

SUPPLEMENT

RECOMMENDED PRACTICE FOR CALIBRATION OF GAMMA RAY SPECTROSCOPY (POTASSIUM-URANIUM-THORIUM, K-U-Th) LOGGING INSTRUMENTS AND FORMAT FOR K-U-Th LOGS

**BASED ON THE UNPUBLISHED
API RECOMMENDED PRACTICE 65 [RP 65]
Final Draft, July 1996
Written and approved by the
API Sub-Committee on Logging Calibration Facilities**

Issued by

**Well Logging Laboratory
October 29, 2002**

**RECOMMENDED PRACTICE FOR CALIBRATION
OF GAMMA RAY SPECTROSCOPY
(POTASSIUM-URANIUM-THORIUM, K-U-Th)
LOGGING INSTRUMENTS AND
FORMAT FOR K-U-Th LOGS**

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SPECIAL NOTES

This document has not been officially endorsed by the American Petroleum Institute. It is based on the unpublished API RECOMMENDED PRACTICE 65 [RP 65], Final Draft, July 1996. The Well Logging Laboratory includes this document in this technical report for information purposes only.

**RECOMMENDED PRACTICE FOR CALIBRATION
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LOGGING INSTRUMENTS AND
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FOREWORD

a. The document, the API Recommended Practice 65 (RP 65), was formulated by the Subcommittee on Logging Calibration Facilities under administration of the Executive Committee on Drilling and Production Practices, American Petroleum Institute, Exploration and Production Department.

Materials for the Fifth and Final Draft were forwarded to the API Washington Office in July 1996. However, staff limitations have prevented printing of the final document. The API has now ended support for the API Subcommittee on Logging Calibration Facilities. The Well Logging Laboratory at the University of Houston is publishing this document as a service to those using the Natural Gamma Ray Spectroscopy Logging Calibration Facility.

b. The recommended practice is the result of a conclusion reached by a large segment of the oil and gas industry that natural gamma ray spectroscopy logging has reached a status where appreciable benefits could be derived by standardizing the units of measure for natural gamma ray spectroscopy (K-U-Th) logs, procedures for statistically checking logging instruments, and procedures for recording statistical checks.

**SECTION 1
INTRODUCTION AND SCOPE**

1.1 Natural gamma ray spectroscopy logs provide a record of: a) total gamma ray radiation emitted by a formation and b) concentrations of potassium (K), uranium (U), and thorium (Th) that ultimately serve as a source of gamma radiation from earth formations. In order to interpret such logs, it is important to know the accuracy, reproducibility, and response to bed boundaries. The API calibration facility provides the means whereby these three characteristics may be documented in a standard manner. The recommended practice provides the procedure whereby comparable records of logging tool characteristics may be established.

1.2 The recommended practice presents specifications of the API Natural Gamma Ray Spectroscopy Logging Calibration Facility, South Park Annex, University of Houston main Campus, Houston, Texas. This facility is designed to be used in establishing standard API Natural Gamma Ray Spectroscopy Units for K-U-Th logs and for calibrating logging instruments in these units. A standard log format for calibration and

field data is recommended as a means of providing a record that may be compared to all other such records. Optionally, a record in whatever format an operator deems appropriate may be provided in addition to the recommended standard format. Nothing contained in this publication should be construed as endorsing any particular natural gamma ray spectroscopy (K-U-Th) system.

SECTION 2 STANDARD API GAMMA RAY SPECTROSCOPY WEIGHT CONCENTRATIONS FOR K, U, AND Th

2.1 Elemental Concentration for K, U, and Th.

In order to provide the industry with standard elemental concentrations for K-U-Th log measurements, the API has adopted:

- 2.1.1** Potassium (K), weight percentage of elemental potassium, K (not ppm potassium-40, K-40).
- 2.1.2** Uranium (U), weight fraction of uranium expressed as parts per million (ppm) uranium (assuming that uranium is in secular equilibrium with all of its daughter decay products).
- 2.1.3** Thorium (Th), weight fraction of thorium expressed as parts per million (ppm) thorium (assuming that thorium is in secular equilibrium with all of its daughter decay products).

The elemental concentrations of K, U, and Th in the models were selected to produce gamma ray spectra with minimal contributions from any radioactive materials in the cement carrier. The radiation intensities in the various zones are representative of the range normally encountered in oil and gas logging operations.

SECTION 3

SPECIFICATIONS FOR API GAMMA RAY SPECTROSCOPY LOGGING CALIBRATION FACILITY

3.1 Pits have been designed and built for use by industry to calibrate natural gamma ray spectroscopy logging instruments¹. Sketches of the K-U-Th calibration facility are shown in Figures 1 and 2.

3.2 The facility consists of two cylindrical forms each 7.75 feet in diameter, set in activity concrete within bored holes and sealed from the surrounding formation. The overall depth of the pits is 30 feet with 15-foot ratholes on each borehole.

3.3 Each pit contains a series of poured layers or zones of “barren” cement and layers of similar cement into which known amounts of K, U, and Th and mixes of K, U, and Th have been added. Calculations² have shown that zones 5 feet thick will appear essentially “infinite” in vertical extent to a 12-inch long gamma ray detector instrument centered within the zone. Each cement zone was constructed in a single pour. Each pit contains three vertical boreholes with diameters of 6 inches, 8 5/8 inches, and 12 inches. Each borehole extends below the bottom of the pit into a rathole approximately 15 feet deep. The arrangement of the boreholes is illustrated in Figures 1 and 2. Calculations² show that the distance between boreholes and between any borehole and the periphery of the model is large enough that a logging tool response will be essentially that of an infinite medium. The boreholes are equipped with thin fiberglass liners (nominal wall thickness of 1/8 inch) that extend one or two feet into the larger diameter steel cased ratholes. The steel cased ratholes are approximately two inches larger in diameter than the thin fiberglass liners in each test hole. The models were constructed using the materials shown in Table I and Table II.

3.4 Pit 1 contains three radioactive zones separated by three barren zones, as shown in Figure 1.

3.5 Pit 2 contains three radioactive zones, as shown in Figure 2.

3.6 The weight concentrations for the various zones are shown in Table III.

3.7 The sequence of radioactive and barren zones can be used to determine bed boundary response of natural gamma ray spectroscopy logging instruments. The 6-inch zone of high mix can be used to establish the instrument response to thin beds.

SECTION 4 OPERATION OF THE CALIBRATION FACILITY

4.1 Introduction.

The API gamma ray spectroscopy logging calibration facility is located at the South Park Annex, University of Houston Main Campus, Houston, Texas. The facility was constructed using funds contributed through the Institute by member companies and additional funds contributed by individual operating and logging companies. Operation of the facility is a function of the University, according to terms of 1982- 1985 agreements between API and the University of Houston (see Appendix A). Funds for operation and maintenance are obtained from fees paid to the University by users of the facility.

4.2 Policies Governing Operation of the Facility

Procedure for reservation and policy for usage of the facility are presented in Appendix B and are also published on the Well Logging Laboratory web site:

<http://www2.egr.uh.edu/~elee1r7/>

4.3 Schedule of Rates and Fees

A nominal usage fee will be charged for using the facility. A schedule of fees is published on the Well Logging Laboratory web site: <http://www2.egr.uh.edu/~elee1r7/>

4.4 Calibration Procedure

When a logging system is calibrated in accordance with this recommended practice, the record of calibration should be made on the company's log heading and log record format. A logging system is defined as a logging tool of a specific type, model, or series and the associated data acquisition and processing equipment. A logging system may consist of many logging tools and associated equipment, but should be identified by a unique designation. A logging system should be re-designated and re-calibrated if any changes in the system affect calibration parameters or results.

4.5 Calibration Data

Data to be provided to the customer, on request, for each service company logging system (of a given designation) should as a minimum include logs of the following:

4.5.1 Zones. Thick zones to be logged (Figures 1 and 2).

- a. High intensity K-U-Th mix (Pit 2)
- b. Low intensity K-U-Th mix (Pit 2)
- c. Potassium (Pit 2)
- d. Uranium (Pit 1)
- e. Thorium (Pit 1)
- f. The reference barren zones located 10-15 feet below the surface (refer to Figures 1 and 2, Pits 1 and 2).

4.5.2 Static and Dynamic Data. Each of the zones designated in Section 4.5.1 should be logged both statically and dynamically in the 8 1/2 in. diameter borehole.

4.5.2.1 Static Run. The gamma ray detector should be held stationary at or near the mid-point of each thick zone. A record of the measured K, U, Th weight concentration and total gamma ray data (API units) should be provided for each designated zone. The type of presentation to be provided depends on the tool type as follows:

1. Analog tool requirements. If the tool records data in an analog manner, the following specifications should be followed:

- a. Time constant not greater than five seconds.
- b. Record for a minimum of five minutes.
- c. Chart speed set at a minimum of one minute/inch.
- d. K, U, Th, and gamma ray records should be presented in the standard log record format illustrated in Section 5.2 and Figure 3.

2. Digital tool requirements. If the tool records data in a digital manner, the following specifications should be followed:

- a. Specified sample interval not greater than three seconds.
- b. Minimum of 100 samples.
- c. Provide a digital record in standard industry format for each zone.
- d. Analog presentation of K, U, Th and gamma ray records should be presented on the standard log record format illustrated in Section 5.2 and Figure 3, with a chart speed of one minute/inch.

4.5.2.2 Dynamic Run. Log all hole sizes from the mid-point of the lower barren zone to the mid-point of the upper barren zone at 10 ft/min. Additional logging speeds are optional.

1. Provide a minimum of two logs per hole (duplicates) at each speed.
2. Record dynamic gamma ray in the API recommended format (Section 5.2) with a depth scale of 25 inches equal 100 feet.
3. For digital systems, provide the digital record in standard industry format.
4. Records as specified above should be provided for each hole size.

4.6 Forms and Records

The University of Houston shall prepare records to verify use of the calibration facility on API Form 1 (page 15). Full compliance with this recommended practice, including all entries on Form 1, is necessary if the calibration is to be considered official. A copy of Form 1 shall be retained on file by the University of Houston for each use of the facility. Requests for calibration data and copies of calibration logs shall be made directly to companies performing calibration, not to the University. The University will verify company use of the facility on a specific date to calibrate a logging system.

4.7 Restrictions on Use of the Calibration Facility

4.7.1 Refer to the documents “Procedure for reservation and policy for usage of the facility” published on the Well Logging Laboratory web site: <http://www2.egr.uh.edu/~elee1r7/> for restrictions on use of the calibration facility.

4.7.2 The inside diameters of the ratholes located at the bottom of each borehole are somewhat larger (approximately 2 in. larger) than the outside diameters of the corresponding fiberglass liners. This configuration creates a lip that can be snagged with a logging tool in operation. The tool cablehead shall not be lowered below the bottom of the fiberglass liner. Extreme care must be exercised to prevent damage to the borehole with the tool configuration in use (refer to Figures 1 and 2).

CAUTION: The 12 inches diameter borehole in Pit 2 (South, refer to Figure 2) has a deformity that begins slightly above the low mix/high mix zones interface. This deformity restricts passage of large diameter tools, such as MWD-type equipment. **DO NOT RUN LARGE DIAMETER TOOLS UNLESS NOTICE OF DEFORMITY REPAIR IS POSTED ON-SITE.**

SECTION 5

STANDARD RECORD FOR SPECTROSCOPY GAMMA RAY (K-U-Th) LOGS

5.1 Log Heading. The log heading should provide standard well information³ and appropriately designate details of the logging tool⁴, including type and dimension of the instrument detector, e.g., sodium iodide scintillation, 2” OD, 12” long.

5.2 Log Record Format. Figure 3 shows an example minimum recommended format for natural gamma ray spectroscopy (K-U-Th) logs.

5.2.1 Total Gamma Ray. In track 1, record total gamma ray in API units. Scale and sensitivity 0-100 API with 10 API/chart division (CD) or 0-150 API with 15 API/CD; responses greater than 150 API pick up at zero in track 1 on the 15 API/CD scale.

- 5.2.2 Potassium (K).** Record in track 2 using weight percent potassium.
Scale: 0-5% or 0-10%.
Sensitivity: 0.5% per chart division for 0-5%; 1% per chart division for 0-10%.
- 5.2.3 Uranium (U).** Record from center of track 2 to the center of track 3 using ppm U (radiometric).
Scale: 0 (center of track 2) to 20 or 0-40 ppm (center of track 3); greater than 40 ppm pick up at zero (center of track 2).
Sensitivity: 2 ppm per chart division for 0-20 ppm;
4 ppm per chart division for 0-40 ppm.
- 5.2.4 Thorium (Th).** Record in track 3 using ppm Th (radiometric).
Scale: 0-20 ppm or 0-40 ppm;
greater than 40 ppm pick up at zero on track 3.
Sensitivity: 2 ppm per chart division for 0-20 ppm;
4 ppm per chart division for 0-40 ppm.
- 5.2.5** Variations from this minimum recommended format should be supplied as a separate log.

SECTION 6

STANDARD FIELD CHECKS AND DATA

- 6.1 Field Verification.** The minimum procedure for verifying tool performance in the field should either:
- 6.1.1** Determine the centroid channels of the peaks resulting from at least two gamma rays of widely separated energies within the range of K-U-Th logging, and optionally determine the energy resolution of these peaks, or
 - 6.1.2** Verify the system performance by measuring the equivalent K-U-Th concentrations of a field standard containing known quantities of these elements which give responses representative of those seen in the field.

The field verification should be run for 3-5 minutes before and after logging to provide statistical information. A digitized or analog record of these tests should be provided in standard log format and attached at the end of the log.

ACKNOWLEDGMENTS

This document is based on a draft prepared by Hugh D. Scott and finalized by L. C. Shen. Financial support from the following companies is gratefully acknowledged: Baker-Atlas, BP, ChevronTexaco, ExxonMobil, Halliburton, Phillips Petroleum, Schlumberger, Shell, and Statoil.

Below is an alphabetical listing of the members and alternate members as of March 1996 with their affiliations at that time:

R. D. Felder (Exxon), L. L. Gadeken* (Halliburton), J. E. Galford* (Schlumberger), W. A. Gilchrist, Jr.*(Western Atlas), D. C. Herrick (Mobil), M. Moseley (Computalog), D. W. Oliver (Western Atlas), T. Sampson (API), H. D. Scott (Schlumberger), L. C. Shen (University of Houston), H. D. Smith (Halliburton), I. R. Supernaw (Texaco), R. Wiley (Amoco).

* Alternate Member

REFERENCES

1. Arnold, Dan M., Chairman; "API Ad Hoc Committee On K-U-T Logging Calibration, Recommended Calibration Facility Design", The Log Analyst, March-April, 1982, p. 60 - 64.
2. Gadeken, Larry L.; Halliburton Logging Services private communication, Computer Code SAM-CE, Radiation Shielding Information Center, Oak Ridge National Laboratory.
3. API RP31A: RECOMMENDED PRACTICE AND STANDARD FORM FOR HARDCOPY PRESENTATION OF DOWNHOLE WELL LOG DATA, available from American Petroleum Institute, 1220 L St., N. W., Washington, D.C. 2005.
4. API RP 33: RECOMMENDED PRACTICE FOR STANDARD CALIBRATION AND FORMAT FOR NUCLEAR LOGS, Third Edition, April 1974, available from American Petroleum Institute, 1220 L St., N. W., Washington, D.C. 2005.

5. Scott, H. D.; “Analysis of Samples from API K-U-Th Logging Calibration Facility”, Paper MM, Society of Professional Well Log Analysts, 30th Annual Logging Symposium, June 11-14, 1989, Denver, Colorado.
6. Koizumi, Carl J., Ulbricht, Wm. H., and Brodeur, John R.; “Log Data from the American Petroleum Institute Calibration Pits”, Westinghouse Hanford Company, Richland, Washington, Document No. 9050470, January 25, 1990.

TABLE I
MATERIALS USED IN CONSTRUCTION OF THE
GAMMA RAY SPECTROSCOPY LOGGING CALIBRATION
FACILITY

The following materials were used in constructing the various zones of the pits.

Uranium:	Schwartzwalder Mine Ore; Cotter Corp, 9305 West Alameda, Lakewood, Colorado.
Thorium:	H. Schwartz Mine; H. Schwartz, 220 Cedar Avenue, Canyon City, Colorado.
Potassium:	Potassium Zone — KCl (potassium chloride) High Mix Zone — $K_2 S_2 O_8$ (potassium peroxydisulfate) Low Mix Zone — $K_2 S_2 O_8$ (potassium peroxydisulfate)
Barren:	Washed fracture sand (10-20 mesh and 40 mesh); Texas Mining Company, Brady, Texas.
Cement:	White Portland cement (Class A).

TABLE II
MATERIALS FOR API GAMMA RAY SPECTROSCOPY
(K-U-Th) CALIBRATION FACILITY ZONES

Materials ^(a)	ZONES									
	K		Barren		U		Low Mix	Th	High Mix	
Class A Cement	100		100		100		100	100	100	
Aggregate	Silica Sand		Silica Sand		Silica Sand		Silica Sand	Silica Sand	Silica Sand	
(Size & Amt.)	10/20	538	10/20	700	10/20	700	10/20 688	10/20 700	10/20 538	
	SSA-2	154	SSA-2	200	SSA-2	200	SSA-2 190	SSA-2 200	SSA-2 154	
	SSA-1	77	SSA-1	100	SSA-1	100	SSA-1 95	SSA-1 100	SSA-1 77	
K ₂ S ₂ O ₈ ^(b)							(0.9%) 42		(3.98%) 207	
KCl	207	-		-		-		-		
U Ore (.309% U)					(22.3ppm)	9.83	(2.98ppm)	0.77	(10.1ppm)	3.86
Th Ore (2.49%Th)							(5.48ppm)	0.19	(65.4ppm)	2.95
Bentonite ^(c)	2.4	-	2.4	-	2.4	-	2.4	2.4	2.4	
CFR-2"B ^(d)	0.5		0.5		0.5		0.5	0.5	0.5	
Water	120		120		120		120	120	120	
NF-1	0.4		0.3		0.3		0.4	0.3	0.4	
Total	1199.3		1223.2		1233.0		1239.3	1226.2	1204.4	
Weight (lb/gal)	19.7		19.7		19.7		19.7	19.7	19.7	
(lb/ft ³)	147		147		147		147	147	147	
Yield (ft ³ /sack of cement)	8.27		8.33		8.33		8.31	8.33	8.27	

(a) Quantities are weights normalized to 100 units of cement.

(b) Potassium peroxydisulfate.

(c) Percent by weight of water.

(d) Percent by weight of cement.

LEGEND:

SSA-1 = powdered silica sand (silica flour).

SSA-2 = ~ 100 mesh silica sand.

CFR-2"B = cement dispersant agent.

NF-1 = anti-foam agent.

TABLE III

WEIGHT CONCENTRATIONS FOR ZONES IN THE MODELS

Quoted errors are 2σ (95% confidence)

PIT	ZONE	METHOD	K (%)	eU (ppm)	eTh (ppm)
1	U	F	0.25 ± 0.05	22.3 ± 1.7	3.3 ± 0.78
1	Th	F	0.32 ± 0.03	1.12 ± 0.19	65.4 ± 3.9
2	K	F	*	1.36 ± 0.27	2.03 ± 1.18
2	Low Mix	F	*	2.98 ± 0.37	5.48 ± 0.68
1 and 2	High Mix	F	*	10.1 ± 1.1	27.0 ± 2.6
1 and 2	Barren	M	0.26 ± 0.03	0.9 ± 0.09	2.35 ± 0.35

F = Determined from flat can sample analysis⁵.

M = Determined from Marinelli beaker sample analysis⁵.

* Zone uncalibrated for potassium

THE UNIVERSITY OF HOUSTON

API NUCLEAR LOGGING CALIBRATION RECORD

No. _____

1. Company: _____ Company Purchase Order No. _____
2. Arrival: Date _____ Time _____ Billing Order No. _____
3. Departure: Date _____ Time _____
4. Total time on location (hours) _____
5. Total time billed (hours) _____
6. Total bill _____
7. Calibration pit used: Neutron _____; Gamma Ray _____; Both _____
8. Calibration or experimental operation performed:

9. Instrument type _____
10. Instrument serial no. _____ Instrument truck no. _____
11. Calibration log attached, indicate whether official calibration, superseded calibration (log must be attached), or other (see remarks)
12. Remarks: _____

13. AGREEMENT:
 The company using the calibration facility expressly agrees:
1. To perform the calibration, and to use the calibration information thus obtained in accordance with *API RP 33: Recommended Practice for Standard Calibration and Format for Nuclear Logs, Third Edition.*
 2. To assume full responsibility for any damage incurred to the calibration pits while in use by them.
14. Witnessed by: (For the University) _____ Signed: (For the Company) _____
- Signature _____ Signature _____
- Title: _____ Title: _____

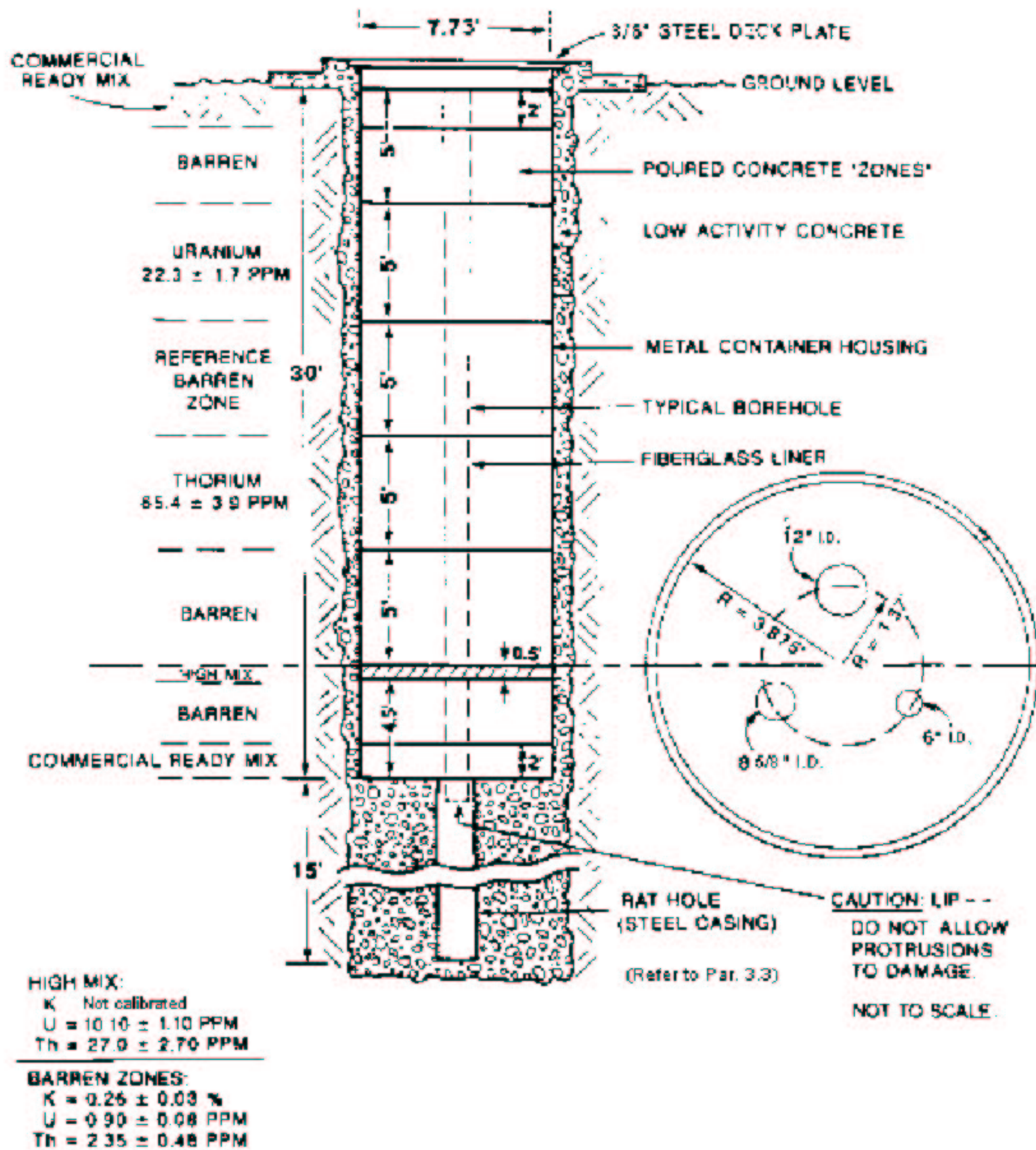


FIGURE 1 K-U-Th Pit No. 1 (North pit)

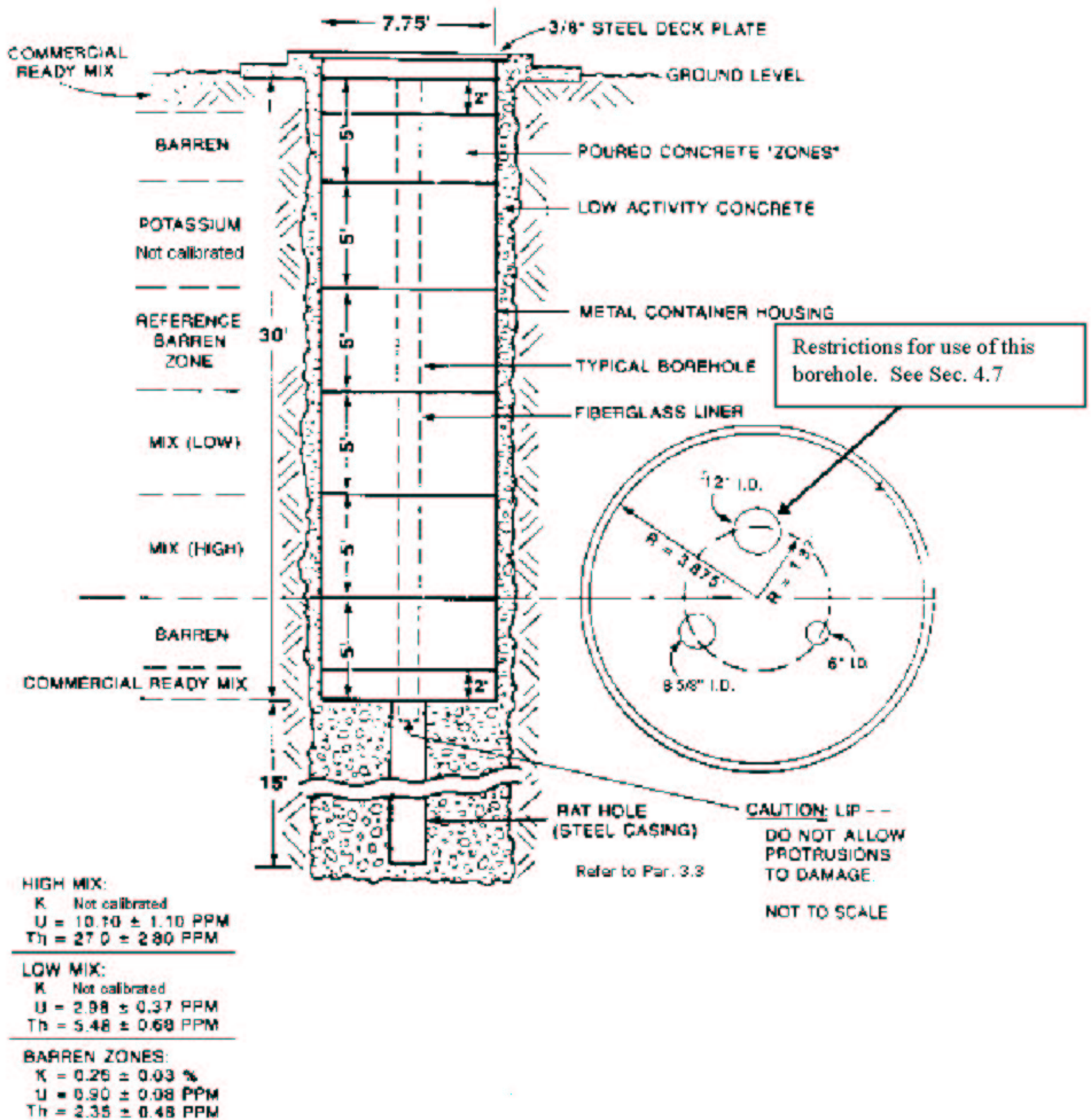


FIGURE 2 K-U-Th Pit No. 2 (South pit)

EXAMPLE RECOMMENDED LOG FORMAT FOR GAMMA RAY
SPECTROSCOPY (K-U-Th) LOGS

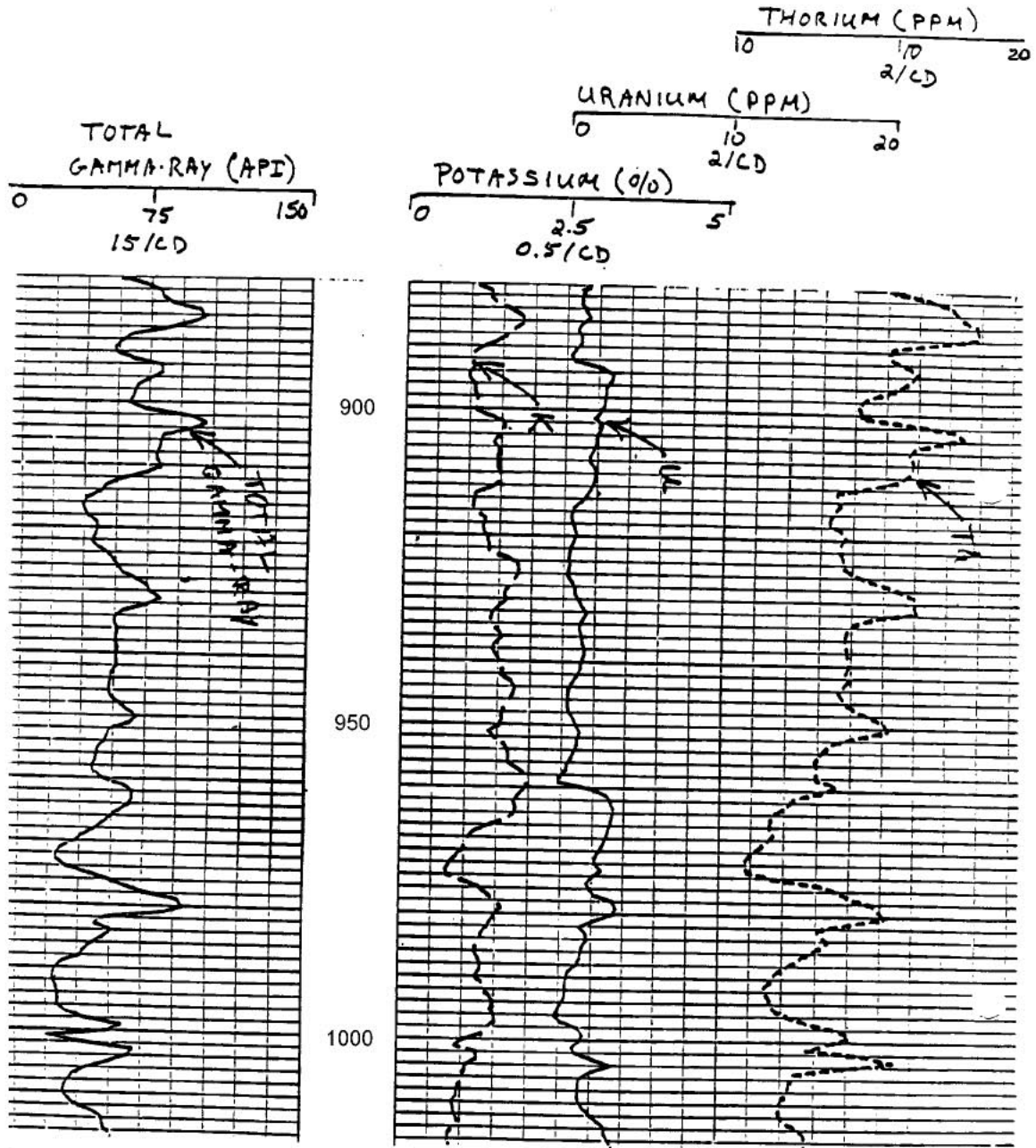


FIGURE 3 Standard Log Record Format

American Petroleum Institute
2101 L Street, Northwest
Washington, D. C. 20037
202-457-7300



APPENDIX A

LEGAL AGREEMENTS

Charles J. DiBona
President

August 19, 1983

Mr. Ted Montz
Facilities Planning & Construction
University of Houston
Central Campus
General Services Building
4211 Elgin Street
Houston, Texas 77004

Dear Mr. Montz:

This letter is your authorization to initiate, with financial support from the American Petroleum Institute (API), work to secure geotechnical information for inclusion in the formal bid package and prepare the bid package for use by the University of Houston (UH) in advertising and securing bids to cover construction of the proposed API potassium-uranium-thorium logging calibration facility.

The soil test boring and production of the required soils field and laboratory data will be performed by McBride-Ratcliff and Associates, Incorporated, and will be accomplished in accordance with their proposal dated July 25, 1983, which is attached hereto and made a part hereof. Preparation of the formal bid package and invitation to bidders will be accomplished by staff personnel of the UH Facilities Planning and Construction Department. Soil test boring work will be accomplished under direction of qualified personnel from UH's Facilities Planning and Construction Department.

This agreement is subject to the following terms and conditions and covers the period September 1, 1983 to October 21, 1983.

1. The total budget covered by this agreement shall not exceed one thousand five hundred dollars (\$1,500). The prescribed work will be accomplished on a cost-reimbursement basis. API will effect payment of fifteen hundred dollars (\$1,500) to UH and costs for work hereunder will be charged against this account. No excess over this agreement's total budget shall be allocated or spent without written authority, duly signed by API's President and

Secretary, or their designees. Any unexpended funds remaining at the end of the period covered by this agreement or on termination of this agreement shall be returned to API.

2. It is agreed and understood that UH is acting as an independent contractor in the performance of any and all work hereunder and shall be solely liable and responsible for any attorney's fees incurred by API, and for the payment of all legal damages awarded to UH's employees or agents, or to any other person or persons, on account of any property damage or personal injury sustained or suffered by, or the death of any person or persons arising out of or in connection with the performance of this agreement due to any act or omission on its part, and shall hold API, its members, officers and employees harmless from such claims, liability or damages, but UH reserves any and all defenses accorded by statute to an agency of the State of Texas.

3. All reports evolving from work hereunder shall be the property of API and may be used by API in any manner API deems appropriate, including use in litigation or other proceedings before governmental bodies. Six (6) copies of the geotechnical engineering report shall be rendered to API no later than October 5, 1983. The technical bid package and invitation to bid shall be prepared in suitable format and in quantities required to satisfy bidding needs plus six (6) copies shall be submitted to the Director, American Petroleum Institute, Production Department, 211 North Eryay, Suite 1700, Dallas, Texas 75201, no later than October 21, 1983.

4. UH agrees to defend work performed under this agreement and to offer testimony thereon before governmental and judicial bodies at reasonable times. API shall pay UH for such testimony at UH's billing rates in effect at the time such services are rendered.

5. UH will maintain complete and accurate financial and technical records pertaining to this work. API shall have the right to examine and/or copy the financial and technical records pertaining to prosecution of work under this agreement and to perform audits to determine the accuracy of the invoices and technical reports.

6. No change, modification, extension, termination or waiver of this agreement will be made unless authorized in writing and in accordance with provisions of this agreement.

7. It is agreed that API shall have the right to terminate this agreement at any time by giving ten (10) days written notice of termination to UH. In the event of such termination, API's sole obligation will be to reimburse UH for costs incurred as of the effective date of termination, including all of UH's commitments to third parties for activities under this agreement. In

the event of such termination, UH shall make every effort to cancel or reduce any outstanding commitments to third parties for activities under this agreement. In no event shall payment include costs and/or anticipated fees for unperformed work or exceed the amount set forth in paragraph 1 above.

8. In the event of inconsistencies between the terms of this agreement and the work proposal attached hereto, the express terms of this agreement shall govern.

9. Paragraphs 1-6 and 8-9 shall survive the termination of this agreement.

If the foregoing correctly sets forth our understanding, please so indicate by signing below and returning one executed copy to the American Petroleum Institute, Production Department, 211 North Ervay, Suite 1700, Dallas, Texas 75201.

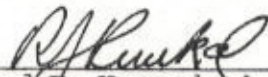
UNIVERSITY OF HOUSTON

AMERICAN PETROLEUM INSTITUTE

BY: _____

BY: 
Stephen Potter, Senior Vice President

DATE: _____

BY: 
Edward J. Hammerbeck, Secretary
R. J. Kunkel for the Secretary

DATE: 8/19/82

University of Houston
Central Campus



Inter-Office Memorandum

Office of the Vice Chancellor of Administration

TO: Dean Eichhorn
College of Engineering

FROM: Peter H. Fitzgerald *Peter*
Vice Chancellor for Administration

DATE: May 17, 1983

RE: Standard Well-Logging Calibration Facility

Dr. Walker has forwarded your memorandum of May 6, 1983 to me with the indication that I should follow up on it. I'm using this memo to advise the offices you mentioned to support the College of Engineering in this activity.

If it has not already been done, an account should be set up in the plant fund to support construction activities. The Facilities Planning and Construction Department are advised that this project has the approval of the Chancellor and they should go forward with appropriate estimates.

Please let me know if you need further information from this office.

PHF/cdb

cc: Hugh Walker
Ted Montz
Julie Norris
Jim Brunjes
Herb Collier



University of Houston
Received

MAY 16 1983

P FITZ

Please handle ✓

University of Houston

Central Campus
Houston, Texas 77004

Office of the Dean
Cullen College of Engineering

TO: Dr. R. Hugh Walker
Interim Chancellor

FROM: Roger Eichhorn
Dean of Engineering

DATE: 6 May 1983

SUBJECT: Construction of Standard Well-Logging Calibration Facility

We have received word from the American Petroleum Institute (API) that it has raised enough funds (approximately \$200,000) to construct a calibration facility at the South Park Annex, UH-UP. The facility will consist of two calibration pits, each containing three holes of different diameters. These pits are to be used as API standards for calibration of well-logging tools that detect radiation in underground formations accessed by bore holes. The facility will also include a single story 375 square foot laboratory building and access road.

Two API standard calibration pits are presently located at UH-UP. These standard pits have been operational since 1958. They are part of the Well Logging Laboratory (WLL) facility of the Electrical Engineering Department in our college. The WLL is presently directed by Professor Liang C. Shen.

The location of this facility was approved by the Coordinating Board on 23 July 1982 (see attachment). The design of the facility is included in a document prepared by the API entitled "Invitation to Bid: K-U-T Logging Calibration Facility Construction." A copy of this will be forwarded to the Office of Facilities Planning & Construction. We request that your office authorize the appropriate offices to assist Dr. Shen in implementing the construction plan.

We believe that the following offices should be involved in this project:

1. Department of Facilities Planning & Construction
2. Office of Sponsored Programs
3. The Well Logging Laboratory, Electrical Engineering Department.

RE:rlb

cc: L. C. Shen
J. Norris
T. Montz





*Alan Duckler - info
Dr. Alex Shultz - file
Dr. Hugo Walker - file*

Coordinating Board

TEXAS COLLEGE AND UNIVERSITY SYSTEM
P.O. BOX 12786, CAPITOL STATION
AUSTIN, TEXAS 78711

July 26, 1982

Dr. Charles E. Bishop, President
The University of Houston System
4800 Calhoun
Houston, Texas 77004

Dear Dr. Bishop:

At its regular scheduled meeting on July 23, 1982, the Coordinating Board, Texas College and University System, granted approval of your request for:

- 1) Relocation of American Petroleum Institute Test Facility - well logging test pits and construction of control office, Central Campus;
- 2) Acquisition of approximately 6.5 acres adjacent to the Downtown College.

In addition, conditional approval was granted for an Animal Care Facility for the College of Optometry, Central Campus.

A certified copy of the minutes of this meeting reflecting the action of the Board will be available at your request within the next few weeks from Mr. James McWhorter, Secretary to the Board.

Sincerely,

Gordon Flack

Gordon Flack
Assistant Commissioner
Division of Campus Planning and
Physical Facilities Development

cc: James McWhorter
Ted J. Montz ✓
Sonja Suessenbach



PRESTON SMITH, CHAIRMAN HERBERT G. SCHIFF, VICE CHAIRMAN ERNEST ANGELO, JR., SAM BARSHOP, CHARLES BUTT, HARRIS CRAWFORD, HAL DAUGHTERY, JR., MARSHALL FURBER, NEWTON GRESHAM, CIPRIANO GUERRA, JR., RY JUDLMAN, MRS. CHANDLER H. LINDSEY, GWYNETHLYN C. MORRISON, ROBERT H. PAPP, WILLIAM B. PATTERSON SR., D.D.S., M.S., MARIE RAMIREZ, M.D., WAYNE THOMAS, M. HARVEY GUN, KENNETH H. ASHBY, ORTHO. COMMISSIONER

APPENDIX B

Procedures for reservation and policy for usage of the facility

Prepared by the

API Subcommittee on Logging Calibration Facilities

I. Pre-visit checklist

- A. Make arrangements with the University of Houston (U of H) -- see Section V
 - 1. Schedule the date(s) for using the facilities (>3 working days notice)
 - 2. Arrange for any U of H personnel needed
 - 3. Furnish U of H a photo, sketch or drawing of tools and decentralization hardware to be used (unless done previously)
 - 4. Obtain API/U of H Agreement "Form 1" or "Form2"
 - 5. Make special arrangements with U of H if planning after-hour operations
 - 6. Notify U of H of any radioactive sources or hazardous materials being used
 - 7. For special needs, such as after-hours operation or blocking traffic temporarily for a long load, notify and request help from U of H police.
- B. Plan for required equipment
 - 1. Provide all tools, pumps, and necessary electronics
 - 2. Arrange for any hoisting equipment needed to supplement on-site equipment
 - 3. Provide safety equipment as needed (hardhats mandatory)
 - 4. Bring 100 ft hose and a pail for filling/refilling water in pit boreholes

- C. Ensure that personnel are familiar with usage rules and procedures in API RP 33 and/or RP 65, and those described below.

II. Pre-logging requirements on-site

- A. Notify U of H of arrival (call phone # 713-743-4411)
- B. Provide executed API Agreement Form 1 or Form 2 to U of H (acknowledging responsibility for any damage to pits)
- C. Ensure that personnel are familiar with on-site hardware
- D. Arrange access to power, water, phones, and bathrooms with U of H representative

III. Logging requirements/restrictions

- A. Applicable to all logging operations
 - 1. Powered backup devices must not be activated in the boreholes and must be replaced by a weaker decentralizing device
 - 2. No exposed hose clamps, fins or other devices which may snag in ratholes or on formations and liners are permitted
 - 3. Rollers are required on any backup decentralizer springs which must be adjusted for minimum contact force
 - 4. Maximum tool diameter must be at least 1 inch less than hole diameter=20
 - 5. Maximum tool weight must be consistent with rating of hoist equipment used
 - 6. Maximum length of any tool section must be 2 feet less than hoist clearance
 - 7. When personnel are not on site, users must rig down, sources must be stored in a shielded container locked to the vehicle, and the gate must be locked.
 - 8. Cover the boreholes so that hand tools or debris will not fall into the boreholes.
- B. Applicable to neutron pit
 - 1. Fresh water cannot be drained from borehole or replaced with any other fluid

2. All backup/contact devices must be approved by an on-site U of H representative
 3. Maximum logging speed is 15 feet/minute
 4. No casings are permitted in the borehole
 5. The lucite guidepipe above the limestone blocks should not be removed
- C. Applicable to gamma ray pit
1. No tool containing a gamma ray source or a neutron source (chemical or accelerator) is permitted in the borehole
 2. The borehole casing must not be removed
 3. The only permissible borehole fluids are fresh water and air
- D. Applicable to K-U-Th pits
1. All backup/contact devices must be approved by an on-site U of H representative
 2. The borehole liners should not be removed
 3. The only permissible borehole fluids are freshwater and air
 4. No tool containing a gamma ray source or a neutron source (chemical or accelerator) is permitted in any of the boreholes

IV. Post-logging requirements

- A. Test pit area cleanup
1. All boreholes must be filled with fresh water
 2. All clutter must be removed from pit areas and buildings
 3. All lids must be replaced over test holes
 4. Gate should be locked upon leaving
- B. API Form 1 and/or API Form 2 must be completed and signed, witnessed by a U of H representative and a copy left at U of H

- C. If the calibration of a tool is to be considered official, a copy of the log (attached to Form 1 or Form 2) must be turned in for archival at U of H

- D. U of H must be notified of any damage to the API facilities.

Repair, which is the sole responsibility of those involved, must be completed as soon as possible

- E. Ensure that U of H has the accurate mailing address for billing

- F. Payment for test pit usage is due within 30 days of receipt of invoice (payment must reference invoice # and dates of pit usage)

V. Useful telephone numbers

- A. Administrative Secretary, U of H EE Department (713-743-4462). Reservations and questions.

- B. U of H: Safety (713-743-5858)

 Police (713-743-0600)

 Emergency (713-743-3333)

April 1995