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FINAL REPORT

SUBCONTRACT 9144J0013-8P
"Technical Support to the ER Program
Subsurface Technologies Team Leader"
Los Alamos National Laboratory

March 15, 1993 to March 15, 1998

By

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E. Dow Davidson, Jr. has served as the Principal Investigator of Curatorial Science Consultant's subcontract to the Los Alamos National laboratory "Technical Support to the ER Program Subsurface Technologies Team Leader" since 1993.

The scope of Work included development of a new geologic sample management facility and associated quality assurance systems for the LANL Environmental Restoration Program. Additional work with the LANL Environmental Restoration Program included the development of Sampling and Analysis Plans (SAP) for various Operable Units (areas to be restored) for the Laboratory. The PI (Davidson) served as the sample curation/sample management specialist on the ER program Subsurface Studies Technical Team. Specialization in Field Unit Data Base systems was the focus of the work towards the end of the contract.

The Service to be delivered Per the Subcontract is as follows:

1. Development of an ER Program Sample Management System, Design and specification of equipment, staffing requirements.

The ER Sample Management System was created, the Sample Management Facility was designed , equipment was installed, staff was put in place, and the facility currently is supporting the ER Program. The following provides a summary of the operational functions of the ER SMF- (Building 271).

COMPLETION OF TASK -SUMMARY

SUBSURFACE TECHNOLOGIES TEAM OPERATIONS AT BUILDING 271

Background

The Subsurface Technologies Technical Team was one of the teams managing technical activities for the laboratory's Environmental Restoration Program. The Subsurface Technologies Team was organized in the summer of 1991 with Sue Goff managing as the Technical Team Leader (TTL). The tasks defined for the Technical Team fell generally into three mission areas; drilling, borehole geophysics, and borehole sample management.

The Team's management of drilling, borehole geophysics, and borehole sample management for the ER program resulted in a broad range of operational activities that were headquarter in the Sample Management Facility (TA-03-271).

Responsibilities

The Subsurface Technologies Technical Team supported RFI activities by providing specialized technical assistance to ER Program management and OUPLs in the three areas. This assistance included :

A. Procurement, deployment, and day-to-day monitoring of all drilling activities.

B. Procurement and management of all geophysical borehole logging activities.

C. Development and management of a quality assured sample management system.

The Team strived for the goal of applying the latest state of the art technologies to the three task areas. This equated to the development and use of the latest drilling, logging, and sample management approaches. Therefore a wide range of technical and administrative operations at Building 271 were necessary.

Operational Activities

Subsurface Technologies Technical Team operations at Building 271 fell into three areas: Sample Management Organization, and Drilling Operations.

I. Sample Management Organization Operations

The Sample Management Organization (SMO) was the organization responsible for the collection, documentation, storage and control of selected types of samples and records collected and distributed for analysis and evaluation. SMO includes the Sample Management Facility (SMF) and Sample Management Field Operations (FO).

The SMF is the facility (Building 271) used for the documentation, examination, physical processing, storage, and control of selected sample remnants, and records collected and distributed for the ER Program. The SMF consists of a physical facility and equipment designed to effectively process and preserve these samples, remnants and records.

Acceptance of Samples for Curation

A primary goal of the SMO is to ensure that sample traceability data received from field sites is valid. To that end all samples undergo a confirmation process whereby traceability documentation is compared with the samples to ensure all markings and identifications are correct.

Additionally, because of the potentially hazardous nature of these samples, a confirmation of field screening values occurs as part of the acceptance for curation process. All samples are required to be accompanied by documentation of the relevant field screening values. These values will be statistically verified by an in-house monitoring program at the SMF. The monitoring program confirmed field screening data on incoming samples as well as periodically monitor the values within the SMF. Hazards such as penetrating radiation, radioactive gases, radiologically contaminated particles (dust, etc.), and non-radiological contamination such as volatile organic compounds will be monitored on an ongoing basis.

Area by Area Operations at the SMF

1. *Sample Storage - 110*
   This area functions as the primary receiving and confirmation area for incoming samples. Additionally it is the storage area for containers of borehole materials, primarily core and cuttings, in waxed interior cardboard boxes. Boxes are stored on metal "pallet" type rack storage system and accessed by means of electric stock picker and placed and removed from the racks by hand. The total estimated capacity for the Sample Storage area is approximately 100,000 lineal feet of core. Other geoscience materials will also be stored in this area such as archived hand samples and soil samples. The volume of non-borehole samples that may be stored is dependent upon the number of OUPLs wishing to archive these materials.

2. *Sample Examination and Logging - 106*
   This is the room designed for the lay-out, examination, and manipulation of samples. This is the area where geologic logging will be performed. An electric stock picker will transport boxes of samples into the room from the Sample Storage area.

3. *Technical Team Leader Office - 105*
   This is the Team Leader's office and will be the center of Technical Team management.

4. *Reception Cubical- 101*
   This area functions as the office of the secretary, who performs duties normally associated with that title.

However, in addition, the reception area is where visitor access to the SMF is documented and controlled.

6. *TECHNICAL TEAM CUBICLES- 101 A, B, C*
These three cubicles are shared by a number of the Technical Team staff, including subcontractors and consultants in the area of drilling and sample management. The Curator of the SMF and the Team financial specialist are also be housed in this area.

7. *Photocopy Area - 102*
This room is equipped with a photocopy machine, facsimile machine, and several types of printers.

8. *Multipurpose Area - 103*
This area will allow the Technical Team to conduct meetings and provide a work area for the lay-out of maps and other large-format documents. The area also allows small in-house training sessions.

9. *Sample Management Logging Trailer(s)*
The SMF also maintains portable trailers where Sample Management Field Operations staff collect, document , and handle borehole samples. The trailers are transferred from active site to active site as necessary and stored in the staging yard of Building 271 when not in use.

10. *Sample Storage Trailer(s)*
The SMF operates multiple sample storage trailers that are positioned at each drill site as needed. These Sample Storage Trailers allow the immediate securing of samples at each site under strict chain-of-custody control. Trailers are stored in the staging yard of Building 271 when not in use.

11. *Office Trailer*
The Technical Team maintains an office trailer in the staging yard of Building 271. This trailer will house various activities associated with team operations.

II. Drilling Operations

Drilling Operations (DO) is the organization responsible for the procurement and field management of ER Program drilling activities. DO works with Operable Unit Project Leaders to coordinate scheduling of drilling and logging activities as part of the overall field work schedule. In addition to the procurement and field monitoring of drilling, DO is also responsible for maintaining an operational capability that includes the in-house maintenance, repair, and modification of existing drilling and sampling systems as well as the development of prototype equipment and related systems. A limited amount of warehouse storage space is dedicated DO.

DO is housed in room 111 of the SMF (Building 271), and utilizes the warehouse structure attached to the east of the SMF as a work shop and storage area.

Area by Area Operations -DO

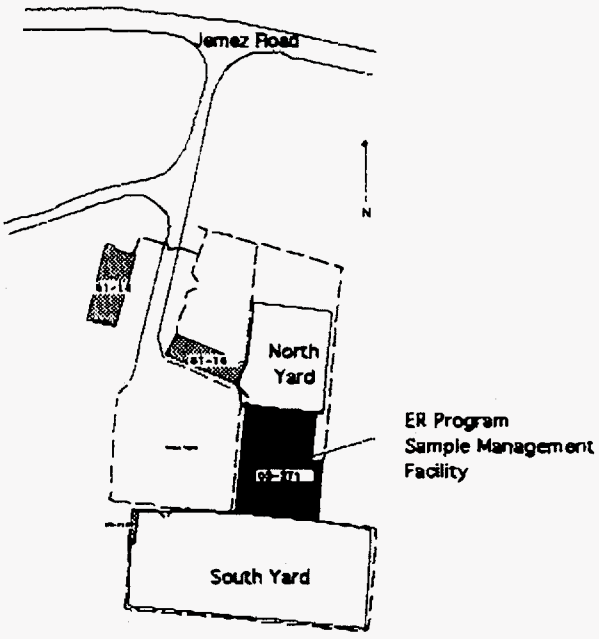
1. *Drilling Operations Office- 111*
This area functions as the headquarters of DO at the building and in the field. The area can accommodate approximately 3 to 5 staff.

2. *Drilling Operations Shop and Storage - 113*

Operations in this area includes storage of drilling and borehole logging equipment, SMO supplies, etc. It also is the location of the DO shop where mechanical repair and fabrication of drilling, sampling, and borehole logging systems takes place. The fabrication of prototype dust collection systems, and other state-of-the-art environmental drilling and sampling systems take place in this area.

3. *Staging Yards Building 271*

The south fenced yard associated with Building 271 is where a majority of pre-drilling operations are staged. A variety of drilling and drill site-related equipment is maintained, rigged-up, and temporarily stored at the yard. The north yard provides storage for drill rig decontamination systems. Operations in this area will include storage of borehole logging equipment.



LOCATION OF THE SUBSURFACE TECHNOLOGIES TECHNICAL TEAM OPERATIONS AT TA-03-271

In March 1997 the scope of work for the subcontract was revised to include the following:

A. The design, development, and implementation of computerized data bases;

B. The generation of sampling and analysis plans, Corrective Action Plans and reports, and other associated documents; and

C. Sample Curation/management expertise to the Environmental Restoration (ER) Project Sample Management Organization, including interpretation and application of regulatory requirements for sample management on the ER Project.

The focus of this work was the development of a FilemakerPro database to track SWMU information for Roy Michelotti's Field Units. An efficient database design was supplied to the Project and is still in use.

Various Sampling and Analysis Plans, analytical data manipulation reporting tasks were also performed for Roy Michelotti.

SUMMARY

The subcontracted services were provided as required - the ER Sample Management Facility is one of a few in the nation that supports the curation of contaminated geologic core. The sample management established by the subcontractor at the SMF provides a high level of regulatory compliance and quality assurance in keeping with the goals of the ER Project.

The support the subcontractor provided to various OU Leaders resulted in a more efficient method for tracking information related to Solid Waste Management Units.

E. Dow Davidson, Jr., Owner Curatorial Science Consultants

Attachment 1.

Borehole Sample Management Policy for the Los Alamos National Laboratory Environmental Restoration Program

February, 1994

ABSTRACT

This document provides the Statement of Policy for the management of borehole samples collected during Environmental Restoration activities at Los Alamos National Laboratory. Large quantities of borehole materials will be collected and numerous analytical samples will be removed from these samples. This Policy meets both US DOE and EPA regulatory requirements for acquisition, traceability, and control of geologic, hydrologic, and related samples collected from ER Program boreholes.

Appendix A details Sample Management plans. Appendix B provides the physical requirements for sample management facilities.

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APPENDIX

BOREHOLE SAMPLE MANAGEMENT POLICY
for the
LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION PROGRAM

Introduction

Activities involving the use of samples collected for the ER Program must conform to regulatory requirements for sample management. Sample management provides a technical and documentary approach to the management of geologic and hydrologic materials gathered for analysis. It includes the overall management system that ensures that the collected material will be properly handled, documented, transferred, stored and/or disposed of. A sample management system incorporates the broader issues of managing the entire life cycle of a geologic sample. The ultimate purpose of a sample management system is to provide assurance that the data produced from a sample will be valid and can technically, scientifically, and procedurally stand independent challenge whether from audit or litigation.

1.0 Sample Management

Borehole sample materials collected for the Los Alamos ER Program will be identified and procedurally managed. Such procedures will define the responsibilities (including interface between organizations) for collection, identification and traceability of borehole samples, for distribution of analytical samples, disposition of samples, and the generation of associated records.

A sample is a physical entity, representative of the whole, that is collected or generated for data, analysis, or testing. For purposes of this Policy, samples have been grouped into the following three categories:

- Borehole sample, this includes drill core, cuttings, and fluids. The borehole sample is the top-level of a hierarchy of samples. It provides that original parent material from which other samples are removed.

- Analytical sample, this is a subsection or portion that has been removed from a borehole sample, an analytical sample may also be known as a specimen or sub-sample.[1]

- Archival sample, this is an interval of a borehole sample that is withheld from analytical sampling to preserve a representative portion of the borehole material for future reference and or to enable replication of applicable geologic analytical procedures at a future date. Archival samples are to be as representative of the type and character of their corresponding borehole samples as possible.

Borehole sample materials will be managed during handling, transport and shipping to preclude damage or loss and to minimize deterioration in storage.

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1. Samples collected exclusively for the monitoring of hazardous wastes and/or radiation such as those coordinated by the Laboratory's CST-9 Sample Coordination Facility will be controlled through SOPs specifically related to the control and analysis of hazardous constituents (e.g., LANL-ER-SOP-01.06).

2.0 Traceability - Chain of Custody

Identification systems will assure traceability of materials to the appropriate source. Identification measures should be designed and maintained to ensure that borehole samples are correctly identified to the time and exact location of origin. Such traceability of materials will be from initial acquisition through final disposition. Procedures will ensure that the chain of custody is maintained. Measures will be taken to preclude the use of samples that have lost their identify.

Custody is defined as immediate charge and control of a sample. Chain of custody is the term denoting the procedural steps that result in the assurance that a sample has remained in a person's or organization's custody from initial collection to final disposition. For the purposes of this Policy, two types of custody are defined:

- Personal custody; this is when the sample is in an individual's actual physical possession, it is in the individual's view, after being in their physical possession, or it was in their physical possession and they then secured it in a manner so that it could not be tampered with. Sample Management staff accepting samples into their custody outside Sample Management Facilities (note: the proposed Sample Management Facilities and staff are discussed in Appendix B) follow procedures that conform to personal custody requirements.

- Organizational custody; this is identical to personal custody, with the exception that once a sample's custody is transferred to a Sample Management staff member at the Sample Management Facility, the responsibility for and custody of the sample is transferred to the organization. This concept requires that the organization be operated by trained staff, and that the physical facility (ies) are secured and controlled-access. A major implication of organizational custody is that the same staff member who accepts custody of a sample, is not required to release custody of that sample.

3.0 Handling and Transport

Controls will be established for appropriate modes of transport, packaging, containers, handling, time constraints on perishable borehole samples, and any other environmental or safety considerations for the materials. Packaging and transportation of all samples will conform to all DOT and LANL regulations. Measures will be taken to avoid cross contamination during handling and storage. Special protective environments, moisture content levels, and temperature levels should be specified and provided where appropriate. Where multiple organizations are involved, appropriate procedures will describe interface and custody responsibilities including assurance that material meet SMF health and safety based acceptance criteria. Identification of borehole sample materials will be verified and maintained when they are handled, and when they are transferred from one organization's responsibility to another.

4.0 Storage

Measures will be taken to maintain sample characteristics and identification capability while in storage. These measures will be consistent with the planned duration and conditions of storage and will describe actions to be taken where materials have a maximum life expectancy. Storage methodology will be developed and implemented to assure that materials are maintained in predetermined environmental conditions commensurate with their intended purpose. Materials will be managed to preclude mixing with other samples. Provisions will be made for storage of analyzed materials in areas physically separated from untested materials.

REFERENCES

1. ANSI/ASME (American National Standards Institute/American Society of Mechanical Engineers) 1989. "Quality Assurance Requirements for Nuclear Facilities. "NQA-1-89, Basic Requirements 8 & 12, 345 East 47th Street, New York, New York

2. DOE (US Department of Energy) 1986, "Quality Assurance." DOE Order 5700.6B, Attachment 1 - Basic Requirements Nos. 8 and 13, Washington, DC.

3. DOE (US Department of Energy) 1991, "Quality Assurance." DRAFT DOE Order 5700.6C, Attachment 1 - Criterion Nos. 4 and 5, Washington, DC.

4. EPA (US Environmental Protection Agency) 1980. "Interim Guidelines and Specifications for Preparing Quality Assurance Program Plans," QAMS-004/80, Elements 5.6 and 5.7, Washington, DC.

5. EPA (US Environmental Protection Agency) 1984. "Soil Sampling Quality Assurance User's Guide, Chapter 7." Environmental Monitoring Systems Laboratory, Las Vegas, NV.

Appendix A

SAMPLE MANAGEMENT PLANS AND PROCEDURES

The following list of plans and procedures implements the requirements of the Sample Management Policy. These documents will provide the necessary detailed planning required to establish the overall sample management system.

1.0 SITE SPECIFIC SAMPLE CURATORIAL PLAN

The Technical Team collaborates with OUPL's to produce a Sample Curatorial Plan that is specific to individual operable units. The Curatorial Plan will be a part of the Site Specific Drilling Package and will delineate the individual curation requirements for geologic characterization samples for each Operable Unit.

2.0 TECHNICAL STANDARD OPERATING PROCEDURES (SOPs)

The following is the list of SOPs required for Sample Management activities:

2.1 Field Logging, Handling, and Documenting Borehole Samples

This SOP (LANL-ER-SOP, 12.01) delineates the requirements and responsibilities for documentation, handling, lithologic and structural logging, core photography, marking, and packaging of ER Program samples at borehole sites. This procedure addresses hold points in the borehole sample recovery process for the monitoring of hazardous wastes and radiation levels. This procedure includes instructions for utilization of the Sample Management trailer(s) and all included core logging and handling equipment contained therein.

2.2 Acceptance of Non-Borehole Samples by the Sample Management Facility

This SOP (LANL-ER-SOP, 12.03) addresses the requirements and responsibilities for the acceptance of any ER Program geologic characterization samples not addressed by other Sample Management SOPs. This SOP allows other samples (soils, etc.) than borehole samples to be curated by the Sample Management Facility. This procedure is in draft form and is expected to be issued by April 1994.

2.3 Transport and Receipt of Borehole Samples by the Sample Management Facility

This SOP (LANL-ER-SOP, 12.02) describes the requirements and responsibilities for the transport of ER Program borehole samples from the field collection (and/or portable trailers) site to the Sample Management Facility, receipt from transport personnel, and admittance for curation.

2.4 Physical Processing and Storage of Borehole Samples at the Sample Management Facility

This SOP (LANL-ER-SOP, 12.04) addresses the requirements and responsibilities for the physical processing and storage of borehole samples at the Sample Management Facility. Physical processing includes photo documentation, marking, labeling, cutting, and packaging. *This procedure is in development and is expected to be issued by June 1994.*

2.5 Examination of Samples at the Sample Management Facility

This SOP (LANL-ER-SOP, 12.05) addresses the requirements and responsibilities for sample examination by ER Program investigators. The SOP deals with the documentation and authorization required to make borehole samples available for hands-on examination. *This procedure is in development and is expected to be issued by June 1994.*

Appendix B

Physical Requirements for Sample Management Facilities

1.0 FUNCTIONAL REQUIREMENTS FOR THE SAMPLE MANAGEMENT FACILITY (SMF) – Building SM-271

The functional requirements for the main Sample Management Facility broadly fall into three categories: (1) provide physical protection for the geologic/hydrologic samples and the associated in-process records; (2) provide adequate space and support for the handling of geologic core and other samples (including receiving, processing, handling, shipping, and storage), and (3) provide adequate space to facilitate scientific investigations by ER Program investigators.

1.1 Physical Security Requirements for the SMF

The minimum physical security requirements for the SMF include: (1) protection from environmental factors such as high and low temperatures, excessive dust, and air pollution; (2) protection from natural disasters such as high winds, flooding, and fire; (3) protection from infestation by insects, rodents, and mold; (4) protection from man-made damage such as fire, mechanical failure (water pipe damage, collapse of storage racks, etc.), acts of vandalism, terrorism, and larceny; and, (5) protection from administrative loss and mishandling of samples. Table 1 presents a summary of the physical security requirements for the SMF and includes information how the specified security requirements are implemented at the SMF.

1.2 Operational Requirements for the SMF

The operational requirements for the SMF includes service as an adequate repository for the curation of borehole samples, analytical samples collected for geologic characterization and associated in-process records as well as providing facilities conducive to high quality scientific investigations of the core.

In order to serve as an adequate repository for the curation of the core, samples, and associated records, the SMF has been designed to accomplish the following generic functions: (1) shipping and receiving of core, and cuttings as well as analytical or sub-samples of these items forwarded to Laboratory entities for analysis; (2) processing of the core and samples, including marking, cutting, packaging, photo documentation and verification of logging; (3) storage space for active core samples, archived core samples, cuttings, soils, sample remnants, and the related in-process records; and (4) office space for the operation and management of the SMF; and, (5) restrictions of access to the samples located in various areas within the facility. Table 2 presents a summary of the allocation of architectural space at the SMF.

2.0 FUNCTIONAL REQUIREMENTS FOR THE SMF TRAILERS

The functional requirements for the SMF Core Logging Trailers(s) are: (l) a portable trailer that can be easily relocated at each ER Program drill site. The units are capable of timely set-up and stabilization. The trailers are lockable and have excellent secureability. The trailers are approximately 8 feet x 20 feet. The units are well-lighted, heated, ventilated, and have mobile voice and data communication capabilities. The trailers have been equipped with work surfaces, core racks, and core transport trays. The units have been provided with video and still photography apparatus.

TABLE 1

PHYSICAL SECURITY REQUIREMENTS FOR THE SAMPLE MANAGEMENT FACILITY

	Item	Limits	How Implemented
1.	Protection from high temperature	<80° F	(1)
2.	Protection from low temperature	>33° F	(1)
3.	Protection from excess humidity	<90 % Rh	(2)
4.	Protection from excess dust	not to exceed interior office levels	(1)
5.	Protection from wind damage	0 occurrences	(1)
6.	Protection from flooding	0 occurrences	(3)
7.	Protection from fire	0 occurrences	(4)
8.	Protection from insect infestation	When the integrity of the sample containers or paper records is compromised	(5)
9.	Protection from rodent infestation	" "	(5)
10.	Protection from mold infestation	" "	(5)
11.	Protection from water pipe leakage	" "	(1)
12.	Protection from air pollution	" "	(1)
13.	Protection from terrorist acts	0 occurrences	(6)
14.	Protection from acts of vandalism	0 occurrences	(6)
15.	Protection from acts of larceny	0 occurrences	(7)
16.	Protection from mishandling of samples	When it results in loss of data or has quality or programmatic impact	(8)
17.	Protection from administrative loss	" "	(8)

Notes to accompany Table 1:

1. The facility is maintained in a manner which will minimize the risk of damage or destruction of the samples or associated records. No water pipes have been placed over the sample and record storage areas.

2. Containers and packaging techniques are relied upon to control the moisture content of borehole samples, and any analytical samples processed by the SMF.

3. The facility is located outside the bounds of the 100 year flood plain.

4. The facility is equipped with a fire detection system.

5. The facility is constructed to minimize infestation by insects, rodents, and molds (i.e., no voids to the exterior, moisture control, adequate facilities for garbage isolation, etc.). Periodic pest inspection will be performed and pest control will be ongoing.

6. The walls are of reinforced masonry, metal or equivalent construction. Facility is kept locked at all times.

7. All visitors to the facility will be cleared before proceeding past the access control desk at the main entrance. All persons, with the exception of regular staff, will be required to sign-in on a visitor access log to provide a written record of their access. Access to the facility for scientific or regulatory purposes will be by authorized by the Curator or designee prior to actual entry into the facility. This practice of access control is necessary not only to guard against malicious acts, but also supports organizational custody procedures for the SMF.

8. The operation of the facility will be carried out under a rigorous system of quality control.

TABLE 2

ARCHITECTURAL SPACE ALLOCATION FOR THE FIXED LOCATION SAMPLE MANAGEMENT FACILITY

Architectural Element	Area (Sq. Ft..)
1. Shipping and receiving geologic samples	300
2. Active borehole sample storage	1,700
3. Archived borehole sample storage	1,700
4. Cuttings storage	200
5. Core sawing/sample preparation (future construction)	300
6. Core/sample packaging	350
7. Core layout for scientific examination	1,000
8. Staff offices (4)	600
9. Forklift storage and recharge	100
10. Record and document storage /Computer Operations	150
11. Training and conferences area	300
12. Printer & Copier area	150
13. Reception/access control	200
14. Drilling Operations Office	330
Net Area	7,330
Gross Area x 1.13* =	8,280

* Net area represents the actual area, or internal room dimensions, required to perform the specified function. Net area makes no allowance for the building space occupied by interior walls, hallways, passageways and ramps connecting various interior rooms; building mechanical functions such as heating, cooling, and ventilating units, fire control systems, security systems, etc.; and, other miscellaneous building needs. To convert net required areas into a gross, or overall, building space requirement, a factor of from 1.1 to 1.35 is generally applied by architects and interior designers. We have chosen to use a factor of 1.13 in our space requirements analyses.