IDENTIFICATION, HANDLING, STORAGE AND DISPOSITION OF DRILL-HOLE CORE AND SAMPLES

Technical Detailed Procedure MDP-01
NNWSI Project Quality Assurance Program
U.S. Geological Survey

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Identification, Handling, Storage and Disposition of Drill Hole Core and Samples

1.0 PURPOSE:

The purpose of this procedure is to establish a system of documented controls to provide for the traceability and accountability of drill hole core and side wall samples used to characterize geologic media and to aide in the evaluation of potential repository sites for the storage of high-level radioactive wastes.

2.0 SCOPE

This procedure provides amplified instructions and requirements for the identification, handling, storage and disposition of all drill core and samples for the NNWSI Project of the USGS. This procedure is applicable to all safety related activities involving drill core and samples, from procurement to final disposition, in a manner that allows for traceability and accountability through all stages. This procedure may be applied to other nuclear waste storage programs where required.

2.1 Requirement

All drill core, cuttings, and sidewall samples, for the USGS NNWSI Project shall be identified, handled, stored or otherwise disposed of in accordance with this procedure.

2.2 Responsibility

All personnel assigned to Program projects with quality assurance requirements involving identification, handling, storage and shipping of drill core and samples are responsible, where appropriate, for adherence to the quality activities specified in this procedure.

3.0 PROCEDURE

3.1 General

The USGS Geologic Data Center (GDC), Mercury, Nevada, provides space for the Core Library, related services, and field needs of Water Resources Division Personnel.

The U.S. Geological Survey, under a Memorandum of understanding with the AEC, has operated and managed the Geologic Data Center at Mercury, Nevada Since 1959. The center was established primarily for the systematic storage of drill core and samples taken at the Nevada Test Site (NTS).

3.2 Personnel

The GDC is managed by a Geologist-in-Charge who is designated by and responsible to the Chief, Special Projects Branch and who is assisted by a staff of clerical, technical and crafts personnel provided by the USGS, Reynolds Electrical Engineering and Fenix & Scisson.

3.3 Definitions

3.3.1 Core - a cylinder of geologic material removed from a mass of rock by coring and which may become fragmented during drilling or removal operations.

3.3.2 Core index - an arbitrary measure of the integrity of a length of drilled core.

3.3.3 Cuttings - fines and particulate matter resulting from the drilling or augering of geologic material.

3.3.4 Sidewall cuttings - geologic material removed from the sidewall of a drilled hole at a specified depth, usually after the drilling is completed.

3.3.5 Strip log - a continuous and sequential graphic description of the lithologic character of the geologic media throughout the depth of a drill hole.

3.3.6 Flow (Blooie) line - the return line carrying cuttings, mud or foam and water from the surface casing to the shale shaker and mud tanks.

3.3.7 Run - a continuous sequence of uninterupted activities of arbitrary duration.

3.4 Technical Procedures

3.4.1 Rig Crew Activities (Reynolds Electrical and Engineering Co. [REECo]).

3.4.1.1 Core Handling

The core barrel containing the drilled core is placed horizontally in an X-frame rack and clamped in place. The latching snagger is removed from the top of the core barrel and the catcher loosened from the bottom end with the use of a pipe wrench. The core with attached catcher is manually pulled from the bottom end of the core barrel and placed into a v-shaped-trough.

The catcher is removed from the core; this sometimes requires breakage of the core at the catcher junction. Broken or stuck core is flushed from the core barrel using a hose adapter fitted to the bottom end of the core barrel and which is connected to a source of hydraulic pressure. The core is flushed into the v-shaped-trough in a manner that maintains core continuity and drill hole orientation. Hammering the sides of the core barrel is sometimes necessary to facilitate removal of core intervals.

3.4.1.2 Drilling and Handling of Cuttings

Under the supervision of the site geologist, cuttings (chips) are collected from the rig flow (blooie) line on drilling to a designated footage. The cutting chips are placed into a 1-pint white, plastic lined "ice cream" carton. The lid and side of the carton are indelibly labeled with the hole designation and the from-to footage depth of the sample. The container is then turned over to the site geologist.

3.4.1.3 Sidewall Sampling

The depth at which a sample is to be taken is selected. A Latch Body with sampling shoe (bit) is lowered into the drill hole to the specified depth. The shoe is forceably extended beyond the drill stem into the sidewall of the drill hole to penetrate the sidewall and remove a sample of the geologic material which is retained in the extended shoe. The sampling tool with retracted shoe is brought to the surface; the material removed from the shoe and turned over to the site geologist.

3.5 Site Geologist Operations (Fenix and Scisson Inc. [F&S])

3.5.1 Core Handling

The duties and responsibilities of the site geologist are tabulated in Attachment A. In addition, dated messages, work schedules, sampling instructions and specific procedures are displayed on message boards; these are initialed by the site geologists after reading.

(1) Core Preparation and Transmittal. The length of drill core in the v-shaped-trough is measured by the site geologist, recorded and compared to the length of core drilled as reported by the driller. The length of core is noted on Geologists Log and on run number block in core box. The geologist then places the core into a three-partitioned five-foot long, wooden core box (See attachment B). Core sections greater than five feet long, are broken as necessary with a hammer to permit fitting the core into the core box. Core orientation is maintained starting with the upper left partition corner of the core box (top footage of core) and continuing to the lower right hand partition corner of the core box (bottom footage of core) as in reading lines in a page of a book. While maintaining orientation, the box of core is transported to the geologist trailer by the geologist or with the assistance by a member of the drill rig crew.

(2) Core Identification and Logging. A yellow duct-tape label showing the drill hole identification (USW-G1), the core-run number and the from-to footage interval of core drilled is affixed to the right hand end of the core box. A run block (2-inch 2X4) is wrapped with yellow duct tape; labeled with a black indelible marking pen listing the run number, the top or "from footage" of core drilled, the drill hole identification; and is then placed label-face up in the upper left hand corner partition of the core box preceeding the core to show where the drilling interval began. The terminal run block is handled in the same manner, but will list the bottom drill depth footage and is placed at the end of the core for that run in the lower right hand partition corner of the core box. There can be more than one run in a single core box as illustrated in Attachment B. The total length, number of pieces and longest section of core are

recorded on the core index log form (Attachment C) by the site geologist.

The core is marked with an indelible marking pen along its entire length with arrow heads pointing to the down-hole direction and with similar identification at the end of core breaks. Core which was broken to fit the core box is painted red at both matching ends of the break. The core index log (Attachment C) is completed listing the run numbers, interval footage of drill, length of core loss, length broken and core index for the run.

(3) Core Sample Preparation. Core samples are selected for specific physical properties testing. These samples, approximately 1.5 feet in length are for Sandia Laboratories, Los Alamos Scientific Laboratory and the U.S. Geological Survey and others as requested and are obtained by breaking the core with a hammer when necessary. The core sample is measured and indelibly marked to show the down-hole direction. A down-hole arrow head is added to the broken end of the core in the core box and matching ends of the broken core are painted red.

Each code sample is circumferentially wrapped with approximately a two-foot length of heavy duty aluminum foil; the aluminum foil is folded over the ends of the core and tamped-down tightly down using a wood block as a hammer. The wrapped core is taped along the aluminum foil seam with masking tape which is labeled to show the hole identification, core run number, depth at which the sample was taken and the agency for whom the sample is intended.

The wrapped core is dipped in molten beeswax to over half its length, redipped after the wax solidifies and redipped a third time to assure that the end is sufficiently sealed. The other end of the sample core is dipped in a similar manner and then placed in the core box. The sample(s) are then remeasured to

ensure that the footages are correct and the core sample log (Attachment D) is then completed.

(4) Lithologic description. A lithologic description of the core is entered into the lithology log book describing the color, crystallization, percent pumice, percent phenocrysts, and orientation direction of dip using the core description supplement referenced in Attachment E.

(5) Strip log. The strip log is completed using the strip log procedure outline (Attachment F).

(6) Fracture analysis and log. The fracture analysis log is completed using the procedure outlined in Attachment G.

(7) Geologist's narrative log. All appropriate information relative to the drilling operation is entered into the geologist narrative log.

3.5.2 Handling of Cuttings

The one-pint "ice cream" carton containing the cutting chips is logged by the site geologist. A written description of the sample and notations on the colored strip log are also completed at this time. The sample is then ready for transmittal to the Geologic Data Centers Core Library.

3.5.3 Sidewall Samples

The sidewall sample may be removed from the sampling shoe by the site geologist at the drill site. The sample is divided into (1) a sample for carbon dioxide analysis which is placed into a plastic bag; (2) a sample for water content which is placed into a plastic bag or can and (3) a lithologic sample placed into a one-pint plastic lined "ice cream" container or plastic bag. The divided samples are labeled using an indelible marking pen to list the drill hole designation, the depth at which the sample was taken, and the type of sample.

A written lithologic description is entered into the lithology log by the site geologist(s) listing the color of the sample, the sizes of the particles obtained and the general lithology of the sample. The sampling record is completed to

show how many tries were required to obtain the sample, the number of shoes broken and whether or not a sample was obtained.

The samples are then ready for transmittal to the Geologic Data Centers' Core Library.

3.6 Teamster Activities for Transmittal of Samples

The core boxes with core, and any sidewall samples or cuttings samples, normally are delivered to the Geologic Data Center Core Library in a van with padded floor by a designated teamster on a daily basis. After pick-up by the teamster, and before delivery to the Core Library, the core undergoes a radiation safety check to determine that the core is within acceptable radiation limits at a Rad-Safe building. Each core box is identified with a light-green tag that lists the name of the Rad-Safe monitor, the core depth-interval footage, the radiation level and other pertinent information. The bottom half of the tag is retained as a record at the Rad-Safe building. Boxes of core exceeding the acceptable radiation limit are stored in Area 12, NTS.

The boxes of core and any other samples are brought to the Core Library, unloaded from the van onto warehouse carts for inspection, logging-in, and processing by Core Library personnel.

3.7 Geologic Data Center: Core Library Activities

The Geologic Data Center is managed by a Geologist-in-Charge who is assisted by a staff of clerical, crafts and technical personnel. The files and records, including the index of core holdings, are maintained by a chief clerk who is assisted by a clerk-typist. The core and other geologic samples from a drill hole are received, dressed, boxed, displayed or shelved, and sample disposition performed by warehouse library personnel who are assigned specific tasks and responsibilities.

3.7.1 Core Handling and Disposition

(1) Receiving, Inspection and Log In. Each box of core upon arrival from the drill site is checked for correct nomenclature labeling and footage interval, for radiation clearance and for possible damage or loss during transit. A use-designated acquisition form (Attachment H) is used to log in the core.

After insertion of the information from the core boxes, the acquisition form will be filed for inclusion in the monthly activity report (Attachment I). The core boxes are kept in sequential order so that continuous footage intervals and continuity may be determined.

2) Core dressing and boxing. The core is transferred from the wood core boxes into standard, 30X30X3 inch four-partitioned cardboard storage boxes. Care is exercised to maintain the relative position of the core footage at all times. Run blocks wrapped in yellow duct tape are indelibly marked to show run number, hole identification and interval footage within each storage box. The run blocks are placed at the beginning and end of each core sequence within the box. Waxed, core and samples are removed for separate processing and marker blocks inserted in their place to show the interval from which the sample(s) was taken and the intended user agency.

Breaks made in the core to fit the box are painted red on both matching ends of the break and an indelible arrow head added to indicate the down-hole direction at the break.

The hole identification and from-to footage is marked on the end of each box with an indelible marking pen and the information entered into the use-acquisition form.

Waxed samples not intended for shipment are boxed in a similar manner except that a yellow duct-tape label is placed on the end of the box for ready identification and the appropriate information entered into the use-acquisition form.

(3) Core photography. The photographing of core is optional and will depend upon the specific informational requirements for each drill hole. When used, this process consists of the layout of the core storage box nested within its lid on a warehouse cart. Six open core boxes

in sequential footage can be accommodated on a cart in this manner. The dolly is moved under a 3X5 Speed Graphic camera mounted on a metal frame with photoflood lamps. The cart with core is positioned with stops and alignment guides for the first exposure. The core is moistened with water immediately prior to photographing in order to bring out the true color and fabric of the core. The first 3 boxes of core is then photographed, the cart backed out to the second position and the other three boxes of core photographed. The core is then placed in layout or into storage depending on requirements.

(4) Core layout and storage. Most newly dressed core is laid out in the storage boxes with lids up on tiered benches in sequential footage order for inspection and logging in by the Geologist-in-Charge assigned to the drill-hole. The core may remain in layout for one or two days or weeks before it is shelved in storage, depending on the need and prior layout space reservations.

Core samples not intended for transmittal, core which is not required for layout or core that has been logged and released from layout is assigned to shelf space in one of the steel, use-designed racks within the Core Library. A floor plan of each Library building shows rack locations; shelves and columns on each rack are marked for reference. Depending on the box size, each shelf accommodates four to seven boxes of core, thus making it relatively easy to withdraw a single box from a multi-box shelf. All racks are numbered sequentially, and divided vertically into alphabetized columns and horizontally into numbered shelves. This provides an alpha-numeric locator combination for each box of stored core. The first box of core containing the top footage, is assigned box number one, a shelf number, a column letter and a rack number. This combination is added to the information on the end of the core box and is also

noted on the file card in the Cardex System (Attachment J).

The same system is used for the storage and accession of the waxed core samples which are stored in a different location within the main Core Library.

Core which is no longer of immediate interest is removed from the main Core Library and stored on pallets in other Core Library buildings.

(5) Core disposition. To ensure against loss, misfiling, and accident, all transfer of core to and from receiving area, layout benches, and shelves, or from one building to another, are made by appropriate Library staff only. All layouts, sample withdrawals, mailings and requests for miscellaneous services are made on a written request for action form (Attachment K).

Loan of core from the Library is recorded and the record kept is a pending file until the core is returned.

Because of limited display shelving, requests for core layout are processed on the arrival of personnel from a requesting agency.

Non-designated sample requests for three feet of consecutive core or ten feet of assorted core are handled by Library staff. Requests for longer continuous lengths and greater total core require supervisory approval. Shipment of designated core is documented on the Sample Disposition Log (Attachment L). This log is also used for cuttings and sidewall samples.

All requests are recorded in the monthly activities report documenting all Core Library activities.

3.7.2 Cutting Sample Handling and Disposition

Drill hole cuttings are received and logged-in using the sampe procedure as for drill core. The cuttings are washed and screened using ASTM screen mesh sizes 28, 32, or 42. The choice of screen is a judgement factor and will depend on the size of the cuttings, the amount of mud present and other factors. The washed sized cuttings are

dried in a forced-air oven at 140-150°F and set out in small cardboard "postal" boxes with lid and box labeled with the appropriate identification information. These preparative operations are performed by crafts personnel. The boxes with lids erect are turned over to the hole geologist for evaluation and then moved to storage or transmittal to a requesting agency.

3.7.3 Sidewall Sample Handling and Disposition.

Sidewall samples are received and logged-in using the same procedure as for core, and are turned over to the drill hole geologist for evaluation. Part of the sample is forwarded to Holmes and Narver for water content determination; part is forwarded to REECO Environmental Sciences for carbon dioxide determination; and part is examined by the drill hole geologist. Records of the data and information obtained are filed and transmitted as appropriate to the requesting user agency.

In additional, certain sidewall samples are forwarded to the NTS Lawrence Livermore Laboratory facility per written request for their independent evaluation and analysis.

All activities are listed in the monthly activities report for the Geologic Data Center.

3.8 Procedure Review, Approval, Revision and Change

The procedures contained within this document shall be reviewed and approved by technical, and quality assurance personnel. Procedures performed by different organizations should be approved by all affected organizations. Approval of procedures prepared to control the activities of only one organization or part thereof should, in general, be required only by that organization.

After approval and acceptance, all changes and revisions to this procedure and procedures contained herein shall be subject to the same level of control as for the original document and will be in accordance with established document control procedures.

4.0 Attachments

Attachment A - Well Site Duties

Attachment B - Placement of Core, Run Blocks and Samples in Core Box.

Attachment C - Core Index Record Sheet

Attachment D - Waxed Sampling Record

Attachment E - Core Lithologic Description Reference

Attachment F - An Example of a Strip Log Procedure

Attachment G - Waxed Sample Procedures and Fracture Analysis Instructions.

Attachment H - Acquisition

Attachment I - Example of Monthly Activity Report

Attachment J - CARDEX Information Form

Attachment K - Request For Action Form

Attachment L - Sample Disposition Log

Attachment A

WELL SITE DUTIES

Waste Isolation Geologists

1. Insure that core is properly placed in core boxes with the correct footages recorded on the run blocks.

2. Perform all tasks necessary to complete the field analysis, description and documentation of the core runs including:

   a. Lithologic description and log.

   b. Core index.

   c. Waxing samples and sampling log.

   d. Fracture analysis and log.

   e. Strip log - lithology and penetration rate.

3. Record all appropriate data in the geologist's narrative log:

   a. Time (and date, if appropriate) at start of shift.

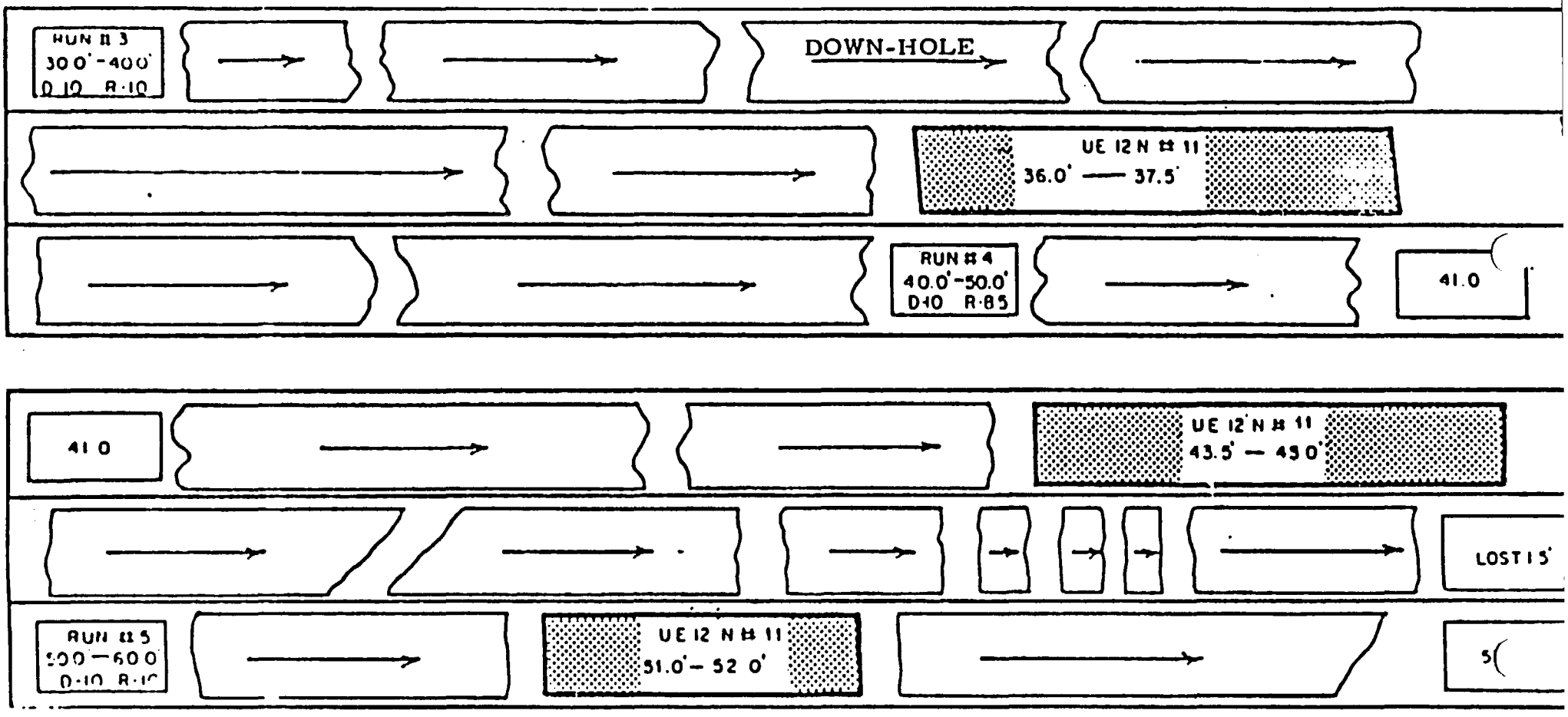
   b. If circulation is lost, the depth and time that it occurs; any means attempted to regain circulation (i.e. LCM's added), and, the depth and time when circulation is regained. Amount of fluid lost (if a calibrated tank is available).

   c. Wherever the rig shuts down; record the time, reason and depth; give the time when drilling starts again (date, if necessary).

   d. Any other information, which the geologist feels, could directly effect either the completion of the drill hole to T.D. or the interpretation of data from and related to the drill hole.

Attachment B

Placement of Core, Run Blocks and Samples in Core Box



UE 25 A # 4	
Top Footage	Bottom Footage

End of Core . :

[illegible]
Geological Survey, [illegible]
[illegible]

[illegible] ___ of ___ pages

Geologist _____
Core hole _____
Total depth _____
Date _____

Core Index [illegible]

[illegible]	[illegible] interval (feet) (meters)	Recovery (feet) (meters)	Intact (feet) (meters)	Broken (feet) (meters)	Joints (per core run)	CI	R	Comments

Attachment D
Waxed Sampling Record

CORE HOLE _____
BOX# _____ to _____

PAGE# ____ of ____

[illegible]	INTERVAL	RECIPIENT	BOX#	INTERVAL	RECIPI

Attachment E

Core lithologic description references

The following references contain procedures and descriptions which are used for tabulating lithologic field data obtained from core at the drill site. The selection of colors, the grouping of features and the methodology in these procedures is for convenience and will vary from geologist to geologist. The procedures are useful for preparing a field strip log and lithologic description of the drill core. After re-examination by the Geologist -in-Charge at the Geologic Data Center, the strip log may be ammended, but will be redone without colors to be used along with lithologic log to prepare an Open File Report describing the lithologic, structural and geophysical features of the drill hole. Details of the lithologic and strip log procedures for tuffaceous , argillitic and granitic rocks with references are contained in the following:

Tuffaceous rock

Spengler, R.W., D.C. Muller, and R.B. Livermore. 1979. Preliminary report on the geology and geophysics of drill hole UE25a-1, Yucca Mountains, NTS. U.S. Geol. Survey Open File Report 79-1244 (enclosure). 43 p.

Argillitic rock

Hodson, J.N., and D.L. Hoover. 1978. Geology and lithologic logs for drill hole UE17a. Nevada Test Site: U.S. Geological Survey Report USGS-1543-1, 17 p.

Hodson, J.N. and D.L. Hoover. 1979. Geology of the UE17a Drill hole, area 17. Nevada Test Site: U.S. Geological Survey Report USGS-1543-2, 36 p.

Maldonado, Florian, D.C. Muller, and J.N. Morrison. 1979. Preliminary geologic and geophysical data of the UE25a-3 exploratory drill hole. Nevada Test Site, Nevada: U.S. Geological Survey Report USGS-1543-6, 47 p.

Granitic rock

Maldonado, Florial. 1977. Summary of the geology and physical properties of the Climax stock, Nevada Test Site: U.S. Geological Survey Open File Report 77-356. 25 p.

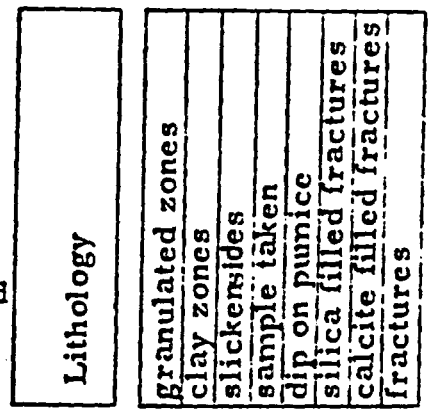
Attachment F

An example of a strip log procedure

This procedure is used to tabulate data as it is obtained at the drill site. The selection of the colors and the grouping of the features is for convenience in preparing a preliminary field strip log and should remain optional to various Geologists-in-Charge. After examination of the core by the Geologist-in-Charge, the strip log is ammended and redone without colors and to be used in the preparation of an Open File Report describing the lithologic, structural and geophysical features of the drill hole.

Lithology 1" = 20' of depth

1. Color in lithology column using appropiate color listed in the handout. Use colors which aptly describe the lithologic characteristics of the core.
2. If there is any core lost, leave a blank space at the end of the depth interval to signify the loss. The blank space should be equivalent to the amount of core lost.



Granulated zones 1" = 20' of depth
blue Mark off the appropiate depth (entire thickness of zones) in the column of the log strip.

Clay zones 1" = 20' of depth
orange Same as for granulated zones.

Slicken sides 1" = 20' of depth
green Same as for granulated zones.

Samples taken 1" = 20' of depth
Using a lead pencil, mark off the appropiate depth interval where a sample has been taken.

Dip on pumice 1" = 20' of depth
Dips on pumice should be taken every 25' or less whenever possible. The dip should be recorded on the strip log at the corresponding depth.

Silica filled and calcite filled fractures 1" = 20' of depth
red for silica, yellow for calcite. Same as for granulated zones except there will only be a line indicating a fracture or a series of closely spaced lines to indicate a set of fractures.

Fractures 1" = 20' of depth
purple All other fractures same as for granulated zones.

Details of the strip log procedure and lithology with references are found in:

Spengler, R.W., Muller, D.C., and R.B. Livermore. 1979, Preliminary report on the geology and geophysics of drill hole UE 25a-1, Yucca Mountains, NTS. Open File Report 79-1244 (enclosure), U. S. Geological Survey, 43 p.