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BANGLADESH AGRICULTURAL RESEARCH PROJECT PHASE-II

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Analytical Chemistry and Instrumentation

Leonard R. Mattick

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BANGLADESH AGRICULTURAL RESEARCH COUNCIL 001067

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Consultancy Report

To

Bangladesh Agricultural Research Council
(BARC)

On

Analytical Chemistry and Instrumentation

March 8 - April 20, 1985

By

Dr. Leonard R. Mattick
IADS Short Term Consultant in
Analytical Chemistry and Instrumentation

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During the term of this consultancy, I received support from many individuals, not only in Bangladesh, but also from the staff at the International Agriculture Development Service (IADS), Arlington, VA.

While in Bangladesh, I would particularly like to express my appreciation to Dr. Sam Portch for his assistance, counsel, and kindness. Regardless of his very busy schedule, he was always available to share his expertise and experience with me.

My appreciation is expressed to Mr. Harvey Carr, Maintenance Specialist for IADS, who arranged all the motor transportation for me and explained and exhibited the maintenance operation, present and planned, for the equipment of BARC affiliated institutes.

The In-country Training Unit of BARC and the Unit at BARI, Joydebpur were invaluable during the courses. Their Aid simplified the course presentation. My congratulations and thanks are extended to these groups.

My gratitude is also expressed to a host of other Scientists at the many government institutes who served to coordinate work or worked with me during my consultancy.

My thanks and appreciation are extended to Dr. David Daugherty and the IADS staff for their logistic support.

Abbreviations used in this report and the corresponding organization:

- BARC - Bangladesh Agricultural Research Council
- BARI - Bangladesh Agricultural Research Institute
- BAU - Bangladesh Agricultural University
- BINA - Bangladesh Institute of Nuclear Agriculture
- BJRI - Bangladesh Jute Research Institute
- BRRI - Bangladesh Rice Research Institute
- DU - Dhaka University
- IADS - International Agricultural Development Service
- RARS - Regional Agricultural Research Station
- SRTI - Sugar Research and Training Institute
- USAID - U.S. Agency for International Development

THE AUTHOR

Dr. Leonard R. Mattick received his training in electronics, while in the U.S. Navy, where he served as an Electronics Technician's Mate. Following his discharge in 1946, he matriculated at The Pennsylvania State College (now The Pennsylvania State University), where the Bachelor and Master of Science degrees were award in 1950 and 1951, respectively. He then attended The University of Connecticut where he received the Ph.D. degree in 1954. All degrees were in the field of Food Chemistry.

At this time analytical instrumentation was beginning to become an integral part of chemistry, and the commercial production of instruments had not yet begun. With the electronic training and experience in Analytical Chemistry, the instruments were designed and constructed in his laboratory. This led to several inventions which were later adopted by industry when they began to manufacture the instruments. These consist of the proportional temperature controller and the dual compensating detector.

Dr. Mattick has over 30 years experience in the area of Analytical Instrumentation and has co-authored several books on Gas Chromatographic. He was Co-director of the Gas Chromatographic Institute at Canisius College in Buffalo, NY. He set up laboratory exercises and lectures for Agricultural Applications. He has also served as a Scientific Consultant to the Food and Drug Administration of the Department of Health, Education and Welfare. The primary duty of the consultant was to aid the scientists of the laboratories in the interpretation of their results analytical procedures for analyzing food, cosmetics and drugs to ascertain their purity for use by the public. This included nutritional and toxicology studies.

His international experience included an active role in research on soybean beverages. This was performed in conjunction with the University of the Philippines at Los Banos. He also was a consultant to Bangladesh in 1984 on Instrumentation Repair and Maintenance.

SUMMARY AND RECOMMENDATIONS.

The consultancy can be divided into two basic parts. a) training and b) instrument repair.

A. Training:

Two 4 extended day (equivalent 6 days) courses were held on the fundamentals of analytical chemistry and instrumentation for 15 and 16 persons from various BARC affiliated institutes.

A summary of scores from a baseline and final exam given to each group is presented below:

	<u>1st Course</u>			<u>2nd Course</u>		
	<u>Baseline</u>	<u>Final</u>	<u>Improvement</u>	<u>Baseline</u>	<u>Final</u>	<u>Improvement</u>
Ave	41.8	65.5	23.3	30.5	45.8	15.3
Range	22-60	36-84		12-62	28-94	

A 170 page manual and aid was prepared prior to the course and a copy given to each participant.

B. Instrument Repair:

Repair visits were made to the following locations/institutes. BARI (Joydebpur, Jessore, Ishurdi), BINA, BAU, STRI, DU, BRRI, and BJRI. The following are observations and recommendations based on this visit as well as a consultancy made about one year ago.

Observations and Recommendations:

1. BARC has taken very little active interest in following the recommendations of either Mr. R. Clayton (1983) or those presented in my report last year. There are two exceptions: a) the BARC/IADS

- support of the IADS Maintenance Specialist who is developing a reliable, adequate model system at BARI, and b) BARC's support of this consultancy and its training component.
2. Probably one of the reasons for lack of adequate support interest lies in the fact that most scientific personnel locally trained have received little or no instruction in instrumentation. It was a shock to me to learn that no formal courses in this area are given to agricultural scientists at either BAU or DU. Yet, BARC and the affiliated institutes spends millions of dollars on instruments and expect their scientists to install, operate and maintain them.
 3. Although it is the duty and obligation of the individual institutes to provide basic maintenance and repair, it is imperative that BARC with donor support, make provisions to establish a Maintenance Section for instrumentation, maintenance and repair personnel. This cannot be done by a yearly consultant visit. It has to be a continuous process that involves an umbrella institute such as BARC that can act directly upon earlier recommendations to a) have a central inventory, b) central purchasing, c) maintain an operational and service manual library, d) purchase and store spare parts, e) control external service, f) be a deposit for spare parts stripped from equipment removed from inventory, and g) demand certain standards in the laboratory facilities of affiliated institutes. BARC should immediately hire directly or contract two well qualified persons to work full time on instrumentation organization, purchasing, repair and preventive maintenance. The system established by Mr. Carr, the IADS maintenance specialist would be helpful as a guide. The soil

science laboratory instrument room at BARI, Joydebpur established by the IADS soil specialist, Dr. Portch, could serve as a minimum standard for BARC-supported laboratories.

Further delays in BARC taking this important step can only result in quick and further deterioration of the situation and of the equipment that is now arriving.

4. Equipment purchases channeled through BARC should demand suppliers' guarantees that include installation and initial operation in Bangladesh.
5. The acquisition and importation of spare parts and chemicals is one of the major problems of instrument operation, maintenance and repair. This applies to such simple materials as pH electrodes, buffers, standard solutions and minor electrical parts. Local scientific equipment distributors should be provided with a complete list of consumables and projected consumption rates so these could be stocked for local purchase.
6. Until BARC has their Maintenance Section established all instruments certified as non-repairable by BARC or its qualified representative should be sent to the BARI Maintenance Section for dismantling and storage of usable parts. This storage could be accomplished by a "Vacu-Pak" machine that packages the individual parts in a vacuum container assuring long shelf life.
7. Both Mr. Clayton and I recommended higher safety standards in the laboratories we visited. Virtually nothing has been done in this

respect. Strong acids and bases are stored and handled without adequate precautions. Electrical equipment is not grounded and frayed wiring or use of the "universal plug" a common occurrence. Serious accidents are bound to happen.

8. A most deplorable and inconceivable situation occurs at nearly all laboratories. Shortages of simple switches and plugs costing no more than 10-25 Taka result in frequent changing of plugs or switches from one instrument to another. Because of the lack of an international color code, sooner or later the wrong wire is attached to the wrong outlet with the resulting shorting out of wiring and severe damage to equipment.
9. The RARS Ishurdi should not receive any further instruments or electrical equipment until proper electrical outlets are installed in the laboratories. Electrical receptacles should be placed every 1.5 meters along the bench walls. This is a simple job that must be done and was referred to in my last report (June 1984 p. 15) yet nothing has been done. The present inadequacy results in costly and delicate instruments being carried to the electrical socket and being placed on a stool or other make - shift "bench". This arrangement endangers both the instrument and the operator. A major accident is waiting to happen.
10. The above (9) and the general situation observed leads me to the conclusion that the individual laboratories or stations must be forced to demonstrate some initiative to maintain their facilities and equipment in proper conditions, and to obtain local repair service

for at least most of the simpler tasks. Many repairs can now be done by submitting a request to BARC through Mr. Carr. Yet this is often not done. It seems that in some cases the laboratories find it easier to get a new piece of equipment than maintain and/or repair the older one. I would strongly recommend that the BARC and donors insist that no replacement equipment be sent to a station or laboratory without first verifying and certifying that the equipment already at the station is non-repairable. If BARC and donors do not follow this recommendation of control then they will continue to undermine and defeat the whole principle of instrument and equipment maintenance and repair. BARC must start to prepare for the days when donor financing is considerably reduced.

D. Future Considerations:

Considering the magnitude of the problem and the importance of the issue of proper understanding and operation of the fundamentals of analytical chemistry and instrumentation to the agricultural research system, the following considerations are made.

1. Six individuals from the past two courses should be selected for further concentrated "hands-on" training during future consultancies. This would include assisting and doing instrument installation and repair. Selection of the candidates would be based on exam scores, interest shown, and their institute's interest.
2. Following this "hands-on" training, two individuals should be selected for six months training in electronics, instrumentation,

requisitioning, maintenance, repair, and inventory systems in the US. These individuals would make the core of the BARC Maintenance Section, and should have an obligatory contract for a specified period after their training. BARC then could institutionalize national training maintenance and operation systems on the fundamentals of analytical chemistry and instrumentation for agricultural scientists.

3. Since the formation of the BARC Maintenance Section is urgent, the above training process should be initiated as soon as possible. Considering contractual time, clearances, financing etc, this could feasibly be considered for sometime during the period September - December 1985.
4. Since a lack of basic knowledge in the fundamentals of analytical chemistry and instrumentation has been observed to be widespread amongst agricultural scientists in Bangladesh, the next consultancy should include terms of reference to: a) evaluate chemistry courses at the universities, b) investigate other sources of training, and c) suggest persons and modules syllabus for local training that could be used to upgrade agricultural scientists involved with laboratory work and research, using local resource personnel, as well as improve the university graduates' knowledge.

1.0 Introduction:

This consultancy was the result of observations made during the consultancy "Analytical Equipment and Instrumentation, June 1984". The need existed for preventative maintenance within laboratories. This could be accomplished by training Scientific Officers of the various laboratories in the proper utilization, care, and operation of scientific instruments and apparatus. A proposal was advanced at that time to offer a course, which would also involve the fundamentals of analytical chemistry and elaborate on the instrumentation utilized in this branch of science.

The consultancy was scheduled for a five week period which was programmed to allow two weeks for the presentation of two - one week short courses on the fundamental aspects of analytical chemistry and instrumentation and three weeks to be spent in the laboratories using this time for personal tutoring of the students of the short course.

The visitations to the laboratories to tutor the students also allowed the opportunity to determine the effectiveness of the previous consultancy of June, 1984. This would offer the opportunity to determine if the practice of instrumentation maintenance has been practiced and the condition of the instrumentation improved.

The mission was largely completed. A report covering the visitations and activities may be viewed in the appendix of this report.

2.0 Terms of Reference:

1. To present a one-week course twice to two groups of 15 Scientific Officers at BARI Joydebpur.

2. The curriculum of the course will embrace the basic concepts of analytical chemistry beginning with the balance and gravimetric methods through the volumetric procedures and the proper installation, maintenance and operation of the basic instruments.
3. The course will also include "trouble shooting" techniques based on common symptoms to accomplish simple repairs.
4. The language of instruction will be English but an interpreter will be used to ensure maximum learning potential.
5. Reference material with illustrations and diagrams in both Bengali and English will be provided.

3.0 Activities:

Short Course on Fundamentals of Analytical Chemistry, Instrumentation, and Maintenance. Two short courses were presented. The first was given March 16-19, 1985, and the second was presented March 30 - April 2, 1985. The original plan was to have these courses last six days during the regular working hours. However, the National Referendum and Independence day caused a reduction in the time. The courses were shortened to four days and the days were lengthened until 4:30 P.M. or an addition $2\frac{1}{2}$ hours each day. The tea breaks were reduced from four - 30 minutes breaks to two - 30 minutes breaks which gave an additional hour for $3\frac{1}{2}$ hours/day and a total of 14 additional hours, which was approximately the two days lost.

The first short course was presented for personnel outside the Dhaka area or the Regional Laboratories. A list of the attendees and

a schedule of the course are shown in the Appendix of this report. A total of fifteen participants attended and completed this course. An Analysis of the Basic Evaluation and Final Evaluation Examination with the difference in grades is shown below:

	Basic	Final	Difference
Average	41.8	65.5	23.3
Range of Grades	22-60	36-84	-4-56
Standard Deviation	±11.23	±12.82	±15.96
Standard Deviation of the Mean	± 3.00	± 3.31	± 4.27
Number	14	15	14

The second course was presented for the personnel in the Dhaka-Joydebpur vicinity. A total of sixteen participants attended this session. The analysis of the Basic and Final Evaluation Examination with the difference in grades for this group is shown below.

	Basic	Final	Difference
Average	30.5	45.75	15.0
Range of Grades	12-62	28-94	-10-46
Standard Deviation	±14.08	±19.35	±14.67
Standard Deviation of the Mean	± 3.52	±11.44	± 3.67
Number	16	16	16

A composite of both groups resulted in the following data.

	Basic	Final	Difference
Average	35.77	55.32	19.0
Range of Grades	12-62	28-94	-10-56
Standard Deviation	±13.85	±19.10	±15.90
Standard Deviation of the Mean	± 2.53	± 3.43	± 2.90
Number	30	31	30

It would appear from the grades that the group from the regions performed better in the course than the personnel from the Dhaka vicinity. However, an examination of the personnel and the experience of the attendees indicates that the first group had a higher percentage of Scientific Officers and Senior Scientific Officers than the second. This experience apparently surfaced during the course.

Following the completion of the course, the participants were requested to evaluate the course by means of a questionnaire. The following is a summary of the course evaluation obtained from the 31 participants.

1. How would you rate the course?

Poor	Good	Very good	Excellent
0	20	10	1

2. Would you recommend that this course be repeated?

Yes	No
31	0

3. What could be done to make the course more effective?

22 The course should be extended for a longer period of time.

10 A practical laboratory exercises for each participant should be included.

4. How do you think the instructor could be more effective in his teaching?

10 The course could be better understood in Bengali.

5. Should anything be dropped or added to this course?

25 Nothing should be dropped or added.

2 Practical laboratory exercise should be added.

4 No comment.

Information was obtained from the participants in the course that the terminology and course was very difficult since they had never been exposed to an instrumentation course. Dhaka University nor Bangladesh Agricultural University do not have instrumentation courses dealing with the theory and operation of analytical instruments. An appeal to these institutions of higher learning should be made to initiate a course covering the fundamentals involved in this phase of Agricultural Chemistry. A person finishing studies at a University should be totally prepared and trained to enter the scientific community. This initiation should be urged at the earliest possible time.

BARI, Maintenance Section, Joydebpur

A visit to the BARI Maintenance Section at Joydebpur was made and a tour and explanation of the operation was given by Mr. Harvey Carr, IADS Maintenance Specialist. An unbelievable amount of progress has been made since the June, 1984 consultancy. A great deal of thought, effort, and work has been expended into moulding this operation. It was gratifying to see that a number of the recommendation advanced in the June, 1984 consultancy had been either adopted or were in the process of being initiated. To cite these which have been adopted and the procedure improved.

1984 recommendation
(number in report)

2	Central Inventory
3	Central Purchasing of parts
6	Library of Operations and service manuals
7	Repair Personnel

Central Inventory: An inventory of the equipment in the laboratories at BARI has been initiated. A record of the essential information concerning the equipment in the laboratories will be on file and any new equipment added as it is received. The repair record as well as the maintenance cost on each piece of equipment will be tabulated. These figures can be considered when future purchases of the same type of equipment are required.

The inventory is primarily of BARI, but it should be extended to all BARC affiliated laboratories.

Central Purchasing of Parts: Spare parts for the transportation fleet were located in a bay at BARC in June, 1984 with inadequate space to work on the vehicles, while the farm implement parts were scattered about in the Agricultural Engineering Section at BARI, Joydebpur. The present day system allows for storage by bin so that a quick location of the part can be made. Accurate records are kept which can be used to maintain an adequate stock of spare parts to keep the transportation fleet and the farm machinery functioning at peak performance. Further, these records can indicate the items which have a frequent turn over and the frequency of restocking can be estimated.

A similar system is planned for the instruments. However, a more rigid storage conditions would be necessary. A room for these spare parts is available. Air conditioning, rodent proofing, and dehumidification are going to be added together with a "Hot-box" for keeping the more delicate parts absolutely moisture free. These precautions should suffice. However, to be absolutely safe, a "Vacu-Pak" machine of

sufficient size for parts would be invaluable and in the overall picture a good economical measure in case of the failure of the present system considering the cost of the parts. The machine incases the part or parts in a plastic wrap on a Cardboard and then evacuates the wrapping to give the absence of atomosphere within the package. It is moisture and dust proof.

Library of Operational and Service Manuals: Mr. Carr has begun to copy all operational and service manuals available in the various laboratories. These manuals have been cataloged and the location of them, if it is available, is rapid. This is a must for instrument repair and/or operation. It is discouraging to learn that instruments are still being delivered without operation manuals. The manuals "disappear" between the point of shipment and the final delivery of the instrument. It is next to impossible to install some instruments without these manuals. Any laboratory having need of an operations or service manual should contact the BARI Maintenance Section. If it is not in their library arrangements should be made for its reproduction or purchase.

Repair Personnel: At the present time, Mr. Carr does not have an instrument repairman. He does have a person who is capable of maintaining and repairing refrigeration, pumps, and mechanical equipment. It is hoped that instrument repair personnel will be available in the very near future. Several bright prospects have been uncovered and have been referred to Mr. Carr.

A method to request repair has been devised. It is the "Work-Order" system. If repair is required a "work-order" is sent to the

Maintenance Section, who will dispatch the proper repairman to the job. If parts are required, they are ordered through Central Purchasing with the Work Order number as part of the order. When the part arrives, it can be immediately identified and the repairs made immediately.

The method has been utilized in almost every type of organization. It is a very feasible method, however, it does require cooperation between Maintenance and the Laboratory and vice versa. This point should be made clear to the laboratories that an inoperative piece of equipment is non-productive and useless. It is to the laboratories benefit to have it back in operation and the only way this can be accomplished is by Contacting Maintenance through the Work Order form.

BINA - Mymensingh:

The instrumentation laboratory has improved greatly since the last visit. Although the room was clean at the initial visit (1984 consultancy), this time it showed definite signs of a continuous and concentrated effort at good housekeeping practices. The instruments were neatly placed on the desk tops with no sign of dust. The pH meters had their electrodes immersed in liquid. The room was air conditioned and the conditioner was operational. However, the doors were often left ajar which indicates that the self closing devices had not yet been installed.

The instrumentation showed signs of being maintained and in repair. With the exception of the three pieces of equipment listed in the Appendix, all instrumentation was in good working order. This can be

credited to Mr. Shafiqullah. He has had a year's training in Electrical Engineering and Computer Maintenance at the University of Vermont in Burlington, VT., USA. He has been doing a fine job keeping the equipment in good functioning condition. The repair record shows this fact. In the 1984 consultancy seventeen pieces of equipment were worked upon, while only three units needed examining at this visit.

Bangladesh Agricultural University - Mymensingh

Dr. Z.H. Bhuiya of the Soil Science Department was at a meeting, but I was met by Dr. M. Eaquab. During the last consultancy he had a trained instrument repair and maintenance person. He has left and at the present time, he is training Mr. Abdul Halim, who was a participant in the course. Mr. Halim shows promise, but will need help. Dr. Eaquab's lab. again was impressive. The cleanliness and obvious care given the instruments show a definite respect for these Analytical Aids.

BARI, RARS, Jessore

There has been no improvement in this laboratory over the year. It is still unclean and dusty. If any observation would be made, the laboratory is more cluttered than it was previously. Two pieces of equipment had refrigeration problems. These problems existed last year. The laboratory made no effort to have local repairman rectify them. One piece of equipment was a deep freeze which would not achieve the required temperature. This was due to the wrong freon gas being in one of the compressors. Instead of getting this repaired locally, a new deep freeze was delivered. This does not help the situation but rather hinders.

Either local repairs or a work order to BARI Maintenance Section could have repaired the unit. No new equipment should be ordered or issued until the laboratories show an effort to maintain their present equipment. If a piece of equipment is beyond repair, it should be so certified by the Maintenance Section Representative.

BARI, RARS, Ishurdi

This was one of the better regional stations visited from a house-keeping viewpoint. The majority of the laboratories were clean and orderly. It appeared that cleaning chores were first on the agenda each day.

No program or work has been started to alleviate the shortage of electrical outlets in the laboratory. This is a major drawback to any type of scientific investigation. In one lab, a pH meter must be moved from the bench to a stool near the outlet to make a pH measurement. This was reported in 1984. There should be a minimum of six to eight outlets in each laboratory, preferably spaced $1\frac{1}{2}$ to 2 meters apart in the bench area, and 1 meter apart in the instrument room. This really is not a job for BARI maintenance. It can be accomplished by local electricians. This should have top priority at this station. It is useless to send equipment and apparatus to RARS, Ishurdi until this shortage of outlets is corrected.

The need for fundamental training in the basic sciences surfaced during conversations with the personnel. This training could have been given during the courses held at BARI, Joydebpur. RARS, Ishurdi did not send any individuals, but SRTI, Ishurdi sent two.

The PSO, Dr. A. Islam, and the Director of SRTI both ask for an extended consultancy. However, commitments at my place of employment in the U.S. would not allow for extension.

SRTI, Ishurdi

Agronomy

The repair to instruments and instructions in the use of them are listed in the Appendix. They are well equipped as far as instrumentation is concerned. Their major drawback is repair. One of the participants of the course is employed in this laboratory. He has already begun a maintenance schedule for instrument upkeep. They need an air conditioned room with self-closing doors to maintain a low humidity in this laboratory. One of the instruments which malfunctioned was found to contain broken connections to an integrated circuit, which was caused by high moisture.

Plant Pathology

Moisture and lack of understanding of their equipment has caused damage to equipment in this laboratory. Heavy crusting of rust has caused the inoperation of microscopes, which now can only be repaired by a precision machine shop. Failure to read the operating instructions has resulted in a burned out transformer and lamps. The unit was plugged into 220 VAC when a step down transformer from 220 VAC to 115 VAC should have been used.

Training and Communication Division

The Head of the Division presented me with a list of equipment in

need of repair. Some of the equipment was in parts with no manual for their placement, others were complicated electronic equipment with no circuit operating instructions. However, seventy percent of the equipment on the list was repaired.

The Director of the SRTI went to the Airport with me and asked that some arrangement be made for instrumentation repairs. This was a major area of concern.

BJRI, Dhaka

Three sections of this institute were visited namely soils, physiology, and microbiology. The physiology section was well kept and showed signs of good housekeeping. The soils and microbiology laboratories were cluttered, dirty, and dusty. The latter two laboratories were not conducive to giving a reasonable longevity to instruments. There was a complete shortage of workable electrical outlets. I would predict that by this fall the working instruments in these laboratories will be reduced by at least 25 percent. These instruments will be beyond repair unless several measures are taken:

- a. A thorough house cleaning - get rid of the dirt and dust and a concentrated effort to maintain a clean surroundings.
- b. Reduce the humidity by dehumidifiers and/or air conditioners. Maintaining a constant atmosphere.
- c. Self closing doors on the instrument rooms. And the doors should be kept closed.
- d. Rodent proof the rooms.

The microbiology section received a HPLC unit. The person using this unit has no idea of its operation, what its use is, and for what purpose it was purchased. This unit is an extremely delicate instrument

which should be used only by an individual with a good technical and theoretical knowledge of its operation. This is a prime example of donors providing sophisticated instrumentation in a case where it is not technically applicable.

Dhaka University, Dhaka

The Soil Science Building was being renovated during the closing of the University. Proper care was not taken of the instrumentation. At least four analytical balances were rendered useless plus four other instruments. These instruments are, for all practical purposes, spare parts. Three of the four Chinese balances installed last year are in ruins. These instruments should have been moved during this renovation or at least a plastic sheet placed over them. This damage was mostly in the teaching laboratories. The research laboratories were in fairly good condition. Especially those laboratories where the faculty have been in attendance on a daily basis.

BRRI, Joydebpur

The Soil Chemistry Section of BRRI has an Electronic Mechanic named Mohammed Hossain. He is attempting to do an acceptable job, but he lacks the technical knowledge of modern day instrumentation. With proper training and tutoring, he would probably be capable of doing a respectable job of maintenance on the less sophisticated instruments. Further, he is working under the handicap of not having the proper tools. He does not have a VOM (volt-ohm-meter), a proper set of screwdrivers, nut drivers, allen wrenches, etc. to do his work properly. There is also

a lack of spare parts, such as spare bulbs for the Mettler Balance, Spare Electrodes, Spare Solutions of Buffers (pH 4.0 and 7.0), assortment of electrical plugs, and other expendable items.

When a piece of equipment is delivered it should be fitted with a plug using the proper wiring color coding. This plug should then not be removed. However this is not the case, as many times I saw evidence of plug switching. A good example occurred in one of the laboratories, where countless time was spent tracing a problem which occurred and rendered a balance inoperable because of plug switching. When the plug was replaced it was wired improperly. Luckily, no damage to the unit was observed or to the power receptacle. It should be mandatory that each piece of electrical or electronic equipment have a plug and employees should be forbidden to remove it.

The instruments in the Soil Chemistry Section are based in at least two separate rooms neither of which follows the basic rules of instrumentation maintenance and preservation. A single room should be selected as the central instrument room with one person in charge and responsible for these units. This person should also be responsible for preventive maintenance on the instruments and be responsible for their upkeep.

There are three major enemies of instrumentation. They are:

1. Dirt and Dust
2. Moisture and Humidity
3. Rodents.

The instruments in the soil chemistry laboratories were observed to have a prominent layer of dirt and/or dust on them. This means that this central instrument room should undergo a thorough house cleaning which would include the ceiling, walls, floors, and desks

(inside and outside). Moisture and humidity can be controlled by either an air conditioner or a dehumidifier. An Air Conditioner is preferred since it also gives a constant temperature of operation. If a room was air conditioned, it would be foolish to leave doors open; therefore, all entrances to the room should have self closing devices in place and it should be mandatory that these doors be kept closed. This will also aid in rodent control. While the room is being cleaned, all small crevices and holes, such as around pipes should be filled to prevent the entrance of rodents. A weekly examination of the instrument room should be made for any possible new entrances.

A good example of this practice is being done in BRRRI. This is in the Physiology Section. Their clean room, which is used for inoculations, is a good example of how an instrument room should look.

REVISED ITINERARY: DR. L. MATTICK

<u>Date</u>	<u>Location</u>	<u>Description</u>	<u>Local Coordinator</u>
<u>March</u>			
8	Dhaka	12:30 Arrival	Dr. Portch
9	Dhaka	Prepare Course Material	Dr. Portch
10	Jcydebpur	BARI	Mr. Carr
11	Joydebpur	BARI	Dr. Portch
12	Joydebpur	BARI	Dr. Portch
13	Joydebpur/Dhaka	Purchasing for BARI	Dr. Portch
14	Dhaka	Prepare Course Material	Dr. Portch
15	Free	Weekend	Dr. Portch
16	Joydebpur	Analytical Chemistry and Course	Dr. Portch/Mr. Carr
17	Joydebpur	" " "	" "
18	Joydebpur	" " "	" "
19	Joydebpur	" " "	" "
20	Dhaka	Evaluate Course	Dr. Portch
21	H	Election	Dr. Portch
22	Free	Weekend	Dr. Portch
23	Mymensingh	BINA	Dr. Habibullah
24	Mynensingh	BAU	Dr. Eaquib
25	Jessore	BARI, RARS	Mr. T. Baten
26	Jessore/Ishurdi	Travel	Mr. Mallick
27	Ishurdi	BARI, SRTI	Mr. Mallick
28	Ishurdi/Dhaka	BARI, SRTI	Mr. Mallick

<u>Date</u>	<u>Location</u>	<u>Description</u>	<u>Local Coordinator</u>
29	Free		Dr. Portch
30	Joydebpur	Analytical Chemistry and Instrumentation	Dr. Portch/Mr. Carr
31	Joydebpur	" " "	" "
<u>April</u>			
1	Joydebpur	Analytical Chemistry and Instrumentation	Dr. Portch/Mr. Carr
2	Joydebpur	" " "	" "
3	Joydebpur	BARI	Dr. Portch
4	Dhaka	BJRI	Mr. Carr
5	Free	Weekend	Dr. Portch
6	Joydebpur	BRRI	Dr. Portch
7	Dhaka	BJRI	Dr. Portch/Mr. Carr
8	Dhaka	Dhaka University	Dr. Portch/Mr. Carr
9	Dhaka	Dhaka University	Dr. Portch
10	Joydebpur	BARI (Agronomy)	Dr. Portch
11	Joydebpur	BARI (ASD)	Dr. Portch
12	Free		Dr. Portch
13	Dhaka	Debriefing 12:00 N	Dr. Portch/Mr. Carr
14	Dhaka	Departure 2:00 PM	Dr. Portch

SHORT COURSE
ON
FUNDAMENTALS OF ANALYTICAL CHEMISTRY
AND INSTRUMENTATION

March 16-19, 1985
BARI, Joydebpur, Gazipur

OBJECTIVES:

Analytical Chemistry and instrumentation provide a valuable support to Agricultural Research. Speed and accuracy are of the utmost importance. Laboratory personnel must understand the fundamentals of analytical chemistry, instrumentation installation, basic instrumentation, and simple repair and maintenance of equipment. This short course is designed to give laboratory personnel needed competence in the major analytical methods used in Agricultural Research.

PROGRAM

<u>Date/Time</u>	<u>Activity</u>	<u>Responsible Person</u>
<u>March 16, 1985</u>		
08:30-09:00	Course Inauguration	Director-General, BARI or Representative
09:00-09:30	Tea	
09:30-13:00	The Analytical Balance	Dr. L. Mattick Cornell University
13:00-14:00	Lunch	
14:00-16:00	Fundamentals of Analytical Chemistry	Dr. L. Mattick
16:00-16:30	Tea	

<u>Date/Time</u>	<u>Activity</u>	<u>Responsible Person</u>
<u>March 17, 1985</u>		
08:00-10:00	Gravimetric Analysis, Volumetric Analysis	Dr. L. Mattick
10:00-10:30	Tea	
10:30-13:00	Hydrogen Ion Concentration	Dr. L. Mattick
13:00-14:00	Lunch	
14:00-16:00	Spectrophotometry (continued)	Dr. L. Mattick
16:00-16:30	Tea	
<u>March 18, 1985</u>		
08:00-10:00	Spectrophotometry (continued)	Dr. L. Mattick
10:00-10:30	Tea	
10:30-13:00	Spectrophotometry (continued) Atomic Absorption Spectrophotometry	Dr. L. Mattick
13:00-14:00	Lunch:	
14:00-16:00	Atomic Absorption Spectrophotometry (continued)	Dr. L. Mattick
16:00-16:30	Tea	
<u>March 19, 1985</u>		
08:00-10:00	Gas Chromatography	Dr. L. Mattick
10:00-10:30	Tea	
10:30-13:00	High Pressure Liquid Chromatography Statistical Treatment of Analytical Data	Dr. L. Mattick
13:00-14:00	Lunch	
14:00-14:30	Review	Dr. L. Mattick
14:30-15:15	Final Evaluation Examination	Dr. L. Mattick
15:15-16:00	Course Closing	Director-General, BARI or Representative

LIST OF THE PARTICIPANTS

ANALYTICAL CHEMISTRY AND INSTRUMENTATION COURSE

March 16-19, 1985

BARI, Joydebpur

<u>Name</u>	<u>Designation</u>	<u>Organization</u>
1. Syed Alauddin Ahmed	S.O.	BJRI
2. Md. Jahurul Hoque	Junior Analyst	SRTI
3. S.M. Khaled	S.O.	BARI
4. Md. Azizul Haque	S.O.	BARI
5. Md. Zulfiqul Alam	Scientific Assistant	SRTI
6. Md. Shafiqullah	S.O.	BINA
7. Mohammad Ali Khan	Laboratory Technician	BAU
8. Md. Momen Miah	S.O.	BJRI
9. Md. Badruddin	J.E.O.	BINA
10. A.Z.M. Shamsuddin	S.S.O.	BARI
11. A.T.S. Zahirul Islam	S.S.O.	BARI
12. Md. Rafiqul Islam	Lecturer	BAU
13. Md. A. Halim	Laboratory Technician	BAU
14. Md. Murshidul Kabir	S.O.	BTRI
15. Mohammed Hossain	Electronic Mechanic	BTRI

LIST OF THE PARTICIPANTS"ANALYTICAL CHEMISTRY AND INSTRUMENTATION"

March 30 - April 2, 1985

BARI, Joydebpur

	<u>Name</u>	<u>Designation</u>	<u>Organization</u>
1.	Md. Abul Hossain	Senior Scientific Officer	BARI, Joydebpur
2.	Md. Nakib-e-Islam	Research Assistant	BARI, Joydebpur
3.	Munawara Begum	Scientific Assistant-1	BINA, Mymensingh
4.	Suraiya Khandker	Scientific Officer	BJRI
5.	A.K.M. Rohul Kabir	Scientific Officer	BJRI
6.	Faruk Ahmed	Scientific Assistant-1	BINA
7.	Md. Mofazzal Haque	Scientific Officer	BARI
8.	Jamaluddin Ahmed	Senior Scientific Officer	BARI
9.	Shahid Akhtar Hossain	Lecturer	DU
10.	Md. Ebadur Rahman	Research Assistant	SRDI
11.	Md. Arshad	Scientific Officer	SRDI
12.	Md. Shamsur Rahman	Scientific Officer	BARRI
13.	Md. Abdul Latif	Research Assistant	BARI
14.	Md. Mahbubul Alam	Senior Scientific Assistant	BARI
15.	Md. Mashihur Rahman	Senior Scientific Assistant	BARI
16.	A.K.M. Anwarul Haque	Scientific Officer	BARRI

BARI, Joydebpur - Soil Science Lab.

Distilled water distribution system - Pumps would keep running and erratically turn off. This caused tremendous pressure at the head of the pumps which resulted in very hot water. This in turn caused the PVC pipe to melt and deform. Removed and examined the pressure cut off switch and found it to be defective and it could not be repaired. Searched in the "Old Dhaka" business district and after several attempts found a used unit which could be adapted to the system. Repaired the pipe connections, placed the cut off switch in the system, and adjusted the Cut-in and Cut-out pressures. Unit in operation.

Mettler balance H31AR S/N 329349

Scale was misaligned and out-of-focus: realigned, focused, and checked operation and sensitivity. Balance Ok

BARI, Joydebpur - Soil Microbiology

Sciencetech balance, Model 3320-01 S/N 2179

Purchased by IADS. Arrived in non-operating condition seven months ago. Obtained a service manual from the company in the United States and hand carried it to Bangladesh. An analysis of the unit indicates that an integrated circuit, ICI-1, is faulty. This is an IC divider DS8857J with a Sciencetech part number of 2246.

By all standards this unit should still be under warranty and should be replaced or repaired by the company. Work order No. 50 has been placed with the Maintenance Section.

Astell Heason Automatic Autoclave, S/N SW0879

This unit has lost its automatic function and must be operated manually with the timer. The unit requires a new timer. This is obtainable from Astell Heason as a Crouzet timer (1 hr) part number XAH523. A work order, No. 49, has been placed with the Maintenance Section

BARI, Joydebpur - Plant Pathology

American Optical microscope light - A faulty step down transformer (115 VAC - 6.3 VAC) has an open in the primary winding. A replacement has been ordered from AO which will be hand delivered to Bangladesh. The transformer can be replace before the end of this consultancy. This was not done because the part did not arrive in time.

Waring Blender, Model 230700A - The wires were frayed and bare. This is an extremely dangerous situation which could cause serious injury or death by electrocution. The wires had shorted causing an open in the line. Repaired the lines only to find the carbon brushes were missing. Brushes were found and unit repaired and operating.

Wild Heerbrugg Microscope, S/N 145204.

The focusing gear at the end of travel was milled smooth. Gear should be replaced. Made a make - shift repair to operate at upper range of the travel. If it steps into the lower range, it can not be returned to upper unless lifted by fingers.

Isuzu Cool Oven. Type KT-50, No. S/N

Complaint was that the oven would not heat. It was not an oven, but a low temperature incubator. The heating coils had been replaced with a flooding refrigeration system. Therefore, it could not heat.

Entomology

Li Cor Leaf Area Meter, Model 3100 S/N LAM453-8211.

Fuse power cord and instruction manual missing. Transformers appear to be shorted. Wires have been disconnected from the unit. A cover for the terminals is broken. This unit requires extensive work. The individuals in the laboratory have no idea of what its purpose is in the laboratory or why its needed.

Agronomy

Li Cor Portable Leaf Area Meter. Model LI-3000 S/N PAM916-3111.

Assembled the unit and put the batteries on charge. They were completely discharged. Needs new battery (NiCad Part No. 403014, 6.0 volts, 4.0 amp hours). Worked on 220 VAC, operates satisfactorily.

Fisher Scientific Co. Scale Model 4020 S/N 145421.

Installed the unit with Step down transformer since it is a 115 VAC unit. Leveled and checked accuracy and precision. Unit Ok.

Fisher Single Pan Balance Model 3000 (Ainsworth S/N 86-2585).

Investigator was disappointed that it read to only one decimal place. A check revealed that this was a single range balance to 3000 g. and reads five figures, thus only one decimal point.

Li Cor Model Li 185B Quantum/Radiometer/Photometer S/N ORPB1266-3111.

Needs two 9 volt transistor batteries. Checked on 220 VAC operation, operates satisfactorily.

Li Cor Steady State Porometer Model - 1600 S/N SSP 328-8111.

Needs Ni Cad battery. Works on 220 VAC. Checked operation works fine.

BINA - Mynensingh:

Turner Flame Photometer Model 510 S/N 41153

Control Unit Model 510 S/N 21153. This unit was previously in Soil Testing Laboratory, BARI, Joydebpur. It was checked out and the electronics appeared to be satisfactory. This was not done with flame operation, since the compressor had been damaged. When a flame was used to check the instrument, the following two malfunctions were found. The photocell (Clairex CL702L) which controls the gas solenoid does not function properly, and the Sodium Photocell, (TS433E) did not respond to the sodium concentrations.

Pye Unicam SP 1000 Infrared Spectrophotometer. S/N 64317.

Defective compression spring in the advance and disengage wavelength drive. Rust on optical null system in the reference side. The optics are fogged and pitted and are beyond repolishing. This instrument can not be repaired for a reasonable sum of money. It would cost more than the instrument is worth. It should be then taken off inventory and sent to the Maintenance Section at Joydebpur for possible spare parts.

Jarrell Ash Dial Atom III Model 82/760. S/N 21671

This instrument was worked on by both Md. Shafiqullah and myself for the better part of 10 hours. The new boards (analog power supply and logic) were placed in the instrument as per the directions of the service manual. The voltages of the proven supply board was checked and found they were as specified. The instrument was started and it was found that the wavelength had no effect on the energy current. A check of the photomultiplier was made and it appeared to be functioning properly. A check of the other troubleshooting descriptions indicated that the photomultiplier was overloading, which might be due to a malfunction in this unit. Nearly every circuit has been checked and found to be working satisfactorily. However, the unit will not function as it is designed to be used. The only new unit would be a new photomultiplier. I have my doubts whether this will correct the malfunctions. This instrument was purchased in 1976 and has possibly given one or two years service. An examination of the history of this indicates that at least eight individuals have examined and attempted to repair this instrument to no avail (Dr. Mattick, Clayton, Hamilton, Rajjak, repairmen from New Delhi, Pakistan, the Nuclear Energy Commission, and Shafiqullah).

If at all possible, I would suggest this instrument be taken off inventory and sent to BARI, Maintenance Section, Joydebpur for spare parts, and if possible, a new unit purchased. The scientists have been delayed in their research by the lack of this instrument.

BARI, RARS, Jessore

LEC Refrigerated Deep Freeze Model LT386 S/N SLT 316/OA.

This unit was inoperative at the visit in 1984. The problem was diagnosed but no action to rectify the situation has been taken. It will require a service person with refrigeration gases (freon) to rectify the situation. Suggest that a work order be sent to BARC Maintenance Section..

Precision Low Temperature Incubator Model 805 S/N 29AK02

This instrument is one of several which was received at the same time which malfunctioned. The transformer on the temperature central board has been the cause of the problem. Suggest a work order be sent to BARC Maintenance Section.

EIL pH Meter S/N 7020/4275

This unit was on the repair list last time. The Electrode has not been replaced as yet. Meter still operates satisfactorily, but electrode is missing.

Avery 40 pound scale No Model No. No S/N.

Linkage again broken, was repaired temporarily last visit. Should be taken off inventory.

Olympus Zoom Scope S/N 276626.

Mechanism of the Zoom is jamming. Will not go to full zoom. One of the Phillips head screws holding the lens in place has had the extracting area of the screw damaged. A screw extractor was needed but not available.

Singer Caramate II Model 8836 S/N A22051

Intermittent operation. Open in the power cord repaired.

Kelvinator Freezer 700 Model KHF 700CV321 S/N M186153.

Installed and checked out. Operates Ok.

BARI, RARS, Ishurdi

Universal Moisture Tester. S/N EH2974

Has no operation manual. Manufactured by Burrows Equipment Co.,
Evanston, IL.

AB Dick Mimeograph Machine, Model 545H S/N 2735 - New

Drum roller is missing. Address AB Dick Co. Inc. 5700 West Touky
Avenue, Chicago, IL 60648.

Yamato Scale Model No. In Japanese S/N In Japanese Linkage was broken, re-
paired linkage, recalibrated the scale.

Inucabor, Model In Japanese S/N In Japanese Indicator lamp burned out,
needs replacement, Thermometer broken needs replacement, Thermostat
reading was incorrect - corrected and adjusted thermostat. Operates
Ok, but needs replacement parts listed.

Ishida Balance, S/N In Japanese - The pans were sticking. The balance
fulcrum was off center, recentered and repaired. Calibrated balance.
Operation Ok.

Hokutow Scale, 2 Kg. - scale was sticking and the balance was not zeroed.
Zeroed balance and eliminated the sticking scale - Calibrated
balance - Operated Ok.

Ainsworth Balance, Fisher Model 3000 S/N 86-4890

It is to be used on 115 VAC was plugged into 220 VAC. A check of the electronics appears Ok. Fuse was blown. Did not have 0.5 amp fuse. Can be obtained locally.

Fisher Accumet pH Meter Model 600 S/N 255

Meter Ok. Needs electrode (Fisher Combination Electrode - Cat No. 13-639-90) also needs pH 4.0 and pH 7.0 buffer.

Ohaus Triple Beam Balance. 2600g Cap. - Agate and knife edges are broken. Take off inventory. Useless in the present condition and would cost more than the balance was worth to repair it.

Eura balance - Mexican made. Model 2000 received with linkages broken. Repaired linkage, but no method available for zeroing the balance. It is factory adjusted scaled. Would not advise buying any more of these balances.

SRTI, Ishurdi

Agronomy

Bausch and Lomb Spectronic 20 S/N 01315520E

Meter would not zero. Instrument was working except for this malfunction. The leads to the integrated circuit OPAM LM308 (metal top) were corroded and open. Needs a new unit. Can be ordered from Bausch and Lomb; Instruments and Systems Division, 42 East Ave., P.O. Box 743, Rochester, N.Y. 14603.

Bausch and Lomb. Spectronic 710 S/N 0318273.

Checked instrument operation. Operates satisfactorily. Needs square cassettes with 10 mm pathlength, Silica, 45 mm tall. Matched set of 2. Cat. No. 33-17-68. From address above. Need 2 sets.

Hach di/2 Spectrophotometer S/N 2806

Checked operation and instructed staff on its operation.

Hach Portable pH Meter Model 16400. Batteries are below required voltage; need to be recharged. The battery charger could not be located.

Gallenkamp Muffle furnace - Element is open. This is an old model.

Parts may not be available for it. Remove from Inventory.

Corning Model 400 Flame Photometer. S/N 400/3251.

This model was assembled when the laboratory was last visited. They did not have success with its operation. After a prolonged examination of the electronics which checked out to be operating satisfactorily; Dismantled the burner and found the burner and burner stem were missing. This instrument came from Melbourne, Australia. Cat No. for burner. 460-39-009F. Cat No. for burner stem 401-02-014L.

Plant Pathology

Bios Microscope S/N 145012. - Fine focusing knob does not operate. When disassembled it was found that a layer of rust was encrusted from the fine focus to the macro focus knob. This can be repaired only by a precision machinist that can grind and polish the shaft.

AO Microscope One Ten Model 1130A. - Light burned out, transformer appears open. This unit is to be used on 115 VAC, it was plugged into the 220 VAC outlet.

Chinese Oven, Model and S/N in Chinese. Replaced the thermostat which was defective with a new unit. This unit was inoperative last year because of this defect. They were told what thermostat to order. This was delivered four months ago and was not replaced until this time. A local electrician could have done this work.

Training and Communication Division

3M Overhead Projector - Power resistor leakage. Repaired resistor and reconnected. Unit functions normally.

Two - Leitz Slide Projector, Pradovit CA 1500 Type 031-049-407

1st Unit slide ejector jammed. - released and repaired checked operation. Operated normally.

2nd Unit could not focus automatically. 1.5 VAC output burned out. Machine will operate remotely, but focusing must be done manually.

Two - Remote Controls

1st Unit - The pivot on the forward and reverse button broken. Repaired by gluing in position with surgical glue. Unit operates normally.

2nd unit - broken wire - repaired. Unit operates normally.

Two - Netzteil Z 131 battery eliminators

1st unit - Primary winding on the transformer open, selector switch

on the unit was at 115V; could have been plugged into 220 VAC which would have damaged the transformer.

2nd unit - Loose Connection at the fuse holder - resoldered. Unit functioned normally.

Lectrosonics Wireless Microphone. S/N M60241.

Uses seven mercury batteries for power. All seven batteries were completely exhausted. No replacements were on hand at the time.

Bell and Howell Sound Movie Projector - This unit had been partially dismantled. The parts were in a bag. No service manual available, therefore no idea where parts belong. Can only be repaired by an expert in movie projectors.

BJRI, Dhaka

Soil Science

Gallenkamp Flame Analyzer Model 25FGA-300-A.

Complaint was given that the galvanometer was unstable. Examination indicated that the air compressor was on the bench next to the unit. This compressor caused vibrations which were transmitted to the unit. When the air compressor was moved to a spot which was isolated from the unit, the difficulty disappeared. Prior to my arrival, an attempt was made to adjust certain units of the instrument. The instrument was readjusted and calibrated. This unit now is in operating order.

Corning Mega Pure System D2 - Complaint was a slow flow rate. Examination indicated that the supply, unit, and receptical plus the position of the hoses gave a total head pressure of approximately 6 inches of

water. The need is to place the bottom of the supply tank approximately six feet above the floor, then the top of the unit about five feet and the receptical on the floor. This will give a head pressure of six foot of water and flow should be normal.

Cenco Digester Cat. No. 34202 Lot. No. A0702

Delivered Nov. 10, 1984. Front panel of controller was "pushed-in" and disconnected. Replaced panel and made connections based on the wire length. There was no manual.

Microbiology

Knauer HPLC System. This unit was received consisting of solvent programmer, two pumps, column heater, injector valve, differential refractive index detector, variable VV - visible detector, dual pen recorder, and other accessories. Manual was missing. Therefore, the connections between the solvent programmer and the pumps or the inlet and outlet of the VV - Visible detector could not be made. The unit was set up to be operated with the differential refractive index detector. A three way high pressure stainless steel valve is needed. Unit was installed and flow checked. I would not allow anyone unfamiliar with the unit and without the manual to work on this unit or severe damage could result.

Physiology

W.G. Pye Model 290 pH Meter. S/N 103973

Instrument operates normally was not calibrated properly. Explained and instructed them in the method of calibration.

Mettler Electronic Pan Balance Model 2000 S/N A86600

The driver/decoder Integrated circuit is defective, needs replacing.

Fisher/Ainsworth Electronic Balance S/N 4124. This unit was delivered a week ago. It was purchased through a local distributor. The dial reads 8.8.8.8.8.8.8. This unit is definitely under warranty. If any work would be done on the unit, it immediately voids the warranty. The local distributor should be called and made to rectify the situation.

Sortorius Model 2004 MP S/N 3112010. This balance is malfunctioning. It has never worked. The same balance caused problems in our laboratory at Cornell and was returned after their service man could not repair it under warranty. There is no manual for operation or otherwise. I am at a loss to determine what is the difficulty.

pH Meter TOA-HM-7B S/N in Japanese was acting erratically.

Checked operation and found that the problem was in the electrode. Needs new electrode or attempt to rejuvenate this one. They had no N/10 HCl or N/10 KOH to do this job.

Mettler Top Loading Balance Model PL200 S/N 747201 ES-43702

Coupling is broken. Needs this part for operation.

BRRRI, Joydebpur

Soil Chemistry

pH Colman Electronic Photofluorometer Model 12C S/N B-10364.

Power cord is missing; Light source is open.

Mettler Balance Model H20T. S/N 373807.

Indicator wheel is missing. Can be operated, but not read. Must have mechanism for reading to repair.

Mettler P1200 Top Loading Balance S/N 390641.

Bulb was burned out; replaced bulb in this unit with bulb from the Model H20T. Unit operative. Focused the scale; adjusted, checked calibration. Unit operated satisfactorily.

Hitachi Atomic Absorption Spectrophotometer, Model 170-10 S/N 6321-5.

Replaced gas adjustment knob. Checked instrument operation and ability to optimize. Unit operated within specifications.

Cahn Electrobalance DTL Model 7500 S/N 70477.

This unit was received inoperative. The parallelogram/flexure support for the weighing pan does not align. This is extremely delicate and should be done only by a factory trained person.

Kodak Carousel 85 Projector - The focusing mechanism was inoperative.

This was repaired to working condition. The lamp is burned out; it needs a Sylvania 500W, 120V. No 2014 bulb.

Physiology

Hayaski Automatic Area Meter. Model AAM-7 S/N 14941. The unit would force the transparent belt to the right. The belt was in poor condition. Replaced the belt, adjusted it, and checked operation. Unit operated satisfactorily.

Mettler H54AR Analytical Balance S/N 25327. The plug was placed on this

unit incorrectly. The green wire was placed in a "hot" position, but in US wiring codes; green is ground. When the plug was wired correctly, the unit operated normally. The balance was adjusted for accuracy and sensitivity.

Dhaka University, Dhaka

OTGIGO Balance (Chinese) Model DTG-160 S/N 79085 1978/12.

Bulb was burned out, Balance was dirty, out of adjustment and focus. Replaced bulb with one from a non-operative unit. Adjusted, cleaned and focused balance. Adjusted for weight accuracy and sensitivity.

OTGIGO Balance (Chinese) Model DTG-160 S/N 79129 1979/12.

Glass doors broken, leveling legs are broken. Weights are missing at least 1/8 inch of dirt and dust inside and outside of the balance. Use for spare parts. Remove from inventory.

OTGIGO Balance (Chinese) Model DTG-160 S/N 79500 1979/12.

In same condition as the one previously described. Use for spare parts. Take off inventory.

OTGIGO Balance (Chinese) Model DTG-160 S/N 79024 1979/12.

In same condition as the previous two units. Use for spare parts. Take off inventory.

Mettler Balance Model H16 S/N 181590. Same condition as the Chinese balances. Can only be used for spare parts; unrepairable. Take off inventory.

Also in the same Category were several other instruments which were examined. These units will require exhaustive cleaning and repair. They were all in the same room with the last mentioned three balances. This room was being repaired. The scrapings, paint chips, dirt and dust fell into these units. No one bothered to cover them during the renovation. The instruments are:

Chloridometer

Colman Junior II Spectrophotometer Model 6/35

pH Colman Fluorometer

Corning Model 7 pH meter

Mettler PI210 Top Loading Balance S/N 536129.

This balance has had the weight knobs forced past the stops. They are bent out of shape. Moisture has also taken its toll; the working mechanisms are rusty. Good for spare parts. Take off inventory.

Sortorius Kilomat Balance Type 206 S/N 26646 1984.

This balance was just received. It was completely out of focus and adjustment. Refocused and adjusted.

EIL pH Meter Model 7020 S/N 7020/3902.

Check operation. Problem lies with the electrodes. Instructed how to rejuvenate the glass electrodes.

Pye Unicam pH Meter Model 291 MK 2 S/N 178001.

Meter checks out as working satisfactorily. Problem lies in the electrode. Instructed the investigator on methods of rejuvenating the electrodes.

International Centrifuge Automatic Timing - Complaint was that it would not run. Found time/manual switch in the off position. Unit operated satisfactorily.

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