



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

16513

PROCESSING OF MEDICINAL PLANTS CULTIVATED
AND COLLECTED IN NEPAL

DP/NEP/80/044

NEPAL

Technical report: Equipment maintenance*

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

Based on the work of Mr. Shahid Ahmed, expert engineer
in the repair and maintenance of equipment

Backstopping officer: R.O.B. Wijsekera
Chemical Industries Branch
Department of Industrial Operations

United Nations Industrial Development Organization
Vienna

676

* This document has been reproduced without formal editing.

TABLE OF CONTENTS

	<u>Page No.</u>
I. INTRODUCTION	1
II. OBJECTIVES AND LOGICS	1
III. ACTIVITIES AND OUTPUTS	1
IV. ACHIEVEMENTS OF OBJECTIVES	5
V. UTILISATION OF PROJECT RESULTS	5
VI. FINDINGS	6
VII. RECOMMENDATIONS	7
VIII. APPENDICES	7
A. List of Drawings/Documents	7
B. Training Programme I.	8
Training Programme II.	9

I. INTRODUCTION

The report under review gives summary of activities, findings and recommendations of Plant Engineer for second part of the mission only. First Terminal Report (11 August 1986 - 10 November 1986) covers the first part of the split mission. At the time of compilation of this report, the mission is concluded as far as time aspect is concerned. Some equipment are yet to be received whereas some are either partly or wrongly supplied. An estimated workload of four to six weeks is still remaining.

II. OBJECTIVES AND LOGICS

Keeping in view the technical know-how and facilities available locally, the assistance in plant engineering was requested. the following objectives were to be achieved:

1. Installation of remaining processing equipment
2. Installation of Boiler and allied equipment
3. Installation of Electric Generator
4. Designing and execution of Electrical Distribution System of the Plant.
5. Installation of Machine Tools and impartation of training on maintenance techniques to concerned staffs.
6. Providing assistance in preparation of specification and selection of remaining process and service equipment in accordance with product requirement and in conformity and prevailing technology within the organization.

III. ACTIVITIES AND OUTPUTS

Under this, the activities and outputs are discussed with reference to job description so as to appraise the actual quantum of work done.

1. Install the equipment including:

Proper layout of various types of equipment foundation fitting, safe and efficient electric, water and steam supply system. The machine layout was prepared during the first part of the mission.

Following equipment have been installed during the second part of the mission:

- a. Vacuum concentrators of 300 litres and 800 litres capacity have been commissioned.
- b. Counter Current Extractor has been commissioned and regular processing is being done.
- c. Hammer Mill (Pulverisor) has been installed and commissioned.
- d. Distilled Water Still has been erected and water produced from this still is being used in the processing.
- e. Glass Rectification Columns have been erected and electrically hooked up.
- f. Pilot Solvent Extraction Unit has been commissioned.
- g. Liquid to liquid Extractor has been tested and put into operation.
- h. Centrifuge has been installed and commissioned.
- i. Nestler Boiler has been erected and commissioned. Steam from this boiler has helped immensely in scaling up the production output.
- j. Electric Generator has been hooked up and being used in case of Electric failure from city mains as an alternative electric supply.
- k. Workshop machines like lathe, drilling, milling, sawing, welding etc. have been commissioned and staff trained on these.
- l. FRP lined tanks have been received without certain essential components. Moreover the tanks do not meet our specification and are not as ordered. The matter has been reported to manufacturer to replace/modify. The installation could not, therefore be undertaken.
- m. Pine Resin Processing Unit has been received but the installation could not be started because of condenser and heat exchanger are not meeting the materials standards. The installation of this unit has been included in the price to be done by the supplier.

- n. The remaining equipment like Jaw crusher, Root cutter and Filter Press have not been received yet.
 - o. Damaged machines like airconditioner and 250kg. balance were repaired in house and commissioned.
2. Advice on optimum utilization of available electricity, water and steam has been given both on verbal and written form.
- As suggested in the previous report, the plant management has procured chemicals for descaling the boiler and dosing. The plant personnel are using these regularly. As a result steam/fuel ratio has increased considerably. A steam output of around 14kg. of steam per kilogram of fuel is achieved which indicates that the boiler is in a good shape and the thermal energy of the fuel is used optimally. It is hoped that the necessary chemicals would be reordered timely and a followup would be made religiously.
 - Use of adequate lagging on pipes and steam jackets was suggested. New boiler has been installed. Pipes have been resized. Some pipes and steam jackets have been lagged. The remaining work, it is hoped would be completed soon.
 - Recirculation of condensate would not only save thermal energy but also reduce the quantity of softwater and water softening chemicals. The design has been worked out. Steam traps already installed. Hot well has been placed. Piping work is still remaining.
 - The water supply system was proposed to improve quality of water and thereby improving heat transfer coefficient which would improve overall efficiency of all heat consumers. The system has been installed and working partially and the benefits are not derived fully. The delay is in commissioning of sand filter and deionisor. As soon as these are hooked up. the system would operate as planned.

- In all heat consumers modulating valves and temperature sensors are incorporated to avoid subcooling/superheating of condensate and thereby saving water and steam
- All electrical machines now have adequately sized electric conductors properly calibrated starters and overloads safteys. New armoured electric feedres are laid. An electric panel comprising of circuit breakers change overswitch and bus bar compartment was designed to isolate supply for individual location at will. This panel has been installed. Some electrical feedres are changed to make the working area safe. Improvement in electrical distribution is felt but there is still some work to be done to bring the process area in accordance with international standards for avoiding the potentially explosive atmosphere.

3. Assist in production trial runs after installation of the equipment with particular reference to safety aspects.

Assistance was provided during the trial runs after installation of each machine. All aspects of machines operation were explained to process persons. Safety was the prime consideration in all installation. Suitable fuses, thermal overloads, earth fault protections, safety valves etc. have been incorporated wherever felt necessary within the limitation of constraints.

4. Set up a machine shop for maintenance, repair and fabrication of small equipment or component.

The machine shop comprised of Lathe, Milling, Drilling, Grinding, Welding (Gas and Electric) and all necessary hand and cutting tools have been set up. A building was constructed to house exlusevely utilities and services like boiler, electric generator and machine tools.

5. To train local personnel in running the machine shop and proper upkeep of the equipment.

This objective has only partially fulfilled due to delay on electrical hook up. Some training, however, has been imparted on use of hand and machine

tools. The maintenance staff has been made conversant to materials and techniques used in Chemical plants. Most of the repair and fabrication jobs are now done in house. It would be beneficial if some sort of formal training is arranged as per training programme given elsewhere in this report .

IV ACHIEVEMENT OF OBJECTIVES

In terms of objectives following are achieved:

- The installation of all remaining processing equipment like vacuum concentrators, counter current extractor, pulverisor, centrifuge rectification column, etc., has been done.
- Boiler and its ancillaries have been installed.
- Electric Generator and its accessories have been commissioned.
- Designing of electrical distribution system and its installation have been done.
- All machine tools have been hooked up and some initial training has been imparted.
- Assistance in preparation of specification of remaining process and service equipment has been provided.

V. UTILIZATION OF PROJECT RESULTS

The project now is at the concluding stage. Most of the planned facilities have been provided. The processes have been developed. On the job training to operate and maintain each piece of equipment has been imparted to the national counterparts. Due to coordinated efforts of all relevant parties, the plant has been made economically viable. With the present range of products and available set of equipment, the national staff would not face any difficulty to run the plant independently. The project, therefore, could be rated as a successful venture.

VI. FINDINGS

The plant management had considered first terminal report quite objectively and most of the recommendations have been implemented expediently. Bottlenecks have been blown out resulting in smooth and streamline processing.

- The electricity supply from the city mains is now 100 kw as against previous 15 kw.
- The installed capacity of steam has been increased to 150C kg/hr from previous generating capacity of 120 kg/hr.
- A plant Engineer has been recruited and all engineering functions are now performed by the engineering group.
- Electrical wiring at production floor have been improved.
- Civil work for workshop building has been completed.
- Steps were taken to advice suppliers to improve packing.
- The boilers are chemically dosed and regular descaling is done.
- Electrical cables to different location have been laid to match the electrical load.
- LT switch gear and LT panel are housed as recommended.
- LDO reservoir would be shifted nearer to point of use. Base has been already made. shifting of reservoir would be done soon.

VII. RECOMMENDATIONS

Short Term

- The orders for remaining equipment should be expedited.
- The remaining work on water supply system should be followed.
- The lagging work on steam pipes and jackets of heat consumers should be completed.
- All undersized steam pipes should be replaced.
- Condensate return system should be installed.
- Training should be provided to selected maintenance personnel on general workshop practices.

Long Term

The plant management should now consider expansion of the plant facilities to match it with its rate of growth.

VIII. APPENDICES

A. List of Drawing/Docuemnts

1. Pine Resin Processing Unit - Drawing
2. Camphor Condensor - Drawing
3. Design of Electrical Distribution System.
4. Specifications Electrical Distribution System
5. Operating INstructions - Boiler
6. Operating Instruction - Electric Generator.

B. Training Programme

Training Programme I.

This training programme is for 75 working days. The incumbent should be at least S.S.C. with working experience at supervisory level.

<u>Training Schedule</u>	<u>Days</u>
1. Introduction An introduction to Hand and Machine Tools	7
2. General Workshop Practices Filing, drilling, tapping, reaming.	7
3. Welding	
a) Gas welding and cutting	4
b) Electric welding	4
c) Special alloy welding techniques TIC, MIG/MAG	10
4. Machine Tools	
a) Lathe	7
b) Milling	4
c) Shaper	4
d) Planer	4
e) Grinding	4
5. An Introduction to fabrication Techniques of Chemical Plants	20
	<hr/>
TOTAL DAYS	75

Training Programme II

This training programme is for 75 working days. The incumbent should be a graduate engineer with some working experience at managerial level.

Training Schedule

	<u>Area</u>	<u>Days</u>
1.	Introduction to Chemical Processes	
	a) Distillation	2
	b) Extraction	7
	c) Drying	2
	d) Crystallization	2
	e) Filtration	2
	f) Crushing and Grinding	2
2.	Introduction to Process Equipment like Reactors, Heat Exchangers, Vacuum Concentrators, Soxhlet, Counter Current Extractors, Filter Presses, Centrifuge, Liquid liquid extractor etc.	15
3.	a) Introduction to Boiler and its accessories	4
	b) Boiler Maintenance	4
	c) Boiler electrical circuitry	2
	d) Safety valves, P.R.V., traps and gauges	2
4.	Introduction to Process Instrumentation	7
5.	Preventive Maintenance of Chemical Plants	7
6.	General Workshop	10
7.	Design Parameters for Chemical Plants	7
	Total days	<u>75</u>