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**WORKSHOP ON REPAIR AND MAINTENANCE OF ANALYTICAL EQUIPMENTS  
ROYAL DRUG RESEARCH LABORATORY  
KATHMANDU, NEPAL**

DP/NEP/80/003/11-57

NEPAL

Technical report: Repair and Maintenance of Analytical Equipments in a  
Chemical Laboratory \*

Prepared for the Government of the Kingdom of Nepal  
by the United Nations Industrial Development Organization,  
acting as executing agency for the United Nations Development Programme

Based on the work of K.R. Sivaraman, Repair and Maintenance Expert

Backstopping Officer: T. De Silva, Chemical Industries Branch

United Nations Industrial Development Organization  
Vienna

\* This document has not been edited.

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### ABSTRACT

This workshop was conducted at the Royal Drug Research Laboratory, Kathmandu, Nepal between dates 27-8-91 to 30-8-91 in order to create an awareness on the aspects of basic repair and maintenance procedures to the various analytical equipments being used in different laboratories, be it an university, research organization, medical or pharmaceutical institution.

The 17 participants deputed from different organizations took keen interest in the workshop. A feedback from them indicated that a longer duration of the workshop was more desirable, at least lasting two weeks, with more lectures as well as practical sessions.

As Nepal is a developing country with very few technical manpower availability, and since they are totally dependent on imported equipments, their needs for technical assistance are also great. Technical manpower from India can help them to a certain extent, but for costly spare parts for instruments they would need financial assistance from outside.

Since UNIDO/UNDP has provided financial support for the purchase of sophisticated analytical equipments in RDRL, it would be better if they can also allocate resources for the optimum and continued use of these costly equipments for the coming years also.

## INTRODUCTION

This report is submitted by K.R.Sivaraman, Scientist-in-Charge, Instrumentation Section, Central Drug Research Institute, Lucknow, India, who was deputed as an expert on mission to Kathmandu, Nepal under the project No.DP/NEP/80/003/11-57/J13422 for a duration of two weeks commencing from 19-8-91. The mission was intended to organise and conduct a workshop on the repair and maintenance of Analytical equipments in a Chemical Laboratory. The workshop was conducted at the premises of the Royal Drug Research Laboratory, Kathmandu and the project co-ordinator was Dr. P.M. Adhikari, Deputy Director General, RDRL.

The expected duration of the workshop was one week. But it has to be limited to 4 days (27-8-91 to 30-8-91) due to intervening national holidays. However, the response to the workshop was highly satisfactory since 17 participants (among these 12 were from outside RDRL) actually took part in the workshop and expressed keen interest in the methods of instrumental repairs.

This workshop though planned to take place in March, 1991, had been postponed due to administrative and other reasons and hence it was organised and conducted in a hurried manner, within the limited time available. In spite of this essential theoretical and practical background have been provided to the participants to illustrate the use and function of the electronic components and circuits used in the present day instruments.

Before the commencement of the workshop, the technical Officers in the RDRL, who are responsible for the maintenance of the Analytical equipments were given necessary instructions and training in the use of the test and measuring equipments available with them for trouble shooting purposes.

## I. SET UP OF THE RDRL - VENUE OF THE WORKSHOP

The Royal Drug Research Laboratory, Tnapathali, Kathmandu is the premier national research organisation involved in the development of basic drugs from natural resources available in Nepal. This laboratory has many sophisticated electronic equipments used in pharmaceutical/drug research laboratories.

Some of the instruments available are as follows :

- a. Nicolet Model 5DX Fourier Transform Infrared Spectrophotometer
- b. Varian model EM 360L Nuclear Magnetic Resonance Spectrometer,
- c. Waters - High Pressure Liquid Chromatograph
- d. Shimadzu Model UV-160A UV-VIS Spectrophotometer
- e. Hilger & Watts Model 1550 Atomic Absorption Spectrophotometer
- f. Hewlett-Packard Model 5890A gas liquid chromatograph

In addition they have a number of modern Test and Measuring instruments as follows :

- a. Oscilloscope, Tektronix, Model 2236 - 100 MHz BW with frequency counter, timer and digital multimeter
- b. Tektronix TM 515 Power module with SC 504 scope, FG 504 Function generator & DC 503A counter
- c. Hewlett Packard 8904A Multifunction Synthesiser
- d. Hewlett Packard 8656B Synthesised Signal generator
- e. Sony(Tektronix) 308 Data analyser
- f. Hewlett Packard 4261A LCR meter
- g. Hewlett Packard 6253A dual DC power supply.

Hence, RDRL could be considered as the best venue in Nepal for the conduct of the workshop on Instrument maintenance. The laboratory has two technical officers, Mr. D.M. Shakya and Mr. D.R. Shakya both of whom have attended training on Instrumentation at Bristol, U.K., lasting six months in each case. They also have an organised tool room for repair of instruments.

## II. INITIAL PREPARATIONS AND SITE ACTIVITIES

Groundwork for the conduct of the workshop started with the planning of the workshop schedule, which included preliminary and introductory lecture classes and demonstration of repairs on instruments used in the laboratory.

With a view on this, the various test and measuring instruments available were tested individually. The use and application of these sophisticated equipments were explained to the technical officers of the laboratory. All the test instruments were found in perfect working condition.

Lecture notes on electronic fundamentals as well as details on basic building blocks of electronic circuits were prepared and photocopied for distribution to the participants, using a standard text book, viz. :

'Electronics for Service Engineer', Vol.II  
by Ian R. Sinclair,  
Published by Technical Press, Oxford, 1980 Edition.

Additional minimum and essential tools required for an electronic laboratory were purchased for use by the participants in order to impart a feeling of involvement.

The repair of the following equipments were undertaken before the commencement of the workshop;

### 1. Varian EM 360L NMR Spectrometer

It was reported to be out of order for quite sometime. The system was inspected. As it is having a permanent magnet it will take atleast a minimum of 7 days for temperature and magnet field stability. However, repair was attempted to obtain an NMR peak for the Homo (water) sample by adjusting the magnetic shunt and probe cleaning. Only a very faint signal response with excessive spinning side bands were obtained and this could not be improved. The console power supply, magnet temperature control unit, the field modulator and the recorder section are found in proper working order. Due to lack of time further check up was not possible.

## 2. Varian Model 635 UV-VIS Spectrophotometer

This instrument was not showing proper response. The source mirror was properly fixed and aligned. Two 12 volts 2W lamps and 3 plane mirrors in the chopper assembly needed replacement, these were replaced from a similar instrument. Later the main electronic printed circuit board also was replaced from the spare unit. The spectral response to a standard sample showed that the performance in the visible as well as the UV regions are satisfactory and the recording is also o.k.

### **III. WORKSHOP PROGRAMME**

Inaugrated by Director General, Dr. S.B. Malla

The workshop schedule consisted of lectures in the morning and practical sessions in the afternoons. Theoretical lecture notes were distributed to the 17 participants. Practical demonstration, use and application of the various test and measuring equipments were explained in the laboratory using the Varian NMR Spectrometer as a test model. Testing of electronic components using multimeters and trouble shooting methods on a defective instrument have been explained from a practical point of view to the participants. Methods of preventive maintenance together with necessary precautions essential in the servicing of optical instruments have been detailed during the lecture classes.

The participants were allowed to interact freely and discuss problems of maintenance that arise in their respective organisations.

The participants greatly enjoyed the practical sessions and were looking for more opportunities for opening and investigating problems.

### **IV. CONCLUSIONS**

At the end of the workshop a feedback questionnaire received from the participants reflected the interest shown by the participants towards the conduct of the workshop. The basic objective of creating an awareness



and need for preventive maintenance was appreciated well. But all of them wished that such a workshop should be of a longer duration to be of any practical use - so that each candidate can get a real grasp and confidence to tackle the problem himself. They are of the view that more practical cases involving instruments of different nature be taken up and they should be given a free hand to trouble-shoot, under supervision.

I think they are correct since I am also of the opinion that it is practically impossible for anybody to impart information on general methods of repairs- especially when one is dealing with advanced instruments with a lot of data - processing capabilities at present. The present workshop can only aim to initiate a person interested in instrument repairs how to go about on repairs and maintenance.

#### V. RECOMMENDATIONS

It is hoped that the workshop would help in the desired goal of proper maintenance of instruments, but it needs follow-up actions on the following lines:

- a. Because the basic infrastructure facilities are available at the Royal Drug Research Laboratory this laboratory can be made to function as a nucleus of instrument maintenance activities for users of instruments in the whole of Nepal.
- b. The RDRL should be developed as a national centre for co-ordinating the procurement of new instruments as well as spare parts.
- c. Holding of such workshops/seminars on the application and maintenance of instruments should be an annual feature lasting two to four weeks.
- d. Technical persons with sufficient basic knowledge in electronics and users, should be deputed for training abroad, the nearest country being India, in order to keep in touch with the state of art in new instruments. The Central Drug Research Institute in Lucknow as well as other national centres can provide necessary help in this regard.

e. With the above measures it is possible that within a span of few years RDRL should be in a position to train and develop enough manpower requirements who can take up small fabrication jobs in addition to maintenance jobs.

Hence, it is recommended that RDRL should take measures to project itself as a national centre for management of Analytical and Process instruments. They should depute persons for training after suitable selection. UNIDO/UNDP should provide necessary financial and technical support by continuing its projects atleast for the next few years till a certain amount of self-sufficiency is achieved by Nepal, in the field of Instrument maintenance.

**Job description**

Term of Reference

**Field :** Instrument Repair and Maintenance

**Job description:** The candidate should be a graduate in electronics with at least 7 to 10 years experience in research laboratory doing regular repair and maintenance work. He/She should be able to assist to conduct the proposed workshop on the Instrumentation and Instrument maintenance and also be able to demonstrate and utilize the test equipments for the purpose of the general maintenance of the analytical instruments like UV/VIS, I.R., A.A. Spectrophotometers, GLC and HPLC etc.

**Duration :** 2 Weeks

**Place of Work:** Royal Drug Research Laboratory, Kathmandu.

Job description of the Expert on Instrument repair & maintenance

1. To act as an expert for conducting a workshop on Instrument Repair and Maintenance by Royal Drug Research Laboratory, Thapathali, Kathmandu, Nepal.
2. To advise and assist RDRL on general repair & maintenance of instruments especially the sophisticated instruments.
3. To train RDRL staff on technical matters related to the repair and maintenance of the electronic instruments.

ANNEXURE - b

**Workshop and course co-ordinators**

1. UNDP Kathmandu
2. Dr. P.M. Adhikari, Dy. Director General, RDRL, Kathmandu
3. K.R. Sivaraman, C.D.R.I., Lucknow, India.
4. Dr. Acharya, Scientific Officer, R.D.R.L, Kathmandu
5. Mr. P.M. Shakya, Technical Officer, RDRL, Kathmandu
6. Mr. D.R. Shakya, Technical Officer, RDRL, Kathmandu.

## Background

Instruments play vital role in analytical, research, quality control etc. for qualitative and quantitative determinations. The modern analytical instruments are indispensable tools for accurate, quick results. It consumes less sample and give meaningful representation of data.

Technician has to solve problems as instrument malfunction from time to time. Where technician's knowledge of maintenance, fault diagnosis and repair skill has to play its part. If he/she lacks the adequate knowledge regarding the service ; contacts the respective representative of instrument for service and repair.

- (a) RDRL is equipped with modern analytical tools which promotes the research programme.
- (b) It has a small unit to maintain, fault diagnosis and to do simple repair.

## Objectives:-

With this background RDRL is organising this workshop to share its experience/problems with fellow participants of other institutions; so that they can share and acquire some practical aspects on repair and maintenance of the analytical instruments.

## Date and Venue

August 27 - 30, 1991.

Opening : RDRL Auditorium

Sessions: RDRL.

## Language

English

## Participants

About 12 participants from different institutes are expected to attend the workshop.

**National Workshop on Instrument Repair and Maintenance**

Details of the programme are as follows:

**Tuesday August 27, 1991**

**Venue RDRL Auditorium**

8:30 -	9:00	Registration,
9:00 -	10:30	Review of basic electricity and electronic components in equipments.
10:30 -	12:00	Inauguration by the chief guest, Welcome address - Dr.S.B. Malla Inaugural address - Chief guest, Vote of thanks, Refreshment
12:00 -	13:00	Review of basic electricity and electronic components in equipments.
14:00 -	17:00	Test and measuring equipments and overview.

**Wednesday August 28, 1991**

9:00 -	11:00	Aspects of preventive maintenance
11:30 -	13:00	Instrumentation I
14:00 -	17:00	Demonstration and practicals

**Thursday August 29, 1991**

9:00 -	11:00	Basic approach to trouble shooting procedure
11:30 -	13:00	Instrumentation II
14:00 -	17:00	Test and analysis trouble shooting methods

**Friday, August 30, 1991**

9:00 -	11:00	Demonstration and practicals
11:30 -	13:00	Demonstration and practicals
14:00 -	15:00	Discussion
15:00 -	16:00	Concluding function

**List of Participants**

<u>S.N.</u>	<u>Name</u>	<u>Designation</u>	<u>Office</u>
1.	Mr. Nirmal Acharya	Med.Technologist	Central Health Laboratory
2.	Mr. Kundan Bahadur Shrestha	Asst.Food Res.Off.	Food Research
3.	Mr. Lalit Ratna Shakya	Deputy Instructor	RECAST
4.	Mr. Rameswore Bhattaraj	Mechanical Engineer	Dept. of Std. & Met.
5.	Mr. Manju Ratna Bajracharya	Electrician	Royal Drug Ltd.
6.	Ms. Pramoda Pradhan	Chemist	Dept. of Mines & Geology
7.	Mr. Sunil Shrestha	Technologist	Bir Hospital
8.	Mr. Deen Bandhu Parajuli	Lab. Assistant	RONAST
9.	Mr. Mrigendra Bhupal Malla	Soil Chemist	Forest Research Div.
10.	Mr. Madhusudan Basnet	Asst. Agri. Engg.	N. A. R. C.
11.	Mr. Kaji Prasad Ghimire	Lab. Asst.	T.U.
12.	Mr. Kedar Subedi	Asst. Sc. Off.	R. D. R. L.
13.	Ms. Roshani Shakya	do	do
14.	Mr. Pradeep Man Shrestha	do	do
15.	Ms. Safala Shrestha	do	do
16.	Mr. Trilochan Upadhya	Asst. Chemist	do

**Backstopping Officer's Technical Comments  
on the Technical Report based on the work of  
K.R. SIVARAMAN, DP/NEP/80/003/11-57**

The activities of the short term consultant are well presented in the report. The expert has done his best to impart the maximum know how possible within this very short mission. The subjects covered during the workshop of three days are just sufficient to create an interest and an awareness about the need for instrument maintenance and repair. With the basic know how imparted, the technical staff at Royal Drug Research Laboratory should be able to confidently diagnose the defects and attend to trouble shooting. It was unfortunate that only three days were available for the workshop. The consultant has also attended to some repair work of instruments and in the process trained the local staff as well.

The recommendations of the Expert are valid and every attempt should be made to implement them.