

Notes: Negative numbers indicate the measured value was less than background.
dpm/100 cm^2 Disintegrations per minute per 100 square centimeters
Rocketdyne Boeing-Rocketdyne
Tetra Tech Tetra Tech EMI Inc.

6.4 REMOVABLE CONTAMINATION AND SOLID SAMPLING RESULTS

One hundred fifty-seven removable contamination samples (swipes) were collected in Buildings T-011, T-019, T-055, and T-100. Swipe samples were shipped to Paragon on October 8, 2001, for gross alpha and gross beta analysis.

Table B-2 in Appendix B presents the analytical data for swipe samples. The most restrictive criteria for alpha activity is 20 dpm/100 cm^2 for radium and transuranic alpha activity. This most restrictive limit is appropriate for Building T-055. The less restrictive criteria (1,000 dpm/100 cm^2) is appropriate for the remaining three buildings. In any case, the alpha removable activity was less than the MDA for all 157 swipes. The beta removable activity also was less than the MDA for all 157 swipes.

Full validation was performed on 16 of the 157 swipe samples. Cursory validation was performed on the remaining 141 samples. The validation was based on satisfactory review of analysis of LCSs, method blanks, and instrument calibrations. No results for gross alpha and gross beta were rejected.

Fifteen solid samples (all concrete) were sent to Paragon for gamma spectroscopy analysis. Twelve of the 15 samples were core samples of the concrete floor and were initially a solid cylinder, about 3 inches in diameter by 2 inches high. The remaining three samples, also concrete, were initially in small pieces. Concrete core samples were crushed sufficiently to be placed in standard sample containers used by Paragon. Concrete samples were analyzed using gamma spectroscopy for photon-emitting isotopes. Table B-3 in Appendix B summarizes concrete sample results. None of the concrete samples showed the presence of any isotopes other than naturally occurring potassium-40 and the naturally occurring daughters of uranium and thorium. The highest concentration of potassium-40 was 21.3 ± 4.4 picoCuries per gram (pCi/g). The highest concentration of naturally occurring uranium and thorium daughter products (actinium-228, bismuth-212 and -214, lead-212 and -214, and thallium-208) was 1.9 pCi/g bismuth-212 in one sample.

Full validation was performed on 2 of the 15 solid samples. Cursory validation was performed on the remaining 13 samples. The validation was based on instrument calibrations and analysis of method blanks and LCSs. No results for gamma spectroscopy analysis were rejected.

6.5 SUMMARY OF GAMMA RADIATION MEASUREMENTS

Gamma radiation level measurements were recorded in each of the four buildings surveyed by Tetra Tech. The measurements were taken with the detector held about 1 meter (m) above the floor and about 1 m away from wall surfaces. These measurements provide representative radiation levels for each building. As noted earlier, the radiation levels were recorded in both counts per minute and in microRoentgens per hour. Background gamma readings were taken in buildings identified by Rocketdyne as being of similar construction and not having a history of handling radioactive materials. For Building T-055, gamma levels ranged from 7,600 to 11,191 cpm and from 10 to 14 μR/hr compared with background measurements for Building T-055 of 8,606 cpm and 12.1 μR/hr. For Building T-011, the levels ranged from 9,822 to 11,012 cpm and from 13.5 to 15 μR/hr, compared with a background of 6,857 cpm and 10.5 μR/hr. Building T-019 high bay and Room 107 had levels ranging from 6,465 to 8,809 cpm and from 9 to 12.5 μR/hr, compared with background levels of 7,889 cpm and 11.6 μR/hr. The Room 109 vault in Building T-019 had higher gamma levels than the rest of the building, with levels ranging from 12,941 to 14,251 cpm and from 18 to 20 μR/hr. Investigation of this apparent anomaly

revealed that the materials of construction of the room (cinder block walls) and concrete floor were causing the higher readings. This was confirmed by measuring gamma levels in the southeastern corner of the room with the instrument probe in contact with both walls. Resultant gamma levels were as high as 15,345 cpm. On the outside of the building, measurements in contact with only the eastern wall of Room 109 had levels as high as 12,933 cpm. In Building T-100 (all rooms, except the vault [Room 110]) gamma levels ranged from 8,652 to 9,426 cpm and from 11.5 to 13 μR/hr compared with background levels of 7,228 cpm and 11.6 μR/hr. Room 110 of Building T-100 is a large room, with a very thick concrete floor and walls. Because of the construction of Building T-100, Room 110, a separate background building (206) was used for comparison purposes. In Room 110 gamma levels ranged from 10,340 to 15,483 cpm and from 16 to 21.5 μR/hr, compared with the Building 206 background of 15,585 cpm and 20.75 μR/hr. MicroRoentgens per hour readings are useful to compare with similar readings taken by Rocketdyne or ORISE during earlier surveys. Rocketdyne previously had established an internal acceptance limit of 5 μR/hr above background for gamma radiation levels. Gamma radiation levels recorded by Tetra Tech meet that criteria for all four buildings. Table 7 compares maximum gamma radiation levels recorded by Tetra Tech with the similar readings taken by Rocketdyne or ORISE.

TABLE 7

MAXIMUM GAMMA RADIATION LEVELS IN MICROROENTGENS PER HOUR ROCKETDYNE SANTA SUSANA FIELD LABORATORY

Building	Tetra Tech EMI Inc.	Rocketdyne	Oak Ridge Institute for Science and Education
T-055	12	--	14
T-011	15	11.3	--
T-019	12.5/20*	10	13
T-100	13/21.5**	15***	--

Notes:

--	reading not available
Rocketdyne	Boeing-Rocketdyne
μR/hr	MicroRoentgens per hour
*	20 μR/hr in Room 109
**	21.5 μR/hr in Room 110
***	Rocketdyne survey was recorded as 0.015 millirem per hour

7.0 SUMMARY AND CONCLUSIONS

Tetra Tech performed radiation surveys for alpha and beta-gamma radiation in Buildings T-011, T-019, T-055, and T-100. During the surveys, Tetra Tech scanned a total of 116 survey grids for total alpha and beta-gamma activity and performed fixed-point measurements in 34 survey grids for alpha and beta-gamma activity. One hundred fifty-seven swipes were collected in the survey areas and sent off site for analysis of removable gross alpha and beta contamination. Tetra Tech also collected 15 concrete samples for off-site gamma spectroscopy analysis. General area gamma radiation levels were also measured in each of the four buildings. All field measurements were performed in accordance with a QA program developed for this survey. All laboratory analyses were performed by Paragon Analytics, Inc., a State of California-certified laboratory, and the laboratory data were independently validated.

None of the field measurements performed by Tetra Tech indicated the presence of surface alpha or beta contamination above NRC guidelines for a 100-cm^2 area. Also, none of the removable contamination samples (swipes) indicated the presence of removable alpha or beta activity greater than criteria established in the NRC Regulatory Guide 1.86 (1974). Similarly, none of the measurements exceeded the limits contained in Proposed Sitewide Release Criteria (Rocketdyne 1996). Fifteen solid samples were analyzed for gamma emitters and contained only naturally occurring radioisotopes (potassium-40 and the daughter products of naturally occurring uranium and thorium).

At the time of the survey, three rooms in Building T-100 (Rooms 112, 113, and 114) were in use for storage or use of radioactive materials. These three rooms were not surveyed and are not covered under this survey report.

The independent data collected by Tetra Tech during the OV survey are of sufficient quality and quantity to: (1) assess the radiological status of each building, (2) supplement and confirm other documentation of facility conditions, and (3) be used by EPA to develop recommendations and conclusions. The data show: (1) good agreement with prior surveys, (2) that surfaces monitored by Tetra Tech are within NRC-established limits, and (3) that exposure rates measured by Tetra Tech do not exceed NRC-established radiological limits.

Tetra Tech's field measurements were compared with the radiological closeout surveys conducted by Rocketdyne and, where applicable, with the confirmation survey by DOE's contractor, ORISE. Although field measurement techniques and data reporting methods differed, Tetra Tech's field measurements confirm the conclusions reached by both Rocketdyne and ORISE.

8.0 REFERENCES

Rocketdyne. 1985. "Radiological Survey Plan for Santa Susana Field Laboratory (SSFL)." No. 154SRR000001. September.

Rocketdyne. 1989. "Nuclear Operations at Rockwell's SSFL – A Factual Perspective."

Rocketdyne. 1991. "Tritium Production and Release to Groundwater at SSFL." No. N001SRR140120. December 6.

Rocketdyne. 1996. "Proposed Sitewide Release Criteria for Remediation of Facilities at SSFL. Revision A." No. N001SRR140127. August 26.

Tetra Tech EM Inc. (Tetra Tech). 1999. "Oversight Verification (OV) and Confirmation Radiological Survey Work Plan (Revision 1)." Prepared for the U.S. Environmental Protection Agency Region 9. October.

Tetra Tech. 2001. "Rocketdyne Technical Support and Field OV and Confirmation Radiological Survey Final Work Plan Addendum for Buildings T-011, T-019, T-055, and T-100."

U.S. Environmental Protection Agency (EPA). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual*. Revision 1. NUREG-1575/EPA/402-R-97-016. August.

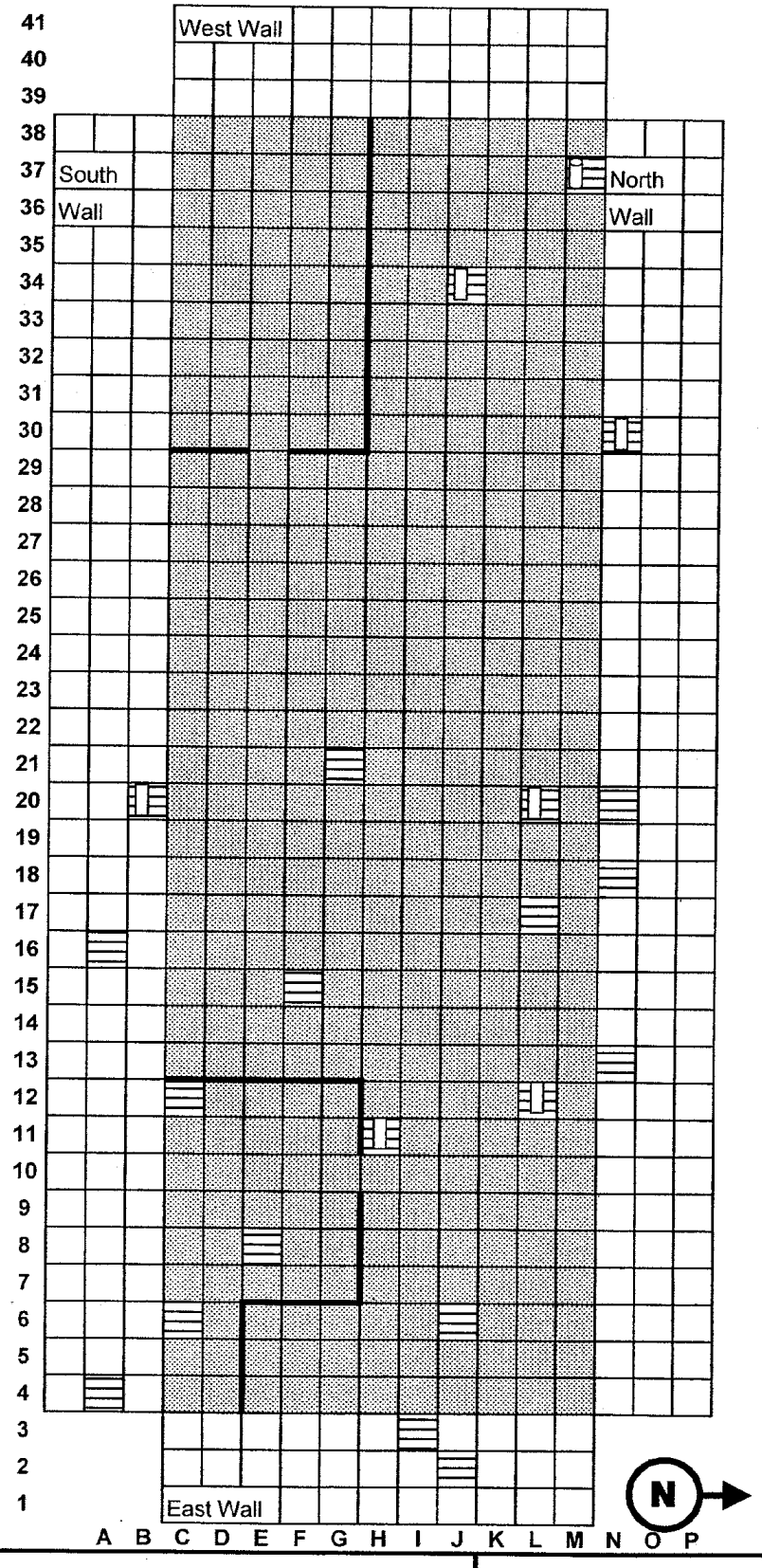
U.S. Nuclear Regulatory Commission (NRC). 1974. *Regulatory Guide 1.86*.

APPENDIX A

SITE SURVEY GRID MAPS

(27 Pages)

EPA Region 9
Oversight Verification (OV) Survey Grids



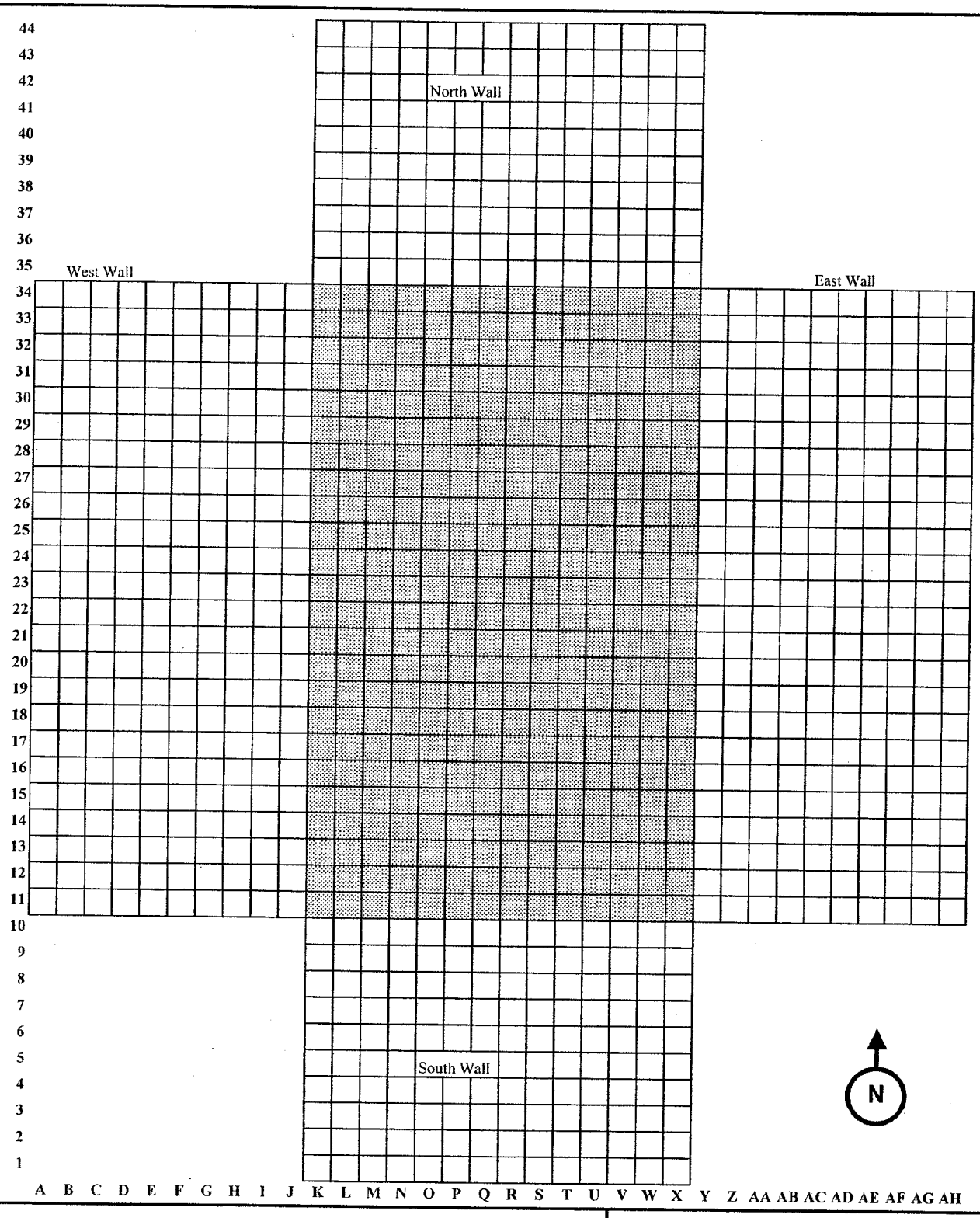
LEGEND

- Wall Grid
- Floor Grid
- OV Survey Grid
- ESSAP Survey Grid
- OV Fixed Count
- Interior Walls
- OV Core Sample

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 11
Survey Overview

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



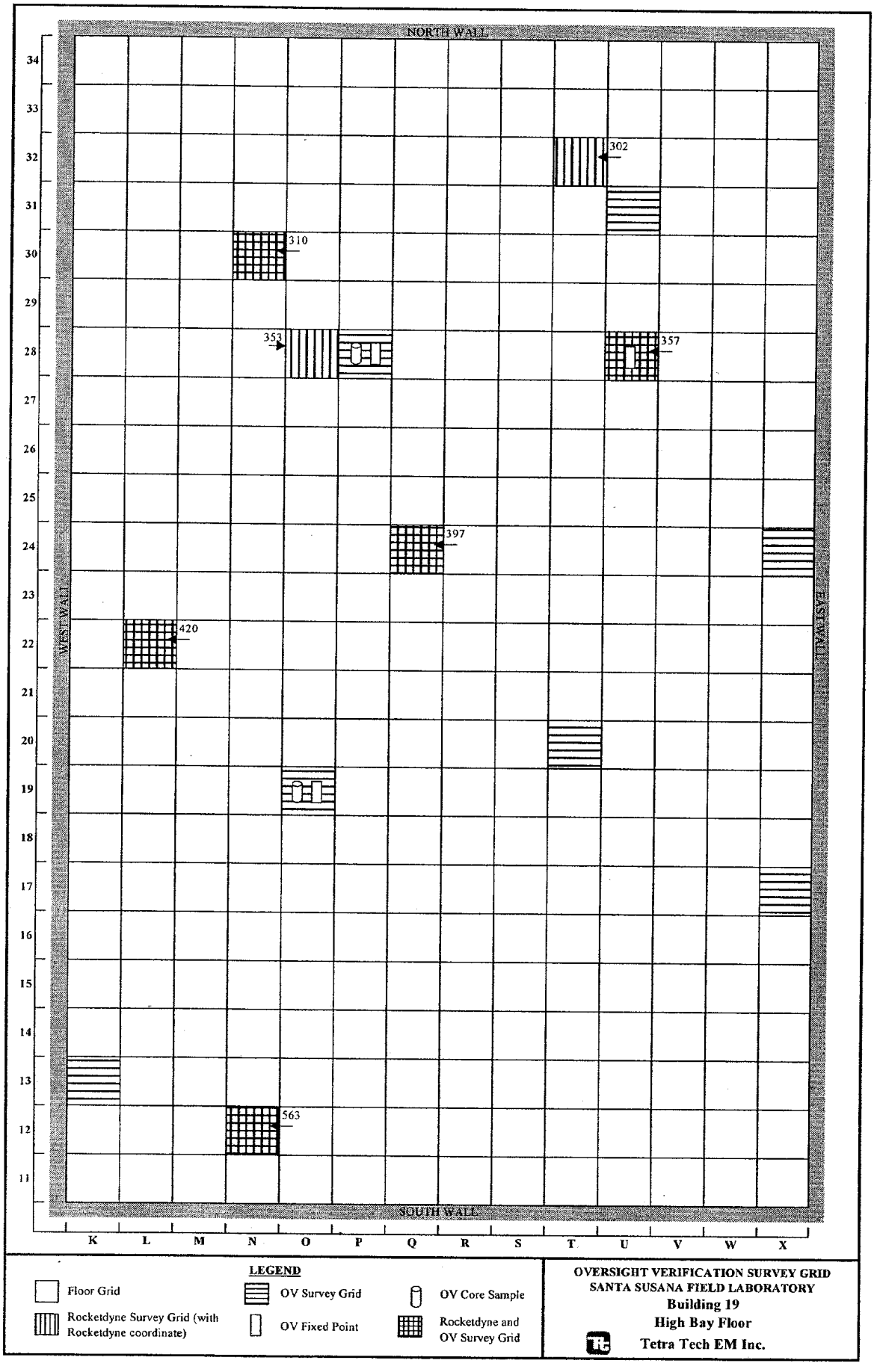
LEGEND

- Floor Grid
- Rocketdyne Survey Grid
- Wall Grid
- OV Survey Grid
- OV Fixed Coint
- Rocketdyne and OV Survey Grid

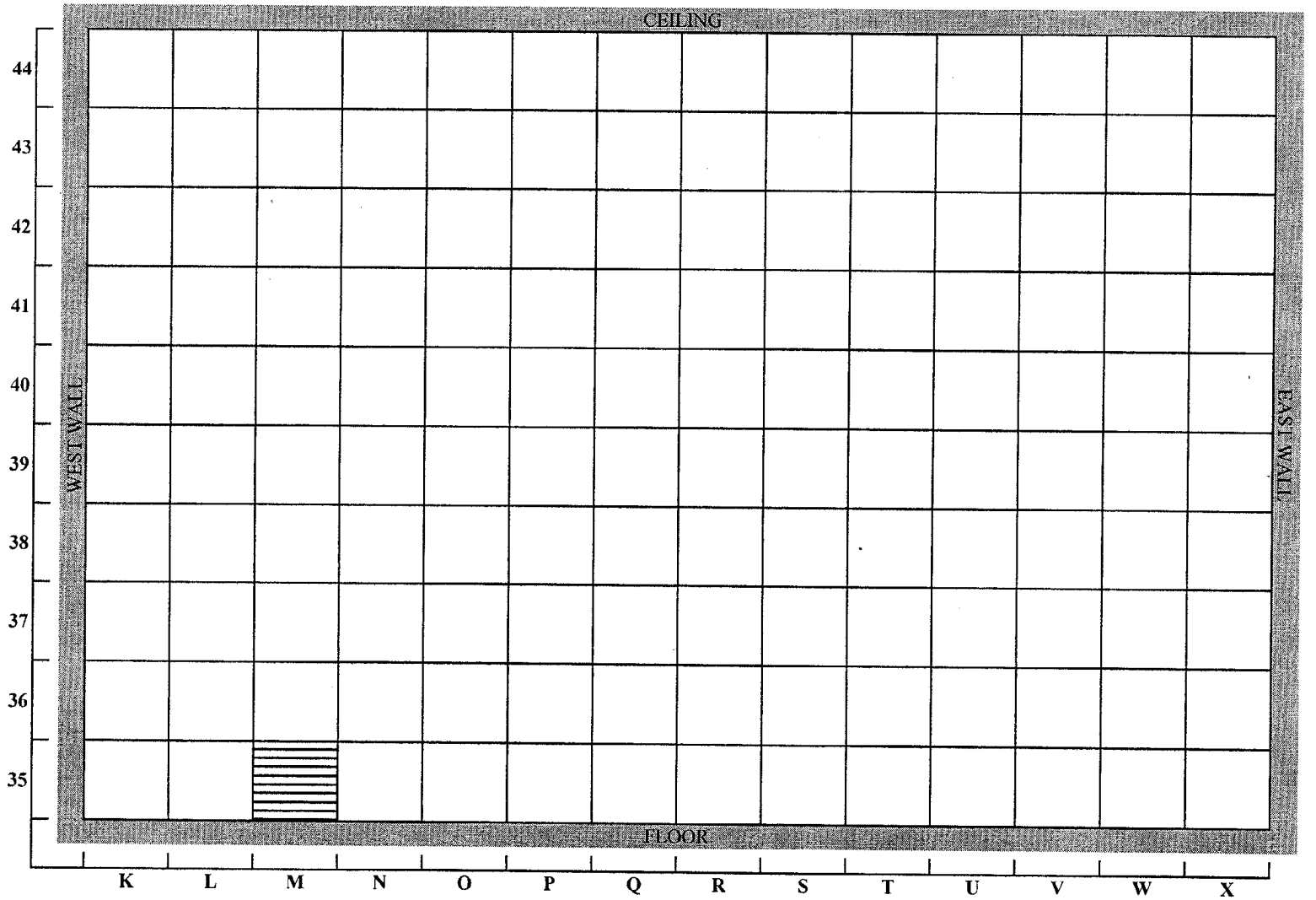
OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 19
High Bay Overview

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Wall Grid

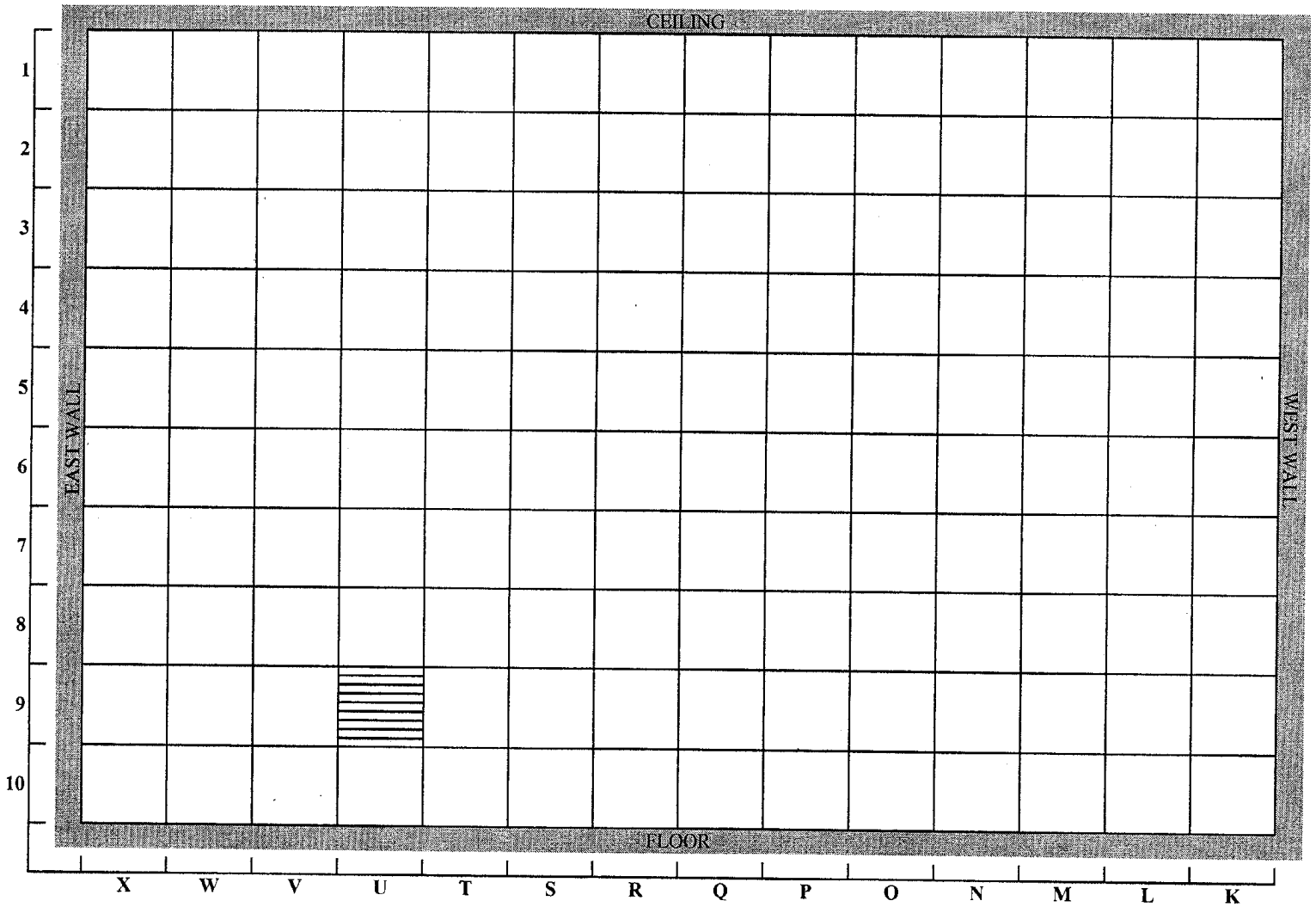
OV Survey Grid

OV Fixed Point

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 19
High Bay North Wall

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Wall Grid

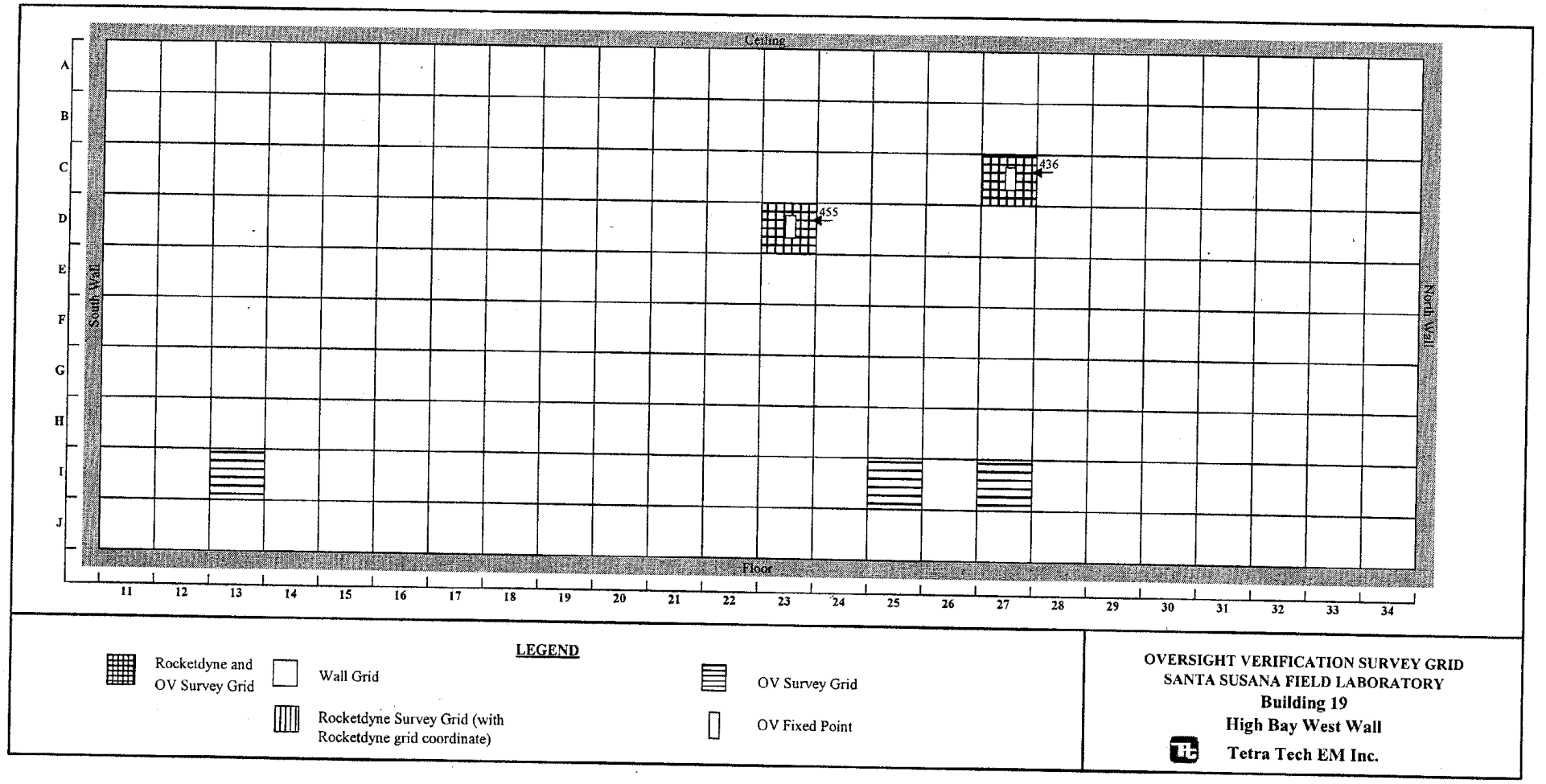
OV Survey Grid

OV Fixed Point

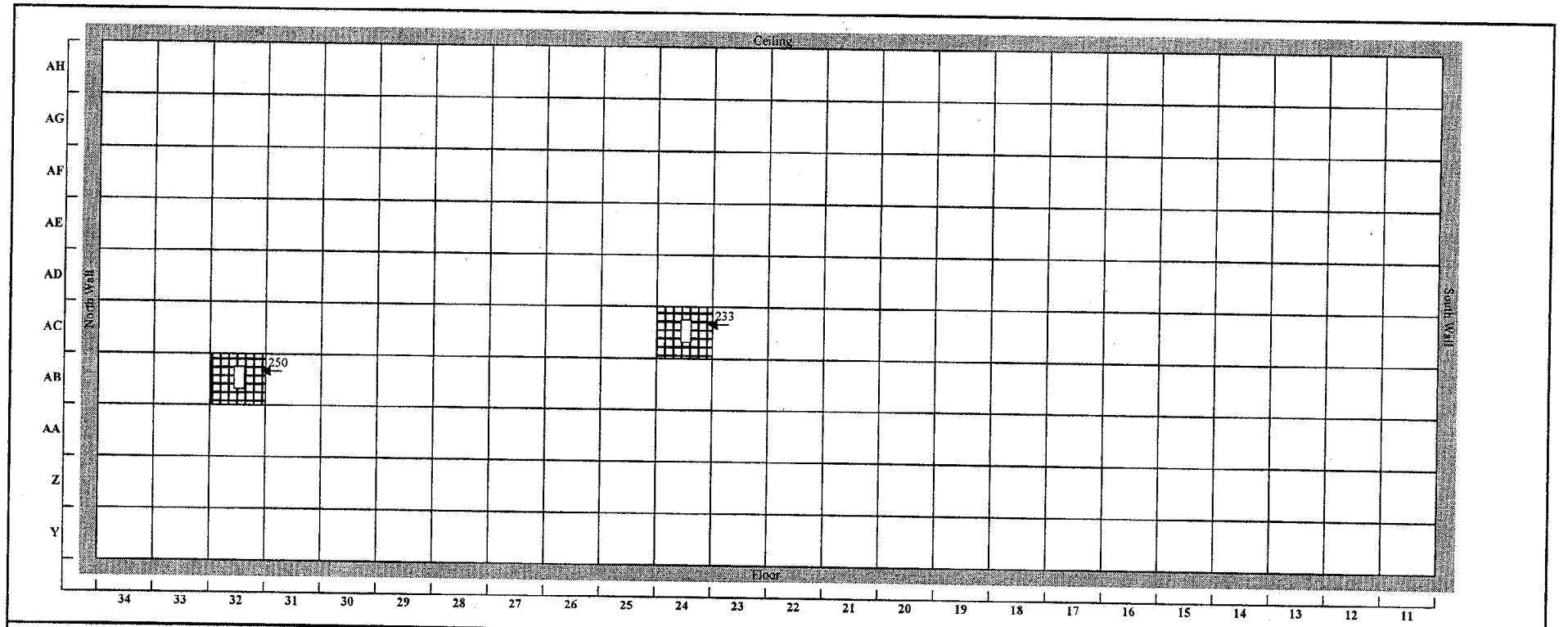
OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 19
High Bay South Wall

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



EPA Region 9
Oversight Verification (OV) Survey Grids

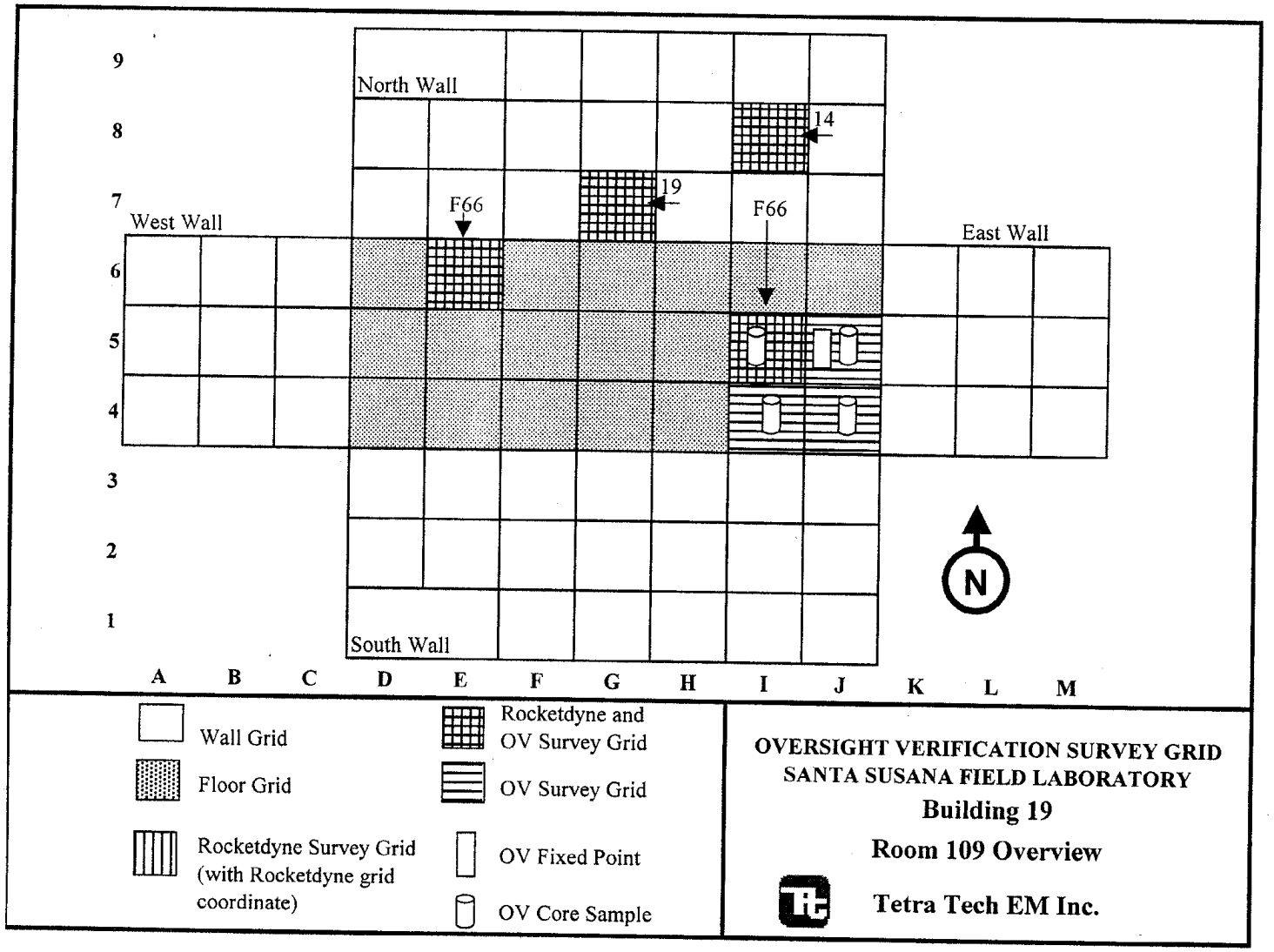


LEGEND

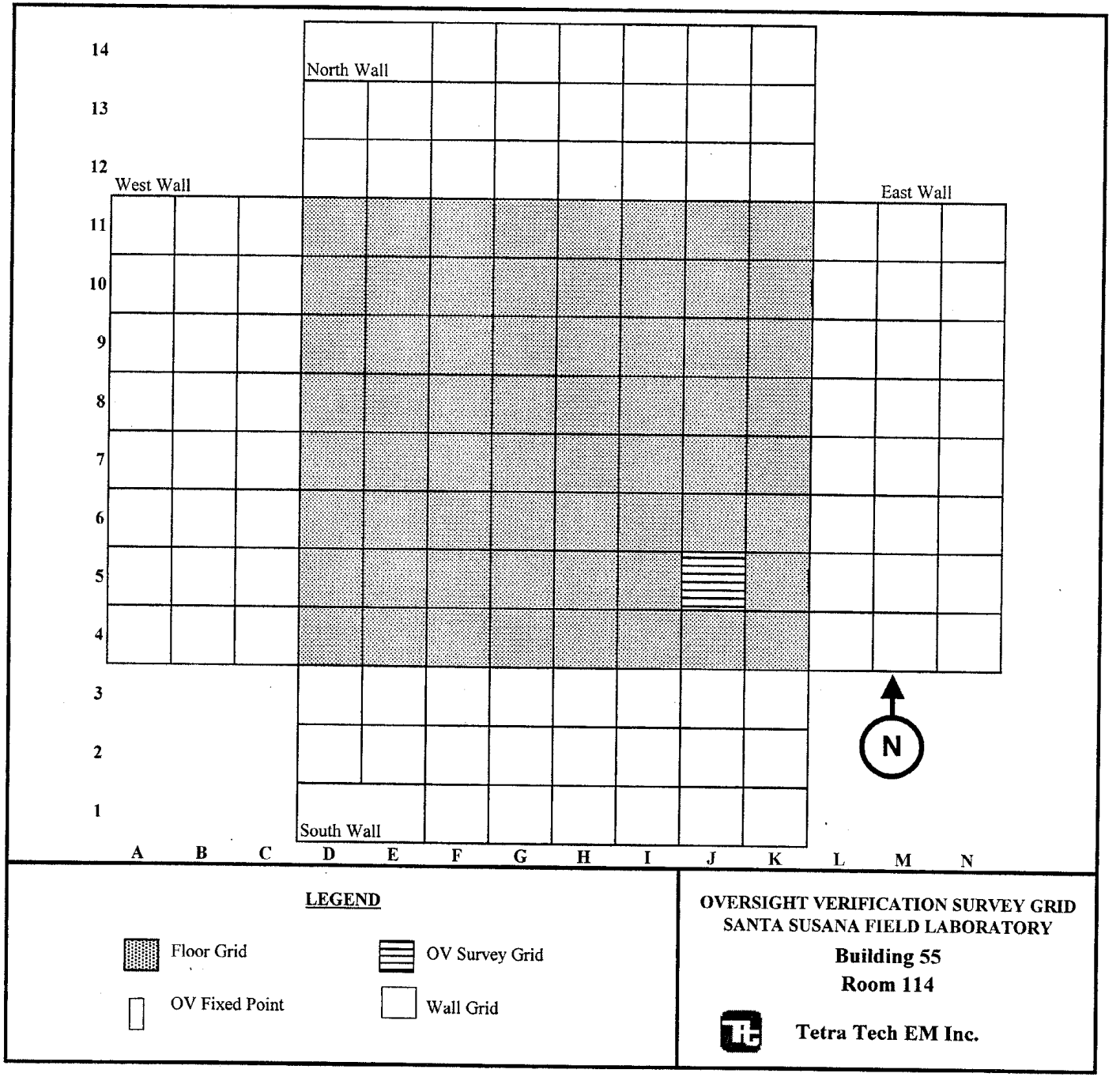
- Rocketdyne and OV Survey Grid
- Wall Grid
- Rocketdyne Survey Grid (with Rocketdyne grid coordinate)
- OV Survey Grid
- OV Fixed Point

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 19
High Bay East Wall
Tetra Tech EM Inc.

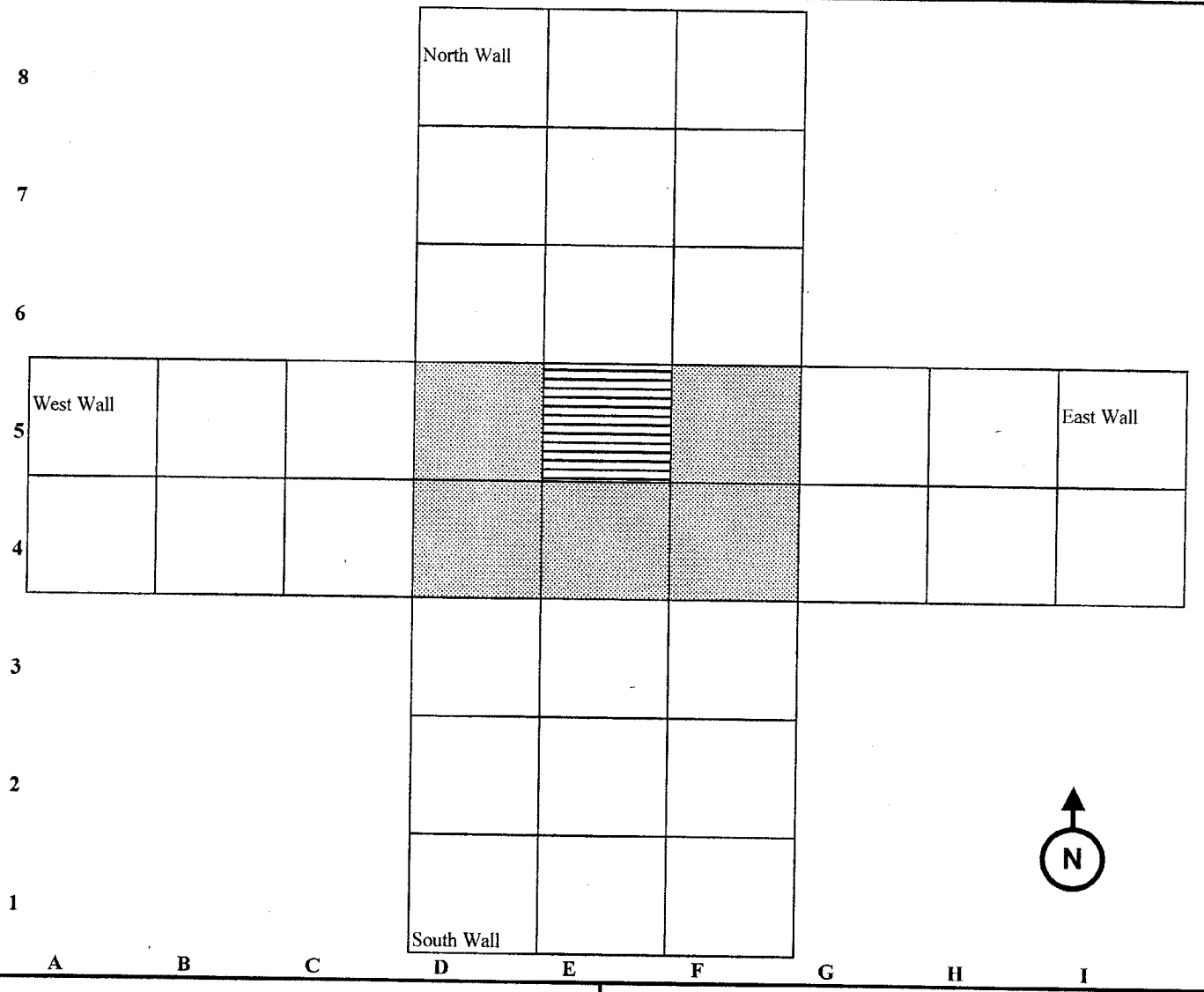
EPA Region 9
Oversight Verification (OV) Survey Grids



EPA Region 9
Oversight Verification (OV) Survey Grids



EPA Region 9
Oversight Verification (OV) Survey Grids



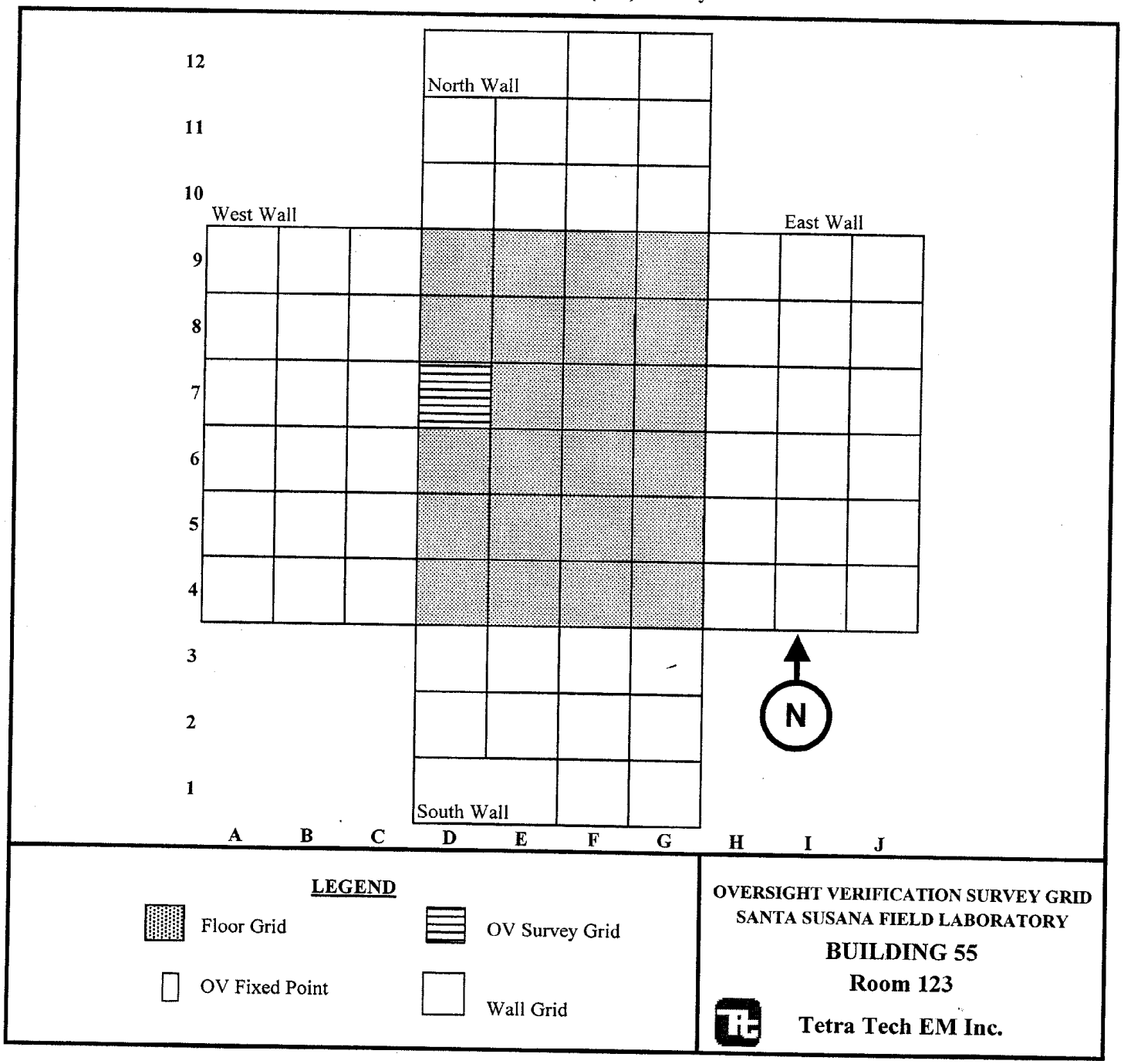
LEGEND

- Floor Grid
- OV Survey Grid
- OV Fixed Point
- Wall Grid

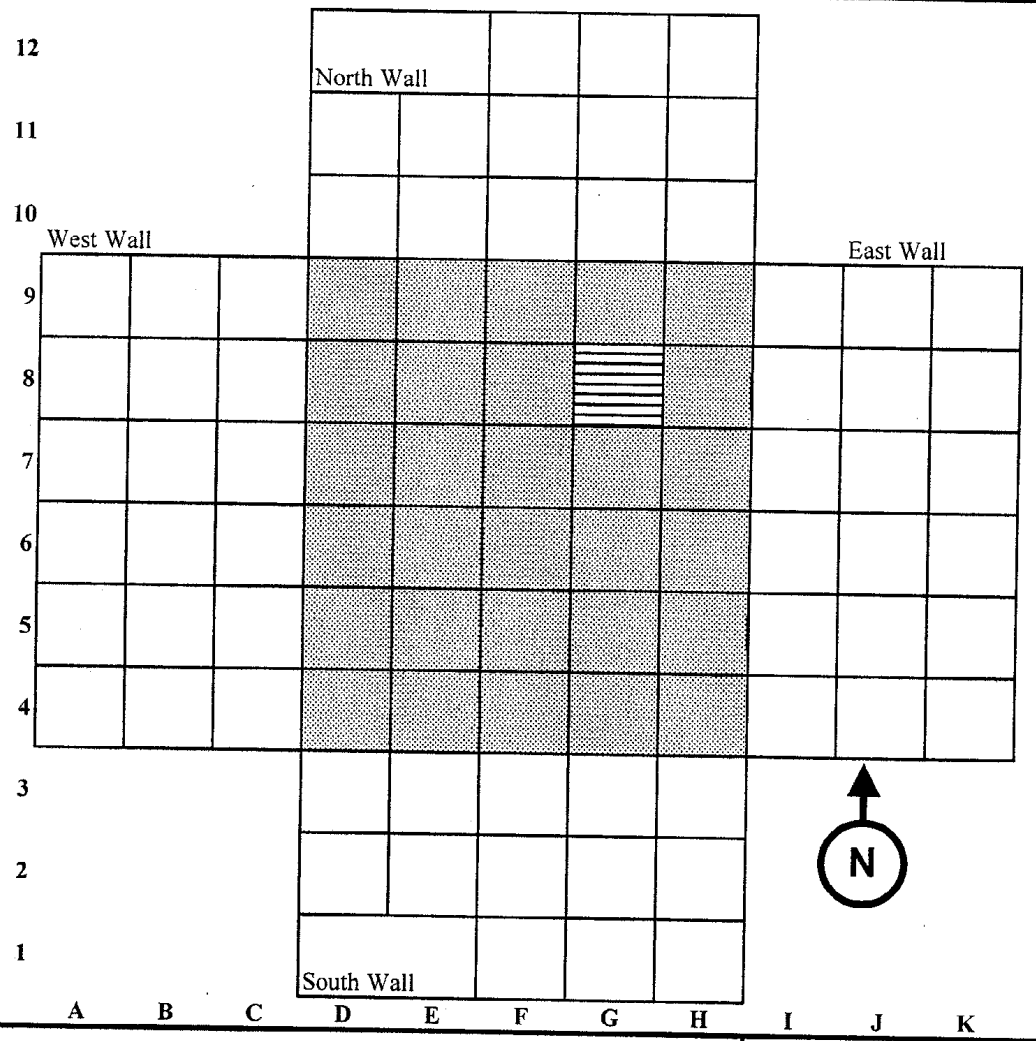
OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
BUILDING 55
Room 116

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



EPA Region 9
Oversight Verification (OV) Survey Grids



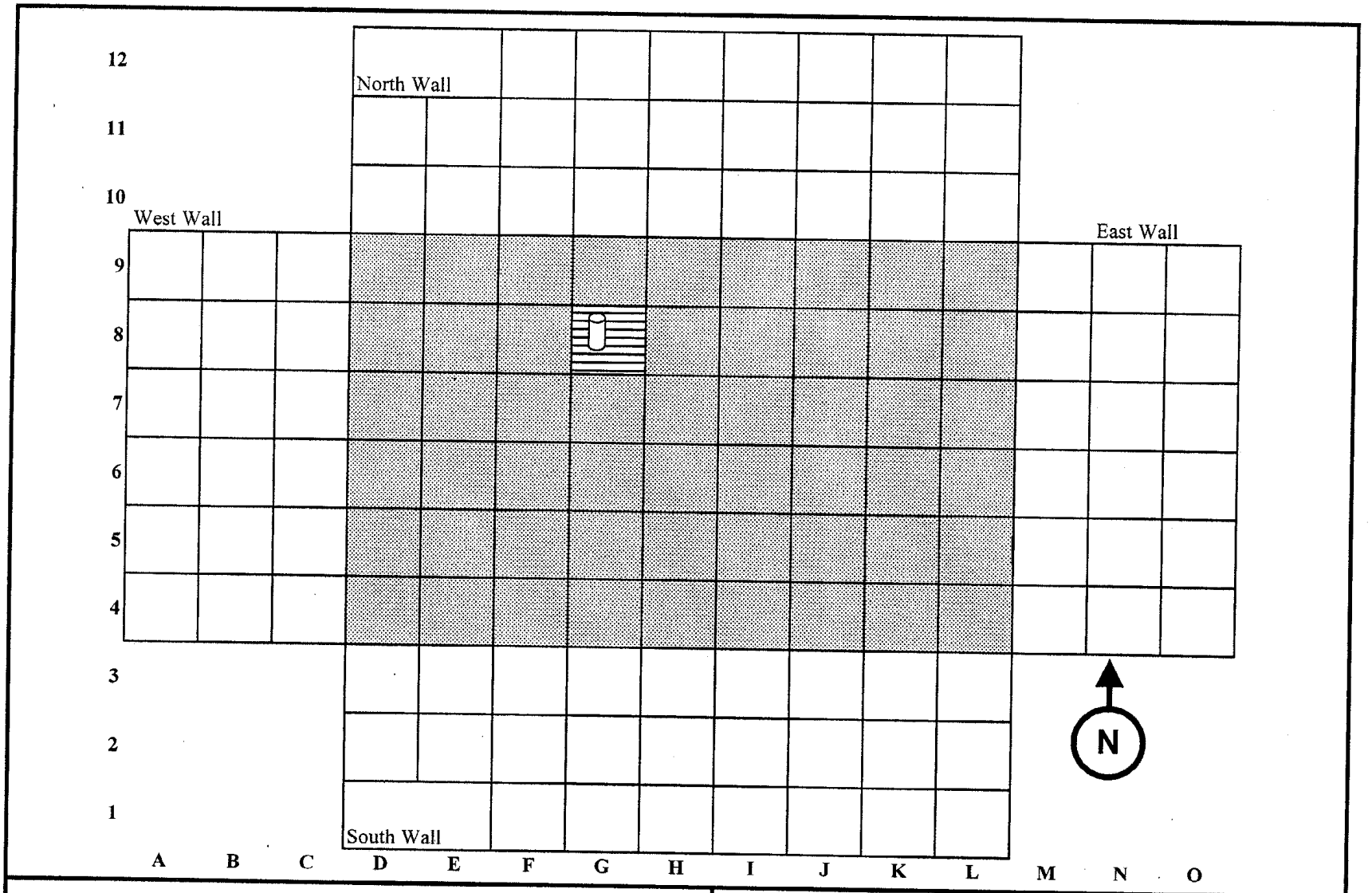
LEGEND

- Floor Grid
- OV Survey Grid
- OV Fixed Point
- Wall Grid

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 55
Room 124

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids

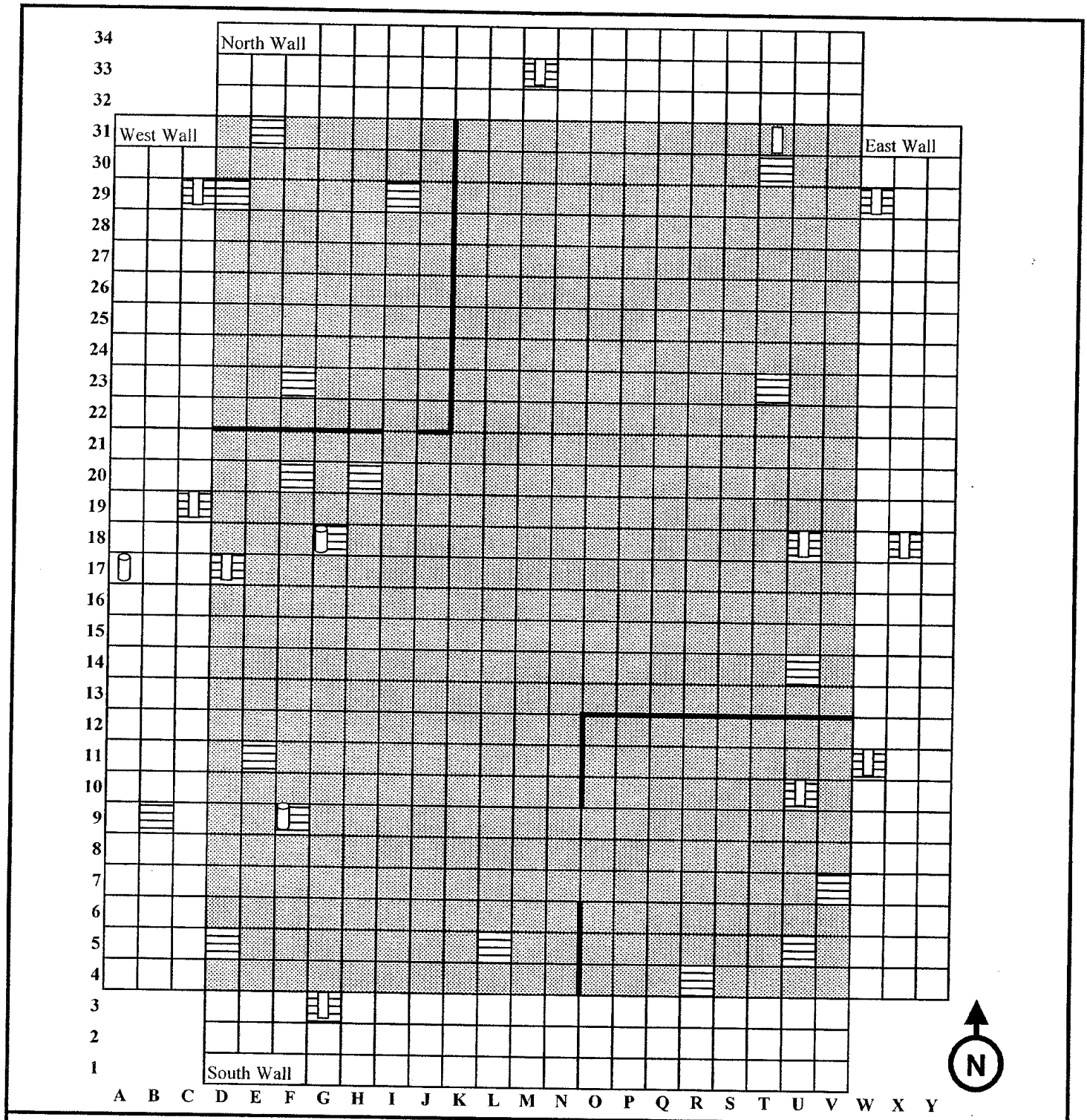


LEGEND

- Floor Grid
- OV Survey Grid
- OV Core Sample
- OV Fixed Point
- Wall Grid

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
BUILDING 55
Room 126
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids

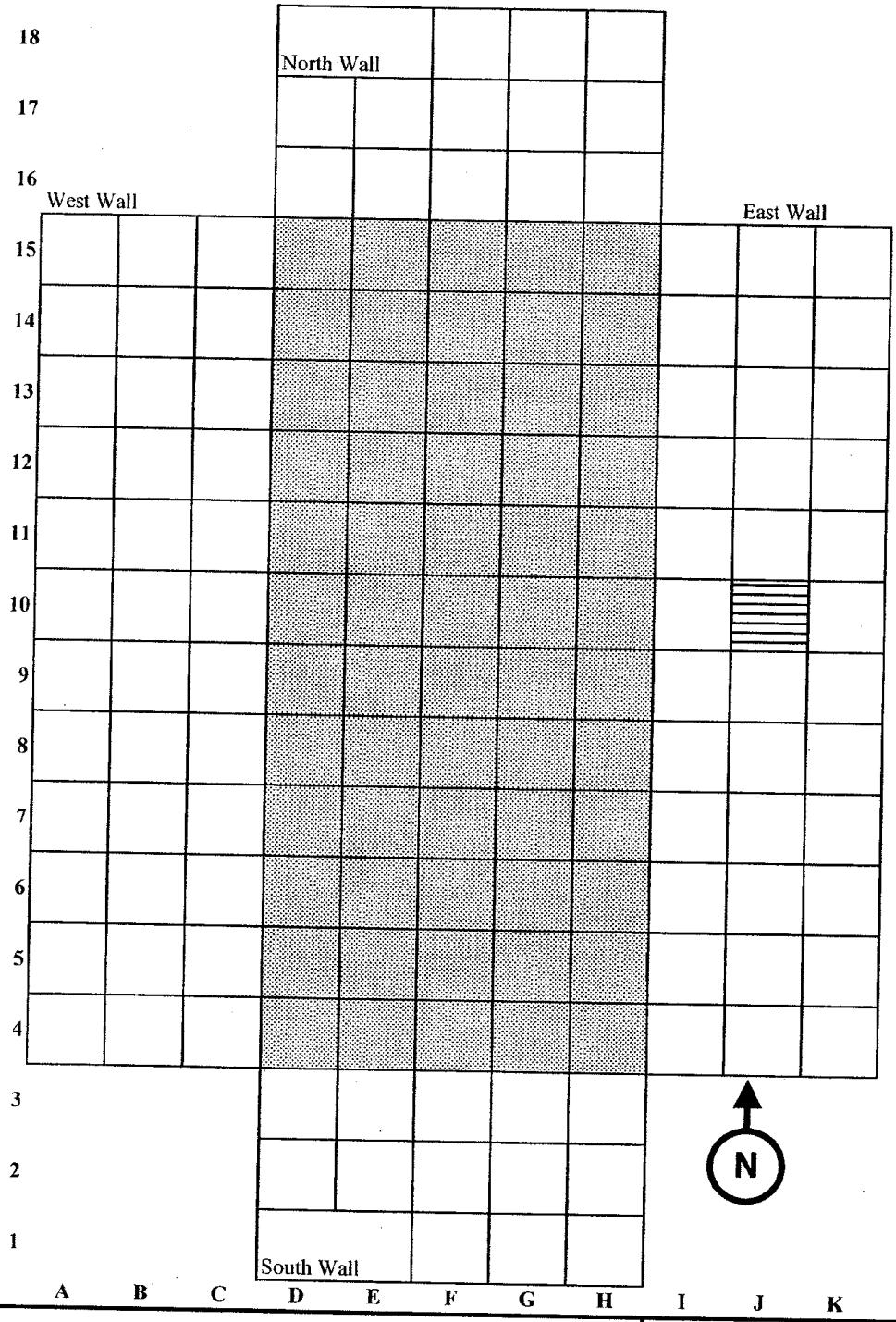


LEGEND

- Floor Grid
- OV Core Sample
- Interior Walls
- OV Survey Grid
- OV Fixed Count
- Wall Grid

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 55
Room 127
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Floor Grid

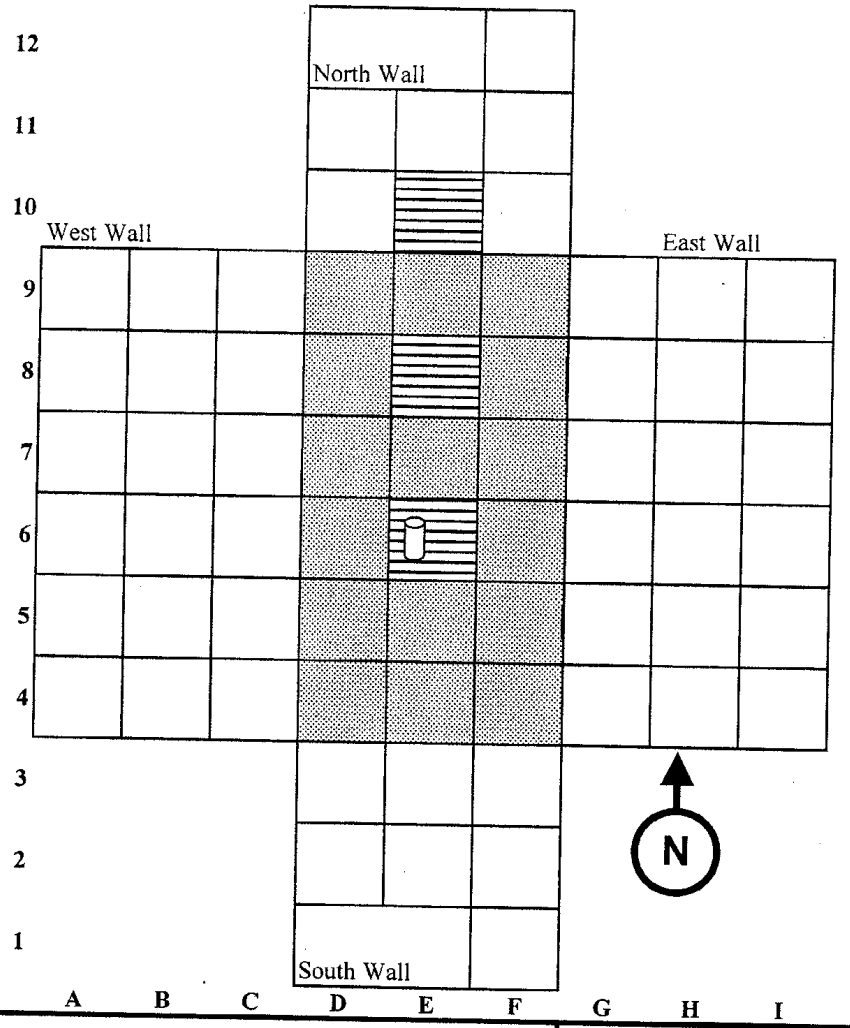
OV Survey Grid

OV Fixed Point

Wall Gri

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
BUILDING 55
Room 129
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids

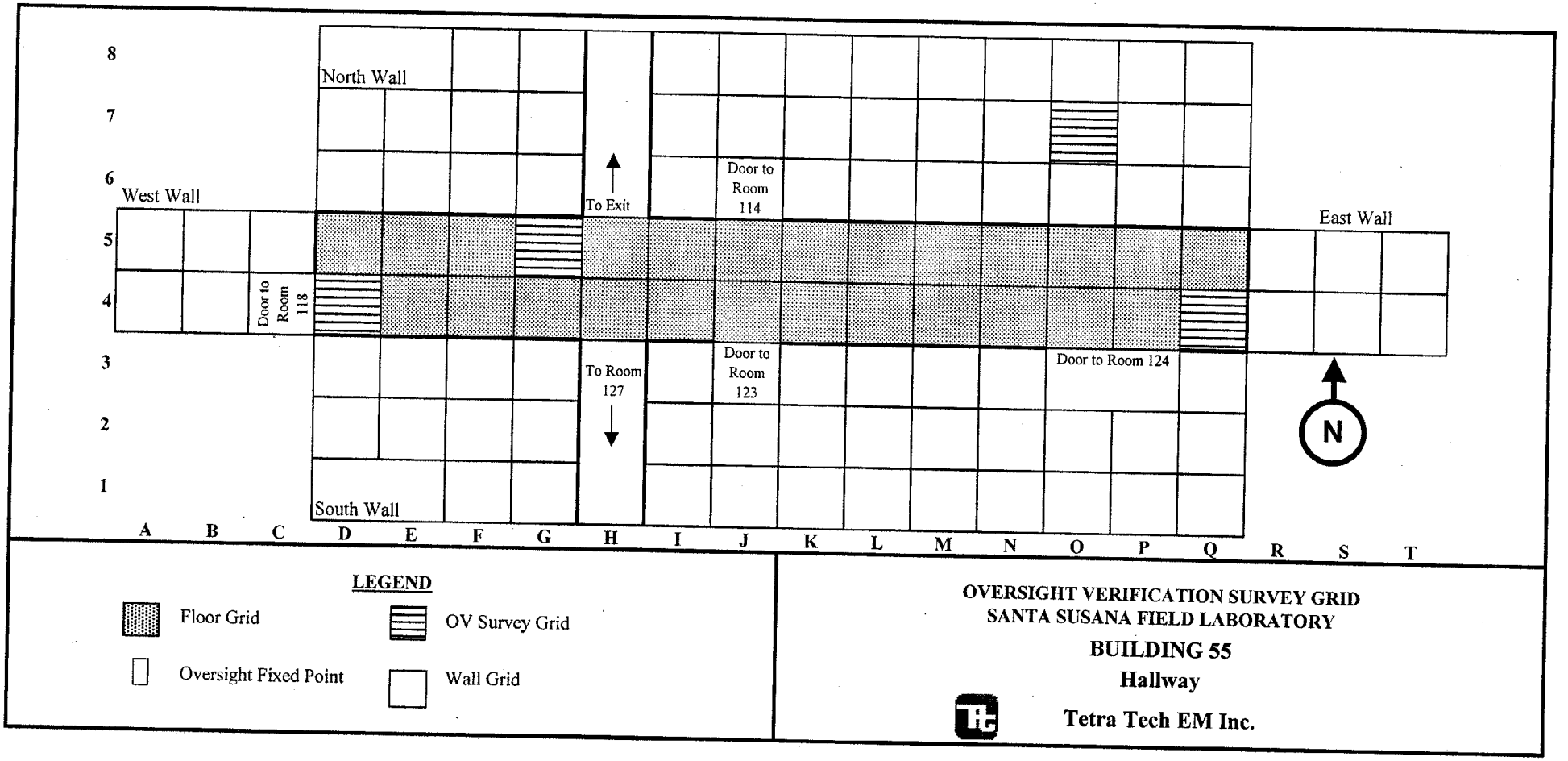


LEGEND

- Floor Grid
- OV Survey Grid
- OV Core Sample
- OV Fixed Point
- Wall Grid

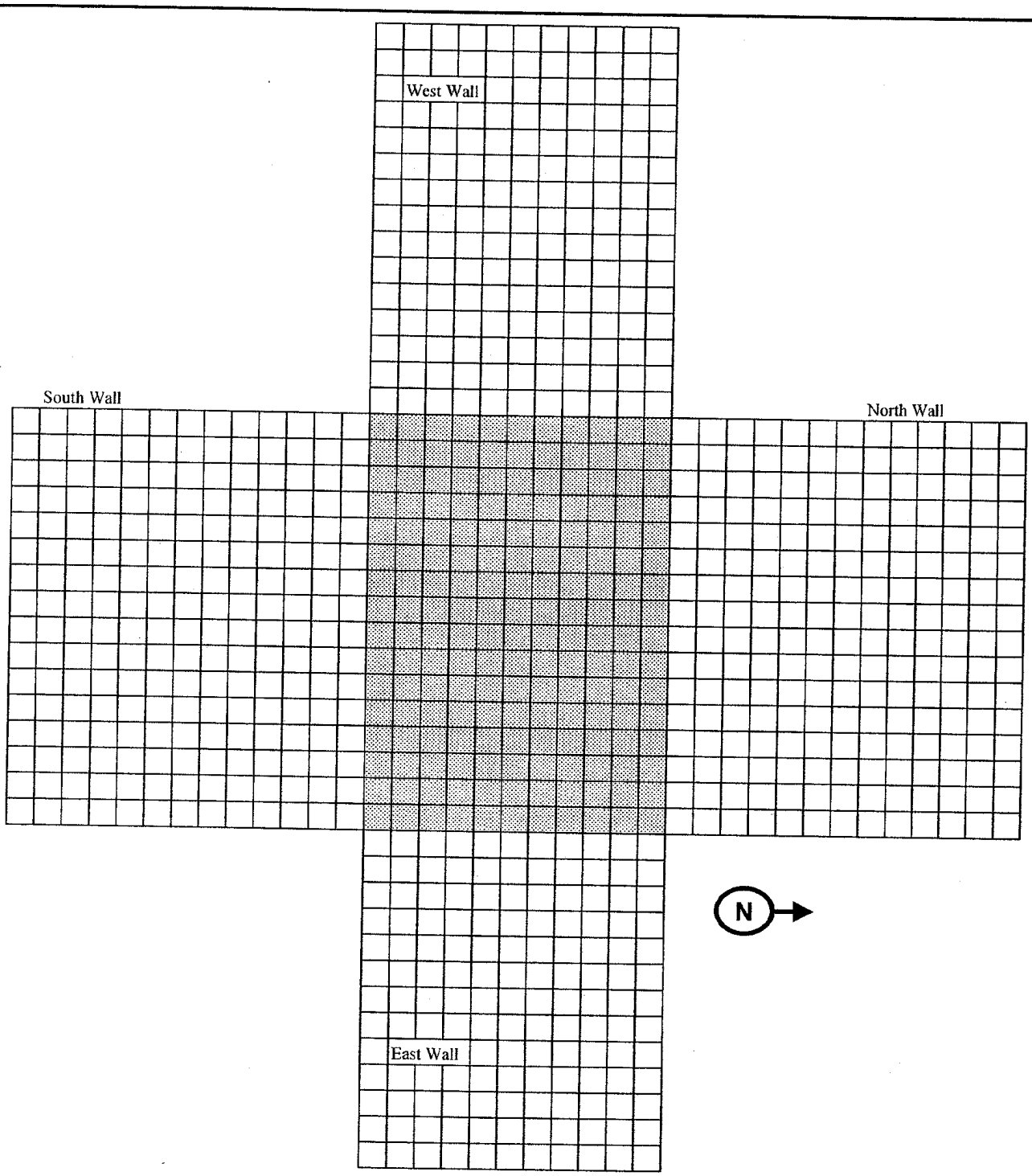
OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
BUILDING 55
Room 131
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
BUILDING 55
Hallway
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Floor Grid

OV Fixed Count

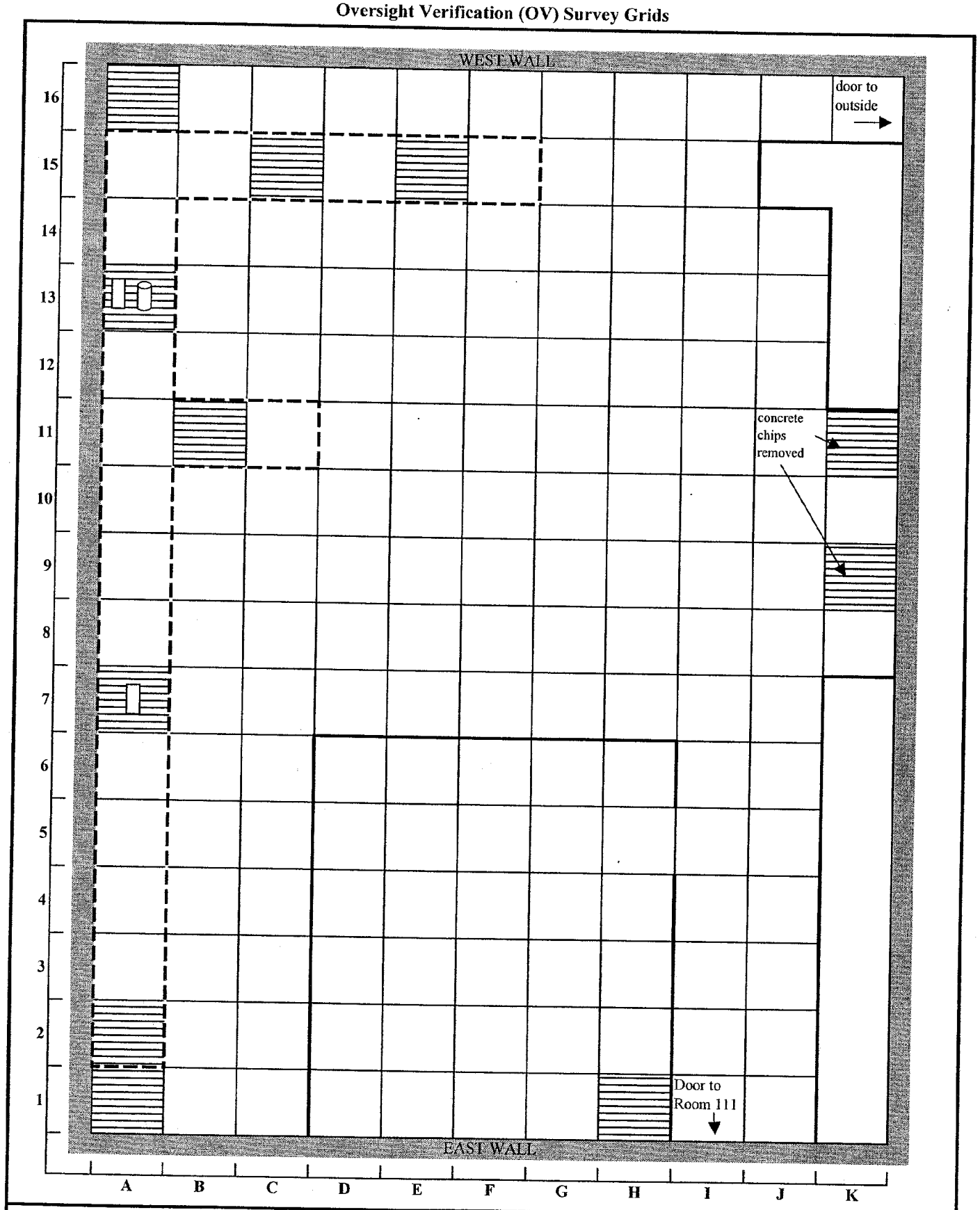
OV Survey Grid

Wall Grid

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 110 Overview

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids

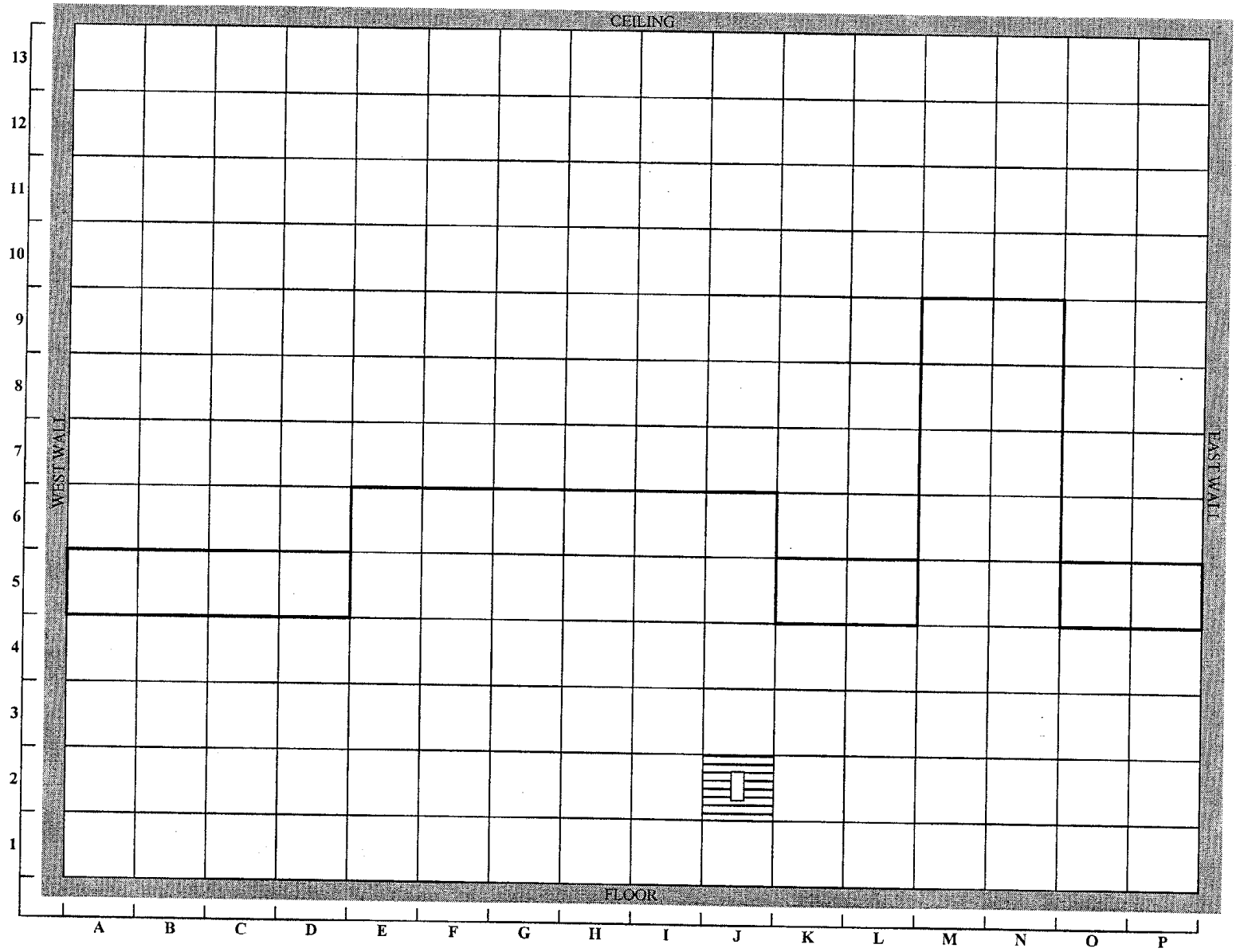


LEGEND

Floor Grid
OV Survey Grid
Trench
OV Core Sample
OV Fixed Count
Interior Walls

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 110 Floor
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Wall Grid

OV Fixed Point

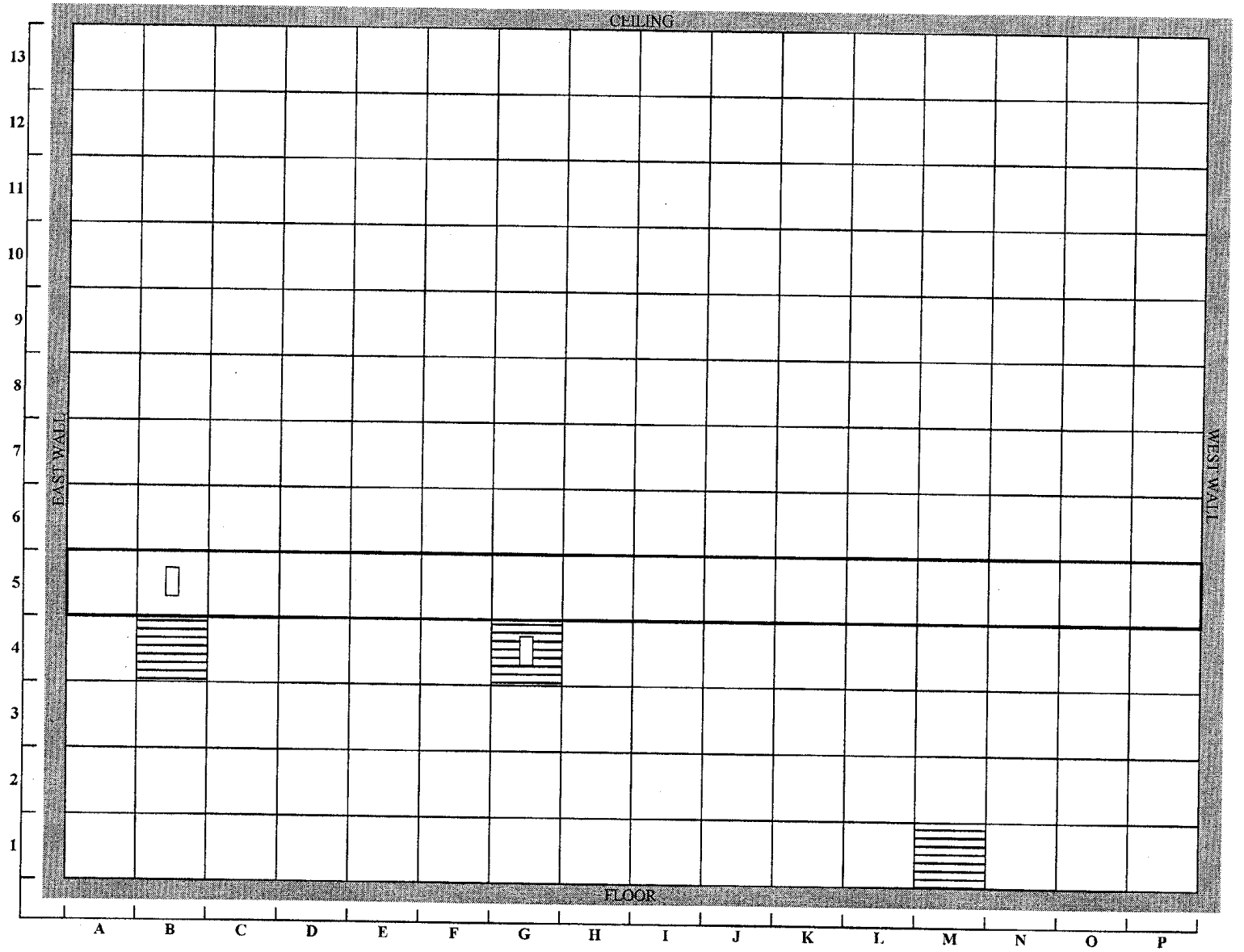
OV Survey Grid

Ledge boundary

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 110 North Wall

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Wall Grid

OV Fixed Point

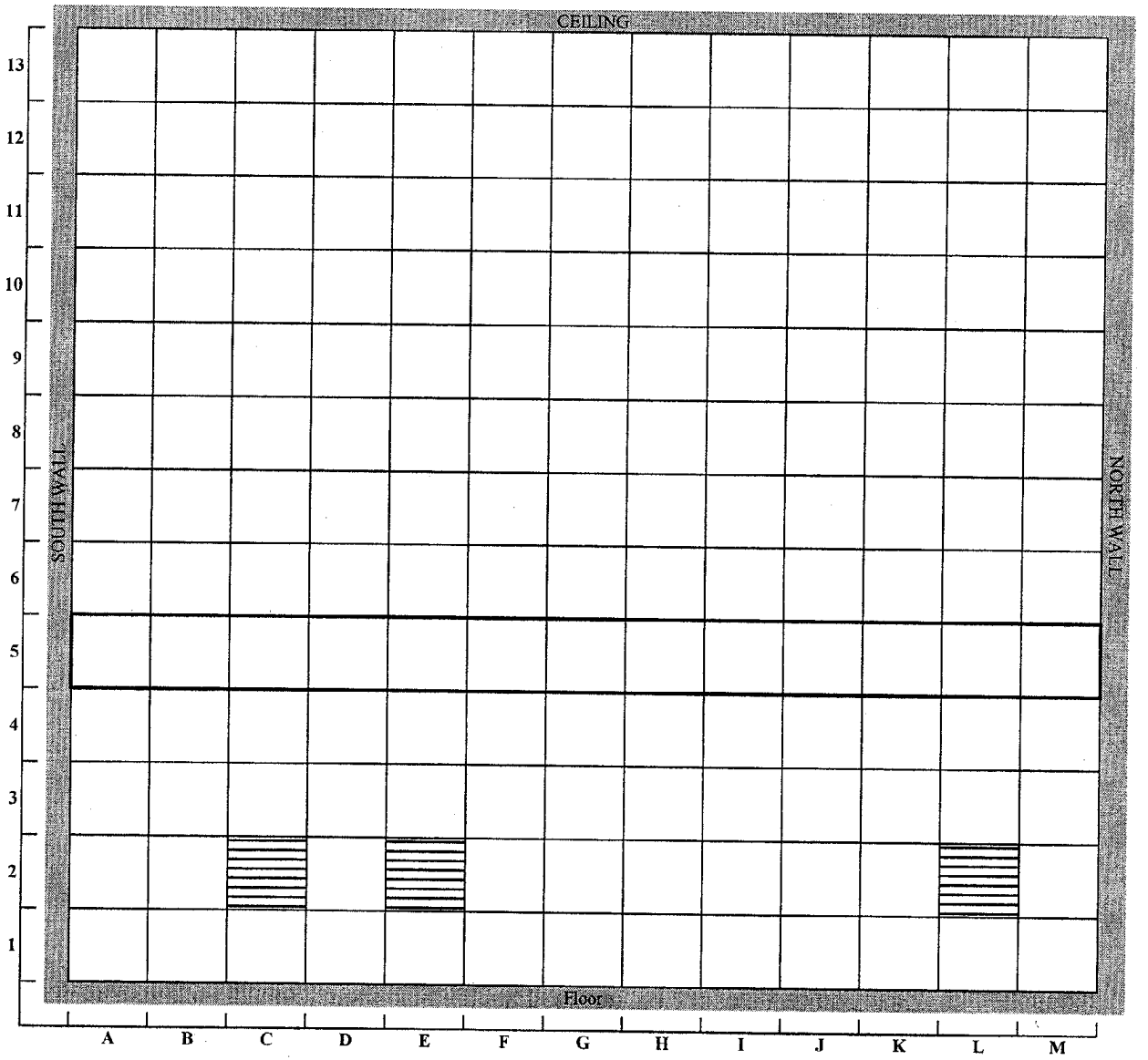
OV Survey Grid

Ledge boundary

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 110 South Wall

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids

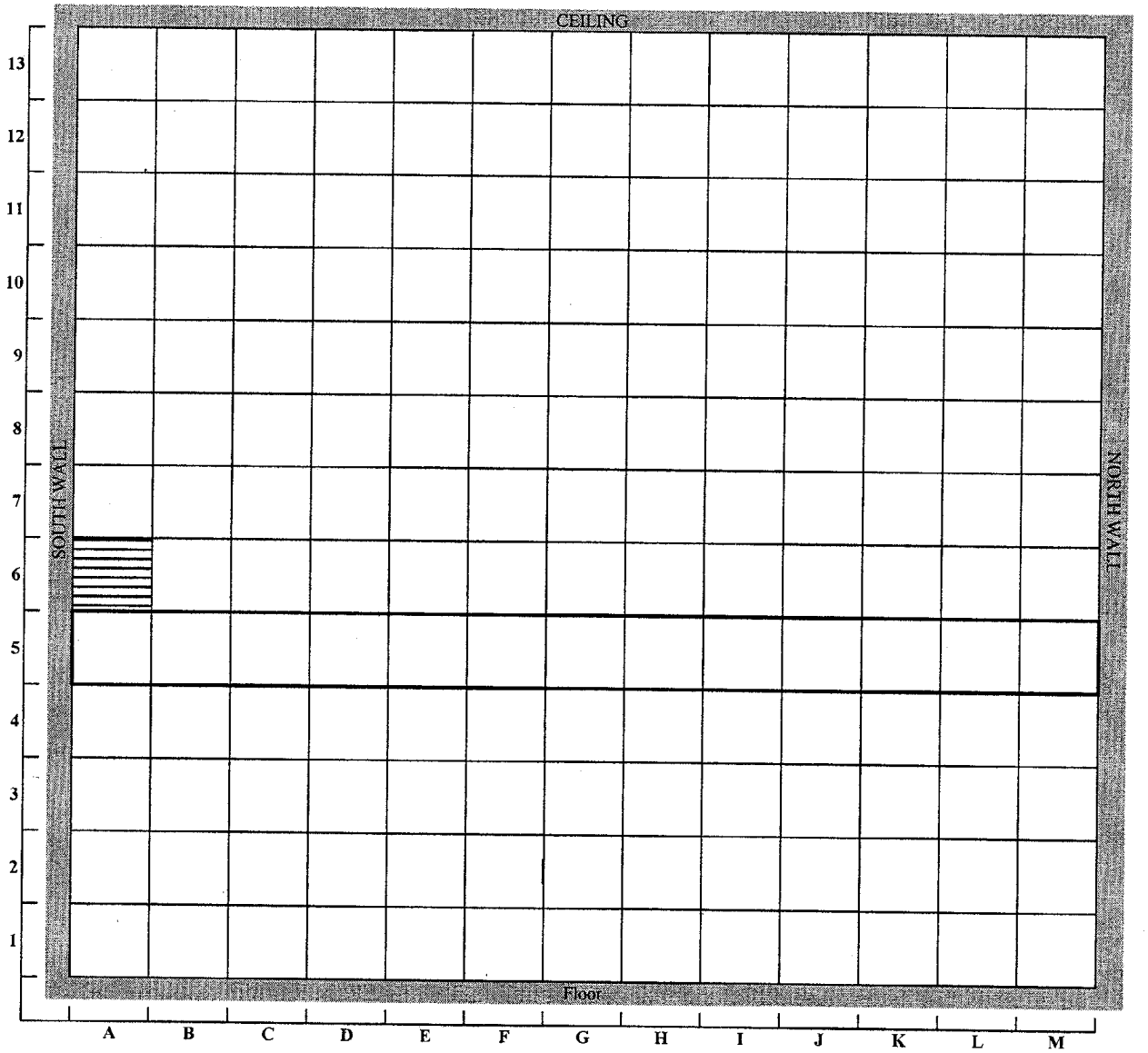


LEGEND

- Wall Grid
- OV Fixed Point
- OV Survey Grid
- Ledge boundary

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 110 West Wall
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids

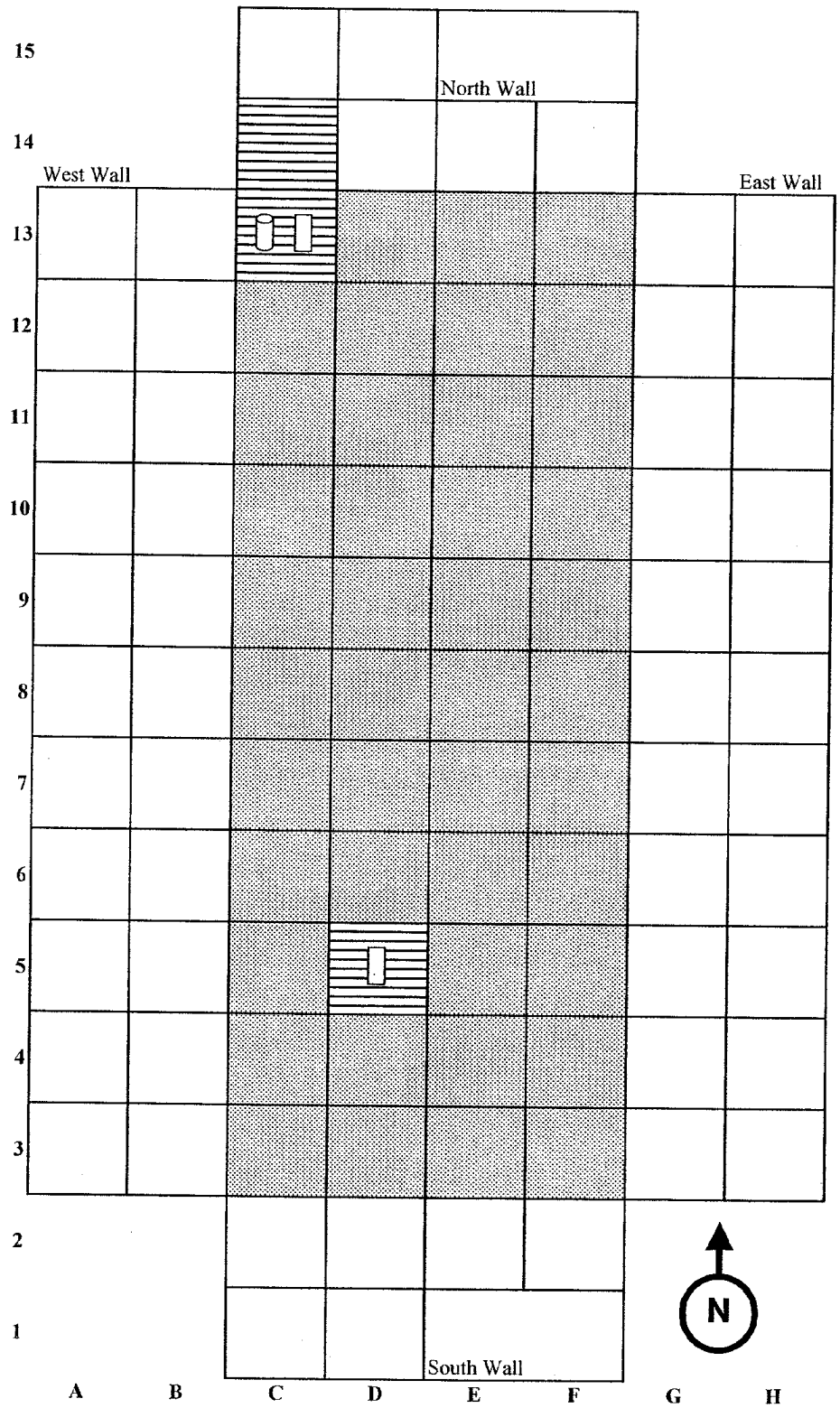


LEGEND

- Wall Grid
- OV Fixed Point
- OV Survey Grid
- Ledge boundary

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 110 East Wall
Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Floor Grid

OV Survey Grid

OV Core Sample

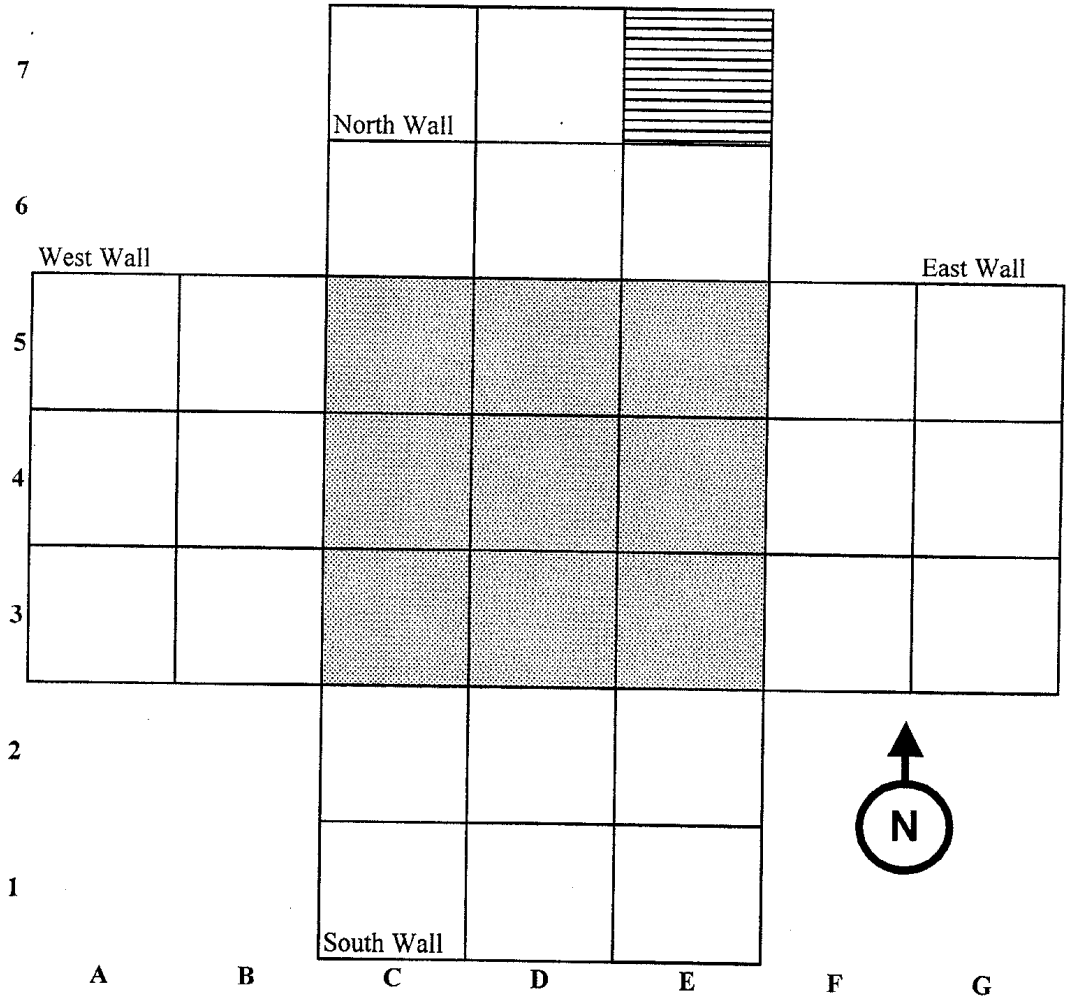
OV Fixed Point

Wall Grid

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 111

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

Floor Grid

OV Survey Grid

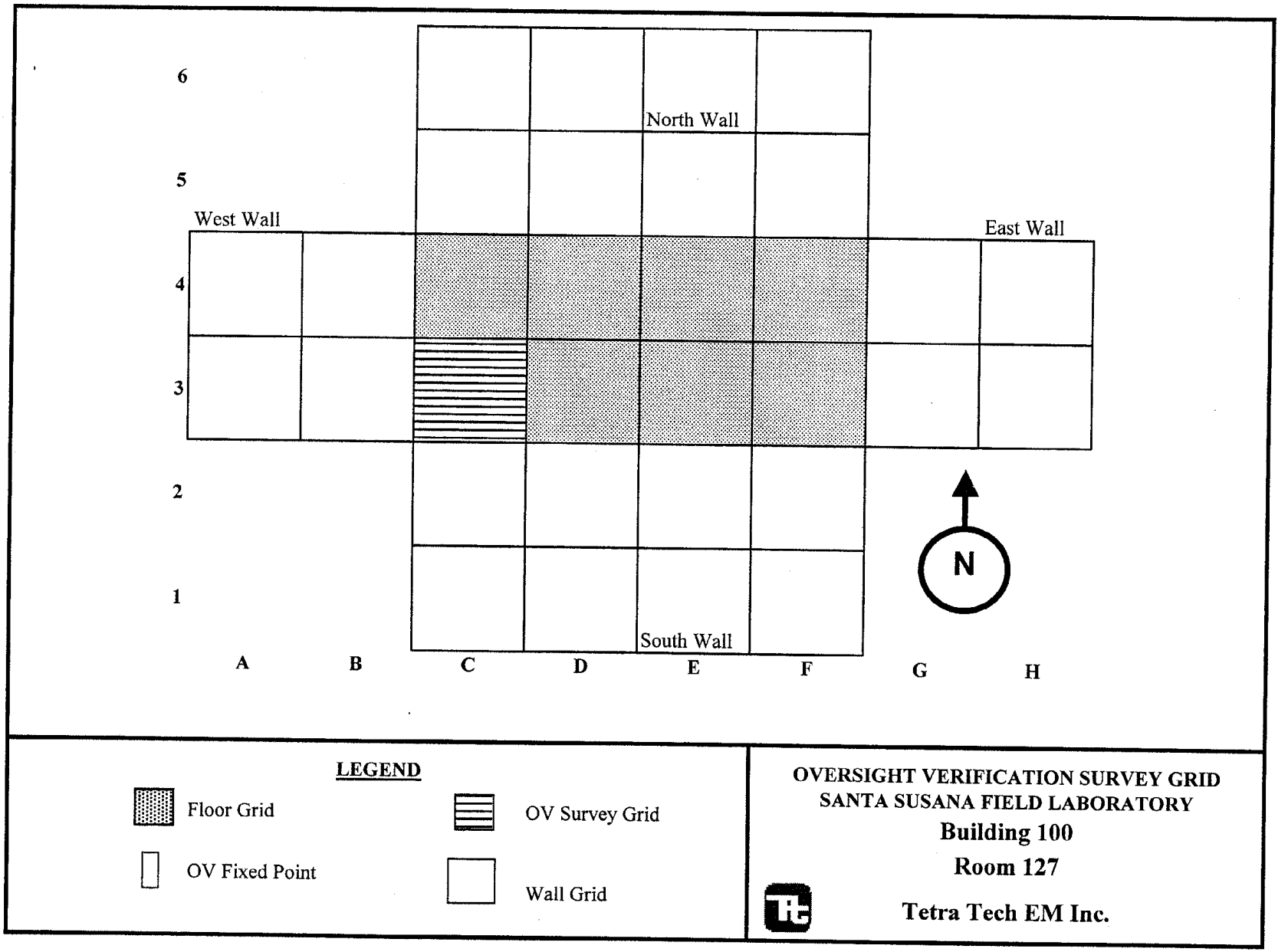
OV Fixed Point

Wall Grid

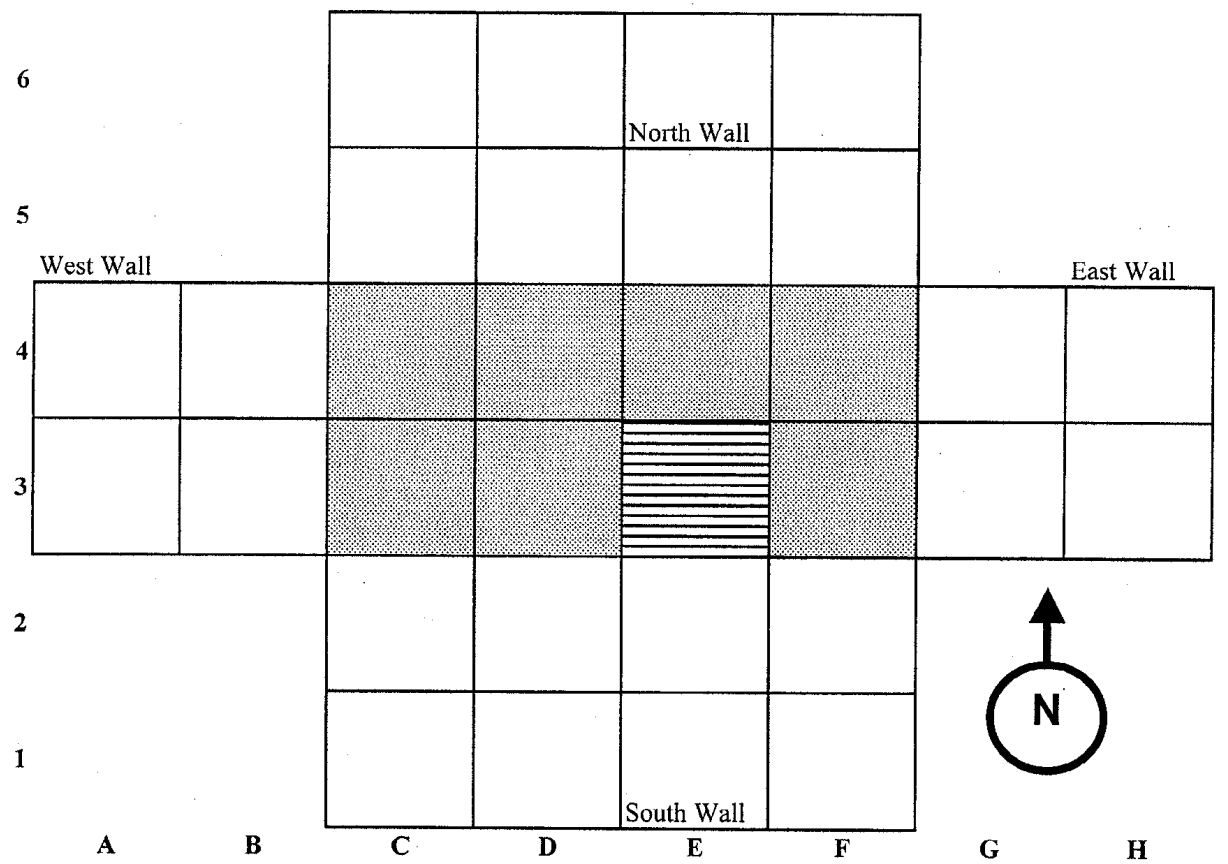
OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 123

Tetra Tech EM Inc.

EPA Region 9
Oversight Verification (OV) Survey Grids



EPA Region 9
Oversight Verification (OV) Survey Grids



LEGEND

- Floor Grid
- OV Survey Grid
- OV Fixed Point
- Wall Grid

OVERSIGHT VERIFICATION SURVEY GRID
SANTA SUSANA FIELD LABORATORY
Building 100
Room 128

Tetra Tech EM Inc.

APPENDIX B

SURVEY DATA

(13 Pages)

TABLE B-1

ALPHA AND BETA SURFACE ACTIVITY
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Date		Building	Room	Tetra Tech Grid No.	R/D Grid No.	Probe Ser.	Survey Type	Alpha or Beta	Bkgd Rate-cpm	Bkgd Time-minutes	Sample Rate-cpm	Sample Time-minutes	L_c (cpm)	L_D (cpm)	Inst. Effic.	Fixed-Point MDC (dpm/100cm2)	Scan MDC(dpm/100cm2)	Reported Activity(dpm/100cm2)	Criteria (dpm/100cm2)
10/1/2001	1	55	127	B9	NA	143875	Scan	alpha	0	20	0	6	0	3	0.127	N/A	Note 1	less than Ld	100
	2	55	127	B9	NA	143875	Scan	beta	99	20	188	6	1.2697795	5.54	0.074	N/A	3445.00	1202.70+/-348.7	5000
	3	55	127	C19	NA	143875	Scan	alpha	0	20	0	6	0	3	0.127	N/A	Note 1	less than Ld	100
	4	55	127	C19	NA	143875	Scan	beta	99	20	198	6	1.2697795	5.54	0.074	N/A	3445.00	1337.84+/-358.7	5000
	5	55	127	C19	NA	143875	Fixed point	alpha	0	20	0	2	0	3.00	0.127	14.65	N/A	less than Ld	100
	6	55	127	C19	NA	143875	Fixed point	beta	99	20	220	2	6.0692475	15.14	0.074	413.02	N/A	1635.14+/-391.3	5000
	7	55	127	G3	NA	143875	Scan	alpha	0	20	1	6	0	3.00	0.127	N/A	Note 1	7.87+/-0.0	100
	8	55	127	G3	NA	143875	Scan	beta	99	20	110	6	1.2697795	5.54	0.074	N/A	3445.00	148.65+/-258.7	5000
	9	55	127	G3	NA	143875	Fixed point	alpha	0	20	0	2	0	3.00	0.127	14.65	N/A	less than Ld	100
	10	55	127	G3	NA	143875	Fixed point	beta	99	20	144	2	6.0692475	15.14	0.074	413.02	N/A	608.11+/-315.9	5000
	11	55	127	M33	NA	143875	Scan	alpha	0	20	1.5	6	0	3.00	0.127	N/A	Note 1	11.81+/-0.0	100
	12	55	127	M33	NA	143875	Scan	beta	99	20	123	6	1.2697795	5.54	0.074	N/A	3445.00	324.32+/-275.7	5000
	13	55	127	M33	NA	143875	Fixed point	alpha	0	20	1	2	0	3.00	0.127	14.65	N/A	7.87+/-0.0	100
	14	55	127	M33	NA	143875	Fixed point	beta	99	20	118	2	6.0692475	15.14	0.074	413.02	N/A	256.76+/-285.5	5000
	15	55	127	W11	NA	143875	Scan	alpha	0	20	1	6	0	3.00	0.127	N/A	Note 1	7.87+/-0.0	100
	16	55	127	W11	NA	143875	Scan	beta	99	20	195	6	1.2697795	5.54	0.074	N/A	3445.00	1297.30+/-355.7	5000
	17	55	127	W11	NA	143875	Fixed point	alpha	0	20	0	2	0	3.00	0.127	14.65	N/A	less than Ld	100
	18	55	127	W11	NA	143875	Fixed point	beta	99	20	181	2	6.0692475	15.14	0.074	413.02	N/A	1108.11+/-354.6	5000
	19	55	127	W29	NA	143875	Scan	alpha	0	20	1	6	0	3.00	0.127	N/A	Note 1	7.87+/-0.0	100
	20	55	127	W29	NA	143875	Scan	beta	99	20	222	6	1.2697795	5.54	0.074	N/A	3445.00	1662.16+/-381.4	5000
	21	55	127	W29	NA	143875	Fixed point	alpha	0	20	2	2	0	3.00	0.127	14.65	N/A	15.75+/-0.0	100
	22	55	127	W29	NA	143875	Fixed point	beta	99	20	199	2	6.0692475	15.14	0.074	413.02	N/A	1351.35+/-372.0	5000
	23	55	127	X18	NA	143875	Scan	alpha	0	20	1	6	0	3.00	0.127	N/A	Note 1	7.87+/-0.0	100
	24	55	127	X18	NA	143875	Scan	beta	99	20	202	6	1.2697795	5.54	0.074	N/A	3445.00	1391.89+/-362.5	5000
	25	55	127	X18	NA	143875	Fixed point	alpha	0	20	0	2	0	3.00	0.127	14.65	N/A	less than Ld	100
	26	55	127	X18	NA	143875	Fixed point	beta	99	20	214	2	6.0692475	15.14	0.074	413.02	N/A	1554.05+/-385.8	5000
	27	55	127	I29	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	100
	28	55	127	I29	NA	148500	Scan	beta	139	20	176	6	1.5045898	6.01	0.076	N/A	4343.00	486.84+/-329.1	5000
	29	55	127	E31	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	100
	30	55	127	E31	NA	148500	Scan	beta	139	20	165	6	1.5045898	6.01	0.076	N/A	4343.00	342.11+/-317.8	5000
	31	55	127	D29	NA	148500	Scan	alpha	1	20	0	6	0.1276176	3.26	0.135	N/A	Note 1	less than Ld	100
	32	55	127	D29	NA	148500	Scan	beta	139	20	171	6	1.5045898	6.01	0.076	N/A	4343.00	421.05+/-324.0	5000
	33	55	127	F23	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	100
	34	55	127	F23	NA	148500	Scan	beta	139	20	162	6	1.5045898	6.01	0.076	N/A	4343.00	302.63+/-314.7	5000
	35	55	127	C29	NA	148500	Scan	alpha	1	20	1	6	0.1276176	3.26	0.135	N/A	Note 1	less than Ld	100
	36	55	127	C29	NA	148500	Scan	beta	139	20	238	6	1.5045898	6.01	0.076	N/A	4343.00	1302.63+/-386.7	5000
	37	55	127	C29	NA	148500	Fixed point	alpha	1	20	2.5	2	0.6099823	4.22	0.135	35.15	N/A	11.11+/-0.0	100
	38	55	127	C29	NA	148500	Fixed point	beta	139	20	242	2	7.1915856	17.38	0.076	471.99	N/A	1355.26+/-399.9	5000
	39	55	127	T30	NA	148500	Scan	alpha	1	20	3	6	0.1276176	3.26	0.135	N/A	Note 1	14.81+/-0.0	100
	40	55	127	T30	NA	148500	Scan	beta	139	20	168	6	1.5045898	6.01	0.076	N/A	4343.00	381.58+/-320.9	5000
	41	55	127	T31	NA	148500	Fixed point	alpha	1	20	1.5	2	0.6099823	4.22	0.135	35.15	N/A	less than Ld	100
	42	55	127	T31	NA	148500	Fixed point	beta	139	20	163	2	7.1915856	17.38	0.076	471.99	N/A	315.79+/-327.7	5000
	43	55	127	T23	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	100
	44	55	127	T23	NA	148500	Scan	beta	139	20	167	6	1.5045898	6.01	0.076	N/A	4343.00	368.42+/-319.9	5000
10/1/2001	45	55	127	U18	NA	148500	Scan	alpha	1	20	3	6	0.1276176	3.26	0.135	N/A	Note 1	14.81+/-0.0	100
	46	55	127	U18	NA	148500	Scan	beta	139	20	178	6	1.5045898	6.01	0.076	N/A	4343.00	513.16+/-331.1	5000

TABLE B-1

ALPHA AND BETA SURFACE ACTIVITY
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Date		Building	Room	Tetra Tech Grid No.	R/D Grid No.	Probe Ser.	Survey Type	Alpha or Beta	Bkgd Rate-cpm	Bkgd Time-minutes	Sample Rate-cpm	Sample Time-minutes	L_c (cpm)	L_D (cpm)	Inst. Effic.	Fixed-Point MDC (dpm/100cm2)	Scan MDC(dpm/100cm2)	Reported Activity(dpm/100cm2)	Criteria (dpm/100cm2)
	47	55	127	U18	NA	148500	Fixed point	alpha	1	20	2.5	2	0.6099823	4.22	0.135	35.15	N/A	11.11+/-0.0	100
	48	55	127	U18	NA	148500	Fixed point	beta	139	20	180	2	7.1915856	17.38	0.076	471.99	N/A	539.47+/-344.5	5000
	49	55	127	D5	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	100
	50	55	127	D5	NA	179869	Scan	beta	208	20	263	5	2.3724527	7.74	0.159	N/A	3408.00	345.91+/-198.4	5000
	51	55	127	F9	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	100
	52	55	127	F9	NA	179869	Scan	beta	208	20	257	5	2.3724527	7.74	0.159	N/A	3408.00	308.18+/-196.1	5000
	53	55	127	L5	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	100
	54	55	127	L5	NA	179869	Scan	beta	208	20	238	5	2.3724527	7.74	0.159	N/A	3408.00	188.68+/-188.5	5000
	55	55	127	E11	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	100
	56	55	127	E11	NA	179869	Scan	beta	208	20	371	5	2.3724527	7.74	0.159	N/A	3408.00	1025.16+/-236.1	5000
	57	55	127	D17	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.172	N/A	Note 1	11.63+/-0.0	100
	58	55	127	D17	NA	179869	Scan	beta	208	20	276	5	2.3724527	7.74	0.159	N/A	3408.00	427.67+/-203.3	5000
	59	55	127	D17	NA	179869	Fixed point	alpha	0	20	2	2	0	3.00	0.172	10.82	N/A	11.63+/-0.0	100
	60	55	127	D17	NA	179869	Fixed point	beta	208	20	261	2	8.7972902	20.59	0.159	273.37	N/A	333.33+/-198.9	5000
	61	55	127	G18	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	100
	62	55	127	G18	NA	179869	Scan	beta	208	20	281	5	2.3724527	7.74	0.159	N/A	3408.00	459.12+/-205.1	5000
	63	55	127	F20	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	100
	64	55	127	F20	NA	179869	Scan	beta	208	20	258	5	2.3724527	7.74	0.159	N/A	3408.00	314.47+/-196.4	5000
	65	55	127	H20	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	100
	66	55	127	H20	NA	179869	Scan	beta	208	20	285	5	2.3724527	7.74	0.159	N/A	3408.00	484.28+/-206.6	5000
	67	55	127	R4	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.172	N/A	Note 1	11.63+/-0.0	100
	68	55	127	R4	NA	179869	Scan	beta	208	20	282	5	2.3724527	7.74	0.159	N/A	3408.00	465.41+/-205.5	5000
	69	55	127	U5	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	100
	70	55	127	U5	NA	179869	Scan	beta	208	20	278	5	2.3724527	7.74	0.159	N/A	3408.00	440.25+/-204.0	5000
	71	55	127	V7	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	100
	72	55	127	V7	NA	179869	Scan	beta	208	20	292	5	2.3724527	7.74	0.159	N/A	3408.00	528.30+/-209.2	5000
	73	55	127	U10	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.172	N/A	Note 1	11.63+/-0.0	100
	74	55	127	U10	NA	179869	Scan	beta	208	20	277	5	2.3724527	7.74	0.159	N/A	3408.00	433.96+/-203.7	5000
	75	55	127	U10	NA	179869	Fixed point	alpha	0	20	0	2	0	3.00	0.172	10.82	N/A	less than Ld	100
	76	55	127	U10	NA	179869	Fixed point	beta	208	20	263	2	8.7972902	20.59	0.159	273.37	N/A	345.91+/-199.7	5000
	77	55	127	U14	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.159	N/A	Note 1	6.29+/-0.0	100
	78	55	127	U14	NA	179869	Scan	beta	208	20	279	5	2.3724527	7.74	0.172	N/A	3408.00	412.79+/-189.1	5000
	79	55	114	J5	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.159	N/A	Note 1	less than Ld	100
	80	55	114	J5	NA	179869	Scan	beta	208	20	251	5	2.3724527	7.74	0.172	N/A	3408.00	250.00+/-179.2	5000
	81	55	116	E5	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.159	N/A	Note 1	6.29+/-0.0	100
	82	55	116	E5	NA	179869	Scan	beta	208	20	268	5	2.3724527	7.74	0.135	N/A	3408.00	444.44+/-235.5	5000
	83	55	123	D7	NA	179869	Scan	alpha	1	20	1	6	0.1276176	3.26	0.076	N/A	Note 1	less than Ld	100
	84	55	123	D7	NA	179869	Scan	beta	139	20	162	6	1.5045898	6.01	0.172	N/A	3408.00	133.72+/-142.4	5000
	85	55	124	G8	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.159	N/A	Note 1	6.29+/-0.0	100
	86	55	124	G8	NA	179869	Scan	beta	208	20	273	5	2.3724527	7.74	0.172	N/A	3408.00	377.91+/-187.0	5000
	87	55	126	G8	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.159	N/A	Note 1	6.29+/-0.0	100
	88	55	126	G8	NA	179869	Scan	beta	208	20	255	5	2.3724527	7.74	0.172	N/A	3408.00	273.26+/-180.6	5000
	89	55	129	J10	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.159	N/A	Note 1	12.58+/-0.0	100
10/1/2001	90	55	129	J10	NA	179869	Scan	beta	208	20	193	5	2.3724527	7.74	0.135	N/A	3408.00	less than Ld	5000
	91	55	130	wall	NA	179869	Scan	alpha	1	20	2	6	0.1276176	3.26	0.076	N/A	Note 1	13.16+/-0.0	100
	92	55	130	wall	NA	179869	Scan	beta	139	20	138	6	1.5045898	6.01	0.135	N/A	3408.00	less than Ld	5000

TABLE B-1

ALPHA AND BETA SURFACE ACTIVITY
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Date		Building	Room	Tetra Tech Grid No.	R/D Grid No.	Probe Ser.	Survey Type	Alpha or Beta	Bkgd Rate-cpm	Bkgd Time-minutes	Sample Rate-cpm	Sample Time-minutes	L_c (cpm)	L_D (cpm)	Inst. Effic.	Fixed-Point MDC (dpm/100cm2)	Scan MDC(dpm/100cm2)	Reported Activity(dpm/100cm2)	Criteria (dpm/100cm2)
	93	55	130	wall	NA	179869	Fixed point	alpha	1	20	2	2	0.6099823	4.22	0.076	N/A	Note 1	13.16+/-0.0	100
	94	55	130	wall	NA	179869	Fixed point	beta	139	20	145	2	7.1915856	17.38	0.172	N/A	3408.00	34.88+/-136.9	5000
	95	55	131	E6	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.159	N/A	Note 1	less than Ld	100
	96	55	131	E6	NA	179869	Scan	beta	208	20	417	5	2.3724527	7.74	0.172	N/A	3408.00	1215.12+/-231.6	5000
	97	55	131	E8	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.159	N/A	Note 1	6.29+/-0.0	100
	98	55	131	E8	NA	179869	Scan	beta	208	20	419	5	2.3724527	7.74	0.172	N/A	3408.00	1226.74-/-232.2	5000
	99	55	131	E10	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.159	N/A	Note 1	less than Ld	100
	100	55	131	E10	NA	179869	Scan	beta	208	20	385	5	2.3724527	7.74	0.135	N/A	3408.00	1311.11-/-283.1	5000
	101	55	Hallway	D4	NA	179869	Scan	alpha	1	20	1	6	0.1276176	3.26	0.076	N/A	Note 1	less than Ld	100
	102	55	Hallway	D4	NA	179869	Scan	beta	139	20	160	6	1.5045898	6.01	0.135	N/A	3408.00	155.56+/-179.4	5000
	103	55	Hallway	G5	NA	179869	Scan	alpha	1	20	1.5	6	0.1276176	3.26	0.076	N/A	Note 1	6.58+/-0.0	100
	104	55	Hallway	G5	NA	179869	Scan	beta	139	20	165	6	1.5045898	6.01	0.135	N/A	3408.00	192.59+/-182.3	5000
	105	55	Hallway	Q4	NA	179869	Scan	alpha	1	20	2	6	0.1276176	3.26	0.076	N/A	Note 1	13.16-/-0.0	100
	106	55	Hallway	Q4	NA	179869	Scan	beta	139	20	174	6	1.5045898	6.01	0.135	N/A	3408.00	259.26+/-187.4	5000
	107	55	Hallway	O7	NA	179869	Scan	alpha	1	20	2	6	0.1276176	3.26	0.076	N/A	Note 1	13.16-/-0.0	100
	108	55	Hallway	O7	NA	179869	Scan	beta	139	20	138	6	1.5045898	6.01	0.135	N/A	3408.00	less than Ld	5000
10/2/2001	109	11		C6	NA	179869	Scan	alpha	2	20	1.5	6	0.1804786	3.36	0.076	N/A	Note 1	less than Ld	5000
	110	11		C6	NA	179869	Scan	beta	152	20	174	6	1.5733759	6.15	0.135	N/A	3408.00	162.96+/-187.5	5000
	111	11		C12	NA	179869	Scan	alpha	2	20	1	6	0.1804786	3.36	0.076	N/A	Note 1	less than Ld	5000
	112	11		C12	NA	179869	Scan	beta	152	20	182	6	1.5733759	6.15	0.135	N/A	3408.00	222.22+/-191.9	5000
	113	11		J2	NA	179869	Scan	alpha	2	20	2	6	0.1804786	3.36	0.076	N/A	Note 1	less than Ld	5000
	114	11		J2	NA	179869	Scan	beta	152	20	166	6	1.5733759	6.15	0.135	N/A	3408.00	103.70+/-182.9	5000
	115	11		L12	NA	179869	Scan	alpha	2	20	2	6	0.1804786	3.36	0.076	N/A	Note 1	less than Ld	5000
	116	11		L12	NA	179869	Scan	beta	152	20	241	6	1.5733759	6.15	0.135	N/A	3408.00	659.26+/-222.0	5000
	117	11		L12	NA	179869	Fixed point	alpha	2	20	1.5	2	0.8626453	4.73	0.076	78.17	N/A	less than Ld	5000
	118	11		L12	NA	179869	Fixed point	beta	152	20	233	2	7.5203672	18.04	0.135	277.23	N/A	600.00+/-221.2	5000
	119	11		L17	NA	179869	Scan	alpha	2	20	2	6	0.1804786	3.36	0.076	N/A	Note 1	less than Ld	5000
	120	11		L17	NA	179869	Scan	beta	152	20	253	6	1.5733759	6.15	0.135	N/A	3408.00	748.15+/-227.6	5000
	121	11		L20	NA	179869	Scan	alpha	2	20	3	6	0.1804786	3.36	0.076	N/A	Note 1	13.16+/-0.0	5000
	122	11		L20	NA	179869	Scan	beta	152	20	253	6	1.5733759	6.15	0.135	N/A	3408.00	748.15+/-227.6	5000
	123	11		L20	NA	179869	Fixed point	alpha	2	20	0	2	0.8626453	4.73	0.076	78.17	N/A	less than Ld	5000
	124	11		L20	NA	179869	Fixed point	beta	152	20	230	2	7.5203672	18.04	0.135	277.23	N/A	577.78+/-219.8	5000
	125	11		I3	NA	179869	Scan	alpha	2	20	1.5	6	0.1804786	3.36	0.076	N/A	Note 1	less than Ld	5000
	126	11		I3	NA	179869	Scan	beta	152	20	168	6	1.5733759	6.15	0.135	N/A	3408.00	118.52+/-184.1	5000
	127	11		N13	NA	179869	Scan	alpha	2	20	1	6	0.1804786	3.36	0.076	N/A	Note 1	less than Ld	5000
	128	11		N13	NA	179869	Scan	beta	152	20	169	6	1.5733759	6.15	0.159	N/A	3408.00	106.92+/-157.3	5000
	129	11		A4	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	5000
	130	11		A4	NA	179869	Scan	beta	208	20	286	5	2.3724527	7.74	0.159	N/A	3408.00	490.57+/-207.0	5000
	131	11		E8	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	132	11		E8	NA	179869	Scan	beta	208	20	372	5	2.3724527	7.74	0.159	N/A	3408.00	1031.45+/-236.5	5000
	133	11		J6	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	134	11		J6	NA	179869	Scan	beta	208	20	453	5	2.3724527	7.74	0.159	N/A	3408.00	1540.88+/-261.2	5000
10/2/2001	135	11		H11	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	136	11		H11	NA	179869	Scan	beta	208	20	643	5	2.3724527	7.74	0.159	N/A	3408.00	2735.85+/-311.6	5000
	137	11		H11	NA	179869	Fixed point	alpha	0	20	2.5	2	0	3.00	0.172	10.82	N/A	14.53+/-0.0	5000
	138	11		H11	NA	179869	Fixed point	beta	208	20	467	2	8.7972902	20.59	0.159	273.37	N/A	1628.93+/-266.2	5000

TABLE B-1

ALPHA AND BETA SURFACE ACTIVITY
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Date		Building	Room	Tetra Tech Grid No.	R/D Grid No.	Probe Ser.	Survey Type	Alpha or Beta	Bkgd Rate-cpm	Bkgd Time-minutes	Sample Rate-cpm	Sample Time-minutes	L_c (cpm)	L_D (cpm)	Inst. Effic.	Fixed-Point MDC (dpm/100cm2)	Scan MDC(dpm/100cm2)	Reported Activity(dpm/100cm2)	Criteria (dpm/100cm2)
	139	11		F15	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	140	11		F15	NA	179869	Scan	beta	208	20	486	5	2.3724527	7.74	0.159	N/A	3408.00	1748.43+/-270.6	5000
	141	11		A16	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	142	11		A16	NA	179869	Scan	beta	208	20	283	5	2.3724527	7.74	0.159	N/A	3408.00	471.70+/-205.9	5000
	143	11		G21	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	144	11		G21	NA	179869	Scan	beta	208	20	481	5	2.3724527	7.74	0.159	N/A	3408.00	1716.98+/-269.2	5000
	145	11		M37	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.172	N/A	Note 1	11.63+/-0.0	5000
	146	11		M37	NA	179869	Scan	beta	208	20	520	5	2.3724527	7.74	0.159	N/A	3408.00	1962.26+/-280.0	5000
	147	11		J34	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.172	N/A	Note 1	11.63+/-0.0	5000
	148	11		J34	NA	179869	Scan	beta	208	20	596	5	2.3724527	7.74	0.159	N/A	3408.00	2440.25+/-299.9	5000
	149	11		J34	NA	179869	Fixed point	alpha	0	20	2.5	2	0	3.00	0.172	10.82	N/A	14.53+/-0.0	5000
	150	11		J34	NA	179869	Fixed point	beta	208	20	439	2	8.7972902	20.59	0.159	273.37	N/A	1452.83+/-258.1	5000
	151	11		N20	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	152	11		N20	NA	179869	Scan	beta	208	20	297	5	2.3724527	7.74	0.159	N/A	3408.00	559.75+/-211.0	5000
	153	11		N18	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	154	11		N18	NA	179869	Scan	beta	208	20	297	5	2.3724527	7.74	0.159	N/A	3408.00	559.75+/-211.0	5000
	155	11		N30	NA	143875	Scan	alpha	0	20	1	6	0	3.00	0.127	N/A	Note 1	7.87+/-0.0	5000
	156	11		N30	NA	143875	Scan	beta	126	20	141	6	1.4325044	5.87	0.074	N/A	3445.00	202.70+/-298.7	5000
	157	11		N30	NA	143875	Fixed point	alpha	0	20	2	2	0	3.00	0.127	14.65	N/A	15.75+/-0.0	5000
	158	11		N30	NA	143875	Fixed point	beta	126	20	150	2	6.8470346	16.69	0.074	462.73	N/A	324.32+/-322.6	5000
	159	11		B20	NA	143875	Scan	alpha	0	20	1	6	0	3.00	0.127	N/A	Note 1	7.87+/-0.0	5000
	160	11		B20	NA	143875	Scan	beta	126	20	142	6	1.4325044	5.87	0.074	N/A	3445.00	216.22+/-299.9	5000
	161	11		B20	NA	143875	Fixed point	alpha	0	20	0	2	0	3.00	0.127	14.65	N/A	less than Ld	5000
	162	11		B20	NA	143875	Fixed point	beta	126	20	145	2	6.8470346	16.69	0.074	462.73	N/A	256.76+/-317.2	5000
10/3/2001	163	19	High Bay	N12	563	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	5000
	164	19	High Bay	N12	563	148500	Scan	beta	140	20	243	6	1.5099923	6.02	0.076	N/A	4343.00	1355.26+/-391.0	5000
	165	19	High Bay	K13	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	5000
	166	19	High Bay	K13	NA	148500	Scan	beta	140	20	207	6	1.5099923	6.02	0.076	N/A	4343.00	881.58+/-359.1	5000
	167	19	High Bay	I13	NA	148500	Scan	alpha	1	20	1	6	0.1276176	3.26	0.135	N/A	Note 1	less than Ld	5000
	168	19	High Bay	I13	NA	148500	Scan	beta	140	20	165	6	1.5099923	6.02	0.076	N/A	4343.00	328.95+/-317.8	5000
	169	19	High Bay	T20	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	5000
	170	19	High Bay	T20	NA	148500	Scan	beta	140	20	242	6	1.5099923	6.02	0.076	N/A	4343.00	1342.11+/-390.2	5000
	171	19	High Bay	X17	NA	148500	Scan	alpha	1	20	1	6	0.1276176	3.26	0.135	N/A	Note 1	less than Ld	5000
	172	19	High Bay	X17	NA	148500	Scan	beta	140	20	218	6	1.5099923	6.02	0.076	N/A	4343.00	1026.32+/-369.1	5000
	173	19	High Bay	L22	420	148500	Scan	alpha	1	20	1	6	0.1276176	3.26	0.135	N/A	Note 1	less than Ld	5000
	174	19	High Bay	L22	420	148500	Scan	beta	140	20	191	6	1.5099923	6.02	0.076	N/A	4343.00	671.05+/-344.0	5000
	175	19	High Bay	I25	NA	148500	Scan	alpha	1	20	1	6	0.1276176	3.26	0.135	N/A	Note 1	less than Ld	5000
	176	19	High Bay	I25	NA	148500	Scan	beta	140	20	135	6	1.5099923	6.02	0.076	N/A	4343.00	less than Ld	5000
	177	19	High Bay	U31	302	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	178	19	High Bay	U31	302	179869	Scan	beta	134	20	304	5	1.9042252	6.81	0.159	N/A	3408.00	1069.18+/-213.3	5000
	179	19	High Bay	X24	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
10/3/2001	180	19	High Bay	X24	NA	179869	Scan	beta	134	20	322	5	1.9042252	6.81	0.159	N/A	3408.00	1182.39+/-219.6	5000
	181	19	High Bay	Q24	397	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	182	19	High Bay	Q24	397	179869	Scan	beta	134	20	325	5	1.9042252	6.81	0.159	N/A	3408.00	1201.26+/-220.6	5000
	183	19	High Bay	N30	310	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	184	19	High Bay	N30	310	179869	Scan	beta	134	20	298	5	1.9042252	6.81	0.159	N/A	3408.00	1031.45+/-211.1	5000

TABLE B-1

ALPHA AND BETA SURFACE ACTIVITY
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Date		Building	Room	Tetra Tech Grid No.	R/D Grid No.	Probe Ser.	Survey Type	Alpha or Beta	Bkgd Rate-cpm	Bkgd Time-minutes	Sample Rate-cpm	Sample Time-minutes	L_c (cpm)	L_D (cpm)	Inst. Effic.	Fixed-Point MDC (dpm/100cm2)	Scan MDC(dpm/100cm2)	Reported Activity(dpm/100cm2)	Criteria (dpm/100cm2)
	185	19	High Bay	M35	NA	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	5000
	186	19	High Bay	M35	NA	179869	Scan	beta	134	20	265	5	1.9042252	6.81	0.159	N/A	3408.00	823.90+/-198.9	5000
	187	19	High Bay	I27	NA	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	188	19	High Bay	I27	NA	179869	Scan	beta	134	20	207	5	1.9042252	6.81	0.159	N/A	3408.00	459.12+/-175.4	5000
	189	19	High Bay	O19	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.172	N/A	Note 1	11.63+/-0.0	5000
	190	19	High Bay	O19	NA	179869	Scan	beta	134	20	372	5	1.9042252	6.81	0.159	N/A	3408.00	1496.86+/-236.3	5000
	191	19	High Bay	O19	NA	179869	Fixed point	alpha	0	20	0	2	0	3.00	0.172	10.82	N/A	less than Ld	5000
	192	19	High Bay	O19	NA	179869	Fixed point	beta	134	20	369	2	7.0610559	17.12	0.159	221.72	N/A	1477.99+/-236.6	5000
	193	19	High Bay	U9	NA	179869	Scan	alpha	0	20	2	5	0	3.00	0.172	N/A	Note 1	11.63+/-0.0	5000
	194	19	High Bay	U9	NA	179869	Scan	beta	134	20	401	5	1.9042252	6.81	0.159	N/A	3408.00	1679.25+/-245.4	5000
	195	19	High Bay	C27	436	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	196	19	High Bay	C27	436	179869	Scan	beta	134	20	215	5	1.9042252	6.81	0.159	N/A	3408.00	509.43+/-178.8	5000
	197	19	High Bay	C27	436	179869	Fixed point	alpha	0	20	0	2	0	3.00	0.172	10.82	N/A	less than Ld	5000
	198	19	High Bay	C27	436	179869	Fixed point	beta	134	20	245	2	7.0610559	17.12	0.159	221.72	N/A	698.11+/-192.7	5000
	199	19	High Bay	D23	455	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	5000
	200	19	High Bay	D23	455	179869	Scan	beta	134	20	242	5	1.9042252	6.81	0.159	N/A	3408.00	679.25+/-189.9	5000
	201	19	High Bay	D23	455	179869	Fixed point	alpha	0	20	0	2	0	3.00	0.172	10.82	N/A	less than Ld	5000
	202	19	High Bay	D23	455	179869	Fixed point	beta	134	20	292	2	7.0610559	17.12	0.159	221.72	N/A	993.71+/-210.4	5000
	203	19	High Bay	AC24	233	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	5000
	204	19	High Bay	AC24	233	179869	Scan	beta	134	20	394	5	1.9042252	6.81	0.159	N/A	3408.00	1635.22+/-243.2	5000
	205	19	High Bay	AC24	233	179869	Fixed point	alpha	0	20	1	2	0	3.00	0.172	10.82	N/A	5.81+/-0.0	5000
	206	19	High Bay	AC24	233	179869	Fixed point	beta	134	20	376	2	7.0610559	17.12	0.159	221.72	N/A	1522.01+/-238.8	5000
	207	19	High Bay	AB32	250	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	208	19	High Bay	AB32	250	179869	Scan	beta	134	20	359	5	1.9042252	6.81	0.159	N/A	3408.00	1415.09+/-232.1	5000
	209	19	High Bay	AB32	250	179869	Fixed point	alpha	0	20	0	2	0	3.00	0.172	10.82	N/A	less than Ld	5000
	210	19	High Bay	AB32	250	179869	Fixed point	beta	134	20	273	2	7.0610559	17.12	0.159	221.72	N/A	874.21+/-203.4	5000
	211	19	High Bay	P28	353	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	5000
	212	19	High Bay	P28	353	179869	Scan	beta	134	20	462	5	1.9042252	6.81	0.159	N/A	3408.00	2062.89+/-263.6	5000
	213	19	High Bay	P28	353	179869	Fixed point	alpha	0	20	2	2	0	3.00	0.172	10.82	N/A	11.63+/-0.0	5000
	214	19	High Bay	P28	353	179869	Fixed point	beta	134	20	467	2	7.0610559	17.12	0.159	221.72	N/A	2094.34+/-266.2	5000
	215	19	High Bay	U28	357	179869	Scan	alpha	0	20	4	5	0	3.00	0.172	N/A	Note 1	23.26+/-0.0	5000
	216	19	High Bay	U28	357	179869	Scan	beta	134	20	514	5	1.9042252	6.81	0.159	N/A	3408.00	2389.94+/-278.2	5000
	217	19	High Bay	U28	357	179869	Fixed point	alpha	0	20	2	2	0	3.00	0.172	10.82	N/A	11.63+/-0.0	5000
	218	19	High Bay	U28	357	179869	Fixed point	beta	134	20	520	2	7.0610559	17.12	0.159	221.72	N/A	2427.67+/-280.9	5000
	219	19	107	K12	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	5000
	220	19	107	K12	NA	148500	Scan	beta	140	20	176	6	1.5099923	6.02	0.076	N/A	4343.00	473.68+/-329.1	5000
	221	19	109	I4	NA	148500	Scan	alpha	1	20	1	6	0.1276176	3.26	0.135	N/A	Note 1	less than Ld	5000
	222	19	109	I4	NA	148500	Scan	beta	140	20	253	6	1.5099923	6.02	0.076	N/A	4343.00	1486.84+/-399.4	5000
	223	19	109	J4	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	5000
	224	19	109	J4	NA	148500	Scan	beta	140	20	306	6	1.5099923	6.02	0.076	N/A	4343.00	2184.21+/-441.4	5000
10/3/2001	225	19	109	J5	NA	148500	Scan	alpha	1	20	2	6	0.1276176	3.26	0.135	N/A	Note 1	7.41+/-0.0	5000
	226	19	109	J5	NA	148500	Scan	beta	140	20	308	6	1.5099923	6.02	0.076	N/A	4343.00	2210.53+/-442.9	5000
	227	19	109	J5	NA	148500	Fixed point	alpha	1	20	2	2	0.6099823	4.22	0.135	35.15	N/A	7.41+/-0.0	5000
	228	19	109	J5	NA	148500	Fixed point	beta	140	20	294	2	7.2174082	17.43	0.076	473.60	N/A	2026.32+/-441.1	5000
	229	19	109	I5	F77	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	230	19	109	I5	F77	179869	Scan	beta	134	20	379	5	1.9042252	6.81	0.159	N/A	3408.00	1540.88+/-238.5	5000

TABLE B-1

ALPHA AND BETA SURFACE ACTIVITY
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Date		Building	Room	Tetra Tech Grid No.	R/D Grid No.	Probe Ser.	Survey Type	Alpha or Beta	Bkgd Rate-cpm	Bkgd Time-minutes	Sample Rate-cpm	Sample Time-minutes	L_c (cpm)	L_D (cpm)	Inst. Effic.	Fixed-Point MDC (dpm/100cm2)	Scan MDC(dpm/100cm2)	Reported Activity(dpm/100cm2)	Criteria (dpm/100cm2)
	231	19	109	E6	F66	179869	Scan	alpha	0	20	0	5	0	3.00	0.172	N/A	Note 1	less than Ld	5000
	232	19	109	E6	F66	179869	Scan	beta	134	20	349	5	1.9042252	6.81	0.159	N/A	3408.00	1352.20+/-228.8	5000
	233	19	109	G7	19	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	234	19	109	G7	19	179869	Scan	beta	134	20	355	5	1.9042252	6.81	0.159	N/A	3408.00	1389.94+/-230.7	5000
	235	19	109	I8	14	179869	Scan	alpha	0	20	1	5	0	3.00	0.172	N/A	Note 1	5.81+/-0.0	5000
	236	19	109	I8	14	179869	Scan	beta	134	20	342	5	1.9042252	6.81	0.159	N/A	3408.00	1308.18+/-226.4	5000
10/4/2001	237	100	110 Floor	H1	NA	148500	Scan	alpha	2.4	20	1.5	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	238	100	110 Floor	H1	NA	148500	Scan	beta	298	20	205	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	239	100	110 Floor	A1	NA	148500	Scan	alpha	2.4	20	3	6	0.1977044	3.40	0.135	N/A	Note 1	4.44+/-0.0	5000
	240	100	110 Floor	A1	NA	148500	Scan	beta	298	20	217	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	241	100	110 Floor	A2	NA	148500	Scan	alpha	2.4	20	2.5	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	242	100	110 Floor	A2	NA	148500	Scan	beta	298	20	246	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	243	100	110 Floor	A7	NA	148500	Scan	alpha	2.4	20	2	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	244	100	110 Floor	A7	NA	148500	Scan	beta	298	20	266	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	245	100	110 Floor	A7	NA	148500	Fixed point	alpha	2.4	20	1.5	2	0.9449806	4.89	0.135	46.89	N/A	less than Ld	5000
	246	100	110 Floor	A7	NA	148500	Fixed point	beta	298	20	278	2	10.529928	24.06	0.076	679.73	N/A	less than Ld	5000
	247	100	110 Floor	A13	NA	148500	Scan	alpha	2.4	20	1	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	248	100	110 Floor	A13	NA	148500	Scan	beta	298	20	259	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	249	100	110 Floor	A13	NA	148500	Fixed point	alpha	2.4	20	3	2	0.9449806	4.89	0.135	46.89	N/A	less than Ld	5000
	250	100	110 Floor	A13	NA	148500	Fixed point	beta	298	20	280	2	10.529928	24.06	0.076	679.73	N/A	less than Ld	5000
	251	100	110 Floor	A16	NA	148500	Scan	alpha	2.4	20	2	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	252	100	110 Floor	A16	NA	148500	Scan	beta	298	20	201	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	253	100	110 Floor	C15	NA	148500	Scan	alpha	2.4	20	1.5	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	254	100	110 Floor	C15	NA	148500	Scan	beta	298	20	229	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	255	100	110 Floor	E15	NA	148500	Scan	alpha	2.4	20	2	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	256	100	110 Floor	E15	NA	148500	Scan	beta	298	20	235	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	257	100	110 Floor	K11	NA	148500	Scan	alpha	2.4	20	2.5	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	258	100	110 Floor	K11	NA	148500	Scan	beta	298	20	225	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	259	100	110 Floor	K9	NA	148500	Scan	alpha	2.4	20	2.5	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	260	100	110 Floor	K9	NA	148500	Scan	beta	298	20	226	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	261	100	110 Floor	B11	NA	143875	Fixed point	alpha	1.1	20	1	2	0.6397549	4.28	0.127	38.48	N/A	less than Ld	5000
	262	100	110 Floor	B11	NA	143875	Fixed point	beta	262	20	221	2	9.8734265	22.75	0.074	656.14	N/A	less than Ld	5000
	263	100	110 W. Wall	L2	NA	148500	Scan	alpha	2.4	20	2	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	264	100	110 W. Wall	L2	NA	148500	Scan	beta	298	20	258	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	265	100	110 W. Wall	E2	NA	148500	Scan	alpha	2.4	20	3	6	0.1977044	3.40	0.135	N/A	Note 1	4.44+/-0.0	5000
	266	100	110 W. Wall	E2	NA	148500	Scan	beta	298	20	235	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	267	100	110 W. Wall	C2	NA	148500	Scan	alpha	2.4	20	3	6	0.1977044	3.40	0.135	N/A	Note 1	4.44+/-0.0	5000
	268	100	110 W. Wall	C2	NA	148500	Scan	beta	298	20	243	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	269	100	110 S. Wall	G4	NA	148500	Scan	alpha	2.4	20	3	6	0.1977044	3.40	0.135	N/A	Note 1	4.44+/-0.0	5000
10/4/2001	270	100	110 S. Wall	G4	NA	148500	Scan	beta	298	20	265	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	271	100	110 S. Wall	G4	NA	148500	Fixed point	alpha	2.4	20	3	2	0.9449806	4.89	0.135	46.89	N/A	less than Ld	5000
	272	100	110 S. Wall	G4	NA	148500	Fixed point	beta	298	20	259	2	10.529928	24.06	0.076	679.73	N/A	less than Ld	5000
	273	100	110 S. Wall	B4	NA	148500	Scan	alpha	2.4	20	3	6	0.1977044	3.40	0.135	N/A	Note 1	4.44+/-0.0	5000
	274	100	110 S. Wall	B4	NA	148500	Scan	beta	298	20	260	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	275	100	110 S. Wall	B5	NA	148500	Fixed point	alpha	2.4	20	5	2	0.9449806	4.89	0.135	46.89	N/A	19.26+/-20.4	5000
	276	100	110 S. Wall	B5	NA	148500	Fixed point	beta	298	20	278	2	10.529928	24.06	0.076	679.73	N/A	less than Ld	5000

TABLE B-1

ALPHA AND BETA SURFACE ACTIVITY
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Date		Building	Room	Tetra Tech Grid No.	R/D Grid No.	Probe Ser.	Survey Type	Alpha or Beta	Bkgd Rate-cpm	Bkgd Time-minutes	Sample Rate-cpm	Sample Time-minutes	L_c (cpm)	L_D (cpm)	Inst. Effic.	Fixed-Point MDC (dpm/100cm2)	Scan MDC(dpm/100cm2)	Reported Activity(dpm/100cm2)	Criteria (dpm/100cm2)
	277	100	127 S. Wall	M1	NA	143875	Scan	alpha	1.1	20	1	6	0.1338465	3.27	0.127	N/A	Note 1	less than Ld	5000
	278	100	127 S. Wall	M1	NA	143875	Scan	beta	262	20	220	6	2.0656719	7.13	0.074	N/A	3445.00	less than Ld	5000
	279	100	110 E. Wall	A6	NA	148500	Scan	alpha	2.4	20	3	6	0.1977044	3.40	0.135	N/A	Note 1	4.44+/-0.0	5000
	280	100	110 E. Wall	A6	NA	148500	Scan	beta	298	20	259	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	281	100	127 N. Wall	J2	NA	143875	Scan	alpha	1.1	20	2	6	0.1338465	3.27	0.127	N/A	Note 1	7.09+/-0.0	5000
	282	100	127 N. Wall	J2	NA	143875	Scan	beta	262	20	233	6	2.0656719	7.13	0.074	N/A	3445.00	less than Ld	5000
	283	100	127 N. Wall	J2	NA	143875	Fixed point	alpha	1.1	20	1.5	2	0.6397549	4.28	0.127	38.48	N/A	less than Ld	5000
	284	100	127 N. Wall	J2	NA	143875	Fixed point	beta	262	20	240	2	9.8734265	22.75	0.074	656.14	N/A	less than Ld	5000
	285	100	111	C13	NA	148500	Scan	alpha	2.4	20	2	6	0.1977044	3.40	0.135	N/A	Note 1	less than Ld	5000
	286	100	111	C13	NA	148500	Scan	beta	298	20	211	6	2.203022	7.41	0.076	N/A	4343.00	less than Ld	5000
	287	100	111	C13	NA	148500	Fixed point	alpha	2.4	20	3	2	0.9449806	4.89	0.135	46.89	N/A	less than Ld	5000
	288	100	111	C13	NA	148500	Fixed point	beta	298	20	262	2	10.529928	24.06	0.076	679.73	N/A	less than Ld	5000
	289	100	111	D5	NA	143875	Scan	alpha	1.1	20	1	6	0.1338465	3.27	0.127	N/A	Note 1	less than Ld	5000
	290	100	111	D5	NA	143875	Scan	beta	262	20	155	6	2.0656719	7.13	0.074	N/A	3445.00	less than Ld	5000
	291	100	111	D5	NA	143875	Fixed point	alpha	1.1	20	2.5	2	0.6397549	4.28	0.127	38.48	N/A	11.02+/-0.0	5000
	292	100	111	D5	NA	143875	Fixed point	beta	262	20	156	2	9.8734265	22.75	0.074	656.14	N/A	less than Ld	5000
	293	100	111	C14	NA	143875	Scan	alpha	1.1	20	1	6	0.1338465	3.27	0.127	N/A	Note 1	less than Ld	5000
	294	100	111	C14	NA	143875	Scan	beta	262	20	210	6	2.0656719	7.13	0.074	N/A	3445.00	less than Ld	5000
	295	100	123	E7	NA	143875	Scan	alpha	1.1	20	0	6	0.1338465	3.27	0.127	N/A	Note 1	less than Ld	5000
	296	100	123	E7	NA	143875	Scan	beta	262	20	127	6	2.0656719	7.13	0.074	N/A	3445.00	less than Ld	5000
	297	100	127	C3	NA	143875	Scan	alpha	1.1	20	1	6	0.1338465	3.27	0.127	N/A	Note 1	less than Ld	5000
	298	100	127	C3	NA	143875	Scan	beta	262	20	174	6	2.0656719	7.13	0.074	N/A	3445.00	less than Ld	5000
	299	100	128	E3	NA	143875	Scan	alpha	1.1	20	0	6	0.1338465	3.27	0.127	N/A	Note 1	less than Ld	5000
	300	100	128	E3	NA	143875	Scan	beta	262	20	233	6	2.0656719	7.13	0.074	N/A	3445.00	less than Ld	5000

Notes:

1	See Section 3.1
ACF	Activity correction factor
Bkgd	Background
cpm	Count per minute
Effic.	Efficiency
Inst.	Instrument
L_c	Critical limit
L_D	Detection limit
MDC	Minimum detectable concentration
N/A	Not available
No.	Number
R/D	Rocketdyne
Report.	Reported Activity
Act.	

TABLE B-2

REMOVABLE CONTAMINATION DATA
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Sample Identification Number	Sample Location	Gross alpha Result (dpm/ 100 cm^2)	MDA	Gross beta Result (dpm/ 100 cm^2)	MDA
B100R110A1	B100R110A1	0.09 ± 0.82	1.7	0.71 ± 1.9	3.3
B100R110A13	Concrete Core	0.36 ± 0.82	1.5	0.04 ± 1.6	2.9
B100R110A16	B100R110A16	0.24 ± 0.73	1.4	1.4 ± 1.9	3.3
B100R110A2B	Dust in Bottom of Trench	0.09 ± 0.60	1.3	1.2 ± 2.0	3.3
B100R110A2W	B100R110A2W	0.09 ± 1.3	2.7	0.18 ± 2.0	3.6
B100R110A7	Inside Cable Penetration	-0.07 ± 0.56	1.3	0.75 ± 1.8	3.1
B100R110A7CR	Near Center Room Well, Inside Cable Penetration	-0.36 ± 0.58	1.6	0.95 ± 1.9	3.1
B100R110B5SW	On Ledge of the Southern Wall	-0.49 ± 1.0	2.2	0.49 ± 2.0	3.6
B100R110C10C	Ceiling	-0.16 ± 0.73	1.7	-0.11 ± 2.0	3.6
B100R110C11	Trench Sidewall	0 ± 0.62	1.4	1.5 ± 1.9	3.1
B100R110C11B	Trench Bottom	-0.04 ± 0.67	1.5	0.71 ± 1.7	2.9
B100R110C11C	Ceiling	0.18 ± 0.75	1.5	1.3 ± 1.9	3.1
B100R110C12C	Ceiling	0.31 ± 1.0	2.0	-0.09 ± 1.9	3.6
B100R110C13C	Ceiling - Vent Hole	0.40 ± 0.78	1.4	1.4 ± 1.9	3.1
B100R110C14C	Ceiling Near Old Vent Exhaust	-0.09 ± 0.75	1.8	0.75 ± 1.8	3.1
B100R110C15	B100R110C15	0.18 ± 0.67	1.3	1.0 ± 1.8	3.1
B100R110C15C	Blank	-0.64 ± 0.98	2.2	-0.71 ± 1.9	3.6
B100R110C1C	Ceiling	-0.04 ± 0.78	1.7	-0.24 ± 1.8	3.3
B100R110C2C	Ceiling	0.22 ± 0.75	1.6	0.16 ± 1.6	2.9
B100R110C2WW	Western Wall, 2m Above Floor	-0.07 ± 0.67	1.5	0.38 ± 1.8	3.1
B100R110C3C	Ceiling	0.91 ± 1.0	1.7	0.29 ± 1.8	3.3
B100R110C4C	Ceiling	0.49 ± 0.75	1.3	-0.91 ± 1.8	3.3
B100R110C5C	Ceiling	0.49 ± 0.93	1.7	0.29 ± 1.8	3.3
B100R110C6C	Ceiling	0.24 ± 0.73	1.4	-0.62 ± 1.8	3.3
B100R110C7C	Ceiling	0.09 ± 0.80	1.7	0.20 ± 1.8	3.3
B100R110C8C	Ceiling	0.07 ± 0.87	1.8	0.22 ± 1.8	3.1
B100R110C9C	Ceiling	0 ± 0.71	1.6	0.53 ± 1.7	3.1
B100R110D5	Blank	0.22 ± 0.78	1.5	-0.29 ± 1.6	2.9
B100R110E15	B100R110E15	0.09 ± 0.80	1.7	0.80 ± 1.9	3.3
B100R110E2WW	Western Wall, 2 m Above Floor	0.49 ± 0.75	1.3	0.82 ± 1.9	3.3
B100R110G4SW	Below Ledge on Southern Wall	0.13 ± 0.82	1.7	-0.38 ± 1.9	3.6
B100R110H1	B100R110H1	0.07 ± 0.71	1.5	1.4 ± 1.9	3.1
B100R110H7EW	Eastern Wall, Above Ledge	0.27 ± 0.87	1.7	1.0 ± 2.1	3.6
B100R110J2NW	Northern Wall, 2 m Above Floor	-0.09 ± 0.71	1.6	0.44 ± 1.8	3.1
B100R110K11	B100R110K11	0.20 ± 0.80	1.6	-0.22 ± 1.8	3.1
B100R110K9	Concrete Chips	0.40 ± 0.78	1.4	0 ± 1.7	3.1
B100R110L2WW	Western Wall, 2 m Above Floor	0 ± 0.64	1.4	0.58 ± 1.9	3.3
B100R110M1SW	Southern Wall, Above Floor	-0.07 ± 0.56	1.3	-0.80 ± 1.6	3.1
B100R110RV1	Vent #1 Above Room 110, Floor inside of vent	-0.07 ± 0.56	1.3	1.2 ± 1.8	3.1
B100R110RV2	Vent #2 Above Room 110, Inside Wall of Vent	0.91 ± 0.95	1.4	0.42 ± 1.8	3.3
B100R111C14	B100R111C14	-0.18 ± 0.71	1.7	0.64 ± 1.9	3.3
B100R111D5	B100R111D5	-0.04 ± 0.62	1.5	0.40 ± 1.8	3.3
B100R111DOOR	Below Sliding Door Near Core	0 ± 0.73	1.7	0.31 ± 1.8	3.1
B100R123E7	B100R123E7	0.62 ± 0.80	1.3	-0.38 ± 1.8	3.3
B100R127C3	B100R127C3	-0.49 ± 1.0	2.2	1.1 ± 2.1	3.6
B100R128G3	B100R128G3	-0.29 ± 0.67	1.7	0.07 ± 2.0	3.6
B11A1	Blank	0.51 ± 0.82	1.4	0.42 ± 1.8	3.3
B11A16	Wall	0.09 ± 0.80	1.7	-0.73 ± 1.8	3.3
B11A4	Wall	-0.47 ± 0.49	1.5	1.2 ± 1.9	3.1
B11B20	Wall	-0.07 ± 0.56	1.3	-0.07 ± 1.7	3.1
B11C12	Wall	0.20 ± 0.80	1.6	-0.98 ± 1.7	3.1
B11C6	Floor	-0.20 ± 0.49	1.3	0.91 ± 1.8	3.1
B11D1	B11D1	0.09 ± 0.80	1.7	-0.91 ± 1.7	3.3
B11E8	Floor	0.89 ± 0.89	1.3	0.47 ± 1.9	3.3
B11F15	Floor	-0.33 ± 0.56	1.5	0.62 ± 1.7	2.9
B11G21	Floor	0.22 ± 0.67	1.3	0.64 ± 1.9	3.3
B11H11	Floor	0.64 ± 0.87	1.4	1.2 ± 1.9	3.3

TABLE B-2

REMOVABLE CONTAMINATION DATA
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Sample Identification Number	Sample Location	Gross alpha Result (dpm/ 100 cm^2)	MDA	Gross beta Result (dpm/ 100 cm^2)	MDA
B11I3	Wall	-0.09 ± 0.71	1.6	0.95 ± 1.9	3.1
B11J2	Wall	0 ± 0.62	1.4	-0.84 ± 1.7	3.1
B11J34	Floor	0.40 ± 0.91	1.7	0.07 ± 2.0	3.6
B11J6	Floor	0.62 ± 0.98	1.7	1.3 ± 1.9	3.3
B11L12	B11L12	0.91 ± 1.1	1.7	0.27 ± 1.9	3.3
B11L17	Floor	-1.1 ± 0.87	2.2	-0.29 ± 1.9	3.6
B11L20	Floor	0.40 ± 0.91	1.7	0.84 ± 2.0	3.6
B11M33	In Drain	0.24 ± 0.87	1.7	0.62 ± 1.9	3.3
B11M37	Floor	0.67 ± 0.84	1.4	0.33 ± 1.8	3.1
B11N13	Wall	0.07 ± 0.71	1.5	0.87 ± 1.8	3.1
B11N18	Wall	-0.49 ± 1.0	2.2	-0.89 ± 1.9	3.6
B11N20	Wall	-0.47 ± 0.49	1.5	-0.11 ± 1.6	2.9
B11N30	Wall	-0.04 ± 0.78	1.7	0.44 ± 1.9	3.3
B11R124DR	Drain	0 ± 0.64	1.4	-0.27 ± 1.8	3.3
B11R124VE	Ceiling Vent Intake	-0.04 ± 0.56	1.3	0.47 ± 1.9	3.3
B17HIGHD23	Rocketdyne Grid 455	-0.33 ± 0.78	1.8	-0.82 ± 1.7	3.3
B19AC24	B19AC24	0.31 ± 0.84	1.6	0.44 ± 1.8	3.1
B19HIGHA1	Blank	0.20 ± 0.75	1.5	-0.78 ± 1.6	3.1
B19HIGHAB32	Rocketdyne Grid 25U	-0.58 ± 0.56	1.7	0.42 ± 2.0	3.3
B19HIGHC27	Rocketdyne Grid 436	-0.07 ± 0.67	1.5	0.42 ± 1.7	3.1
B19HIGHI13	B19HIGHI13	-0.11 ± 0.78	1.7	0.02 ± 1.9	3.3
B19HIGHI25	B19HIGHI25	0.20 ± 0.75	1.5	-0.29 ± 1.7	3.1
B19HIGHI27	B19HIGHI27	0.20 ± 0.80	1.6	-0.31 ± 1.8	3.1
B19HIGHK13	B19HIGHK13	0.36 ± 0.93	1.8	-0.71 ± 1.9	3.6
B19HIGHL22	B19HIGHL22	0.20 ± 0.67	1.4	-0.69 ± 1.8	3.3
B19HIGHM35	B19HIGHM35	0.51 ± 0.95	1.7	-0.33 ± 1.8	3.3
B19HIGHN12	B19HIGHN12	0.20 ± 0.67	1.4	0 ± 1.9	3.3
B19HIGHN30	B19HIGHN30	0.62 ± 1.0	1.8	-0.31 ± 2.0	3.6
B19HIGHO19	High Bay Core at Grid O19	0.36 ± 0.93	1.8	0.51 ± 2.0	3.6
B19HIGHP28	High Bay Core at Grid P28 in Trench	0.36 ± 0.93	1.8	0.47 ± 2.1	3.6
B19HIGHP28A	Blank	-0.11 ± 0.67	1.6	-0.53 ± 1.6	3.1
B19HIGHQ24	B19HIGHQ24	-0.33 ± 0.56	1.5	-0.44 ± 1.6	2.9
B19HIGHT20	B19HIGHT20	-0.18 ± 0.62	1.5	-0.02 ± 1.7	3.1
B19HIGHU28	B19HIGHU28	0.02 ± 0.71	1.6	0.80 ± 1.8	3.1
B19HIGHU31	B19HIGHU31	0.31 ± 0.80	1.5	0.29 ± 1.8	3.1
B19HIGHU9	B19HIGHU9	-0.11 ± 0.78	1.7	0.47 ± 1.9	3.3
B19HIGHX17	B19HIGHX17	0.93 ± 0.93	1.4	1.1 ± 1.8	3.1
B19IBEAM	I-Beam North of Pit	-0.33 ± 0.78	1.8	0.38 ± 1.8	3.3
B19LOWVE	High Bay Pit Exhaust Duct about 3 feet Below Floor	0.20 ± 0.67	1.4	-0.84 ± 1.8	3.3
B19R1071	B19R1071	-0.11 ± 0.71	1.6	0.36 ± 1.8	3.1
B19R109E6	B19R109E6	0.36 ± 0.98	1.8	1.4 ± 1.9	3.3
B19R109G7	B19R109G7	-0.38 ± 0.58	1.6	-0.13 ± 1.7	3.1
B19R109I5	Near Core Sample at Grid I5	0.07 ± 0.71	1.5	0.36 ± 1.7	3.1
B19R109I8	B19R109I8	0.31 ± 0.84	1.6	0.09 ± 1.8	3.1
B19R109VAULTVE2	Fuel Vault Vent Intake, 2-inch Duct	0.47 ± 0.84	1.5	-0.89 ± 1.6	3.1
B19RD707	Rocketdyne Grid 707, Ceiling, I-beam South of Pit	1.0 ± 1.1	1.8	0.04 ± 2.0	3.6
B19UPPERVE	Pit Exhaust Vent, Upstream of Filter	0.49 ± 0.95	1.8	2.2 ± 2.2	3.6
B19VAULTVE1	Fuel vault vent, southeast corner upstream of filter	-0.11 ± 0.78	1.7	-0.22 ± 1.8	3.3
B55HALLD4	B55HALLD4	-0.18 ± 0.73	1.7	-0.75 ± 1.8	3.3
B55HALLG5	B55HALLG5	-0.91 ± 0.91	2.2	-0.02 ± 2.0	3.6
B55HALLO7	B55HALLO7	0.09 ± 0.80	1.7	1.1 ± 1.9	3.3
B55HALLQ4	B55HALLQ4	0.20 ± 0.80	1.6	-0.56 ± 1.7	3.1
B55R114J5	B55R114J5	0.40 ± 0.78	1.4	-1.1 ± 1.6	3.1
B55R116E5	B55R116E5	-0.04 ± 0.67	1.5	1.2 ± 1.8	2.9
B55R123D7	B55R123D7	0.49 ± 0.84	1.5	0.62 ± 1.7	2.9
B55R124G8	B55R124G8	0.18 ± 0.75	1.5	0.11 ± 1.8	3.1
B55R126G8	B55R126G8	0.07 ± 0.71	1.5	-0.13 ± 1.8	3.1

TABLE B-2

REMOVABLE CONTAMINATION DATA
DRAFT OVERSIGHT VERIFICATION AND CONFIRMATION RADIOLOGICAL SURVEY

Sample Identification Number	Sample Location	Gross alpha Result (dpm/ 100 cm^2)	MDA	Gross beta Result (dpm/ 100 cm^2)	MDA
B55R127A2	Blank	-0.07 ± 0.56	1.3	-0.07 ± 1.7	3.1
B55R127A5	Wall Cut Out	0.07 ± 1.2	2.2	-0.11 ± 2.0	3.6
B55R127B9	B55R127B9	0.07 ± 0.71	1.5	0.38 ± 1.8	3.1
B55R127C19	B55R127C19	0.36 ± 0.89	1.7	-1.2 ± 1.7	3.3
B55R127C29	B55R127C29	0.44 ± 0.75	1.3	0.42 ± 1.7	3.1
B55R127D17	B55R127D17	-0.20 ± 0.60	1.5	0.87 ± 1.8	3.1
B55R127D27	Ceiling	0 ± 0.64	1.4	0.07 ± 1.8	3.3
B55R127D29	B55R127D29	0.04 ± 0.60	1.3	0.67 ± 1.7	3.1
B55R127D5	B55R127D5	1.1 ± 1.1	1.7	0.31 ± 2.0	3.6
B55R127E11	B55R127E11	-0.04 ± 0.56	1.3	-0.98 ± 1.8	3.3
B55R127E17	Ceiling	0.09 ± 0.80	1.7	-0.40 ± 1.8	3.3
B55R127E31	B55R127E31	-0.40 ± 0.47	1.4	0.16 ± 1.8	3.3
B55R127F20	B55R127F20	0.13 ± 0.67	1.4	-0.33 ± 1.7	3.1
B55R127F23	B55R127F23	0.22 ± 0.84	1.7	-0.47 ± 1.8	3.3
B55R127F9	B55R127F9	0.09 ± 0.60	1.3	0.56 ± 1.9	3.3
B55R127G18	B55R127G18	-0.33 ± 0.56	1.5	1.4 ± 1.9	3.1
B55R127G3	B55R127G3	0 ± 0.64	1.4	-0.36 ± 1.8	3.3
B55R127H20	B55R127H20	0.20 ± 0.80	1.6	0.20 ± 1.8	3.1
B55R127I29	B55R127I29	-0.16 ± 0.73	1.7	-0.47 ± 1.9	3.6
B55R127L5	B55R127L5	0.38 ± 0.78	1.4	1.5 ± 2.0	3.3
B55R127M33	B55R127M33	-0.24 ± 0.51	1.4	0.16 ± 1.8	3.1
B55R127M9	Ceiling	0.09 ± 0.60	1.3	-0.22 ± 1.8	3.3
B55R127P13	Ceiling	0.53 ± 0.82	1.4	-0.09 ± 1.7	3.1
B55R127P30	Ceiling	0.04 ± 0.60	1.3	0.09 ± 1.7	3.1
B55R127R4	B55R127R4	0.33 ± 0.84	1.6	1.7 ± 1.9	3.1
B55R127S7	Ceiling	-0.02 ± 0.78	1.7	-0.56 ± 1.9	3.6
B55R127T23	B55R127T23	-0.13 ± 0.58	1.4	0 ± 1.7	3.1
B55R127T30	B55R127T30	0.31 ± 0.71	1.3	0.60 ± 1.7	3.1
B55R127U10	B55R127U10	0.13 ± 0.69	1.4	-0.69 ± 1.8	3.3
B55R127U14	B55R127U14	-0.64 ± 0.98	2.2	0.58 ± 2.0	3.6
B55R127U18	B55R127U18	0.22 ± 0.67	1.3	-0.38 ± 1.8	3.3
B55R127U5	B55R127U5	-0.58 ± 0.56	1.7	1.1 ± 1.9	3.3
B55R127V18	Ceiling	0.20 ± 0.80	1.6	-0.07 ± 1.8	3.1
B55R127V7	B55R127V7	-0.07 ± 0.56	1.3	-0.16 ± 1.7	3.1
B55R127W11	B55R127W11	0.09 ± 0.60	1.3	0.64 ± 1.9	3.3
B55R127W29	B55R127W29	-0.22 ± 0.64	1.6	0.02 ± 1.8	3.1
B55R127X1	B55R127X1	0.33 ± 0.84	1.6	0.11 ± 1.8	3.1
B55R127X18	B55R127X18	-0.91 ± 0.91	2.2	0.49 ± 2.0	3.6
B55R129WALL	B55R129WALL	0.09 ± 0.71	1.5	-0.29 ± 1.6	2.9
B55R130WALL	B55R130WALL	-0.31 ± 0.67	1.7	0.18 ± 1.9	3.3
B55R131E10	B55R131E10	-0.31 ± 0.67	1.7	-0.07 ± 1.9	3.3
B55R131E6	B55R131E6	0.13 ± 0.82	1.7	-0.98 ± 1.9	3.6
B55R131E8	B55R131E8	-0.18 ± 0.62	1.5	0.29 ± 1.7	2.9

Notes: 1	All data in disintegrations per minute per 100 square centimeters (dpm/100 cm2)
2	All alpha and beta-gamma activity values are less than MDA
dpm/100 cm^2	Disintegrations per 100 square centimeters
MDA	Minimum detectable activity
±	Plus or minus

TABLE B-3

CONCRETE CORE SAMPLE GAMMA SPECTROMETRY DATA
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

SAMPLE ID:	B100R110A13Z			B100R110K9Z			B100R111BD			B11CORE			B19HIGHO19Z			B19HIGHP28Z		
Analyte	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.
Actinium-228	0.65 ± 0.21	0.33		0.60 ± 0.34	0.44		0.66 ± 0.26	0.47		0.92 ± 0.32	0.52		0.82 ± 0.29	0.37		0.89 ± 0.41	0.55	
Aluminum-26	-0.01 ± 0.04	0.11	U	0.02 ± 0.05	0.09	U	-0.04 ± 0.09	0.18	U	-0.02 ± 0.05	0.12	U	-0.01 ± 0.02	0.07	U	-0.00 ± 0.06	0.16	U
Americium-241	-0.05 ± 0.10	0.18	U	0.04 ± 0.08	0.14	U	0.13 ± 0.33	0.56	U	-0.21 ± 0.49	0.90	U	0.02 ± 0.09	0.16	U	0.18 ± 0.72	1.3	U
Antimony-125	0.02 ± 0.12	0.22	U	-0.03 ± 0.16	0.30	U	-0.04 ± 0.18	0.33	U	0.08 ± 0.16	0.27	U	-0.01 ± 0.15	0.27	U	0.11 ± 0.25	0.43	U
Bismuth-212	1.1 ± 0.76	1.0		0.91 ± 0.99	1.6	U	1.4 ± 1.1	1.6	U	1.0 ± 0.99	1.5	U	1.3 ± 0.90	1.3	U	0.80 ± 1.5	2.6	U
Bismuth-214	0.30 ± 0.16	0.22		0.27 ± 0.18	0.25		0.16 ± 0.22	0.37	U	0.25 ± 0.18	0.26	U	0.17 ± 0.14	0.20	U	0.25 ± 0.29	0.47	U
Cesium-134	0.05 ± 0.05	0.09	U	0.04 ± 0.06	0.11	U	-0.15 ± 0.14	0.26	U	0.03 ± 0.07	0.12	U	-0.04 ± 0.06	0.11	U	0.05 ± 0.12	0.22	U
Cesium-137	-0.04 ± 0.06	0.12	U	-0.03 ± 0.06	0.12	U	-0.05 ± 0.07	0.14	U	0.01 ± 0.07	0.13	U	0.07 ± 0.06	0.10	U	-0.06 ± 0.11	0.22	U
Cobalt-60	0.04 ± 0.07	0.11	U	0.06 ± 0.08	0.14	U	0.04 ± 0.07	0.12	U	0.00 ± 0.06	0.12	U	-0.04 ± 0.06	0.13	U	-0.04 ± 0.11	0.25	U
Europium-152	0.54 ± 0.46	0.64	U	-0.25 ± 0.47	1.0	U	-0.21 ± 0.69	1.3	U	-0.19 ± 0.38	0.87	U	-0.15 ± 0.40	0.85	U	0.71 ± 0.72	1.0	U
Europium-154	-0.10 ± 0.38	0.73	U	0.16 ± 0.36	0.64	U	0.15 ± 0.42	0.74	U	-0.19 ± 0.38	0.79	U	0.13 ± 0.28	0.50	U	-0.45 ± 0.60	1.4	U
Europium-155	-0.06 ± 0.13	0.24	U	0.12 ± 0.13	0.20	U	0.10 ± 0.20	0.34	U	0.04 ± 0.21	0.36	U	0.08 ± 0.12	0.20	U	-0.03 ± 0.25	0.47	U
Lead-212	0.76 ± 0.19	0.17		0.63 ± 0.20	0.20		0.69 ± 0.22	0.25		0.93 ± 0.23	0.20		0.86 ± 0.21	0.17		0.64 ± 0.24	0.28	
Lead-214	0.36 ± 0.13	0.23		0.26 ± 0.18	0.27	U	0.56 ± 0.19	0.29		0.31 ± 0.17	0.24		0.44 ± 0.14	0.18		0.42 ± 0.25	0.33	
Niobium-94	0.01 ± 0.05	0.10	U	0 ± 0.06	0.11	U	-0.02 ± 0.08	0.15	U	-0.02 ± 0.06	0.12	U	0.01 ± 0.05	0.10	U	0.03 ± 0.11	0.19	U
Potassium-40	18.9 ± 3.9	1.1		16.5 ± 3.7	1.3		17.2 ± 3.7	2.3		15.6 ± 3.6	2.1		19.4 ± 4.0	1.2		19.1 ± 4.8	2.1	
Protactinium-234	10.0 ± 10.0	16.0	U	-1.0 ± 10.0	21.0	U	-5.0 ± 14.0	26.0	U	-3.0 ± 11.0	23.0	U	-2.8 ± 9.0	18.0	U	5.0 ± 17.0	33.0	U
Ruthenium-106	0.12 ± 0.48	0.86	U	0.07 ± 0.69	1.3	U	0.55 ± 0.79	1.3	U	0.05 ± 0.54	0.99	U	-0.04 ± 0.42	0.82	U	0.77 ± 0.87	1.3	U
Sodium-22	-0.00 ± 0.06	0.12	U	-0.09 ± 0.10	0.21	U	-0.02 ± 0.10	0.18	U	0 ± 0.09	0.17	U	0.02 ± 0.07	0.12	U	0.01 ± 0.10	0.21	U
Thallium-208	0.22 ± 0.09	0.12		0.22 ± 0.10	0.12		0.22 ± 0.11	0.15		0.26 ± 0.10	0.11		0.33 ± 0.11	0.11		0.25 ± 0.14	0.17	
Thorium-227	-0.23 ± 0.32	0.61	U	-0.17 ± 0.39	0.75	U	-0.33 ± 0.63	1.1	U	-0.44 ± 0.58	1.1	U	0.03 ± 0.41	0.71	U	0.22 ± 0.89	1.5	U
Thorium-234	0.74 ± 0.74	1.2	U	0.15 ± 0.60	1.0	U	0.70 ± 1.2	2.0	U	0.40 ± 1.0	1.7	U	0.66 ± 0.70	1.1	U	1.4 ± 1.7	2.7	U
Uranium-235	0.22 ± 0.30	0.49	U	0.03 ± 0.24	0.43	U	-0.11 ± 0.42	0.74	U	0.24 ± 0.31	0.51	U	-0.22 ± 0.26	0.50	U	-0.18 ± 0.47	0.89	U
Grid number		A13			K9			Below Door			M37			O19			P28	

SAMPLE ID:	B19R109I4			B19R109I5Z			B19R109J5			B19R109J4			B55R126CORE			B55R127CORE2		
Analyte	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.
Actinium-228	0.85 ± 0.27	0.42		0.64 ± 0.25	0.47		0.69 ± 0.19	0.25		0.61 ± 0.19	0.24		0.82 ± 0.28	0.45		0.96 ± 0.33	0.52	
Aluminum-26	-0.02 ± 0.06	0.13	U	-0.03 ± 0.08	0.16	U	-0.01 ± 0.03	0.07	U	0.01 ± 0.02	0.02	U	0.03 ± 0.07	0.12	U	0.03 ± 0.06	0.11	U
Americium-241	-0.09 ± 0.09	0.16	U	-0.11 ± 0.56	1.0	U	-0.10 ± 0.23	0.41	U	-0.10 ± 0.42	0.75	U	0 ± 0.58	1.0	U	-0.34 ± 0.36	0.66	U
Antimony-125	-0.07 ± 0.18	0.34	U	-0.02 ± 0.16	0.30	U	0.04 ± 0.10	0.17	U	0.02 ± 0.13	0.24	U	-0.06 ± 0.15	0.29	U	0.01 ± 0.19	0.34	U
Bismuth-212	1.9 ± 1.0	1.2		0.44 ± 0.80	1.4	U	0.43 ± 0.57	0.94	U	0.93 ± 0.69	0.98	U	1.0 ± 1.1	1.7	U	0.60 ± 1.1	1.9	U
Bismuth-214	0.29 ± 0.17	0.23		0.28 ± 0.16	0.22		0.32 ± 0.13	0.17		0.23 ± 0.15	0.22		0.29 ± 0.29	0.47	U	0.14 ± 0.21	0.35	U
Cesium-134	0.01 ± 0.05	0.09	U	-0.00 ± 0.08	0.14	U	0.02 ± 0.07	0.11	U	0.01 ± 0.04	0.08	U	-0.07 ± 0.09	0.18	U	-0.00 ± 0.09	0.16	U
Cesium-137	-0.01 ± 0.06	0.11	U	-0.04 ± 0.07	0.14	U	-0.01 ± 0.04	0.06	U	-0.02 ± 0.05	0.10	U	-0.05 ± 0.07	0.14	U	-0.04 ± 0.08	0.16	U
Cobalt-60	0.06 ± 0.07	0.11	U	-0.01 ± 0.07	0.13	U	0.00 ± 0.04	0.07	U	-0.02 ± 0.05	0.10	U	-0.02 ± 0.07	0.15	U	0.03 ± 0.09	0.16	U
Europium-152	-0.12 ± 0.41	0.88	U	0.21 ± 0.48	0.85	U	0.13 ± 0.28	0.48	U	-0.05 ± 0.29	0.60	U	0.22 ± 0.56	1.0	U	0.06 ± 0.66	1.2	U
Europium-154	-0.04 ± 0.36	0.70	U	0.11 ± 0.38	0.69	U	0.11 ± 0.22	0.37	U	-0.11 ± 0.26	0.54	U	0.04 ± 0.44	0.81	U	0.15 ± 0.48	0.84	U
Europium-155	0.06 ± 0.14	0.24	U	0.10 ± 0.21	0.35	U	0.03 ± 0.13	0.23	U	0.05 ± 0.16	0.27	U	0.20 ± 0.22	0.35	U	0.20 ± 0.22	0.35	U
Lead-212	1.3 ± 0.29	0.18		0.89 ± 0.23	0.20		0.82 ± 0.18	0.13		0.88 ± 0.20	0.14		0.82 ± 0.22	0.20		0.94 ± 0.26	0.28	
Lead-214	0.21 ± 0.11	0.18		0.39 ± 0.16	0.24		0.43 ± 0.12	0.15		0.35 ± 0.12	0.15		0.43 ± 0.17	0.24		0.26 ± 0.16	0.27	U
Niobium-94	-0.05 ± 0.05	0.11	U	0.01 ± 0.07	0.12	U	0.03 ± 0.04	0.07	U	0.02 ± 0.05	0.09	U	0.02 ± 0.07	0.12	U	-0.00 ± 0.09	0.15	U
Potassium-40	15.9 ± 3.6	1.4		16.6 ± 3.8	2.2		16.1 ± 3.0	1.0		16.8 ± 3.4	1.0		19.8 ± 4.3	1.5		21.3 ± 4.4	2.3	
Protactinium-234	1.0 ± 11.0	21.0	U	6.0 ± 11.0	19.0	U	-3.4 ± 6.9	13.0	U	-4.5 ± 7.4	16.0	U	-1.0 ± 11.0	22.0	U	-1.0 ± 16.0	29.0	U
Ruthenium-106	0.14 ± 0.52	0.93	U	-0.05 ± 0.64	1.2	U	0.27 ± 0.42	0.70	U	0 ± 0.39	0.73	U	0.20 ± 0.63	1.1	U	1.0 ± 0.84	1.3	U
Sodium-22	-0.05 ± 0.08	0.17	U	0.02 ± 0.10	0.17	U	0.06 ± 0.04	0.06		0.08 ± 0.07	0.10	U	0 ± 0.11	0.20	U	-0.05 ± 0.09	0.18	U
Thallium-208	0.45 ± 0.13	0.11		0.25 ± 0.10	0.11		0.24 ± 0.07	0.07		0.19 ± 0.08	0.09		0.25 ± 0.11	0.13		0.29 ± 0.13	0.17	
Thorium-227	0.28 ± 0.48	0.76	U	-0.29 ± 0.59	1.1	U	-0.20 ± 6.3	10.0	U	-0.80 ± 6.8	11.0	U	-0.43 ± 0.57	1.1	U	-0.68 ± 0.69	1.3	U
Thorium-234	0.80 ± 1.0	1.7	U	0.30 ± 1.1	1.9	U	0.58 ± 0.74	1.2	U	0.18 ± 0.98	1.7	U	-0.80 ± 1.2	2.1	U	-0.10 ± 1.3	2.2	U
Uranium-235	0.14 ± 0.28	0.48	U	-0.22 ± 0.33	0.60	U	0.05 ± 0.26	0.45	U	0.01 ± 0.28	0.50	U	-0.15 ± 0.32	0.59	U	-0.04 ± 0.40	0.71	U
Grid number	Room 109	I4		Room 109	I5		Room 109	J5		Room 109	J6		Room 126	G8		Room 127		

TABLE B-3

CONCRETE CORE SAMPLE GAMMA SPECTROMETRY DATA
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

SAMPLE ID:	B55R127COREF9			B55R127WALL			B55R131COREE6		
Analyte	Result	MDC	Val.	Result	MDC	Val.	Result	MDC	Val.
Actinium-228	0.51 ± 0.20	0.37		0.90 ± 1.1	1.8	U	0.93 ± 0.26	0.27	
Aluminum-26	-0.00 ± 0.05	0.10	U	-0.27 ± 0.40	0.95	U	0.05 ± 0.05	0.07	U
Americium-241	0.00 ± 0.09	0.17	U	-0.10 ± 0.19	0.39	U	-0.12 ± 0.10	0.19	U
Antimony-125	0.03 ± 0.13	0.23	U	-0.30 ± 0.62	1.3	U	0.02 ± 0.14	0.25	U
Bismuth-212	0.92 ± 0.82	1.2	U	4.4 ± 3.6	5.1	U	0.57 ± 0.92	1.5	U
Bismuth-214	0.27 ± 0.15	0.20		0.57 ± 0.63	1.0	U	0.45 ± 0.18	0.20	
Cesium-134	-0.03 ± 0.05	0.10	U	-0.21 ± 0.28	0.58	U	-0.00 ± 0.06	0.10	U
Cesium-137	-0.01 ± 0.05	0.10	U	-0.06 ± 0.24	0.50	U	-0.05 ± 0.06	0.12	U
Cobalt-60	-0.02 ± 0.06	0.13	U	0.14 ± 0.29	0.51	U	0.03 ± 0.06	0.10	U
Europium-152	-0.10 ± 0.33	0.72	U	0.70 ± 2.3	4.4	U	0.25 ± 0.47	0.80	U
Europium-154	-0.12 ± 0.28	0.58	U	-0.20 ± 1.6	3.3	U	-0.16 ± 0.34	0.70	U
Europium-155	0.01 ± 0.11	0.20	U	0.14 ± 0.37	0.65	U	0.08 ± 0.13	0.22	U
Lead-212	0.70 ± 0.18	0.16		1.2 ± 0.48	0.53		0.93 ± 0.23	0.18	
Lead-214	0.27 ± 0.13	0.19		-0.12 ± 0.49	0.94	U	0.49 ± 0.15	0.18	
Niobium-94	0.04 ± 0.05	0.09	U	-0.10 ± 0.27	0.55	U	0.01 ± 0.06	0.11	U
Potassium-40	18.3 ± 3.8	1.3		12.9 ± 5.8	4.7		17.4 ± 3.7	1.3	
Protactinium-234	3.7 ± 9.4	17.0	U	37.0 ± 43.0	66.0	U	4.8 ± 9.7	17.0	U
Ruthenium-106	0.24 ± 0.49	0.85	U	0.70 ± 2.4	4.3	U	-0.42 ± 0.52	1.1	U
Sodium-22	-0.01 ± 0.07	0.13	U	0 ± 0.26	0.55	U	0.02 ± 0.07	0.13	U
Thallium-208	0.21 ± 0.09	0.10		0.33 ± 0.32	0.49	U	0.33 ± 0.10	0.09	
Thorium-227	0 ± 0.28	0.51	U	0.70 ± 1.5	2.3	U	0.03 ± 0.33	0.59	U
Thorium-234	0.35 ± 0.74	1.2	U	0.10 ± 1.9	3.4	U	1.3 ± 1.0	1.6	U
Uranium-235	0.27 ± 0.29	0.47	U	0.72 ± 0.85	1.4	U	0.15 ± 0.29	0.49	U
Grid number	Room 127	F9		Room 127	West Wall		Room 131	E6	

Notes: 1	When the validated qualifier column is empty, activity above minimum detectable was found
2	All results in picoCuries per gram
MDC	Minimum detectable concentration
U	Result is less than the sample specific MDC
Val.	Validated qualifier
±	Plus or minus

TABLE B-4
GAMMA RADIATION LEVEL MEASUREMENTS
ROCKETDYNE SANTA SUSANA FIELD LABORATORY

Building	Room	Grid	Gamma Radiation Level (cpm)	Gamma Radiation Level (μR/hr)
T-011	NA	L12	10,231	13.5
T-011	NA	G21	11,012	15
T-011	NA	M37	9,822	14.5
T-019	109	I5	14,251	20
T-019	109	E6	12,941	18
T-019	High Bay	K13	7,860	12
T-019	High Bay	O19	8,809	12.5
T-019	High Bay	L22	6,465	9.5
T-019	High Bay	028	7,646	10
T-019	High Bay	U31	8,444	11
T-019	107	NA	7,485	9
T-055	126	NA	8,185	11.5
T-055	127	E11	7,600	10
T-055	127	G18	7,950	11
T-055	127	T31	8,273	12
T-055	127	U14	8,751	10
T-055	131	NA	11,191	14
T-100	110	A2	12,892	18
T-100	110	A13	14,539	20
T-100	110	H1	10,340	16
T-100	110	H15	14,507	19
T-100	110	I7	15,483	21.5
T-100	111	NA	9,426	13
T-100	127	NA	8,821	13
T-100	128	NA	8,652	11.5

Notes:
Cpm counts per minute
μR/hr microroentgens per hour

APPENDIX C

FORMULAS AND EQUATIONS

(Two Pages)

Critical Level (L_C)

$$L_C = \frac{K_a}{t_s} \times \sqrt{t_s r_b \left(1 + \frac{t_s}{t_b}\right)}$$

Detection Limit (L_D)

$$L_D = \frac{K_a^2}{t_s}\left[2 \times \frac{K_a}{t_s} \times \sqrt{t_s r_b \left(1 + \frac{t_s}{t_b}\right)}\right]$$

Activity in dpm/100cm^2 (A)

$$A(dpm/100cm^2) = \left(\frac{n_s}{t_s} - \frac{n_b}{t_b}\right) \times A_{CF} \pm \left(A_{CF} \times K_b\right) \times \sqrt{\frac{r_s}{t_s} - \frac{r_b}{t_b}}$$

Less Than Value for Reportable Activity (LTV)

$$\text{LTV (for } r_s - r_b \leq L_C) = \left(\frac{n_s}{t_s} - \frac{n_b}{t_b}\right) \times A_{CF} + \left(A_{CF} \times K_a\right) \times \sqrt{\frac{r_s}{t_s} - \frac{r_b}{t_b}}$$

Activity Conversion Factor (A_{CF})

$$A_{CF} = \frac{1}{\varepsilon} \times \frac{100cm^2}{area_d}$$

Efficiency (ε)

$$\varepsilon = \frac{A_{source}}{\left(\frac{n_{cal}}{t_{cal}} - \frac{n_{b-cal}}{t_{b-cal}}\right)} \times f_1 \times f_2 \times f_3 \bullet\bullet\bullet$$

FORMULA AND EQUATION TERMS AND DEFINITIONS

A	=	Activity (dpm/100cm^2)
A_{CF}	=	Activity conversion factor (dpm/100 cm^2 per cpm)
A_{source}	=	Activity of the standard calibration source (dpm)
$area_d$	=	Detector surface area (cm^2)
cpm	=	Counts per minute
dpm	=	Disintegrations per minute
ε	=	Efficiency
f_i	=	Other conversion factors
K_a	=	1.645 (one-sided 95 percent standard deviation)
K_b	=	1.96 (two-sided 95 percent standard deviation)
L_C	=	Critical level (dpm/100 cm^2)
L_D	=	detection limit (dpm/100 cm^2)
n_b	=	Total background counts
n_{cal}	=	Total calibration source counts
$n_{b\text{-}cal}$	=	Total background counts at calibration location
n_s	=	Total sample counts
t_s	=	Sample count time (minutes)
t_{cal}	=	Calibration count time (minutes)
$t_{b\text{-}cal}$	=	Background count time at calibration location (minutes)
t_b	=	Background count time (minutes)
r_b	=	Background count rate (cpm) = n_b/t_b
r_s	=	Sample count rate (cpm) = n_s/t_s