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PURDUE UNIVERSITY
International Education and Research
International Programs in Agriculture

PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT

(Contract AID/NE-C-1701)

REPORT ON
SHORT-TERM STAFF ASSIGNMENT

Submitted by
DR. WILLIAM C. DAHNKE
Soil Science Department
North Dakota State University
Fargo, North Dakota

April 7 - June 6, 1985

PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT
(Contract AID/NE-C-1701)

REPORT ON
SHORT-TERM STAFF ASSIGNMENT
AT THE
UNIVERSIDADE DE EVORA
EVORA, PORTUGAL

April 7 - June 6, 1985

Submitted by

DR. WILLIAM C. DAHNKE
Soil Science Department
North Dakota State University
Fargo, North Dakota

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PORTUGAL UNIVERSITY INSTITUTES DEVELOPMENT PROJECT

Report on Short-term Staff Assignment

OBJECTIVE

The objective of this consultancy was to assist in the setting up and beginning operation of a soil testing laboratory mainly devoted to testing of soil samples for farmers.

BACKGROUND AND PRESENT STATUS

A soil testing laboratory, to be located at the Nucleo de Valverde (Herdade da Mitra) of the Universidade de Evora, has been in planning since about 1978. In 1980 or 1981, some of the equipment for this laboratory was obtained through USAID (see Appendix I). About the same time, rooms and laboratory benches were built on the second floor of one of the buildings at Mitra.

To aid in the decisions concerning the establishment of this laboratory, Prof. Ario Lobo Azevedo, Rector of the University, established the following committee:

- Prof. Ario Lobo Azevedo, Rector
- Eng. J. Teles Grilo, Geociencias
- Dr. Alfredo Goncalves Ferreira, Engenharia
- Prof. C. Ferreira de Miranda, Quimica
- Prof. Jose Carlos Dargent de Albuquerque, Fitotecnia

Dr. Alfredo Goncalves Ferreira was assigned as my counterpart.

The layout of the proposed laboratory was designed by Professor Miranda. As can be seen in Appendix II, the plan consisted of many small rooms and rather narrow (50 cm) laboratory benches. These rooms and the benches were installed in a room on the second floor of one of the buildings at the Nucleo de Valverde.

ACTIVITIES

To familiarize some of the committee with a routine soil testing laboratory, a trip was made to the Laboratorio Rebelo da Silva in Lisbon, one of the PROCALFER project labs that I have been working with the past four years.

Eng. Teles Grilo, Prof. Ferreira de Miranda, Dr. Alfredo Goncalves Ferreira and Dr. Maria de Lurdes Pimenta went on this trip.

Eng. Soveral Dias, Director of the laboratory, gave a complete explanation and tour of the soil and plant testing parts of the laboratory. After this trip and several meetings the following possible courses of action were presented to Prof. Ario Azevedo:

1. Proceed with the laboratory layout as presently constructed (Appendix II).
2. Remove two partitions to make the area more usable.
3. Remove nearly all of the partitions and try to rearrange the laboratory benches.
4. Move the soil testing laboratory to the ground floor and convert part of the second floor to a soils teaching laboratory and use the rest for the soil physics laboratory now located on the ground floor.

To proceed with the layout as planned by Professor Miranda would have required either using part of the ground floor for soil storage and grinding or the addition of two more rooms to the building.

Prof. Ario Azevedo decided to move the soil testing laboratory to the ground floor (Option 4).

We then proceeded to draw up plans for placing the soil testing laboratory on the ground floor and planning the division of the upstairs laboratory into a teaching laboratory and a soil physics laboratory. The new plan (Appendix III) has approximately 60 percent more bench area and is open and spacious. In addition, there will be no need to use part of another floor or add on to the building in order to have adequate room for soil sample drying, storage, and grinding. Several meetings were held with a contractor to explain the proposed changes and plans. The contractor promised to have the second floor ready by the end of June for the soil physics laboratory. He has started to make some of the benches and soil sample storage units that will go into the routine soil testing laboratory. He plans to have the new laboratory ready about the end of July.

There were several rumors that the equipment (Appendix I), which was selected for the proposed laboratory by Prof. Ferreira de Miranda, had been damaged when the warehouse was supposedly flooded with about 18 inches of water. Most of the packing crates were opened by Dr. Alfredo Ferreira and myself but no evidence of damage was found.

Although the equipment appears to be in good shape some of the equipment is not needed to analyze soils using the accepted soil testing methods used in Portugal. After obtaining copies of the soil testing procedures for pH(H_2O), pH(KCI), lime requirement, total carbonates, phosphorus, potassium, organic matter, and conductivity, considerable time was spent making a new list of the equipment,

glassware and chemicals needed to run these tests (Appendix IV). These items will be ordered and hopefully will arrive about the time the contractor has the laboratory constructed. After the contractor has finished and the equipment and chemicals have arrived it should take approximately one month to get the laboratory operational.

In addition to the above tests, which are commonly run in Portugal, plans are to also test for nitrate and ammonium nitrogen. Hopefully, this will encourage research on testing for nitrogen in Portugal.

A summary of daily activities is included in this report as Appendix V--Daily Itinerary.

RECOMMENDATIONS

1. It is recommended that as soon as someone is selected to be in charge of this laboratory, plans be made to send that person to the Soil Testing Laboratory at North Dakota State University for about one month. The purpose would be to give the person experience in the day-to-day management of a routine soil testing laboratory. It is recommended that this person be there during September or early October, which is the busiest part of the soil testing season.

Dr. Maria de Lurdes Pimenta, who has training in chemistry, would be a good candidate for this position. It is recommended, however, that Dr. Alfredo Goncalves Ferreira be put in overall charge of the laboratory because of his training in soils. He would make decisions about what soil tests to use, soil sampling recommendations, fertilizer recommendation tables, etc.

2. Steps should be taken to make some type of arrangement with the Regional Service in the Alentejo to promote soil testing.

3. The equipment and glassware (listed in Appendix IV) should be purchased as soon as possible so it is available for use when the laboratory construction is completed.

ACKNOWLEDGEMENTS

I would like to thank Prof. Ario Lobo Azevedo for his encouragement, his ready availability and decisions when problems were encountered and for the many visits to his home for coffee. Thanks to D. Maria do Carmo Silveira for the many things she did to make my stay at the Universidade de Evora enjoyable. I would especially like to thank Dr. Alfredo Goncalves Ferreira for the many ways in which he made my job much easier and for being a pleasant and cooperative colleague. Thanks also to Eng. J. Teles Grilo and Prof. Jose Carlos Dargent de Albuquerque for their encouragement and to the many others who showed an interest in this project.

APPENDIX I

List of Equipment Obtained Through USAID

UNIVERSIDADE DE ÉVORA

LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 1	6	- Screw type AUGERS (A-4)*
A 2	6	- Soil conservation bucket AUGERS (DR-30)*
A 3	4	- Bouyoucos moisture meters (A-74)*
A 4	50	- Bouyoucos soil-blocks, gypsum type (A-70)*
A 5	6	- Munsell soil color CHARTS (A-27)* with set of 2 tropical soil charts (A-28)*
A 6	1	- Solu-bridge for CONDUCTIVITY soil testing (A-60 with A-54)*
A 7	4	- Basic volumeasure Density set, for field density tests of soils (ML-85)*
A 8	1	- Pressure MEMBRANE apparatus, with mercury differential regulator and other standard equipment (A-81, A-82, A-83, A-84 and A-85)*
A 9	3	- Irrometer MOISTURE indicator, 12" length (A-50)*
A 10	3	- Irrometer MOISTURE indicator, 24" length (A-51)*
A 11	4	- Speedy MOISTURE tester (MC-320)*
A 12	1	- Porous PLATE apparatus (A-86)* with the accessory manifold (A-142)*
A 13	4	- Mechanical soil analysis STIRRER (CI-272 or CL-273)*
A 14	4	- Complete combination TESTER (A-7A)*

* SOILTEST catalog symbols.

UNIVERSIDADE DE ÉVORA

LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 15	1	- Torvane Shear device (CL 600)
A 16	1	- Pocket Penetrometer (CL700)
A 17	1	- Pocket Penetrometer Adapter foot (CL 700)
A 18	1	- A.S.T.M. liquid LIMIT set (CL 209)
A 19	2	- Plastic LIMIT set (CL 251)
A 20	6	- 8" Diameter brass sieves 4" CBC 8400
		3" CBC 8300
		2" CBC 8200
		1" 1/2 CBC 8150
		1" CBC 8100
		3/4" CBC 8075
		3/8" CBC 8037
		nº 4 CB 84
		nº 10 CB 810
		nº 20 CB 820
		nº 40 CB 840
		nº 80 CB 860
		nº 140 CB 8140
		nº 200 CB 8200
		nº 400 CB 8400
		CB 8500
		CB 8506
A 21	12	- Special brass Sieves, with 3" diam. and 0,0080" sieve openings (model CB 370)
A 22	1	- Volume change apparatus (C-290)
A 23	1	- Specific gravity and absorption of fine aggregate set (G-352A)
A 24	5	- Specific gravity data sheet (CL-9) (CL-10)
A 25	1	- Sample splitter (CL 283)
A 26	1	- Cenco-Meinzer sieves shaker (CL 323)
A 27	1	- With transformer (LT 500)
A 28	3	- Sampling spoon (CN 995)
A 29	1	- Metric Basic Field density set (CN 600 M)

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LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 30	2	- Eley volumeter (CN 840)
A 31	1	- Proctor penetrometer, Basic set (CN 419)
A 32	1	- Field density samples
A 33	1	- Corps of engineers surface soil samples (CN 1030)
A 34	1	- Corps of engineers surface soil samples (CN 1031)
A 35	1	- Soil Moisture - Temperature Meter Set (MC 312)
A 36	1	- Motorised direct shear apparatus (D 120 A-B)
A 37	1	- Shear box bousing (D 181)
A 38	1	- Direct shear box (D 183)
A 39	1	- Spare Gripper assembly (D 185)
A 40	1	- Square Specimen cutter (D 187)
A 41	1	- Corundum insert set (D 189)
A 42	6	- Direct shear data sheets (DS 12)
A 43	6	- Direct shear data sheets (DS 13)
A 44	1	- Bench model Triaxial apparatus (T 130)
A 45	1	- Triaxial Panel board stand (T 116)
A 46	1	- Triaxial accessory set (T 550-B)
A 47	6	- Data sheets (DT-1)
A 48	6	- Data sheets (DT-2)
A 49	6	- Data sheets (DT-3)
A 50	2	- Oven (L 18A-B)
A 51	6	- Tin sample boxes (LT 40)
A 52	8	- Tin sample boxes (L 17)
A 53	1	- Top pan precision balance (L 897)
A 54	3	- Circular miter boxes (P 20)
A 55	3	- Circular miter boxes (P 24)
A 56	1	- Portable pH meter (LT 225)
A 57	1	- Buffer solution ph 7.0, 1000 ml (LT 236)
A 58	2	- Max-min Soil Thermometer (G 225)
A 59	2	- Soil thermometer (G 190)
A 60	1	- Soil pressure meter and cells set (R 207)
A 61	1	- Bouyoucos Bridge (A 76-A)

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LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 62	1	- Salinity bridge (A 35)
A 63	1	- S. bridge soil tester kit
A 64	1	- Complete soil test kit
A 65	3	- Dial Type soil moisture gauge Tensiometer 6" - A-161
A 66	3	- Dial Type soil moisture gauge Tensiometer 12" - A-162
A 67	3	- Dial Type soil moisture gauge Tensiometer 18" - A-163
A 68	3	- Dial Type soil moisture gauge Tensiometer 24" - A-164
A 69	3	- Dial Type soil moisture gauge Tensiometer 30" - A-165
A 70	3	- Dial Type soil moisture gauge Tensiometer 36" - A-166
A 71	3	- Dial Type soil moisture gauge Tensiometer 42" - A-167
A 72	3	- Dial Type soil moisture gauge Tensiometer 48" - A-168
A 73	3	- Dial Type soil moisture gauge Tensiometer 60" - A-169
A 74	1	- Insertion tool 30" -A-159
A 75	1	- Insertion tool 54" -A-160
A 76	1	- Insertion tool 76" -A-178
A 77	3	- Jet-fill Tensiometers 8" - A-215
A 78	3	- Jet-fill Tensiometers 12" - A-216
A 79	3	- Jet-fill Tensiometers 24" - A-217
A 80	3	- Jet-fill Tensiometers 36" - A-218
A 81	3	- Jet-fill Tensiometers 48" - A-219
A 82	3	- Jet-fill Tensiometers 60" - A-220
A 83	1	- Terrarium L-87
A 84	3	- Soil water sampler 6" - A-147
A 85	3	- Soil water sampler 12" - A-148
A 86	3	- Soil water sampler 24" - A-149
A 87	3	- Soil water sampler 36" - A-150
A 88	1	- Accessory soil water sampler A-151
A 89	1	- Accessory soil water sampler A-152
A 90	1	- Accessory soil water sampler BR-2
		Soiltest, Inc. General Catalog

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LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 91	2	- Analytical Balances In Mitra Single pan. Preweighing system. Air release system. Taring facility, weighing range 0-160g. Readability 0.1mg. Optical scale range 0-1000mg. METTLER - H 35 AR METTLER INSTRUMENT CORPORATION, BOX 100, PRINCETON, N.Y. 08540, USA. Tel (609)448 - 3000
A 92	2	- Precision Balances In Mitra Top loading. Weighing range 3200g. Readability 0,1g. Electronic METTLER - PL 3000 METTLER INSTRUMENT CORPORATION, BOX 100, PRINCETON, N.Y. 08540, USA, Tel (609)448 - 3000
A 93	2	- Balance Accessories Vibrospatulas, electric for despensing of powdered or granular substances to weighing scoop. With four different stainless steel spoons. METTLER METTLER INSTRUMENT CORPORATION, BOX 100, PRINCETON, N.Y. 08540, USA, Tel (609)448 - 3000
B 94	4	- Water Bath Constant level, electric range room to 60º C using water as bath medium. Neon pilot lamps, removable side panel. Size inside In 36" x 18" x 9". FREAS - MODEL 170 CMS catalog
B 95	4	- Water Bath Cover Stainless steel, 6 concentric rings. Holes In 6" x 4 1/8". FREAS - MODEL 160 CMS catalog

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(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 96	2	- Balances Triple Beam In Mitra Metric, magnetic damping, stainless steel pan. Capacity 2600 grams with attachement Sensivity 0.1 grams Agate bearings OHAUS model 710 CMS Catalog
B 97	1	- Oil Bath Electrically heated, range 5º C - 260º C with built-in over-temperature protection. Size inside 90cm x 45cm x 23,75cm. MAGNI - WHIRL - MODEL MW 1156C - 1 CURTIN MATHESON SCIENTIFIC INC CATALOG
B 98	1	- Bath - Circulator Constant temperature, control range - 5ºC to + 120ºC, temperature stability ± 0,01ºC at 70ºC; Platinum PT 100 temperature sensor; low - liquid - level cut - out; Pumping capacity of 10 liters/min. maximum head of 1,6 meters. THERMOMIX - MODEL 1440 B. Braun - CMS CATALOG
C 99	10	- Burets Automatic zero, yellow filled graduation, with central filling tube and stopcock. Complete with bottle rubber stopper, connecting tube, and rubber bull. 25ml. graduated in 0.1 ml. Pyrex Brand glass CMS CATALOG
B 100	1	- Glass Blower Burner Suitable for borosilicate glass, for oxygen propane flame, multiflame, with revolver mounted tips. Bench type. Fisher. CMS CATALOG

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UNIVERSIDADE DE EVORA

LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 101	1	- Centrifuge In Mitra General propose. Unit will acomodate any of four free-swinging horizontal heads of four 52º angle heads, permitting use of over 50 different combinations of tubes sizes ranging from micro to 100 ml capacities; solid state electronic speed control system. Automatic times. Thumbswithch-controlled with transparent. LIXAN Cover. Housing for centrifuge is 15" D x 18 1/2" W x 10"H DYNAC - CLAY ADAMS CMS CATALOG
A 102	1	- Horizontal Head For The Centrifuge 4 - Place, holds four 50 ml tubes CLAY ADAMS - 0108 CMS CATALOG
A 103	1	- Horizontal Head For The Centrifuge 8 - Place, holds eight 15 ml tubes CLAY ADAMS - 0109
C 104	30	- Clamps castaloy R, three prong, vinylised, 6 1/2"
C 105	20	- Clamps castaloy R, three prong, vinylised, 8 3/4"
C 106	5	- Clamps castaloy R, three prong, vinylised, 10 7/8" CMS CATALOG
B 107	12	- Desiccators In Mitra TOUGH plastic. Cover with knob for handling and a vacuum house connection with plastic needle valve. With desicant pan 25 cm diameter. BEL ART CMS CATALOG

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LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
A 108	1	- Water Demineralizer With separated anionic and cationic exchange resins. Regeneration facilities. Exchange capacity between regeneration cycles: 1000 liters of water 25 hydrotimetric degrees (5 x 10.3 equiv./liter) Flow rate up to 50 l/hour. With purity indicator meter.
B 109	1	- Distilling apparatus Water still, glass, 4 l/h with storage tank. BARNSTED A 1050 and A 1051 CMS CATALOG
A 110	1	- Furnace Muffle, Electric, 220V, temperature regulator, up to 1200ºC, plus automatic timer for timing begining and duration of ignition. Internal dimension of chamber: WDH aprox. 24 x 34 x x 22 cm (WD: not less than 20 x 30 cm.) THERMOLINE CMS CATALOG
A 111	1	- Furnace Induction 2 KW, 220V, biphasic. With security in case cooling water accidently stops. For igniting graphite crucibles 30 cm Ø, 30 mm high in N_2 atmosphere. Similar to FA2 induction furnace of Hermann-Moritz, agent in Paris, 7 Rue Nicolas Houel, 75005 - PARIS Tel. 3377362 or 28480 Chassant, France Tel. (37) 094521

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DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
B 112	2	- Ovens Drying Temperature range to 200ºC, thermostatically controlled to ± 1ºC, adjustable, electrically heated, useful capacity about 100 liters. NATIONAL CMS CATALOG
A 113	1	- pH - Meter Output BCD, pH meter and multivoltimeter, digital, temperature correction. METROHM - MOD E 632/2
A 114	4	- Combined Electrodes Re. EA - 120 METROHM
A 115	2	- Calomel Electrodes Ref. EA - 402 METROHM
A 116	2	- Platinum Electrodes Ref. EA - 201 METROHM
A 117	2	- Oxygen Electrodes MODEL EA 541 METROHM
A 118	1	- Combi - Titrators pH meter, impulsomate, titration unit registrator. METROHM COMBI - TITULATEURS METROHM CATALOGUE SUISSE

UNIVERSIDADE DE ÉVORA

LIST OF EQUIPMENT TO BE OBTAINED THROUGH USAID

(RURAL VOCATIONAL EDUCATION LOAN 150 - K - 012)

DEPARTMENT OF SOILS LABORATORY

Item nº	Quantity	Equipment specifications (Equipment identical or equal to)
119	1	- Automatic Colorimeter Identical or equivalent to the Autoanaliser II of TECHNICON with: -Sampler S-IV -Pump P III -Analytical module or modules permitting determination of silicium, aluminium, iron, titanium, phosphorus, boron, chromium, molybdenum, nitrogen (indophenol blue) and carbon (dichromate). (Research module with accessories might be suitable). -Colorimeter -Digital printer -Registrator
A 120	1	- Atomic Absorption Spectrophometer In Mitra Double beam apparatus, optic range 190/870 mm. with deuterium background corrector. With microprocessor for autozero and two standards calibration facilities. With 10 cm. single slot titanium burner and nebulizer. Desirable: microprocessor gas regulated flame. PERKIN ELMER MODEL 380
A 121	1	- Autosampler for 50 samples PERKIN ELMER AS 50 AUTOSAMPLER
A 122	1	- Printer PERKIN ELMER PRS - 10 Printer
A 123	1	- Hollow cathode Lamps for: Calcium plus magnesium. Cobalt, Copper, Lead, Lithium, Manganese, Nickel, Potassium, Sodium, Vanadium, Zinc. IMPORTANT NOTE: ALL ELECTRIC APPARATUS FOR 220V. 50Hz MAINS EVEN WHEN NOT EXPLICITY MENTIONNED.

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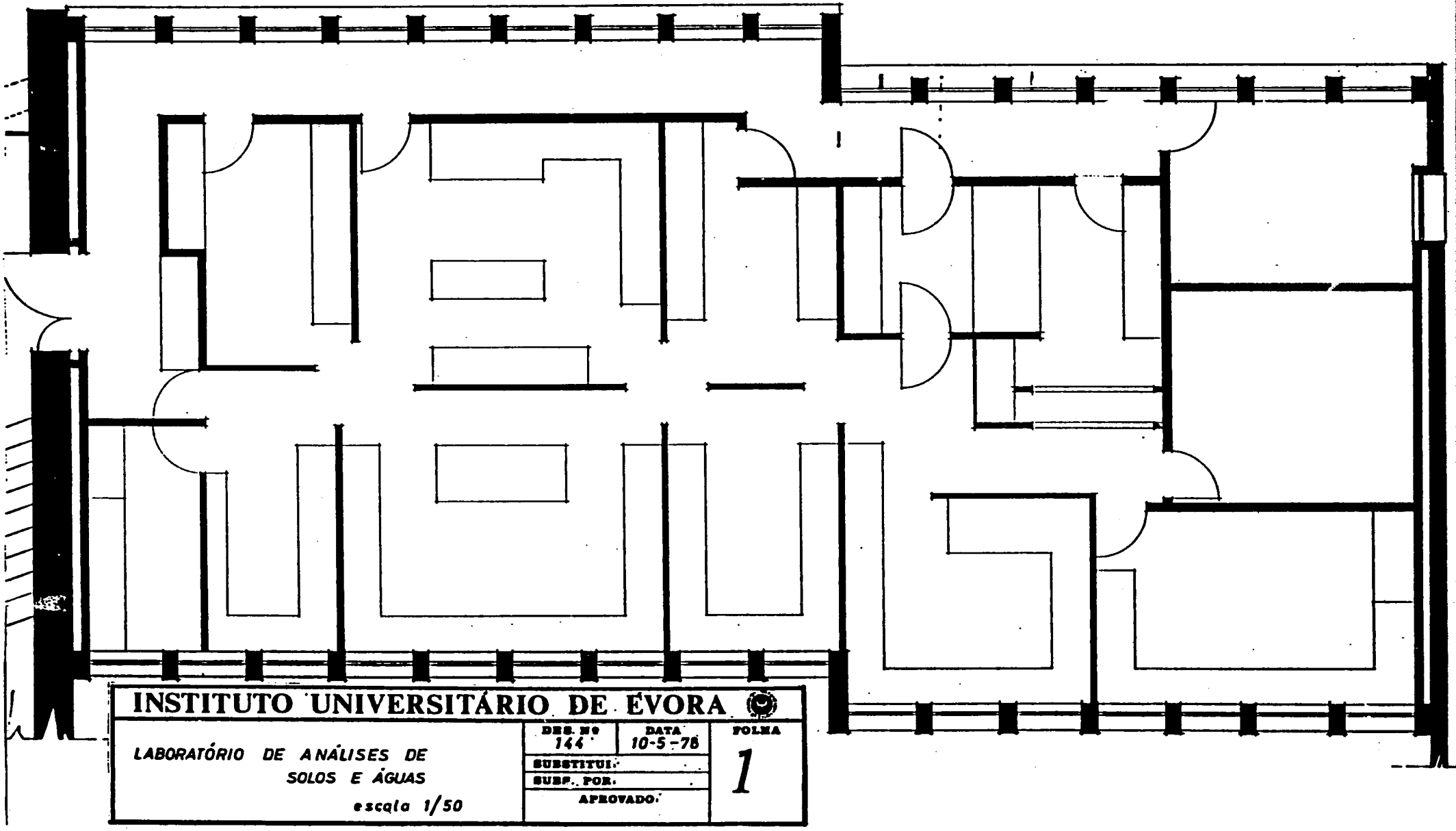
APPENDIX II

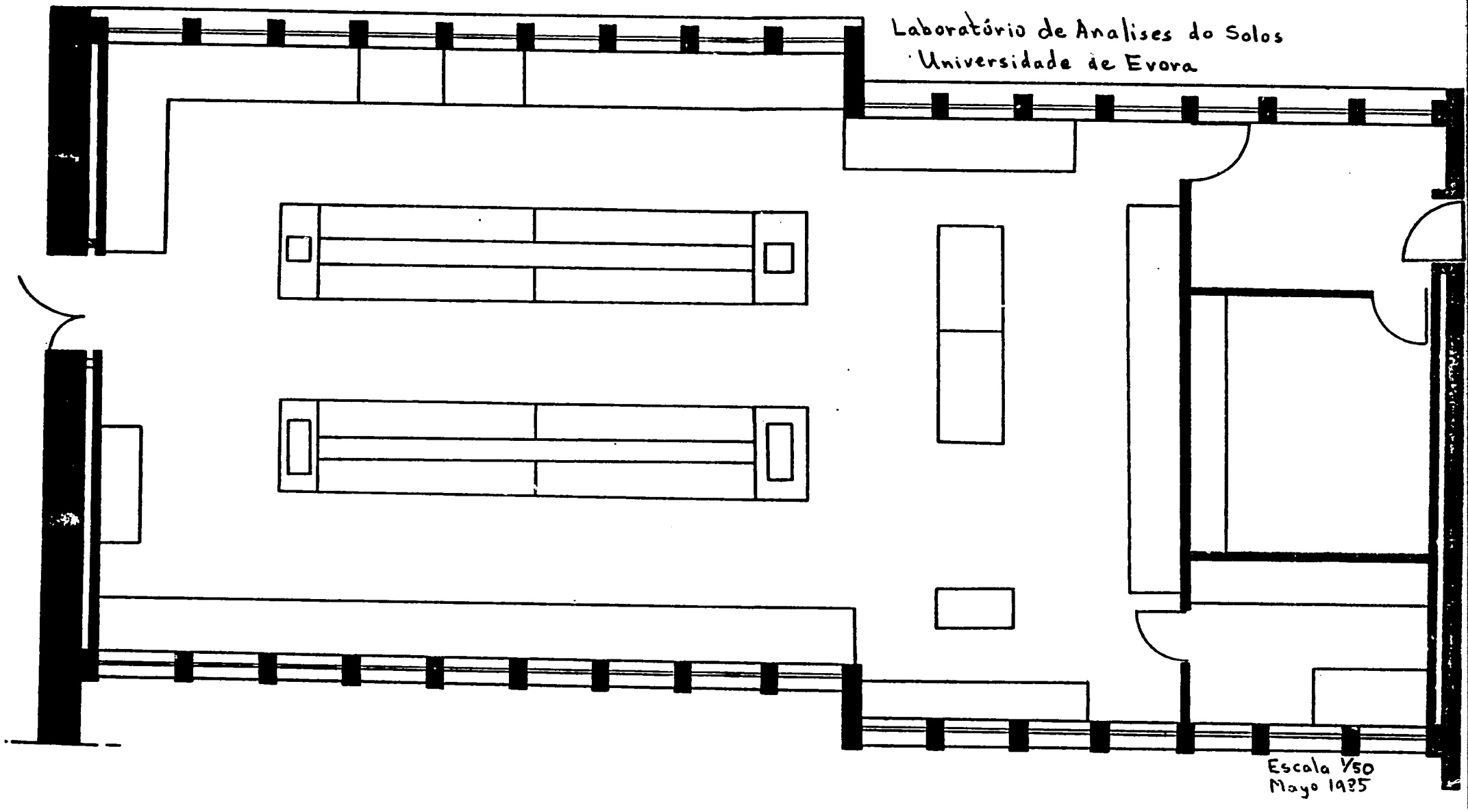
Original Floor Plan for Soils Testing Laboratory



INSTITUTO UNIVERSITÁRIO DE ÉVORA			
LABORATÓRIO DE ANÁLISES DE SOLOS E ÁGUAS escala 1/50	DES. Nº 144	DATA 10-5-78	FOLHA 1
	SUBSTITUI:		
	SUBS. POR:		
	APROVADO:		

APPENDIX III

Revised Floor Plan for Soils Testing Laboratory


Laboratório de Analises do Solos
Universidade de Evora
Escala 1/50
Mayo 1985

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APPENDIX IV

Additional Equipment, Glassware and Chemicals Being Order for the Laboratory

WHEN USING A TYPEWRITER SET TAB STOPS AS SHOWN ON THIS STUB Fold at (>) to fit 771 DU-O-VUE® Envelope. JET Type

ALIGN TYPE DIRECTLY ON THIS LINE _____

PRODUCT 105-4 Nebs Inc. Groton, Mass. 01471 To Order PHONE TOLL FREE 1 + 800 225 6380 (Mass. residents 1 + 800 252 9226)

CUSTOM LABORATORY EQUIPMENT INC.
P. O. Box 757
ORANGE CITY, FLORIDA 32763

PROFORMA

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

2470

DATE	ORDER NO.
May 2, 1985	letter - April 24, 1985

SHIP TO

TO
Alfredo Goncalves Ferreira
Divisao de Engenharia
Universidade de Evora
Apartado 94
7001 Evora Codex
Portugal

SALESPERSON	DATE SHIPPED	SHIPPED VIA	F.O.B. POINT	TERMS
		Airborne	Orange City, FL	Letter of credit

QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
2	AD-3 Three volume-three aliquot dispenser - 25 ml syringes	391.00	782.00
1	SCD-1 Combination diluter dispenser - 5, 20 and 25ml syringes	361.00	361.00
3	GV-1 Glass valves	33.00	99.00
1	DC-2 Dynacrush soil crusher - 220 v, 60 cycles	630.00	630.00
	Shipping and handling		225.00
	TOTAL FOB		$2,097.00
	This proforma invoice valid until August 15, 1985.		
	Terms: irrevocable letter of credit (see enclosed instructions)		
	Expiration date: 75 days Shipping date: 45 days		
	Alen B Hunter		
	Alen B. Hunter - President		
	custom Laboratory Equipment Inc.		

ORIGINAL

Thank You

IV-1

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CUSTOM LABORATORY EQUIPMENT, INC.

P. O. BOX 757 OR 205 E. MICHIGAN AVE. ORANGE CITY, FLORIDA 32763 Telephone: 904-775-2322

TERMS

All prices are FOB Orange City, Florida, U.S.A.

Shipping is prepaid and added.

Payment terms are irrevocable and confirmed letter of credit.

Letters of credit should be established with the following guidelines:

1. must be irrevocable and confirmed
2. must be payable upon presentation of documents
3. expiration date to be 75 days after date of issue
4. latest shipping date to be 45 days after date of issue
5. should state "Airway bill consigned to _____"
6. should state "Commercial invoice covering 'Laboratory equipment conforming to the specifications contained in order number _____' consigned to the order of _____"
7. for insurance, simply state "Insurance certificate required"
8. other documents: Certificate of origin (if required)
   Consular invoice (check to see if this is required)

Fisher Scientific
Hottingerstrasse 14
8032 Zurich, Switzerland
Phone: 011-41-1-251-2992

EQUIPMENT FOR SOIL TESTING LAB

Fisher Catalog Nº	Quantity	Description
02-555-20A	2 cases (48/case)	250 ml Glass beakers
13-374-16	2 rolls	Parafilm
05-779	4	Buret clamp
05-847	1 lot (12/lot)	Hose clamp
08-570-21A	1 case (12)	Graduate cylinder, 10 ml
08-570-21B	1 case (12)	Graduate cylinder, 25 ml
08-570-21D	1 case (8)	Graduate cylinder, 100 ml
08-570-21G	1 case (4)	Graduate cylinder, 1000 ml
09-965A	1	Filter pump
10-039C	1 case (48)	50 ml Glass Erlenmeyer flask
10-041-15A	3 case (36/case)	50 ml Polycarbonate Erlenmeyer flask
10-200F	1 case (12)	500 ml Volumetric flasks
10-200G	2 case (4/case)	1000 ml Volumetric flasks
10-371A	1 PK (6)	Plastic funnels
11-409-5	1	Face Shield
12-961B	1	Mortar
12-961-5B	1	Pestle
13-160	1	Digestion unit
13-163-1	2 case (25/case)	Digestion tubes
21-131-10	1	Kjeldahl distillation unit
13-639-3	2	Rugged pH electrode
13-639-51	2	Calomel reference electrode
13-650B	2	Volumetric pipets, 1 ml
13-650C	2	Volumetric pipets, 2 ml
13-650F	2	Volumetric pipets, 5 ml
13-650L	2	Volumetric pipets, 10 ml

Fisher Catalog Nº	Quantity	Description
13-650P	2	Volumetric pipets, 25 ml
13-650S	2	Volumetric pipets, 50 ml
13-650U	2	Volumetric pipets, 100 ml
13-687-21	1	Repipet disperser, 20 ml
14-371B	1 PK (12)	Spatulas
14-377	1	Spectronic 21 model DV
14-385-912B	1 pack (4)	Spectrophotometer cells
14-743	1	Pipet holder
91-162	1	Glassware drainage rack
14-169-1J	2 pack (15n/pack)	1/4" Tygon tubing
15-319C	1 pack (12)	T-shaped connectors
15-315-8	1 pack (6)	Twistcock connecting tubes
03-409-10E	1 pack (4)	Wash bottles
14-635-5D	2	Vacuum grease
02-952F	1 pack (6)	1000 ml Polypropylene bottles
02-887C	4	19 liter Pyrex carboys
02-923J	1 case (6)	4 liter Polyethylene bottles
02-555-20E	1 pack (6)	1 liter glass beakers
08-732	1 pack (144)	Weighing dishes
13-641-943	1	Nitrate electrode
13-641-888	1	Nitrate activity standard
13-641-922	1	Ammonia electrode
13-641-924 C	1	Ammonium chloride standard solution
13-641-717	1	Orion 901 pH/Mv and specific ion meter
13-641-737	1	Orion 407A/L pH meter
14-493-221T	1	Magnetic stirrer
11-392-15	1 pair	Insulated gloves
11-493-201T	1	Hotplate
09-810E	100 packs	Whatman Nº 2, 11 cm filter paper
07-850-10	1 pack	Cork borers

FISHER CHEMICALS

Catalog Number	Quantity	Description
192-P	2 x 500 g	p - nitrophenol
C-46	6 x 500 g, cs	calcium acetate
P-330	2 x 10 Kg	potassium chloride
P-217	500 g	potassium chloride
P-117	500 g	calcium oxide
P-220	6 x 500 g, cs	potassium chromate
I-77	6 x 1 Kg, cs	ferrous ammonium sulfate
A-162	6 x 500 ml, cs	lactic acid
A-38-5	6 x 500 ml, cs	acetic acid, glacial
A-637	6 x 500 g, cs	ammonium acetate
A-674	500 g	ammonium molybdate
A-865	500 g	antimony potassium tartrate
A-61	6 x 25 g, cs	ascorbic acid
A-300-C	2(6 x $2\frac{1}{2}$ liter), cs	sulfuric acid
A-144C	6 x $2\frac{1}{2}$ liter, cs	hydrochloric acid
C-78	500 g	calcium chloride
P-79	25 g	phenolphthalein
P-382	500 g	potassium phosphate
So-B-109	500 ml	pH 7 buffer
So-B-99	1 x 6, cs	pH 4 buffer
So-B-141	1 x 6, cs	pH 10 buffer

Other equipment needs:

1. Plant tissue grinder
2. Refrigerator
3. Shakers
4. Chimney for atomic absorption unit
5. Styrofoam
6. Electric (Busen) burner for 220 V
7. 2 hour timer
8. Dip type conductivity cell
9. Calcimetro de Scheibler (see page 16 of sector Fertilidade do Solo, documentação 2)
10. Bottle washer in sink
11. Conductivity dip cell
12. Hot water heater
13. Air compressor

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CUSTOM LABORATORY EQUIPMENT, INC.

P.O. Box 757

Orange City, FL 32763

U.S.A.

Catalog Number	Quantity	Description
B-50	400	50 ml plastic bottles
CO-1	1	Sample changer
-	2	Extra hammers for soil crusher

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APPENDIX V

Daily Itinerary

DAILY ITINERARY

April 7 - June 6, 1985

Sunday, April 7	- Left my home at 9:45 a.m. and arrived in New York at 6:00 p.m.
Monday, April 8	- Arrived in Lisbon at 11:00 a.m. Stayed overnight in Lisbon.
Tuesday, April 9	- A driver for the PROCALFER project drove me to Evora. Arrived in Evora at 3:00 p.m. Met with Dr. Alfredo Goncalves Ferreira, my counterpart.
Wednesday, April 10	- Had a short meeting with Prof. Ario Lobo Azevedo, Rector of the Universidade de Evora.
Thursday, April 11	- Met with the Soil Testing Laboratory Committee.
Friday, April 12	- Obtained copies of the layout of the proposed laboratory.
Monday, April 15	- Worked on the proposed laboratory plans. Met with Professor Azevedo, Jose Luis Pinheiro and Vivian Rider.
Tuesday, April 16	- Took Dr. Alfredo Goncalves Ferreira, Dr. Maria de Lurdes Pimenta, Eng. Teles Grilo and Professor Miranda to visit Laboratorio Rebelo da Silva in Lisbon.
Wednesday, April 17	- Met with Prof. Ario Azevedo, Prof. Miranda and Dr. Alfredo Goncalves Ferreira at the request of Prof. Miranda. He wanted to discuss the administrative organization of the laboratory.
Thursday, April 18	- Tried to figure out how to use the present laboratory layout.
Friday, April 19	- Dr. Alfredo Ferreira and I met Prof. Ario Azevedo to discuss possible alternatives with respect to soil testing laboratory. Professor Azevedo decided to put the soil testing laboratory on the first floor and convert what was to be the soil testing laboratory into a soils laboratory for teaching and the other part will be used as the soil physics laboratory which is presently on the first floor.

Monday, April 22	- Started working on the plans to have the soil testing laboratory on the first floor.
Tuesday, April 23	- Professor Miranda requested a meeting with me at Mitra but he did not show. Worked on lab plans.
Wednesday, April 24	- Met with Dr. Alfredo Ferreira to work on lab plans.
Thursday, April 25	- Revolution Day
Friday, April 26	- Dr. Alfredo Ferreira and I measured some of the benches and tables in the proposed room for the laboratory to see if they could be used in the new laboratory.
Monday, April 29	- Spoke to class of students who will be going to the U.S. in a few months. Made preparations to start unpacking some of the laboratory equipment that came in 1980 and 1981 and supposedly was damaged by water.
Tuesday, April 30	- Finished working on laboratory layout and contacted a drafter to have the plans drawn up in pencil.
Wednesday, May 1	- May Day
Thursday, May 2	- Showed the proposed laboratory plan to Prof. Ario Azevedo. He approved them. This plan has over 60 percent more bench space plus there is room to store soil samples and for soil drying and grinding. Therefore, two more rooms will not have to be added to the building as was originally planned.
Friday, May 3	- Plans given to drafter for inking. Started working on a list of equipment.
Saturday, May 4	- Met with the contractor that will make modifications at the laboratory in Mitra.
Monday, May 6	- Worked on equipment list. Tried to find a 50 ml Erlenmeyer flask so the extraction racks can be designed. No luck.
Tuesday, May 7	- Tried to find copies of soil testing laboratory procedures for the test that will be run.
Wednesday, May 8	- Got the final inked lab plans from the drafter. Prepared for tomorrow meeting with Prof. Ario Azevedo and Professor Miranda at which Professor Miranda will be told that the laboratory layout he prepared will not be used.

Thursday, May 9	- Met with Prof. Ario Azevedo, Professor Miranda and Dr. Alfredo Ferreira to discuss the present plans for the laboratory. Professor Miranda does not think that the new plan provides as pleasant working conditions as his plan and, therefore, will result in inferior soil test results. He also does not think the sophisticated equipment he ordered should be used in the new laboratory because it will be too dirty.
Friday, May 10	- Dr. Alfredo Ferreira and I met with the contractor. The contractor is asking approximately 1,500,000$00 to set up the new laboratory. It will take until the end of July to do the work.
Saturday, May 11	- Dr. Alfredo Ferreira and I met with the contractor at Mitra to discuss the planned work.
Monday-Friday, May 13 - 17	- Vacation
Monday, May 20	- Visited laboratory supply houses in Lisbon to get samples and possibly find a local source for some of the plastic labware that will be needed. Worked some on the PROCALFER project.
Tuesday, May 21	- Obtained copies of all the laboratory procedures currently used in routine soil testing in Portugal. Observed each procedure being used in Laboratorio Rebelo da Silva. Spent part of the day on the PROCALFER project.
Wednesday, May 22	- Met with Eng. Almeida Alves to discuss progress on the PROCALFER project and to inform him and get his suggestions on this project. Took the bus back to Evora.
Thursday, May 23	- Met with Dr. Alfredo Ferreira to discuss present status of laboratory and make a decision about where to order the equipment, glassware and chemicals that will be needed. He decided to order from the U.S. A catalog for Fisher Scientific was located.
Friday, May 24	- Worked on list of laboratory supplies.
Saturday, May 25	- Met with Dr. Alfredo Ferreira at the laboratory to check on the progress of the contractor.

Monday, May 27	- Worked on supply list. Dr. Alfredo Ferreira and I met with Eng. Maria do Rosario Oliveira to inform her of the changes being made. Eng. Oliveira just returned from the U.S. She is in charge of the soil physics laboratory at Mitra and a possible candidate to be in charge of the soil testing laboratory.
Tuesday, May 28	- Dr. Alfredo Ferreira and I met with Dr. Maria de Lurdes Pimenta to explain the changes being made in connection with the soil testing laboratory. She is working for Dr. Miranda now but was originally hired to work in the soil testing laboratory to be established at Mitra. Finished list of equipment, glassware and chemicals and gave it to Dr. Alfredo Ferreira.
Wednesday, May 29	- Dr. Alfredo Ferreira and I met with Eng. Maria do Rosario Oliveira at the laboratory in Mitra to show her the changes being made. Worked on report.
Thursday, May 30	- Worked on final report.
Friday, May 31	- Met with Eng. Maria do Rosario Oliveira to discuss possible ways to use the second floor laboratory.
Monday, June 3	- Met with Dr. Alfredo Ferreira, Eng. Maria do Rosario Oliveira and the contractor to explain changes needed on the second floor laboratory and to review the plans for the soil testing laboratory.
Tuesday, June 4	- Finished final report and list of supplies.
Wednesday, June 5	- Travelled to Lisbon and met with Jose Luis Pinheiro, USAID, American Embassy.
Thursday, June 6	- Departed for the U.S.