UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

# Design and Construction of a Mobile, Core-Processing Facility

by

Thomas C. Michalski and William Linenberger[1]

Open-File Report 90-344

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

[1]Denver, Colorado

1990

CONTENTS

APPENDIX

## INTRODUCTION

In June, 1986, the U.S. Geological Survey Core Research Center was assigned the task of providing a sophisticated core-processing facility for a deep-drill-hole project that was soon to begin at Cajon Pass, California, as part of the national Continental Scientific Drilling Program. Because this type of on-site facility was neither available from operations within the USGS nor commercially available on the open-market, it was necessary to design and construct the mobile facility at the USGS Core Research Center, near Denver, Colorado. Because of limited time and budgetary constraints, the design and construction proved to be challenging and they occupied nearly all staff-time at the Core Research Center between July and November, 1986.

The deep-drill-hole project at Cajon Pass was a highly visible, widely publicized operation which generated much interest from government, industry, academia, and the general public. The USGS core-processing facility was acknowledged by those familiar with drilling operations as being quite sophisticated and well run. Because of the high level of interest in this facility, we decided to summarize herein the Survey's involvement in this part of the project and describe the design and construction of the facility.

## BACKGROUND

The Geologic Division of the U.S. Geological Survey has a long-term interest in investigating the deep interior of the earth's continental crust. This interest has been until recently, restricted to general geophysical investigations and the drilling of many boreholes for scientific research. None of the boreholes are more than 1,524 meters (5,000 feet) deep. To augment studies of the geologic processes in the deep continental crust and to coordinate activities with other government agencies, the U.S. Geological Survey (USGS), the National Science Foundation (NSF), and the Department of Energy (DOE) signed an Interagency Accord on Continental Drilling on April 2, 1984. This accord affirmed the Geological Survey's interest in vigorously participating in a national Continental Scientific Drilling Program (CSDP).

Under terms of a cooperative agreement with the National Science Foundation, a private not-for-profit consortium of universities known as Deep Observations and Sampling of the Earth's Continental Crust, Inc. (DOSECC) was established in March, 1984. DOSECC was organized to identify and prioritize drilling targets, to design and implement related programs of scientific study, and to provide drilling management and logistical services as part of the national Continental Scientific Drilling Program.

It was agreed by all parties involved with the CSDP that the unique and irreplaceable samples generated by the program, combined with the sophisticated tests that would be applied to them, would demand meticulous sample-handling and curatorial procedures not normally available at conventional drill-site operations. In May, 1985, DOSECC solicited and received proposals from various universities, state geological surveys, and federal agencies who were interested in providing core handling and curation of samples produced by DOSECC-sponsored drilling projects. DOSECC accepted the USGS proposal to provide the handling and curation of samples produced by DOSECC-sponsored drilling projects for three years at no charge to DOSECC.

After many comments and suggestions from scientists in industry, academia, DOE, and the USGS, a DOSECC document that specifies the services and procedures required of the USGS was issued in May, 1986, as the "DOSECC Sample Handling and Curation Protocol" (appendix I). In June, 1986, a formal letter of agreement between DOSECC and the USGS, which states that the guidelines for services and procedures as outlined in the DOSECC Protocol would govern the services to be provided to DOSECC from October 1, 1986 through September 30, 1989, was signed by the Director of the USGS and the president of DOSECC.

Because of its expertise in core-sample processing, testing, and curation, the USGS Core Research Center (former USGS Core Library) was assigned the task of providing the facilities, equipment, and services outlined in the DOSECC protocol. DOSECC's decision to begin drilling at Cajon Pass, California, in November, 1986, created a sense of urgency because all needed instruments and equipment had to be purchased, delivered, tested, and installed in the yet to be acquired mobile facility; which in turn had to be shipped to California, staffed, and be operational at the drill-site by the end of November, 1986.

## DESIGN CONSIDERATIONS

The decision concerning the type of facility best suited to DOSECC's needs was based on several factors. First, since DOSECC was planning a series of drill-holes at various sites across the continental USA, (and possibly Alaska and Hawaii) the structure had to be very mobile. The ideal facility had to be capable of being transported to various locations via interstate highways, commercial railways, and ships, and most certainly have the capability of being transported along unimproved dirt roads. Secondly, since Cajon Pass is a high wind area and because the facility would be used for many years in the future, the facility had to be sturdy and durable. Future drill-sites would have highly variable climates, consequently the facility would need insulation and capacities for air-conditioning and heating.

The floor plan for the facility had to be adaptable to several configurations since each DOSECC project would have different core-processing/testing requirements. The ideal facility would consist of several modules which could be arranged in various configurations. Because the Cajon Pass drill-hole project (and probably most DOSECC drill-holes) would be a conspicuous, widely publicized operation, the structure needed to have a presentable exterior and interior. Finally, because of the limited budget and lead-time, the facility had to be relatively inexpensive and quickly available.

## POSSIBLE OPTIONS

Based on the design considerations described above, several possible sources for the mobile core-processing facility were investigated. The first and most cost-effective option was to of obtain a suitable facility from the USGS. Unfortunately, none of the USGS branches involved in field-laboratory operations had field-laboratory trailers that were appropriate. Another option was to obtain several trailers from the U.S. Government's excess property. A few trailers were available from several federal agencies, but they were in poor condition and could not be salvaged. Several types of collapsible and inflatable buildings were also investigated but were rejected because of high cost or their lack of durability in adverse weather.

The possibility of having several trailers constructed to our specifications was investigated and quickly rejected because of the cost and excessive time required. It became obvious that the most viable option was to purchase several semitrailers and have our staff remodel the interiors to meet our specific needs. Although new semitrailers were readily available, their cost exceeded our budget. Contacts with commercial trucking companies, however, indicated that many used semitrailers were available in the Denver metropolitan area. After examining a large number of used semitrailers, four that were reasonably priced and road-worthy were located in the Denver area. The four trailers were purchased for $2,495 each ($9,980 total). Their interior dimensions were 8 ft. wide, 40 ft. long, and 10 ft. high. The total useable floor-space in the four trailers was 1,280 square ft.; the cost of $7.80 per square ft. was reasonable.

## TRAILER CONFIGURATION AND INTERIOR DESIGN

The process of converting the four used semitrailers into an integrated and functional facility was dependent first on establishing a general design concept for the relative positions of the trailers. The arrangement of the trailers would be dependent on the location of doors, traffic patterns between trailers, safety considerations, and the configuration of the drill-site.

The original access to the interior of the trailers was through two large doors at the rear of each trailer. Both doors were hinged so that they could swing open and be latched to the sides of the trailer. To take full advantage of this feature, it was decided that when each trailer was used the rear doors would be latched open and the rear of all trailers would be abutted to a central platform.

To have an efficient and orderly flow of foot-traffic the trailers would be positioned so that two sets of two trailers were parallel and their rears abutted against a central platform (fig. 1). After assembly at the drill-site, the platform would be totally enclosed and fitted with two exterior access doors. An emergency exit door would be installed in one side of each of the trailers. Having established the relative positions of the trailers, planning proceeded to the details of the interior design, such as the means of normal access and the locations of emergency doors.

The interior design of the trailers was primarily dependent on the following: the sequence of core processing requirements as outlined in the DOSECC Protocol (appendix I), the size and shape of equipment, and the specific needs of the Principal Investigators on-site. Although the DOSECC Protocol document spelled out the general sequence of core-processing procedures for DOSECC cores, a more specific plan was needed for the cores from Cajon Pass. After several meetings with the principal investigators, a plan for processing the DOSECC cores was developed. The Core Recovery Operations Flow Chart (fig. 2) summarizes the sequence of procedures which were planned for the cores from Cajon Pass. Appendix II provides details of the procedures outlined in the Core Recover Flow Chart.

Having developed a detailed plan for processing the Cajon Pass cores, the equipment needed, and its availability and space requirements were determined. Thereafter, the four trailers were designated as specific functional areas that would contain sequential core-processing operations.

One trailer, designated the `office-trailer`, would be used to document core recovery and processing, as well as for meetings, logistical support, etc. Another trailer which was designated the `examination-trailer` would provide a large area for the examination and storage of cores and cuttings. A third trailer was designated the `saw-trailer` and would be used for core-slabbing and the cutting of samples for various types of analysis. The fourth trailer was designated the `photo-trailer` and would be used for still photography and video documentation, as well as for housing several analytical instruments.

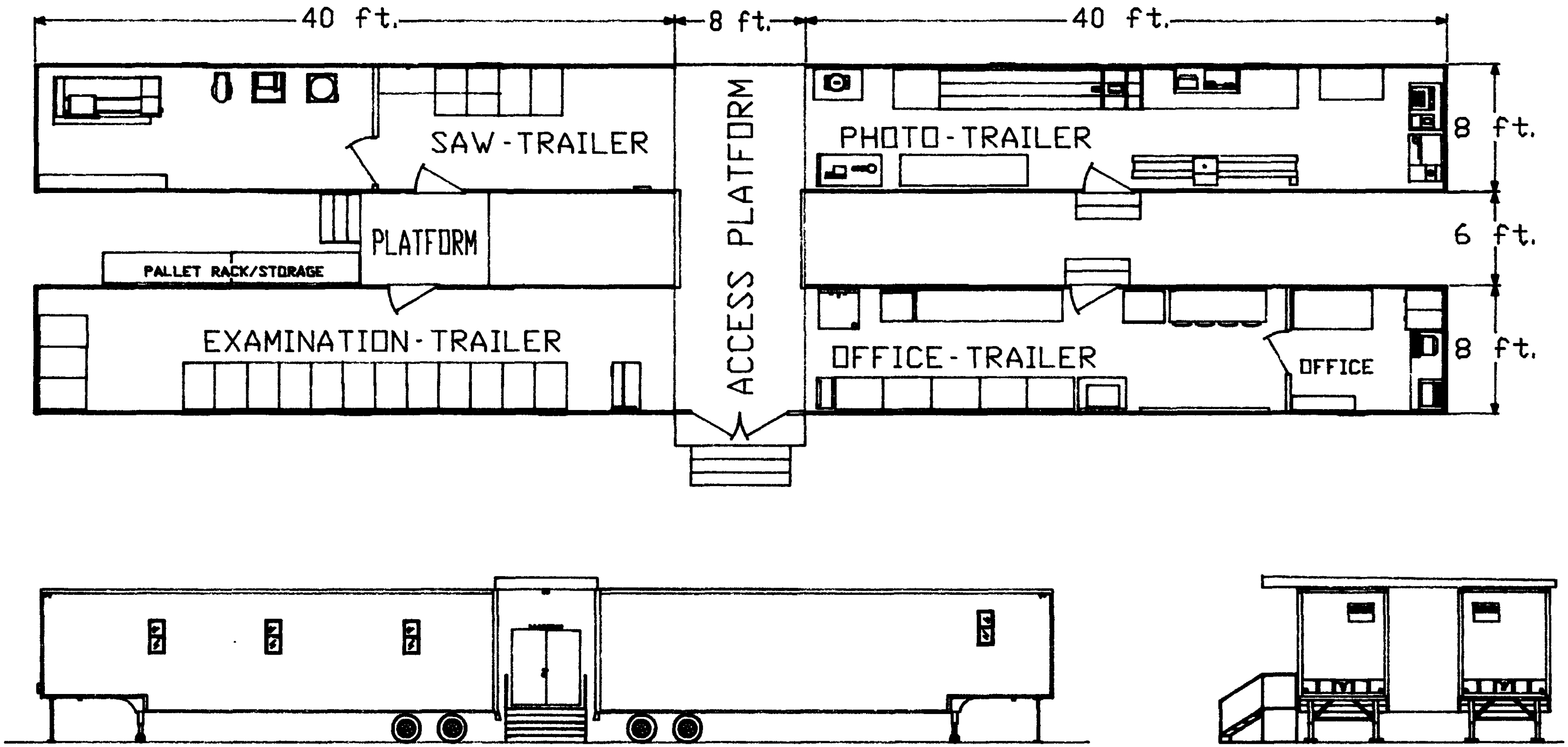
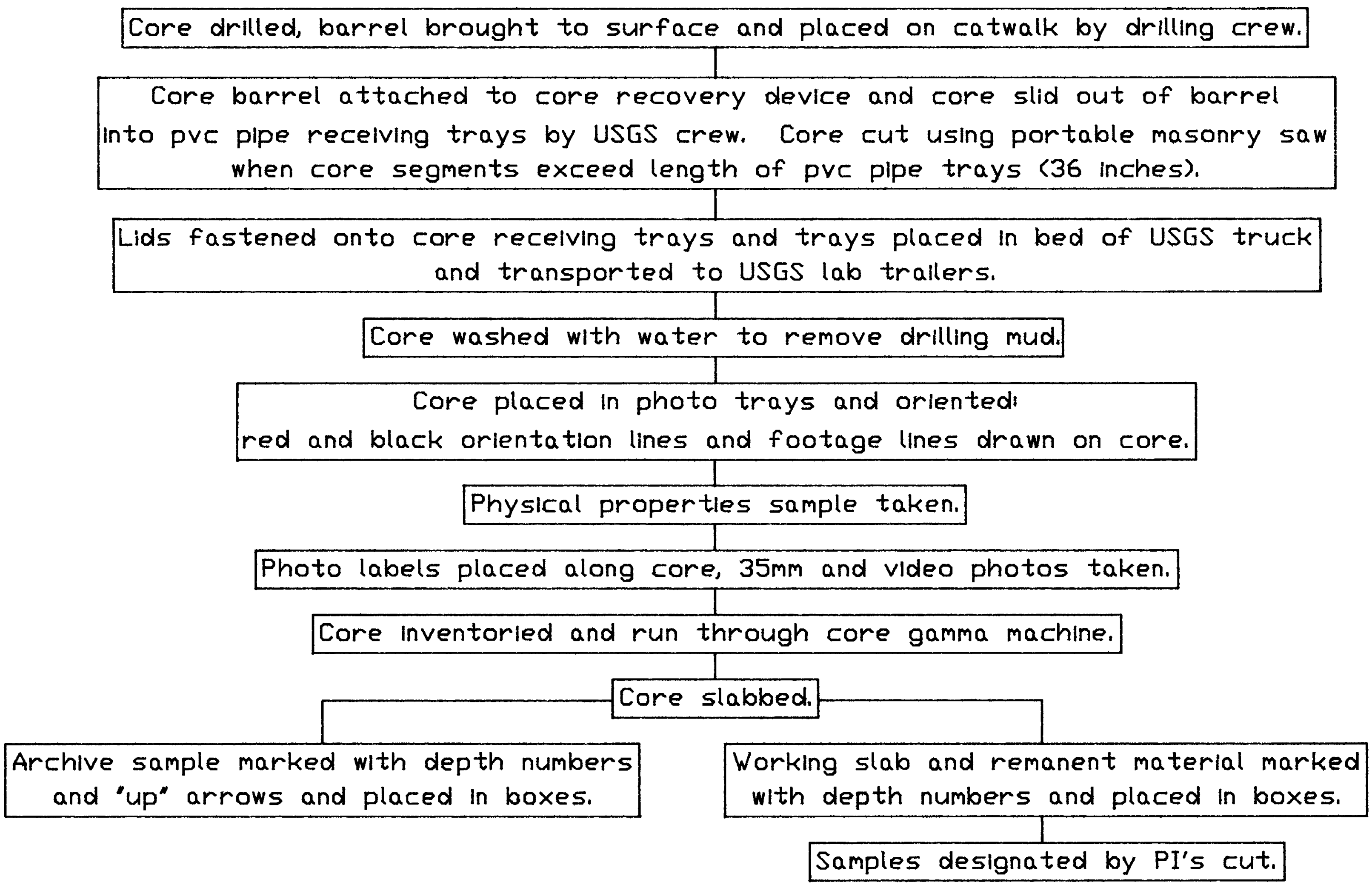



Figure 1. CONFIGURATION OF TRAILERS ON-SITE

FIGURE 2. CORE RECOVERY OPERATIONS FLOW CHART

Cajon Pass Drilling Experiment



## INTERIOR LAYOUT

The layout for the interiors of the trailers involved establishing the positions of equipment, instruments, furniture, partitions, etc., for the most effective use of the space. Also considered were the orderly flow of core-processing functions, noise abatement, the type and amount of samples to be processed and stored, and the interior structural limitations of the trailers. Some flexibility in the plans for the interiors was necessary to accommodate possible changes in core-processing requirements after the trailers were on-site.

## OFFICE-TRAILER

The internal configuration of the office-trailer was the easiest to visualize and design. As indicated in figure 3, an area at one end of the trailer was separated from the remaining space with a partition and was designated as a private office for the USGS on-site supervisor. A desk, shelving, file-drawers, computer, and printer were to occupy this part of the office-trailer. The outer wall of the office would contain a window for visually monitoring drilling activities. The central section of the trailer was for a conference/lunch room and would be equipped with a conference/lunch table, blackboard, microwave/sample dryer, and refrigerator/film-storage unit. The other half of this trailer was for general storage and maintenance; it would house a row of storage shelves, a work bench with tool-storage capacity, a sink, a hot-water heater, and a bottled-water dispenser.

## PHOTO-TRAILER

Photographic documentation would be an essential element of the core processing at Cajon Pass. Since all cores would be sampled extensively on-site, an accurate and detailed photographic record of all cores prior to sampling was necessary. One trailer was therefore designated the photo-trailer. Although planned mainly for core photography, this trailer would also house several analytical instruments.

To prepare a detailed photographic record, the committee decided that the outer surface of all cores would be photographed in color using a 35mm camera and that approximately one foot of core would be recorded in each photograph. In addition, the outer surface of each core would be documented by means of a video camera and recorder. To complete the photography and video recording in an orderly manner and to minimize the handling of each length of core (often friable), a custom-designed, variable-speed photo-tray system was planned for one wall of the photo-trailer (fig. 3). The 35mm camera, video camera, video-cassette recorder, video monitor, and photo-flood lights would be mounted on brackets above the variable-speed photo-tray system.

A work table would be placed against the wall opposite the photo-tray system so that, subsequent to photography, samples of core could be properly documented prior to analysis. The documentation would include the weighing and preservation of samples, for the testing of physical properties, by repeatedly dipping the samples in molten beeswax. A scale would be positioned on a cart adjacent to the work table so that the weight of samples from the cores could be determined and recorded. A hot plate and a large pot of beeswax would be placed on a table near the rear of the photo-trailer (fig. 3) for sample preservation.

A gamma ray recording machine also would be located in the main section of the photo-trailer. This instrument measures and records on a strip log the gross gamma radiation emitted from core samples. The strip log is used to correlate the core depth with the down-

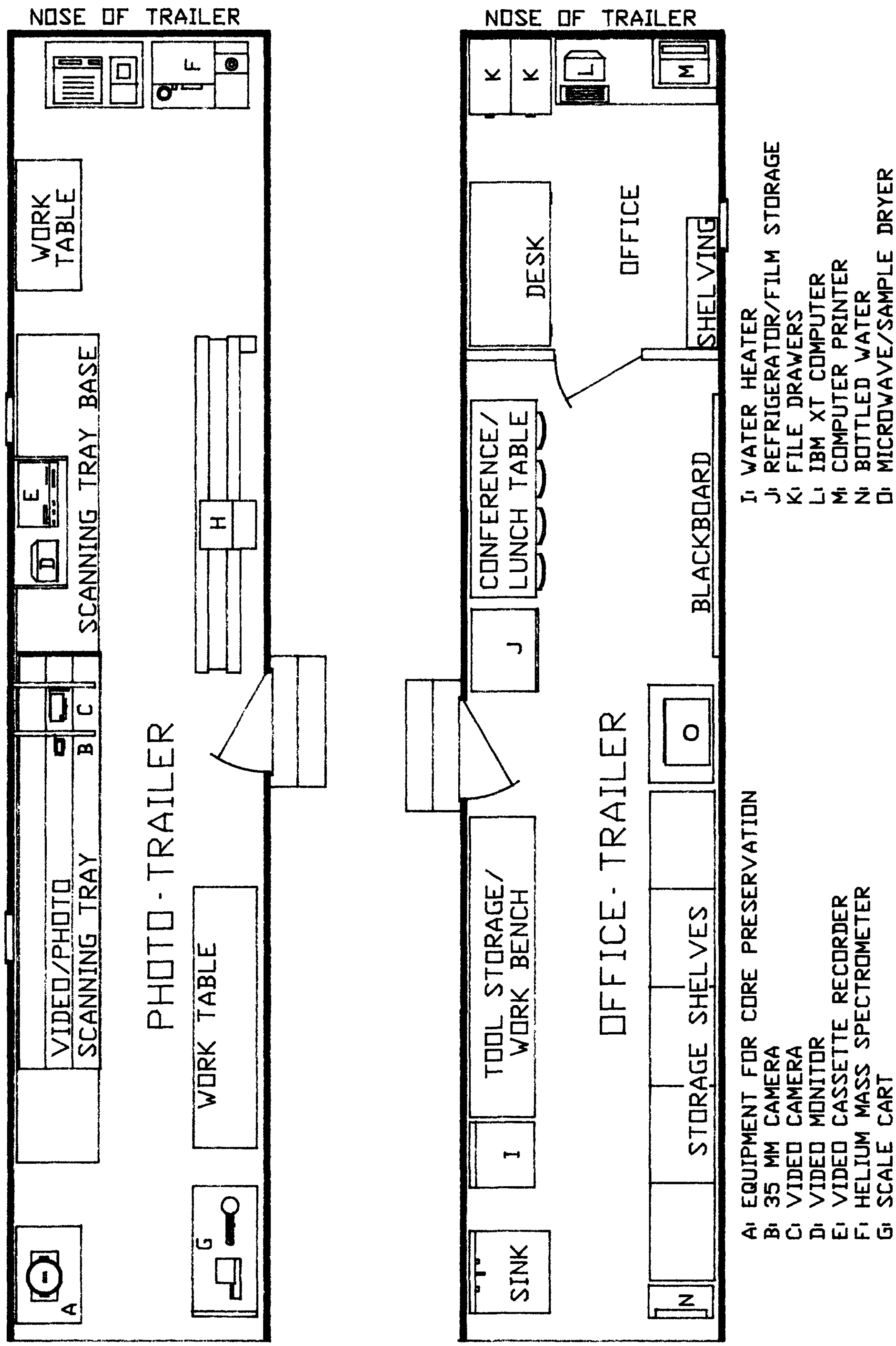



FIGURE 3. FLOOR PLAN FOR OFFICE & PHOTO TRAILERS

hole gamma logs. A helium mass-spectrometer that would be installed in the raised nose of the photo-trailer would monitor helium emissions of the drilling mud.

## EXAMINATION-TRAILER

In the plan, the examination-trailer was divided into two general areas (fig. 4). The raised nose of the trailer (fig. 4, area G) would include an archival storage area that would be equipped with metal shelves capable of storing 2,000 ft. of slabbed core. In a protected area adjacent to the trailer, pallet racks would be erected and used for the storage of drill-cuttings. The majority of the space in the trailer was for the examination of core.

A core-examination table that measured 3 ft. high, 3 ft. 3 in. wide, and 24 ft. long would be constructed along the outer wall of the trailer. The space beneath the table would be fitted with shelves for the storage of full-diameter cores before they were processed. A total of 432 feet of 6 in. diameter core could be stored in this space. To provide additional light for core examination, three windows would be installed in the wall of the trailer above the examination table. Electrical outlets of 20 Amp capacity at the end of the examination table would accommodate the high-intensity photo-flood lights used for core examination and photography. A box-strapping machine was assigned a position adjacent to the core examination table and would be used to seal core-boxes for storage or shipment.

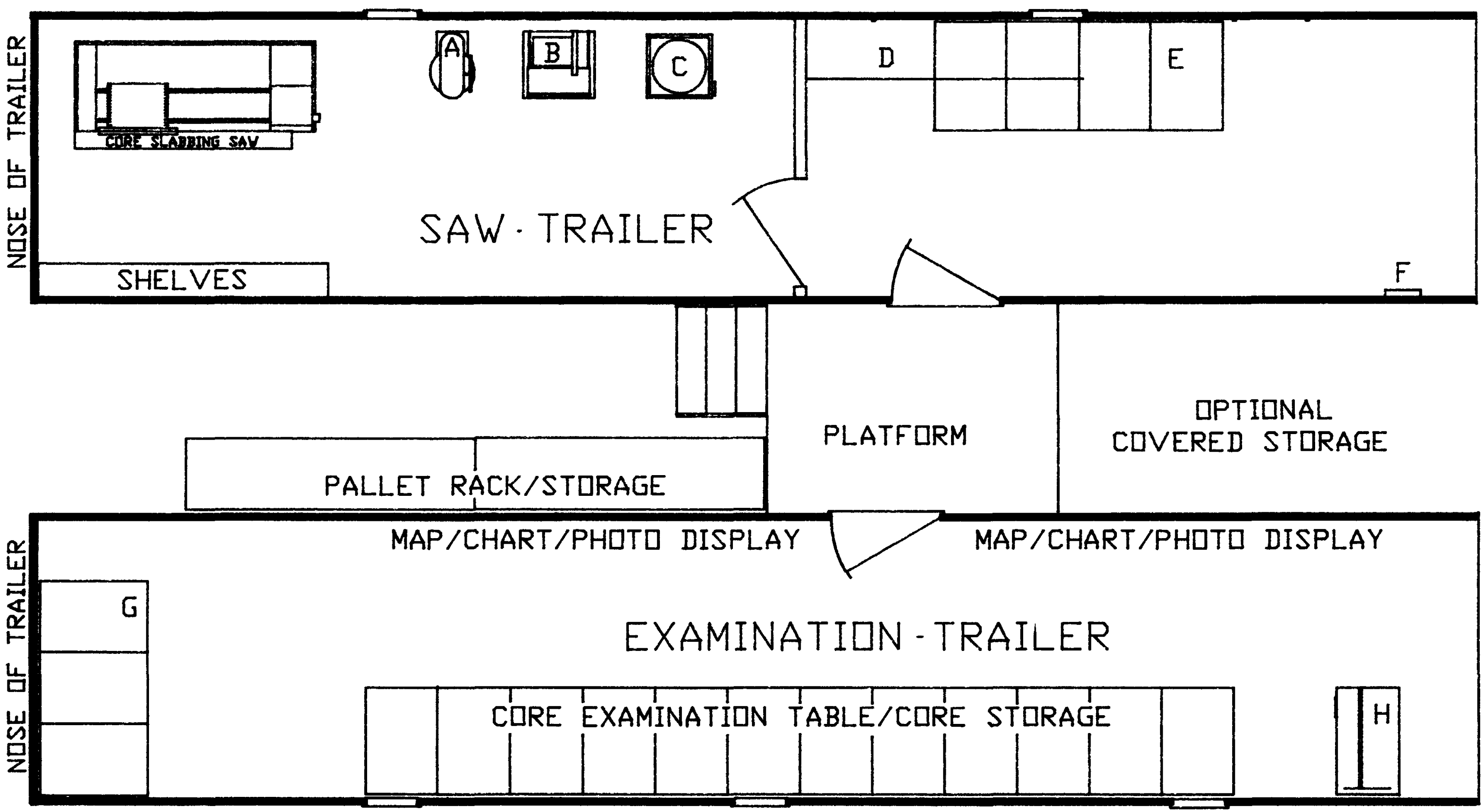
When located at Cajon Pass, California, the examination-trailer was often a gathering place for principal investigators, visiting scientists, government officials, school groups, etc. To properly discuss the nature of the core-samples, the geologic setting of the drill-site, etc., a large area was needed to display maps, charts, and photographs. The wall space opposite the examination table was ideal for this purpose and has been extensively used for the display of a variety of graphic materials.

## SAW-TRAILER

The DOSECC Sample Handling and Curation Protocol specified that subsequent to initial examination and photography, all non-friable cores would be slabbed on-site. To accomplish this task and to house the equipment needed for various types of sampling, the third trailer was designated the saw-trailer. This trailer was divided into two areas to muffle the noises generated while the cores were being sawn. A sound-insulated wall would be added to isolate the noisiest equipment in the forward half of the trailer. As indicated in figure 4, the plan included a large core-slabbing saw in the raised nose of the trailer. Shelves for the storage of diamond saw blades, tools, etc., would be installed along an adjacent wall. The remainder of the space in the saw-room was for a drill press/core plugger, a core-trim saw, and a lapping machine. The other half of the trailer would be used to store and assemble core boxes. In this area, a series of hollow-core steel beams would span the width of the trailer at 3 ft. below the ceiling and would be used to store core boxes. A large table, foot-operated box stapler, and related equipment would also be positioned in this area and be used for box assembly and sample shipping.

## ELECTRICAL LAYOUT AND INSTALLATION

The electrical equipment and lighting needs of the trailers were addressed after the on-site configuration, use designation, and sample-processing protocol had been determined. We decided that, if possible, equipment would be connected by plug outlets. This allowed for repositioning, addition, or removal of equipment as project requirements changed. The




A: DRILL PRESS/CORE PLUGGER
B: TRIM SAW
C: ROTARY LAP
D: OVERHEAD STORAGE
E: OVERHEAD STORAGE
F: MAIN ELECTRIC POWER PANEL
G: ARCHIVE STORAGE
H: BOX STRAPPER

FIGURE 4. FLOOR PLAN FOR EXAMINATION & SAW TRAILERS

probable power requirements and sources (drill rig, commercial, and field generator) were evaluated and a 220/110 Volt 4-wire (3 phase + common) system was determined to be the most practical. With these decisions made, the purchase of equipment and the layout of the electrical distribution system began.

Since specific distances between the trailers could not be determined until the trailers were positioned on-site (the distances would change from site to site), a main power panel would be installed in the saw-trailer. The power panel (fig. 5) would have a 200 Amp. main breaker with 26 distribution circuit slots and would have the capacity to accept piggy-back type dual breakers which would allow for the doubling of 110 volt circuits. The other trailers would be serviced by 1 1/2 inch flexible conduit which would feed to connection boxes F2, F3, and F4 in the rear of each trailer. Figures 6 and 7 are wiring diagrams for each trailer and identify breaker numbers for each circuit. Three-wire Romex cable would be used for most circuits and it would terminate at connection boxes. The wire size was determined by the circuit load and breaker rating (30 Amp.-10 gage, 20 Amp.-12 gage, 15 Amp.-14 gage). The general-service outlet-circuits would be placed in the walls, and the other circuits would be placed in the ceiling.

The exceptions to this procedure were:

-The slabbing saw would be connected to the wall box with flex conduit.

-Access platform (connecting shell-structure) lights would be connected by flexible cord to a switched outlet in the saw-trailer.

-The box-making area-lights would be mounted on the bottom of the removable storage shelf and would be connected by flexible cord to a switched outlet in the saw-trailer.

-The exterior flood lights and exterior outlet would be connected by flexible cord to a switched outlet in the office-trailer.

-The variable speed (1 inch per minute to 100 inch per minute) video table drive-unit would be connected by surface mount conduit.

In order to accommodate future needs, the main circuit panel would have several unused breaker slots which could be used for additional circuits. Each trailer's wiring was also designed to function independently, if a main breaker box were installed.

## WATER NEEDS AND SUPPLY

Water needs for the trailers' on-site operation fell into three categories based on the type of usage. The first need was for a supply of water for human consumption. Water for this use had to be quite pure, but of a relatively small volume. Secondly, there was a need for water to cool and flush the core slabbing saw, trim saw, core plugger, and rotary lap. Water for this use must have at least moderate purity and would have to be available only intermittently. Lastly, water would be needed for core washing, hand washing, general cleaning of equipment, floors, etc. This water would have to be moderately pure and available continuously.

Two options for a supply of water for on-site human consumption were considered. Water from the drill-rig water tank could be piped to the trailers and run through a water filtration system to remove impurities or bottled water could be delivered to the trailers on a regular basis by a commercial water supply company. Due to the high cost of water purification systems and the relatively small volume needed, we decided to have bottled water

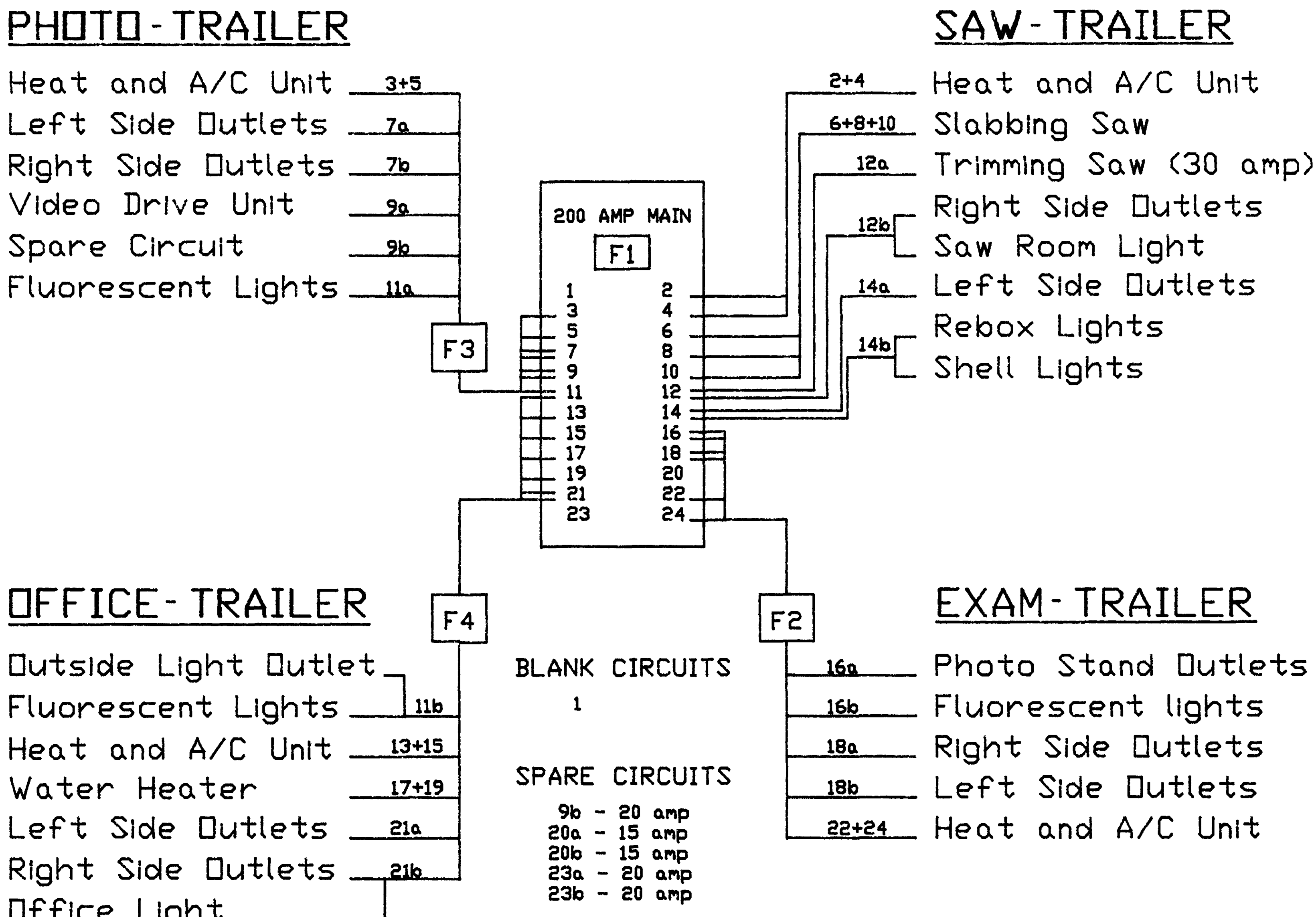
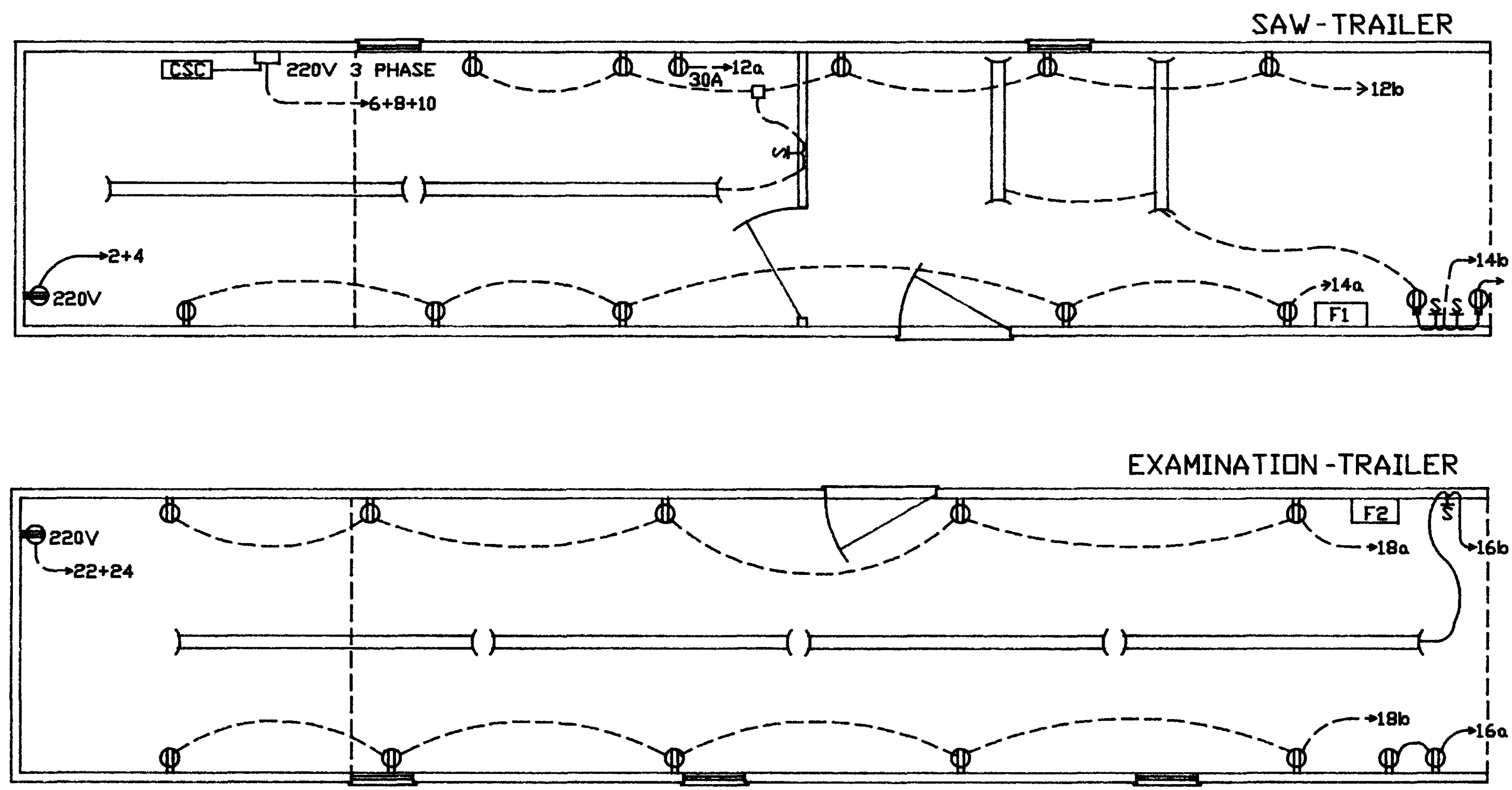
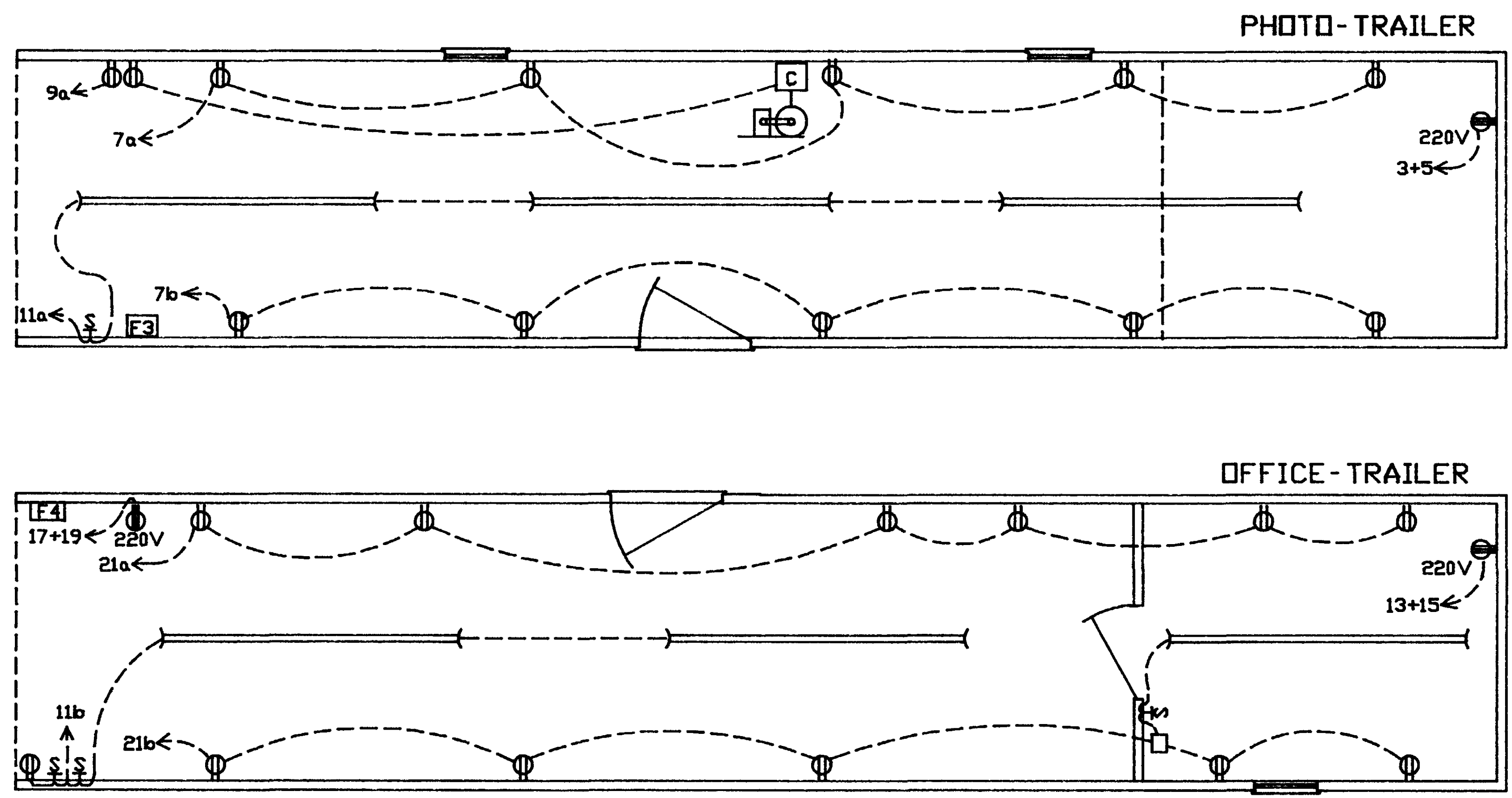



FIGURE 5. LAYOUT FOR ELECRIC POWER PANEL




F1: MAIN ELECTRIC POWER PANEL
F2: EXAMINATION TRAILER ELEC. FEED BOX
FLUORESCENT LIGHTS
LIGHT SWITCH
110 V OUTLETS
220 V OUTLETS
CSC: CORE SLAB SAW (220 V - 3 PHASE)
12b: CIRCUIT # (FIG. 5)

FIGURE 6. WIRING DIAGRAM FOR EXAMINATION & SAW TRAILERS




F3: PHOTO TRAILER ELEC FEED BOX
F4: OFFICE TRAILER ELEC FEED BOX
(symbol): FLOURESCENT LIGHTS
(symbol): LIGHT SWITCH
(symbol): 110 V OUTLETS
(symbol): 220 V OUTLETS
C: CONTROLER FOR SCANNING TRAY
7a: CIRCUIT # (FIG. 5)

FIGURE 7. WIRING DIAGRAM FOR OFFICE & PHOTO TRAILERS

delivered to the trailers. A bottled water dispenser was positioned in the office-trailer and supplied all water needed for human consumption while the trailers were on-site.

Water to cool and flush the trim saw, core plugger, etc., and for washing and cleaning had to have the same general degree of purity and could, therefore, come from the same source. We decided that the purity and volume of water from the drill-rig water tank would be adequate for these needs. Since the exact on-site position of the trailers relative to the water tank could not be determined until both were set-up on-site, we decided to use a single, heavy-duty, "garden" hose as the main supply line from the water tank to the trailers. A tee fitting would be attached to the hose beneath the office-trailer. Two separate hoses would be attached to the tee fitting and serve as secondary supply lines for the office- and saw-trailers. The secondary lines, would enter the trailers via a hole drilled in the floor of each trailer.

In order to provide maximum flexibility in the positioning of equipment, all water lines within the trailers also would consist of garden hoses and fittings. To have a supply of warm water for hand washing, general cleaning, etc., a tee fitting would be attached to the line within the office-trailer for another line to the sink and water heater. A high-temperature hose would supply hot water from the water heater to the adjacent sink.

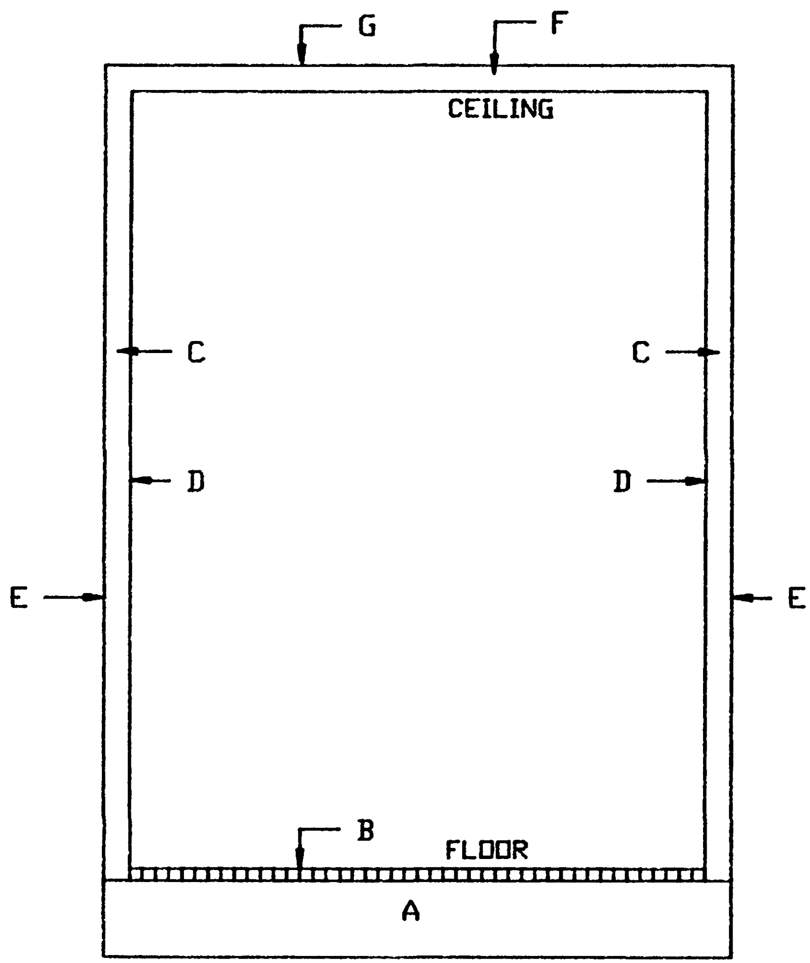
The disposal of waste water from core cuttings, core washings, etc., was of some concern since regulations concerning the disposal of waste water at the drill-site were not clear during trailer construction. In order to assure compliance with environmental regulations, which might be in effect at the drill-site, we decided to have all waste water from the trailers drain into 50 gallon steel drums beneath the trailers. The drums could then be hauled off-site for disposal, be drained into the drill-site mud pit, or drained into the local intermittent drainage system if local regulations so allowed. Each of these options were used at various times while the trailers were on-site at Cajon Pass.

## STRUCTURAL MODIFICATIONS

To function as a clean, well-lighted, safe, and habitable on-site facility, the interior of each trailer had to undergo structural modification. Although the floor, walls, and ceiling of each trailer were in basically sound condition when purchased, the trailers were not originally designed and constructed to function as on-site laboratory facilities. Past usage left the interiors of the trailers in a well-worn condition. Since the trailers were not originally designed to be heated or air-conditioned, much of the interior modification was aimed at creating an environment suitable for human occupation during adverse weather conditions.

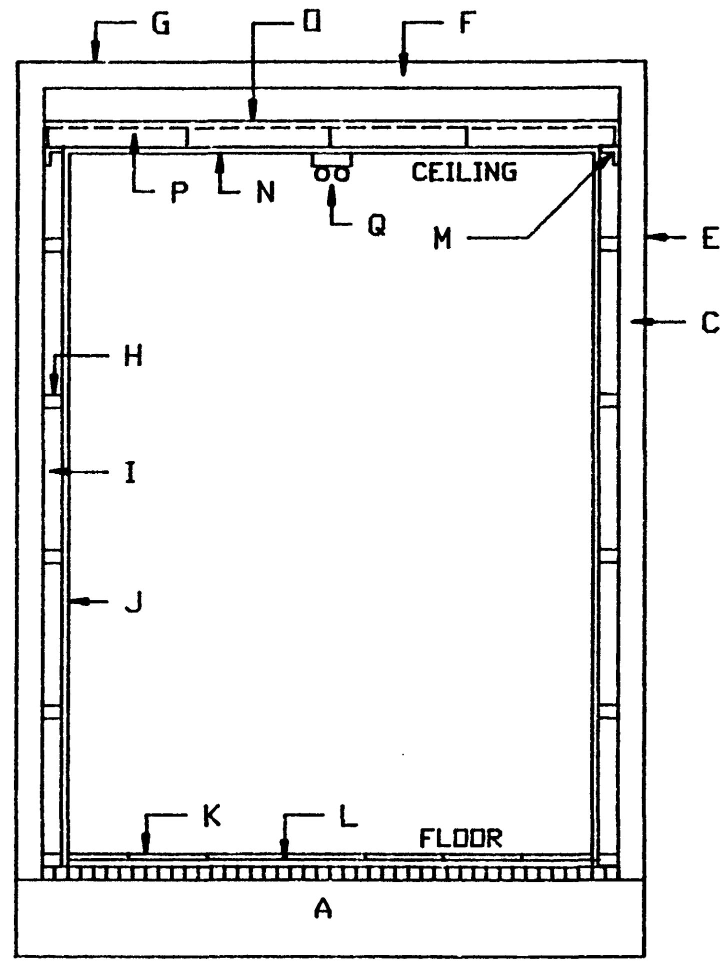
The original walls of the trailers (fig. 8) consisted of a sheet metal exterior which was riveted to parallel upright posts that were welded to the main frames (bed) of the trailers. The original interior walls consisted of 1/4 inch thick plywood that was screwed to the posts. Because these plywood walls were in poor condition and did not properly insulate the interior of the trailers, we decided to cover the original walls with more appropriate paneling.

We also decided that one-inch-thick, wooden furring strips screwed horizontally to the metal posts would significantly increase the rigidity of the trailer walls and would provide a sturdy base for the new wall covering. The horizontal furring strips were spaced 14 inches apart to facilitate the installation of electrical wiring and to provide a convenient space for insulating material. One-inch-thick panels of rigid-foam insulation were placed in the spaces between the furring strips to reduce the flow of heat/cold through the trailer walls (fig. 8). One-quarter-inch-thick plywood sheets were glued and nailed to the furring strips in the saw- and photo trailers. The plywood was painted white and provided a sturdy, light reflective, interior wall surface. Stained wood paneling was used to cover the walls in the office and examination trailers.




**INTERIOR OF TRAILER PRIOR TO RENOVATION**

A: MAIN FRAME (BED)
B: OAK STRIPS
C: UPRIGHT BEAM
D: PLYWOOD WALL
E: SHEET-METAL EXTERIOR
F: METAL BEAM
G: SHEET METAL ROOF




**INTERIOR OF TRAILER AFTER RENOVATION**

H: FURRING STRIP
I: FOAM INSULATION
J: PLYWOOD WALL
K: VINYL TILE
L: EXTERIOR GRADE PLYWOOD
M: SLOTTED ANGLE IRON
N: PLYWOOD CEILING
O: 2 X 4 BEAM
P: BATT-TYPE INSULATION
Q: FLUORESCENT LIGHTS

FIGURE 8. CROSS SECTIONS OF TRAILERS

The original floor of each trailer consisted of long, one-inch-square, oak strips laid parallel on top of the main frame of the trailer. Unfortunately, the oak floor was heavily worn and oil stained. To prepare a smooth flat, floor area, one-half-inch-thick exterior-grade plywood sheets were screwed to the top of the original floor. Vinyl floor tiles were then glued to the plywood to provide a durable and easily cleanable floor surface.

The ceiling of the trailers originally consisted of large pieces of sheet-metal riveted along their edges to metal beams that spanned the width of the trailers. To properly insulate the trailers and to provide support for lighting fixtures, a new ceiling was installed. The new ceiling structure was designed to be rigid, in order to withstand the stress of cross-country transport.

Long pieces of slotted angle-iron that are 1 1/2 in. wide by 2 1/2 in. wide were bolted horizontally to the tops of the vertical metal posts along the sides of the trailers (fig. 8); they are the basic structural support for the ceiling. The angle-iron was positioned 9 inches below the original ceiling to provide space for electrical wiring, insulation, etc. Nominal 2 in. by 4 in. wooden beams that span the width of the trailers were spaced two feet apart on top of the angle-iron bracing and were held in place with screws. Sheets of 1/4-inch-thick plywood which were screwed to the wooden spans, and painted white, acted as a sturdy, light-reflective ceiling. Three-inch-thick batt-type fiberglass insulation was placed on top of the plywood ceiling and formed an effective heat/cold barrier. Eight-foot-long fluorescent lighting fixtures were fastened to the ceiling along its center-line and positioned end-on-end along the length of the trailers.

To provide a comfortable working environment in the trailers under the variable climatic conditions at Cajon Pass, a safe and reliable means of heating and cooling the trailers was necessary. After examining several options, two combination heat-pump/electric heating units were ordered. Each unit has a cooling capacity of 15,800 BTU's, a heat-pump heating capacity of 14,500 BTU's, and an electric-resistance heating capacity of 16,500 BTU's. The original plan was to have the heated/cooled air from the two units distributed to all four trailers via a system of ducts.

After the units arrived and were tested, it was obvious that a separate unit would be needed for each trailer to provide an adequate amount of heating and cooling. Two additional units were purchased and installed. The units were mounted 5 1/2 ft. above floor level in the nose of each trailer. Each unit required a 220 volt, single-phase, 23 AMP electrical supply system. The units were connected to the main electrical system by a wall plug so that the heating/cooling units could be easily disconnected and stored in the trailers during transport.

The original sheet-metal exterior of the trailers, although structurally sound, was pitted and oxidized. To provide a durable and presentable appearance, the exterior of the trailers was resurfaced by a commercial truck maintenance company. The sheet-metal was first acid etched, then painted with a metal primer, and thereafter painted with a coat of blue enamel. Four USGS logos (4 ft. in diameter) were attached to the sides of the trailers with rivets; they contribute to the exterior appearance of the trailers.

## FINAL NOTE

After several months (July-November, 1986) of hectic renovation, the four used semitrailers were transformed into a presentable and functional mobile laboratory. Two weeks prior to the beginning of drilling at Cajon Pass the mobile laboratory was shipped to California via train and emplaced at the drill-site. During the 10 months of drilling at Cajon Pass, approximately 20 scientists used the trailers on a daily basis. Although a few minor modifications to the core-handling procedures were necessary, the renovated trailers generally functioned well. While the trailers were at Cajon Pass, they were visited by approximately 2,000 people, including geologists, engineers, college students, scientists from foreign nations, and reporters from the news media. The positive reactions of those visitors to the facilities and operations were expressed to the USGS and they prompted the writing of this report.

APPENDIX 1

# DOSECC SAMPLE HANDLING AND CURATION PROTOCOL

DEEP OBSERVATION AND SAMPLING
OF THE EARTH'S CONTINENTAL CRUST, INC.
(DOSECC)

1755 Massachusetts ave., N.W., Suite 700,
Washington, DC 20036

May 1986

CONTENTS

## DOSECC SAMPLE HANDLING AND CURATION PROTOCOL

## EXECUTIVE SUMMARY

Studies of samples collected during projects managed and funded by Deep Observation and Sampling of the Earth's Continental Crust, Inc. (DOSECC) as part of the national continental scientific drilling program encompass two time frames: detailed studies during drilling and immediately following hole completion, and reexamination of samples with new analytical techniques and research objectives after project completion. This protocol provides guidelines to ensure that the handling and curation of samples is such to permit these studies. The protocol, along with the project Science Plan, will be the documents governing samples collected for each DOSECC project.

A U.S. Geological Survey (USGS) curation staff at the drill site, under the supervision of a project Sample Manager, will be responsible for initial handling and analyses of drilling samples. The samples will be split at an appropriate time to provide a Working Sample for experiments by the project scientists, and an Archive Sample to be curated at the USGS Core Research Center in Denver, CO.

The protocol describes the responsibilities of the on-site drilling project personnel for sample collection, and lists equipment available for immediate on-site analyses. The project Principal Investigator, working under a DOSECC contract, has the prime responsibility for managing sample analyses and sub-sampling for other investigators as specified in the Science Plan. The Sample Manager and curation staff are provided under an agreement between the USGS and DOSECC addressing sample handling, on-site analyses, and curation as described herein. Responsibilities of archive facilities are specified, and a policy for sample distribution is promulgated.

## INTRODUCTION

Comprehensive scientific information acquired during a Deep Observation and Sampling of the Earth's Continental Crust, Inc. (DOSECC) research drilling project will come from core, cuttings, and fluid samples. Careful handling, analysis, and curation of samples are vital in providing the following critical elements of the national continental scientific drilling program:

1) Materials and information required to accomplish the proposed science goals of a research drilling project.
2) Permanent documentation of the geological, geophysical, geochemical, and hydrological environments encountered in the drill hole.
3) Correlation of sample properties with geophysical, drilling, and mud logs to enhance the interpretation of such logs and allow correlation with results of surface geological, geophysical, geochemical, and hydrological studies.
4) Timely information to the drilling staff and project scientists to allow possible modifications to the Science Plan to maximize the scientific value of the project.
5) Preservation of samples and relevant data for future scientific studies.

Scientists from academic institutions, industry, and government laboratories provided comments in the preparation of this document. This protocol, along with each project's Science Plan, will govern the sample handling and curation activities for DOSECC research drilling activities.

## OBJECTIVES

For the purpose of this protocol, handling will be defined as the physical handling of samples from the drill rig to the on-site sample processing and laboratory facilities, to intermediate archival facilities, and finally to the USGS Core Research Center in Denver, CO. Analyses of the samples on-site, as described in this document, are considered part of sample handling. Curation refers to the identification, boxing, indexing, filing, accession, and deaccession of drilling samples under the control of DOSECC through principal investigators, intermediate archival facilities, and/or the USGS Core Research Center.

The objectives of this protocol are to ensure that all drilling samples and related data collected during DOSECC funded projects are properly handled and curated, and to provide a permanent physical record of the drill hole for future studies. The protocol provides guidelines for scientists requiring sample material from DOSECC research drilling projects.

Basic concepts for handling and curation of research drilling samples and related data are as follows:

1) Samples and data are owned by DOSECC and represent a present and future national resource.
2) Drilling samples will undergo analyses to determine the source of the material from within the geological section penetrated by the drill, to provide documentation of each drilling project, and to identify in a timely manner certain ephemeral properties that must be measured as soon as possible after the drill penetrates the environment. Most on-site analyses will be conducted on whole-diameter cores prior to slabbing.

3) After appropriate analyses on site, a representative sample (the Archive Sample) and suite of descriptive data from the drilling project will be permanently archived for future access by the public at the USGS Core Research Center. As new scientific ideas and analytical tools become available, the Archive Samples will provide opportunities to restudy the material and hence maximize the value of each drilling project.

4) The remainder of the sample (the Working Sample) will be available for subsampling and analyses by the principal investigators and other contracted scientists. It is the obligation of the scientists conducting experiments for each project to curate the Working Sample and subsamples in such a manner as to preserve their integrity, identity, orientation, and location. Upon completion of the project studies, the remaining Working Sample, with thin or polished sections and analytical results, will be archived at the USGS Core Research Center, or at an appropriate curation facility as designated in the project's Science Plan.

5) A timely and complete record of observations, measurements, and techniques employed will be added to the data base following each step of sample handling and analysis.

6) Deaccession of DOSECC samples and/or related data from archive facilities will occur only with joint approval of DOSECC and archive management.

## PERSONNEL AND RESPONSIBILITIES

The final Science Plan for each project, as approved by DOSECC's Science Advisory Committee (SAC), contains detailed information on the sampling program, including sampling intervals, time to be allotted for sampling, and cost estimates. Figure 1 is a general organization chart that indicates individuals having a role in handling and curation of samples.

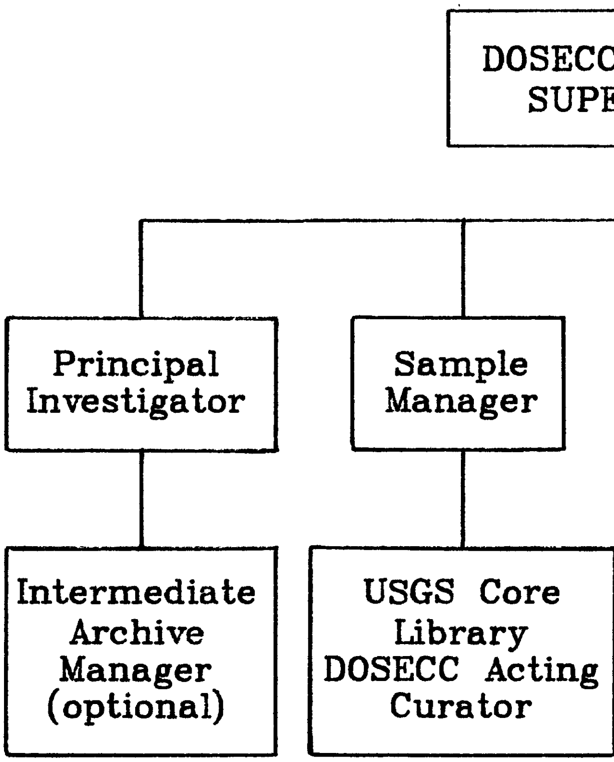
The Drilling Supervisor is a DOSECC employee, and the Logging Contractor and Principal Investigator work under contract with DOSECC. The Sample Manager, along with other sample handling and curation personnel, are employees of the USGS working under an agreement between the USGS and DOSECC. The intermediate archive managers and DOSECC Acting Curator are responsible to DOSECC for sample management and archiving as defined in this protocol.

The Principal Investigator is responsible for implementing and managing the Science Plan, including supervision of scientific personnel and coordination of downhole science experiments with the Drilling Supervisor and other scientific investigators.

The Drilling Supervisor is resonsible for supervising contractors in all aspects of the operation, including drilling, coring, and logging at the drill rig, and for scheduling and coordination of sample collection activities.

The Sample Manager supervises personnel responsible for receiving samples from the drill rig floor and mud logger, conducting and recording sample preparation (cleaning, marking, orientating, etc.) and specified standard on-site analyses, and preparing the Working Sample and the Archive Sample. The Archive Sample is boxed and shipped to the USGS Core Research Center by the Sample Manager at a time appropriate for optimum conduct of the drilling experiments. At the USGS Core Research Center, the DOSECC Acting Curator (at present, the USGS Curator) is responsible for proper archiving of DOSECC samples.

FIGURE 1: SAMPLE HANDLING AND CURATION PERSONNEL



The Principle Investigator is responsible for handling the Working Sample made available by the Sample Manager, including standard fracture and lithologic logs and project-specific analyses, subsampling, on-site storage, and proper curation at an intermediate curation facility if specified in the Science Plan. Transportation of the Working Sample to an intermediate archive is the responsibility of the Principal Investigator. Other project scientists receiving subsamples are responsible for proper handling and curation to preserve the integrity of these materials. Unused portions of the subsamples are to be returned, along with thin or polished sections and analytical results, to the Principal Investigator or the DOSECC Acting Curator as outlined in the Science Plan.

The Logging Contractor is responsible for correlation of the geophysical logs collected downhole with the geophysical scans conducted on the core samples and the determination of true depth intervals from which the sample was cut.

## ON-SITE EQUIPMENT

Facilities and equipment required for handling, standard analyses, and curation of drilling samples on site will be provided by the USGS under the responsibility of the Sample Manager. Sample processing facilities and other temporary buildings or truck trailers will be available for on-site analyses, examination, and storage of archive samples and portions of working samples as required. Housing for the Sample Manager and the handling and curation team during a drilling project will be provided by the USGS.

Table 1 summarizes equipment to be provided by the USGS. Other analytical equipment required for on-site scientific studies will be provided by project investigators.

TABLE 1: ON-SITE SAMPLE PROCESSING EQUIPMENT PROVIDED BY THE USGS.

Facilities

Sample processing
Sample examination and storage
Transport of samples to archive(s)

Equipment

Layout tables with long core trays
core racks
*Core total and spectral gamma analyzer
Sonic scan
*Magnetic susceptibility scan
Video camera and play-back equipment
35-mm cameras for color photographs
Photo table with quartz lights
Binocular microscopes
Sample marking, measuring, and examination (hand lenses) equipment
Sample transport carts
Drill press and plugger with 1-inch diameter standard bit
Slab saw
Trim saw
Exhaust hood for saws
Lapping machine
Sink and water storage tank
Water heater
Core storage boxes
Box stapler
Box banding machine
Desks, chairs, lights, etc.
Vacuum cleaner
Freezer
Hooded chamber

*To be purchased by DOSECC

## ON-SITE SAMPLING PROCEDURES

Most drilling projects undertaken by DOSECC will involve the acquisition of extensive, and often continuous cores. Cuttings and fluid samples will be collected as specified in the individual project Science Plan. A standard fluid sampling schedule may evolve as the DOSECC drilling program develops.

Samples will normally undergo certain standard handling procedures and analyses under the direction of the Sample Manager prior to being transferred to the project Principal Investigator and scientists responsible for project studies and subsampling. Project scientists or their representatives must be on site to accept subsamples when taken by the Sample Manager. Timing is critical when the Science Plan calls for measurement of ephemeral properties by these scientists. A DOSECC Sample Handling Procedure Manual, prepared by the USGS, provides details of specific on-site sampling operations, including numbering, labeling, core aligning, cleaning, marking, on-site analyses, video scans and photography, breaking and slabbing, and data forms.

## CORE HANDLING AND CURATION

Since most coring will be conducted using wire-line techniques, handling and curation procedures begin when the core liner (metal inner tube, with or without plastic liner) is removed from the hole. To accommodate core handling and fluid sampling, use of a triple-tube core barrel with an inner plastic core liner is being considered based on efficiency of core recovery and cost. The core sample handling flow diagram when using a plastic core liner is shown in Figure 2A and will be discussed below. Figure 2B shows the flow diagram when the plastic liner is not used, and will be discussed in the next section. Figures 3 and 4 show continuation of the sample processing flow after slabbing.

Coring Using Plastic Liners. The drilling/coring crew will remove the plastic liner from the inner tube, measure the core recovery, cap each end, and deliver it to the Sample Manager at the on-site sample processing laboratory for initial marking. When transferring the core sample, care will be taken to avoid disturbance or breaking of the core.

In the laboratory, the Principal Investigator or a project scientist will collect fluid samples through the plastic liner if called for in the Science Plan and the presence of fluids of interest is recognized from a study of the mud and drilling logs. Then a sonic scan of the liner will be conducted to determine the optimal locations for cutting the lined core into practical lengths for handling (1 meter or less).

When cut, the Sample Manager and his staff will mark the lined core sections and conduct a total gamma-ray emission scan on each section. If sampling for studies of ephemeral properties (e.g., active chemical processes, stress relaxation, special sample preservation) is called for in the Science Plan, preparation for this sampling will be made at this time.

FIGURE 2A. ON-SITE CORE SAMPLE FLOW DIAGRAM (PLASTIC CORE LINER)

(*,@, and # denote responsible manager - see below)

@ Core liner delivered to sample processing laboratory.

↓

* Mark core liner.

↓

# Volatile/fluid sampling (from Science Plan).

↓

* Sonic scan; cut lined core into 1 meter sections and mark.

↓

* Total gamma-ray emission.

↓

* Remove core sections from liner; place in trays.

↓

* Clean, align, and mark core.

↓

* Video tape recording scan.

↓

* Spectral gamma-ray emission; magnetic susceptibility.

↓

# & * Sample for ephemeral properties (from Science Plan).

↓

- - - - - - - - - - Time Pressure Ends - - - - - - - - - -

↓

# & * Whole-core sampling; plugging; special measurements (from Science Plan).

↓

# Fracture log; outline lithologic log.

↓

* Slab core.

↓

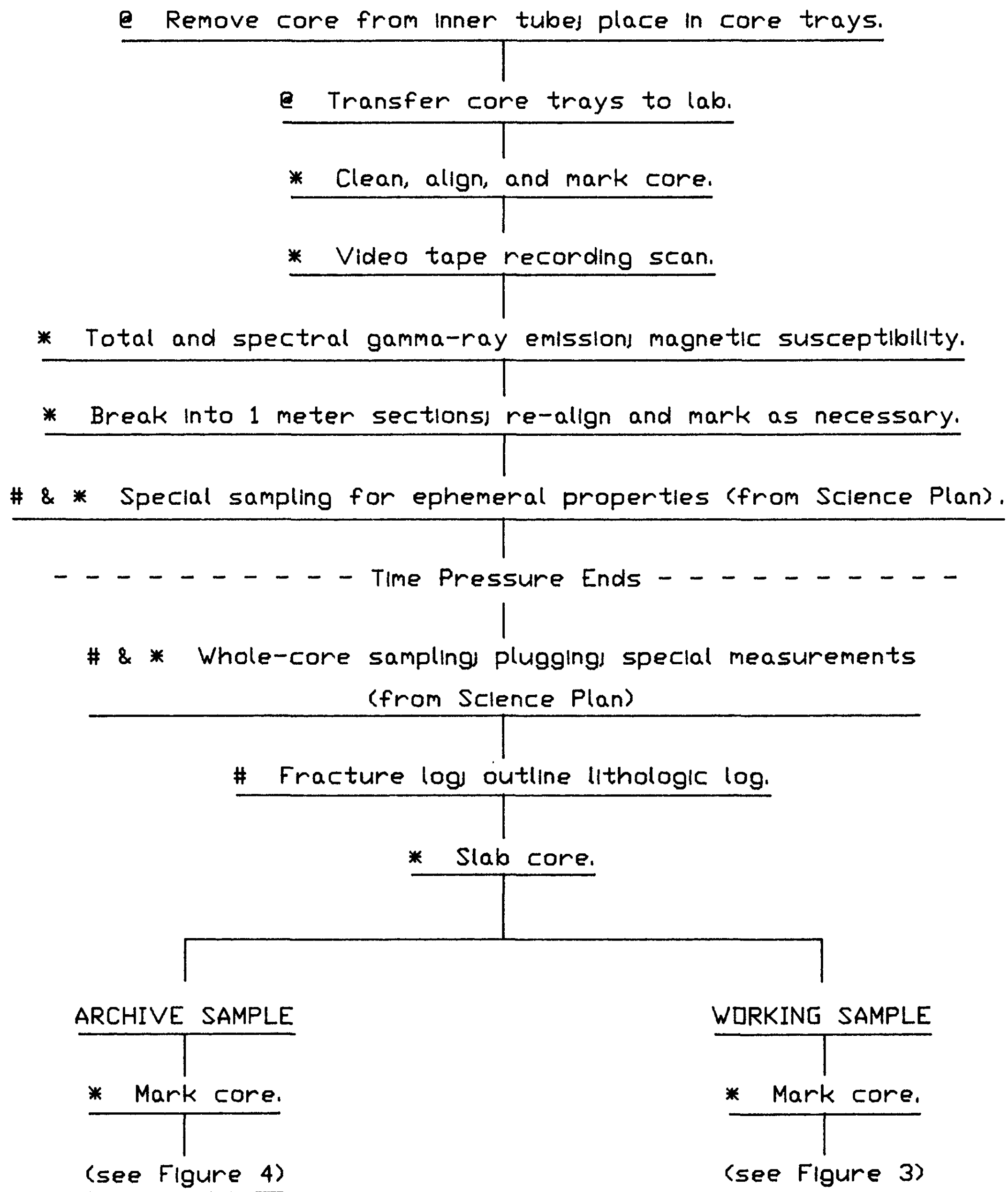
ARCHIVE SAMPLE → * Mark core. → (see Figure 4)

WORKING SAMPLE → * Mark core. → (see Figure 3)

---

@ = Drilling Supervisor  * = Sample Manager  # = Principle Investigator

FIGURE 2B. ON-SITE CORE SAMPLE FLOW DIAGRAM (NO PLASTIC CORE LINER)
(*, @, and # denote responsible manager - see below)




@ = Drilling Supervisor * = Sample Manager # = Principle Investigator

FIGURE 3. CORE WORKING SAMPLE FLOW DIAGRAM

(Principal Investigator Responsibility)

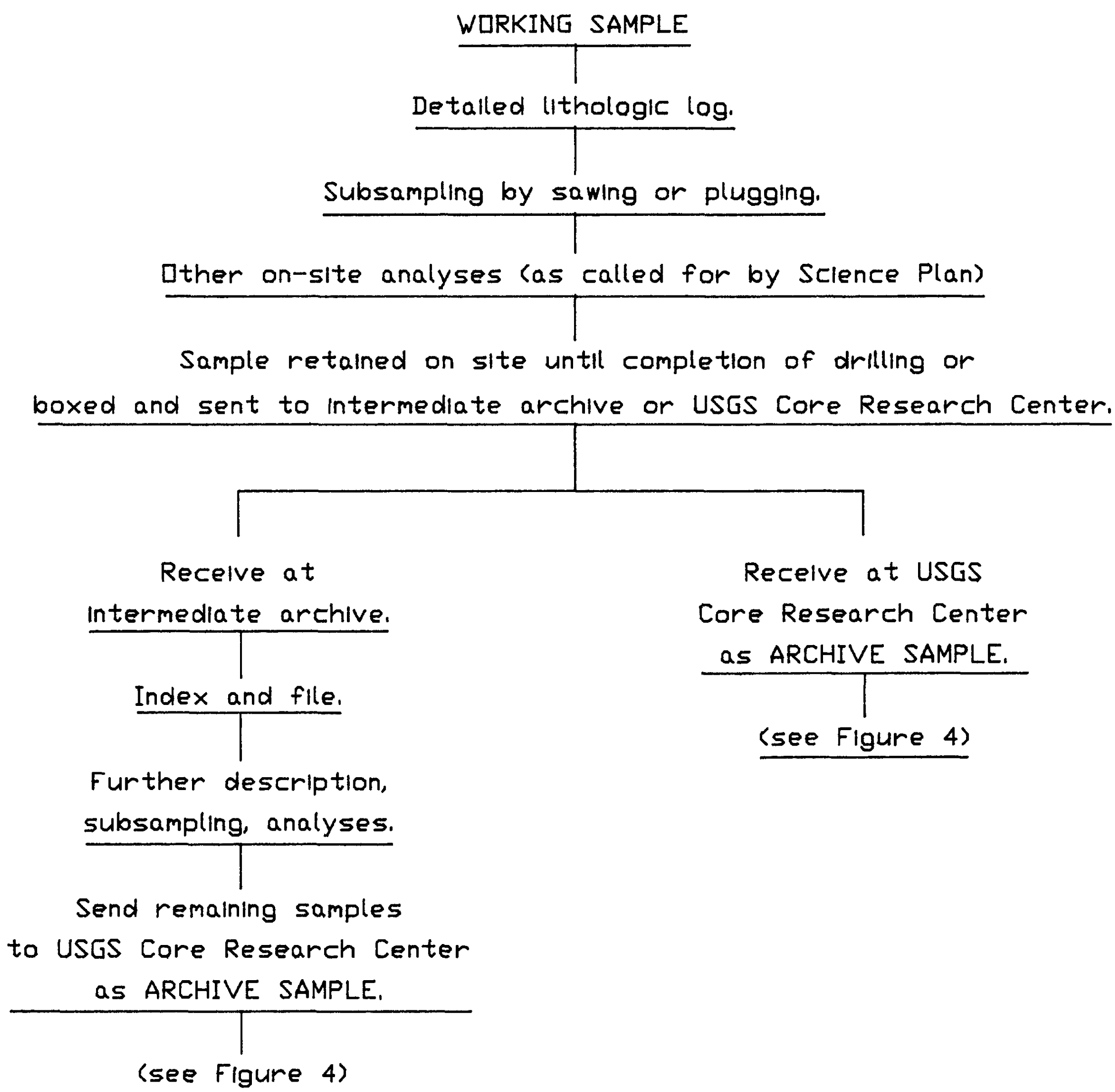


FIGURE 4. CORE ARCHIVE SAMPLE FLOW DIAGRAM

(Sample Manager Responsibility)

ARCHIVE SAMPLE

Color photography (copies to archive, drill site, project scientists, etc.)

Ship to the USGS Core Library.

Index and file at USGS Core Research Center.

Non-destructive study.

Combine with WORKING SAMPLE.

Deaccession procedures.

The core section will then be removed from the plastic liner and placed in trays, where it will be cleaned, aligned, and marked. A video recording tape scan of the sample will be conducted, followed by spectral gamma-ray and magnetic susceptibility scans. Then whole-core sampling will be conducted for ephemeral properties as directed in the Science Plan. At this point in the flow diagram, the pressure to collect subsamples from the core to measure time-dependent properties is relieved.

If short sections of whole core or plugs of whole core are required for later analyses, as identified in the Science Plan, such subsamples will be taken by the Sample Manager at this time. Each of the subsamples will be assigned a unique identification number before being removed from the core sample. The scientific investigators receiving these subsamples for analyses are responsible for returning unused portion to the Principal Investigator or the DOSECC Acting Curator upon completion of analyses, along with any thin or polished sections, experimental techniques, and the copies of the analytical results.

Fracture logs will be run before breaking and slabbing the core. This work will be conducted under the supervision of the Principal Investigator and provides an opportunity to begin an outline lithologic log. The Science Plan will identify the responsible investigators. At this point in the core processing flow, the Science Plan may call for occasional delay of one or two days before going to the next step (slabbing of core) to enable project scientists to study the whole core for inhomogeneous textures and composition that may be disturbed by division during slabbing. Some additional whole core subsamples may be required.

An appropriate width longitudinal slab will be made of each core section. The slab will become the Archive Sample and be marked, photographed, boxed, and transported by the Sample Manager to the USGS Core Research Center in Denver, CO. The remainder of the core is marked, and then becomes the Working Sample for distribution and study under the direction of the Principal Investigator as defined in the Science Plan. In special instances, a project Science Plan may specify that, at this point in the processing, all of the whole core will be sent to the USGS Core Research Center for subsequent slabbing and further processing.

Coring without Plastic Liner. If a plastic liner is not used, the drilling and coring crew will remove the core from the inner tube, place it in core trays, and transport it to the sample processing laboratory. When transferring the core sample, care will be taken to avoid disturbance or breaking of the core.

In the laboratory, the core will be cleaned, aligned, and marked. A video tape recording scan will be conducted, followed by gamma-ray emmision and magnetic susceptibility scans. Then the core will be broken into 1 meter sections and realigned and marked as necessary.

If studies of ephemeral properties is called for in the Science Plan, appropriate samples will be collected at this time. The time pressure to collect subsamples from the core is now relieved, and the flow of sample processing becomes the same as for the core recovered in plastic liners.

Working Sample. Normally the Working Sample will be prepared, described, subsampled, and stored at the drill site for a specified period of time. In special cases, the project Science Plan may specify that the Working Sample be transported immediately to an intermediate archive or the USGS Core Research Center.

The Principal Investigator and other project scientists will prepare a detailed lithologic log from the Working Sample (Figure 3), using the standard format described in the DOSECC Sample Handling Procedure Manual. Subsamples for experiments approved in the Science Plan may then be taken. No sample may be removed until assigned a unique identification number. Further on-site analyses as provided for in the Science Plan are the responsibility of the Principal Investigator.

Upon completion of drilling, the Principal Investigator is responsible for delivering the Working Sample to an intermediate archive as specified in the Science Plan or to the USGS Core Research Center for further study and subsampling. If the sample is transferred to an intermediate archive, the Principal Investigator is responsible for the sample and making it available for additional studies.

Two years after completion of the drill hole, the remaining Working Sample and associated thin or polished sections, analyses, data compilations, etc., will be sent by the Principal Investigator to the USGS Core Library to be merged with the Archive Sample unless other arrangements are stipulated in the Science Plan. If the Working Sample is kept at the intermediate sample archive, DOSECC retains ownership of these samples and is responsible for decisions on deaccession of such samples.

Archive Sample. The Archive Sample will be photographed in color on site and shipped to the USGS Core Research Center (Figure 4). This sample will be preserved for visual inspection and examination, and no subsampling will be allowed without written approval from DOSECC. At the USGS Core Library, the DOSECC Acting Curator assumes responsibility for the maintenance of DOSECC samples, including indexing and filing for availability by the public 1 year after completion of drilling or, for multiyear drilling projects, after an appropriate conference of principal investigators to review interim results for preparation of publications. When the remainder of the Working Sample is received at the USGS Core Research Center, DOSECC and the DOSECC Acting Curator will decide action on requests for subsamples from the Working Sample. Any decisions for deaccession of DOSECC samples will be made by DOSECC.

True Depth Determination and Marking. After geophysical logging is completed in the project drill hole, the Logging Contractor will correlate the gamma-ray emission and magnetic susceptibility scans of the core with appropriate logs to determine the true depth intervals of the core sample. These depth determinations will be sent to the Sample Manager or the DOSECC Acting Curator, who will distinctively re-mark the Archive and Working Samples. If the Working Sample is under the control of the Principal Investigator, the DOSECC Acting Curator will notify him/her as to the proper re-marking. Scientists working on subsamples also will be notified by the DOSECC Acting Curator as to the true depth determinations.

CUTTINGS

During drilling, with or without continuous coring, specified amounts of cuttings will be collected at regular depth intervals as prescribed in the Science Plan. If continuous coring does not provide adequate samples, the Principal Investigator may direct collection of cuttings at more frequent depth intervals. Under the direction of the Sample Manager, cuttings will be collected, washed, described, subdivided, and placed in properly labeled sample bags by the Mud Logger. The Sample Manager will send the Archive Sample to the USGS Core Library for indexing and filing.

The Working Sample of cuttings is described by the Principal Investigator, after which subsamples will be distributed as specified in the Science Plan. Any material remaining from the Working Sample and its subsamples, including thin sections, board-mounted material, and analytical data, will be returned to the DOSECC Acting Curator upon completion of analyses for filing.

FLUIDS

Collection of fluid samples will be identified in the Science Plan and may include samples of drilling fluid and additives to provide information on contamination of formation fluids. These samples will be collected by the Mud Logger under the direction of the Principal Investigator. Fluid sampling from the core will be conducted by the Principal Investigator at a time designated by the Sample Manager. Some fluid analyses may be conducted by the project scientists at the drill site, whereas other chemical and isotopic constituents can be analyzed in laboratories if the samples are appropriately preserved with stabilizing agents and properly stored in containers.

Science Plans that require the collection of fluid samples as part of a project will specify the collection method and the techniques for preservation.

## ARCHIVING PROCEDURES

DOSECC, in consultation with the DOSECC Acting Curator and the project Sample Manager, will assign appropriate unique identification numbers to each project sample and subsample. These identifiers will be used by all scientists and archive managers for documentation. Since representatives of the three classes of samples (Archive Sample, Working Sample, and/or subsample) associated with a DOSECC drilling project may be in the process of analysis or storage at several locations, careful records will be taken by the Principal Investigator or intermediate Archive Manager and sent to the DOSECC Acting Curator as to the person responsible for each sample. Scientists receiving subsamples must handle such materials in such a manner that unused portions may be integrated into the Archive or Working Sample upon return to the proper archive.

Procedures for archiving drilling samples will follow those used by the USGS Core Research Center. Upon receipt, the sample and relevant data are cataloged and a permanent data card is entered into a file. Core sample boxes are given permanent labels containing a library number, the number of boxes in each project, the drill hole identifier plus a subsample identifier if appropriate. This information is simultaneously entered into the archive's master file. Core boxes are then stored.

Cuttings, thin sections, photographs, logs, and analytical data are stored in a manner specified by the DOSECC Acting Curator and cross-referenced to samples collected from the same drill hole. Examination rooms with microscopes and photography equipment will be available at each archive facility holding DOSECC samples.

## SAMPLE DISTRIBUTION POLICY

The policy for distribution of samples produced in DOSECC-supported projects will follow generally that currently being used by the Ocean Drilling Program (JOIDES, 1985; Ocean Drilling Program, 1985). Samples herein referred to are subsamples from the Working Sample, or short whole-core samples collected on-site before slabbing. The following addresses are relevant to this policy:

Chairman, Science Advisory<br>Committee<br>601 Elm St., Room 438C<br>Norman, OK 73019

DOSECC<br>1755 Massachusetts Ave.,N.W.<br>Suite 700<br>Washington, DC 20036

DOSECC Acting Curator<br>U.S. Geological Survey<br>Core Research Center<br>Bldg 810, Entrance S-26<br>Denver Federal Center<br>Lakewood, CO 80225

Principal Investigator--<br>identified for each project<br>or contacted through DOSECC

Distribution of DOSECC samples is undertaken to provide scientists with material to achieve the scientific objectives of the project, and to provide samples to conduct detailed studies beyond the scope of each DOSECC project Science Plan.

The project Principal Investigator and the DOSECC Acting Curator are responsible to DOSECC for distributing, preserving, and conserving sample materials, and, acting on advice from appropriate DOSECC advisory panels, are responsible for enforcing the provisions of this sample distribution policy. They are responsible for maintaining a record of all samples that have been distributed, both on-site and subsequently from the archives, indicating the recipients and the nature of investigations proposed. This information is available to interested investigators on written request. Distribution of sample materials is made directly by the project Principal Investigator at the drill site or from an intermediate sample archive under his/her control, or from the USGS Core Research Center by the DOSECC Acting Curator or the designated representative(s).

DOSECC-SUPPORTED EXPERIMENTS

Each DOSECC project Science Plan approved by SAC will identify scientists to receive samples for analyses. Other investigators wishing to acquire samples from a DOSECC project may submit a written proposal to the Chairman of the DOSECC Science Advisory Committee (SAC). Requests for specific sample studies must be received at least three months in advance of the project starting date in order to allow time for review of the request and suitable on-site sampling program if the project is approved. The request should include a statement of the nature of the proposed research, size and approximate number of samples required to complete the study, and any particular sampling technique or equipment required. Requests will be reviewed by SAC and the project Science Experiments Panel (SEP). Approval/disapproval will be based upon the scientific merits of the project. The scope of a request must be such that samples can be processed, research be completed, and results described in an appropriate report in time for inclusion in the relevant DOSECC project report.

Except for unusual situations, the total volume of samples removed will not exceed one-quarter of the volume of the total sample recovered, and no interval will will be depleted without written approval of DOSECC. A slab sample of core representing the Archive Sample will be retained at the USGS Core Research Center in a pristine condition.

The project Principal Investigator may invite scientists who are not project participants to perform special studies of selected samples in direct support of on-site project activities. In such instances, a careful record of samples removed will be made by the Principal Investigator and Sample Manager. Such investigations will contribute to the project reports to the same extent as original participants in the Science Plan. All requirements of the Sample Distribution Policy apply to such secondary experiments.

Requests to publish DOSECC drilling project-generated results in other than DOSECC reports within twelve (12) months of completion of the drill hole must be approved by the Principal Investigator and DOSECC in writing. After twelve months, other scientists may submit related papers for open publication provided they have already submitted and had accepted their contributions to DOSECC reports. Investigations which are not completed in time for inclusion in DOSECC reports for a specific project may be published in later DOSECC reports; however, project-related articles may not appear in other journals until the appropriate DOSECC project report has been published.

## NON-DOSECC SUPPORTED EXPERIMENTS

Sample Requests. Researchers who wish to use samples for studies beyond the scope of the DOSECC project reports should submit sample request forms to the SAC Chairman for consideration by SAC and the DOSECC Acting Curator. Requestors are required to specify quantities and intervals of samples required, the nature of the proposed research, time required to complete the work and to submit results for publication, funding status, and availability of analytical equipment and space for the research.

Additionally, if the requestor has received samples from DOSECC previously, he/she will account for the disposition of the samples by citing published works, one copy of which must be sent to DOSECC. If no report has been published, the requestor will send a brief report on the status of the research. Unused and residual samples will be returned to the DOSECC Acting Curator when the project has terminated.

Requests for samples from researchers in government, academia, and industry will be honored in a similar manner as original investigators. Such researchers will be subject to the same obligations to publish results promptly in the open literature. Scientists examining DOSECC samples will provide to DOSECC copies of reports published and of data acquired in their research. To insure that all requests for samples can be considered, approval of requests and distribution of samples not indicated in the original Science Plan will be delayed until twelve (12) months after completion of the drilling project, or two (2) months after official publication of the sample descriptions, which ever occurs earlier. The only exceptions to this policy will be made for specific requests involving ephemeral properties. Copies of original core logs and data will be kept on open file at the DOSECC office and at the USGS Core Research Center in Denver.

Sampling Limits. It is anticipated that most sample examinations can be accomplished with sample weights of 25 grams or less. Investigators requesting larger amounts will provide justification for the larger sample sizes or for frequent intervals within the total sample. Requests for samples from thin layers, stratigraphically important boundaries, sections that are badly depleted, or sections in unusually high demand, may be delayed in order to coordinate requests from other investigators. Exceptional sample requests will require more time for processing than routine requests.

Investigators who wish to study ephemeral properties may request a waiver of the waiting period. If approved, the requestor may join the original project scientists and incur obligations noted earlier in the section on DOSECC supported experiments.

Funding. DOSECC project samples will be distributed after the requestor provides DOSECC with evidence that funding for the proposed research is available, or unnecessary. If a sample request is dependent upon pending funding, DOSECC may, at its discretion, provide the proposed funding organization with information on the availability of suitable samples. In exceptional cases, where the proposed research is innovative and highly relevant to the scientific objectives of a project, DOSECC may consider funding part or all of the research.

Responsibilities. Investigators who receive samples incur the following obligations:

1. To publish results promptly; however, project-related reports may not be submitted for publication prior to twelve (12) months following the completion of the relevant project unless it is approved and authored by the original on-site scientists under the direction of the Principal Investigator.
2. To acknowledge in pulications that the samples were supplied by DOSECC.
3. To submit twelve (12) copies of reprints of all published works to DOSECC.
4. To submit copies of all final analytical data obtained from the samples to the DOSECC office and the DOSECC Acting Curator.
5. To return all unused or residual samples, in good condition and with a detailed explanation of any processing they may have experienced, upon termination of the proposed research. In particular, all thin or polished sections manufactured on-site or in the repositories are to be returned to the DOSECC Acting Curator.

Repositories. The Archive Sample will be available for examination by interested parties at the USGS Core Research Center. If the Core Research Center has received the Working Sample from the Principal Investigator or the intermediate sample archive, it may be subsampled with the approval of DOSECC and the DOSECC Acting Curator. Only the DOSECC Acting Curator or delegate will remove samples from the archived materials.

Reference Library. A reference library of DOSECC project generated thin or polished sections, sample photographs, and drilling and analytical data will be maintained at the USGS Core Library for the use of visiting investigators. All thin sections produced on-site, at archives, and in the project scientists' laboratories will eventually be availbale at this library. It is recognized that project scientists may require further use of thin or polished sections in post-drilling studies. These sections must be returned to the DOSECC Acting Curator after a borrowing period of three (3) months.

## REFERENCES

Goff, S. 1985. Curatorial policy guidelines and procedures for the Continental Scientific Drilling Program. Draft unpublished report, Los Alamos National Laboratories. 12pp. plus Field Procedures Manual.

JOIDES. 1985. Guide to the Ocean Drilling Program. JOIDES Journal, vol. XI, Spec. Issue No. 4. 93pp.

Michalski, T.C. 1980. U.S. Geological Survey Core Library, Denver, Colorado, Administrative Report. Preliminary unpublished report, U.S. Geological Survey. 20pp.

Ocean Drilling Program (ODP). 1985. Shipboard Scientists Handbook, Ocean Drilling Program, Texas A & M University. ODP Tech. Note No. 3. 170pp.

APPENDIX II

## SUMMARY OF CORE HANDLING PROCEDURES AT CAJON PASS

I) **Core Recovery:**

A) Core barrel placed on catwalk.
B) Core removed from core barrel.
C) Recovered core "caught" in numbered plastic trays as it exits the core barrel.
D) Core washed with local well water.
E) Trays covered, secured, and transported to USGS lab trailers.
F) Unusual situations relative to core recovery photographed and noted.
G) "Catwalk Operations" form completed.

II) **Initial Preparation:**

A) Tray covers removed.
B) Exposed core washed with local well water.
C) Measurement taken of total core recovered.
D) Entire core washed carefully and thoroughly with local water, using sponges and paper towels (as core condition permits).
E) Core segments adjusted to approximate 3 foot lengths using the appropriate number of trays to accomodate the segments.
F) Fractured pieces aligned and fitted together where possible.
G) Fracture match points marked with symbols (□, O, V, etc.) for visual assistance in unique fitting of pieces.
H) Segment numbers assigned. (Segment #1 = bottom segment with increasing numbers upward.)
I) Archive lines added--looking downhole black line on right, red on left.
J) Depth marked on core at one-foot intervals.
K) On-site geologist specifies sample to be wax-dipped for physical properties and fluid analysis.
L) Photographs for sample location indentification taken.
M) Sample for physical properties and fluid analysis prepared.
    1) Sample separated from core. Where necessary, sample separated using conventional rock saw.

2) Orientation maintained by noting it on remaining core and sample.
3) Sample dipped in bee's wax, wrapped with cellophane, and covered with another layer of bee's wax.
4) Sample's orientation and depth marked on the bee's wax.
5) Waxed sample replaced into its original position in the core until photographic documentation completed.

N) Pieces >2" numbered using the following numbering system:
1) Each piece numbered with depth number in tenths of feet (eg. 3445.9).
2) When more than 1 piece located at the same depth can be fit accurately into the core, assigned depth number is supplemented with "-A, -B, -C, etc." (eg. 4221.6-A, 4221.6-B, 4221.6-C).
3) Unfitted pieces >2" assigned depth numbers supplemented with "-1, -2, -3, etc." (eg. 2431.8-1, 2431.8-2, 2431.8-3).
4) Unfitted pieces < =2" placed into appropriately sized plastic bags according to their respective core depth intervals. Bag is labelled. (eg. CORE #XX - RUBBLE FROM INTERVAL 2231.5 - 2234.3).

O) Thin-section specimens identified, documented, and removed. (Note: this step does not necessarily take place in this particular sequence of "Initial Preparation" procedures.)
P) "Initial Core Examination" form completed.
Q) Transfer core to filming room.

## III) Video Recording and 35mm Photography Procedures:

A) Core is aligned end to end in segment order with Archive Lines up. (Facing perpendicular to layed out core, top is on the left.)
B) Labels added for filming (eg. CORE #, SEG. #, DATE, FOOTAGES).
C) Core is dampened using a spray bottle of local water.
D) Core is filmed from top to bottom with overhead fluorescent lights turned off.
E) Core is rotated and filmed at each rotation. (Core rotated either 90 degree turns or 180 degree turns in a counterclockwize direction looking down the axis of the core depending upon the condition of the core.)
F) Specially requested photography, if any, performed.
G) "Core Documentation" form completed.

IV) **Core-Gamma Procedures:**

A) Four-inch "Core Standard" run in static position for a representation of 2" on the recording paper (approx. 8 minutes).
B) Core run:
  1) Each core run independently.
  2) Core must be solid, full diameter or pieced together to form a solid cylinder.
  3) Core run in static position at intervals of 1 foot, for a 2" representation on the recording paper.
C) To end Core-gamma run, the "Core Standard" is run in the same fashion as above.
D) Procedure duplicated for subsequent cores.

V) **Inventory of Core:**

A) Each core is inventoried and reinventoried in detail every step of handling.
B) "Core Inventory Forms" completed.

VI) **Boxing of Cores:**

A) Transfer each segment of core to core storage boxes.
  1) At discretion of handler, fragile or potentially disrupted core wrapped in plastic and/or placed in pvc pipe tube trays with covers and secured with tape, prior to box storage.
  2) Containers labeled with core #, segment #, core interval, box number, and box number of boxes per core.

VII) **Cutting and Slabbing Procedures:**

A) Less than 4-1/2" diameter core:
  1) cut one slab 1-1/4" thick, the full length of the core.
  2) position the core with the archive slab continuous across breaks, fractures, etc.
  3) place original black and red lines on sample material side of the core.
  after cutting, add "up" arrows and depth marks to archive face.
  4) photograph core in each archive box after the box has been filled and "up" arrows and depth marks have been placed on the core.

B) Greater than or equal to 4-1/2" diameter core:

1) cut 2 slabs, 1-1/4" thick, the full length of the core; a) archive slab, b) working slab.
2) position core as with the >4-1/2" diameter core to produce a continuous slab.
3) align segments so cut/break joints are matched. Include part of the break joints on both slabs.
4) make 2nd cut at 90 degree angle to the first cut to produce 90 degree angle on the cut faces of sample material.
5) photograph core in each archive box using same procedure as smaller diameter core.

C) Oriented Core:

1) for core diameter < = 4-1/2", proceed the same as for reqular core except cut core with reference scribe on the archive slab.
2) for core diameter > = 4-1/2", position core with a reference scribe line on the archive slab and another scribe line located 120 degrees counter clockwise from reference (looking downhole) on the working slab.

D) Core #, segment #, which slabs taken, date, and handler(s) recorded on the "Slabbing Record" form.

## VIII) **Core Allocation Procedures:**

A) Allocations approved by the allocations committee or, in rare circumstances, by the acting chief scientist.

B) "Allocation" forms completed, including signatures.

C) Samples packaged with regard to each investigator's request.

D) Samples released either:

1) personally to investigator.
2) to be shipped to investigator.