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UNITED NATIONS
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ORIGINAL: ENGLISH

SPECIAL TECHNICAL ADVISORY SERVICES

Assistance for Pesticide Technology*

Prepared for the Government of the United Republic of Tanzania
by the United Nations Industrial Development Organization

Based on the work of M. Gimeno,
specialist in pesticide formulation technology

*This document has not been edited.

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ABBREVIATIONS

NCI	- National Chemical Industries
TISCO	- Tanzania Industrial Studies and Consulting Organization
UNDP	- United Nations Development Programme
UNIDO	- United Nations Industrial Development Organization
TPRI	- Tropical Pesticides Research Institute at Arusha

1. Recommendations :

1. The pesticide complex at Moshi can be considered a high standard complex comparable to 90 % of the plants known and visited by the consultant during the past years, both in developed and in developing countries.

2. The layout and process guarantee a good environmental climate for the workers with low potential risk for health if the safety equipment and standard procedures are used and followed respectively.

3. Improvements which can be made in order to achieve better standards in production, quality control, safety, and environmental control are as follows:

3.1. Warehouse - Fire alarm system (8 points)
Forced ventilation system.

3.2. Insecticides (Unit 200), Liquid & Flowable Herbicides Formulation (Unit 300)-

The actual estimated output through the filters is 140 kg/year of active ingredient based on one shift of 8 hours and filters working at the maximum efficacy. Additional scrubbers for the two units have to be installed in order to reduce the estimated output to zero.

3.3. Laboratory and unit 300 need to be connected by a drainage system to the sump of 38,0 m (discharge tanks). Waste proceeding from unit 200, 300, and laboratory needs to pass through a CARBO-FLOW unit. Then the water can be sent to the river and the sludge can be incinerated.

3.4. All items of equipment of the units 200 and 300 and the areas where they are located are designed for dry cleaning and the inert materials used for cleaning their interior are recycled in the next production. Special care has to be taken when Standard Procedures for production will be written in the areas where contaminated recycled inert materials are used.

3.5. The units for ClH(1)(600) and Copper Oxychloride (100) can be considered environmentally friendly after big improvements in effluent treatment have been made.

Three mechanical safety systems (sucking flow, vacuum breaker, hydraulic seal) will avoid any possible escape or leakage of Cl₂ (g) but nevertheless the installation of a Cl₂ (g) detector will add a specific safety feature with low costs.

3.6. Laboratory improvements :

- Double suction hoods need to have an absolute filter system.
- Suitable bottles for sampling and storage of products during 3 years are not available in the country according NCI. This subject has to be investigated and followed up in order to guarantee supply.
- No proper ventilated room for the storage of samples during 3 years is available.
- Missing equipment in the actual list of equipments supplied by TECHNIMONT which is fundamentally necessary:

- . Ultrasonic bath
- . Electronic Densimeter
- . Particle size equipment (Microscope is not suitable for process follow up)
- . High performance liquid chromatograph (HPLC) for some technical and formulated active ingredients and for effluent analysis.
- . O.C.D.(oxygen chemical demand) equipment for continuous analysis of the effluent.
- . Sampling air pump with specific traps for environmental control.

3.7. Incineration is considered crucial as the end of the effluent treatment and cleaning system. Any container has to be precleaned in a basic or acid water solution with post pH adjustment and carbo flow treatment. If the steps of cleaning and effluent treatment are followed the incinerator will be working with clearly identified solid materials and will be depending on :

- . expected quality
- . type of active ingredient
- . presence of liquid
- . type of decomposition products by temperature.

Request for a new offer of incinerator with a gas cleaning system.

The containers(drums and plastic) can be reused in the plant after cleaning. Containers which are not needed in the plant should be pressed and invalidated after cleaning for any further use before leaving the plant.

4. Formulation know how transfere by TECHNIMONT is not very actual. Inert materials like KAOLIN, SILICA are approved by TECHNIMONT as locally available materials.

5. Manufacturing Specifications according GMP/GLP and ISO 9000 need to be written for one product at least as an example for the rest.

6. Tanzanians should be assisted in proper running of the plant after commissioning by Technimont with 18 w/m (12 +3+3) of non resident plant Manager, 6 w/m (4+1+1) of expert in Quality control and 3 w/m (1+1+1) safety and waste management expert.

I. WORK CARRIED OUT AND FINDINGS

1. Introduction

Under an Italian soft loan agreement the Tanzanian government has constructed a pesticide complex at Moshi with knowhow and plant installations by TECHNIMONT of Italy and civil work by MBEGA MELVIN of Tanzania.

As backup information various reports from the project SI/URT/86/875 were used.

The installation of this pesticide complex at Moshi has been used by the local green party as a political tool with non-scientific comments and clear exacerbation of the reality.

The complex is located about 5 km from the main populated area of Moshi in an Industrial district.

2. Activities and findings of the mission

After arrival in Dar es Salaam a meeting was held in the UNDP office for briefing and preparations of the meeting with the Minister of Industry. The Minister highlighted the main purpose of the mission, informed about political issues, and claimed an urgent and independent report about the pesticide complex. For persons met during the mission see annex 1 and annex 2 for job description.

A Probe team has been created in the country in order to get a second independent opinion about the pesticide complex. The team is formed by specialists in different areas. For more information please see the press release (annex 3).

A short meeting requested by Probe team was held in the TISCO offices. The main purpose of the meeting was to know the purpose of the mission and the consultant's professional qualifications. No information about findings of the Probe team during their visit to the complex were given.

After some delays due to travel constraints Monday, the 27th it was possible to pay the first detailed visit to the pesticide complex. Findings about the complex are mentioned in the chapter recommendations.

The plant has a layout good for the easy flow of the raw materials. All the construction material used by Technimont is of good quality and according to modern standards. No highly sophisticated electronic controls are used due to the lack of expertise and spare parts in the country. On the other hand the mechanical controls are easily accessible and repairable.

The list of spare parts previewed by Technimont was received and has been considered acceptable and sufficient for two years of normal work.

A training in maintenance of the equipment must be reinforced as a fundamental issue for the future of the complex.

Wednesday, 29th 01 92 , consultant visited TPRI for the evaluation of the actual human and equipment resources and for recommendation on the improvement of the Quality Control Laboratory and creation of a R&D Formulation Laboratory assisting the pesticide complex at Moshi. These measures should result in an improvement in the quality, utilisation of the local raw materials, and introduction of new products maintaining the plant occupied all year long.

The layout of the laboratories is adequated with plenty of free space for equipment. TPRI complex can be considered well located with infrastructure and good communications (phone, fax, courier) .

Electrical power, maintenance and spare parts for the equipment are a serious problem necessary to be solved if a R&D center needs to be created.

The project document for assistance to the TPRI is complete and does not need any specific revision. The project document for assistance to the Pesticid complex at Moshi needs to be updated by recommendations in the following :

- . Plant Manager- Non residential CTA 18 w/m.
- . Bio assay specialist (not needed in Moshi) 0 w/m
- . Quality Control Expert 6 w/m
- . Quality Control Laboratory Equipment US\$ 92.000.-
- . Safety and waste management expert 3 w/m

3.Environmental impact of the plant

Based on the experience of the consultant, a plant of this nature does not pose any threat to the immediate surroundings if all safety precautions are taken in managing the plant according to standard norms.Regarding the type of products transported in and out of the plant, there are general to any country even if they are not formulating but importing finished products.As long as the transport is carried out by safe means, carrying safety data sheets and emergency instructions following international practice, there should not be any problem in transporting of raw materials and formulated products.

II.FUTURE WORK

- .Improvement of the actual formulas given by Technimont.
(annex 4)
- .Substitution of products by more safe and more modern ones.
- . Specific seminars for formulation technology need to be attended by the new Formulation Manager at TPRI.
- . Expert in plant commissioning from UNIDO needs to be present during the start up of the plant and before Technimont left the site.
- . The specifications need to cover the following :
 - handling of the raw materials by the workers
 - process and formulation description in detail
 - specification of the raw materials and the final product
 - analytical methods for physical and chemical analysis
 - label, packing, and transport regulations
 - safety data sheets for every product.

ANNEX 1

PERSONS MET DURING THE MISSION

Tanzanian Authorities :

Mr.A.A.KYITI - Director of Heavy Industry

Mr.A.R.NGEMERA - Director of Investment Department

Mr.B.KAPYA - Director of External Trade acting in
representation for the Minister of Industry

Ms.E.E.MANGESHO - Senior Economist

Mr.J.F.MSAKI - TISCO

Mr.C.L.C.MIGIRO - Director of the Institute for Production
Innovation

Mr.G.S.MSANGI - Project manager Moshi plant

Ms.E.UNDIRI - NCI

Mr.H.N.KITILYA - Director of Development & Finance NCI

Mr.M.P.OLE PARESOI - General Manager NCI

Mr.F.C.KOMBE - NCI

Dr.F.W.MOSHA - Director of TPRI

Mr.J.B.CHOGO - TPRI

Dr.A.O.MOSHI - TPRI

UNDP:

UNDP - Representative

Mr.V.J.AKIM - UNIDO National Officer

Technimont:

Mr.Renzo SCHIAVETTI - Construction manager.

B. Sugavanam/rp &
22 November 1991

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

Post title Pesticide Formulation Technology Specialist

Duration 0.7 m/m

Date required As soon as possible

Duty station 2 weeks in Dar-es-salaam, 1 week in Vienna

Purpose of project To assist the National Chemical Industries of the Tanzanian Government to take necessary decision based on independent evaluation of the present status of the newly built pesticide complex at Moshi, Kilimajaro so as to make start up and trial run and long term planning for proper and safe running of the plant.

Duties The consultant is expected to visit the project site, have detailed discussions with the National Chemical Industries who are the owners of the plant and is expected to:

- assess the status of the plant and examine the type of product they are planning to produce and advise on any modification that could be introduced in the product profile;
- recommend a phased programme to include locally available raw materials into pesticide formulation, based on existing survey of raw materials and tests already carried out;
- advise on the personnel both skilled and semi-skilled needed to carry out the start-up and test run of selected products;
- assess the quantity and the type of raw materials that are to be imported to run the plant at optimum utilization to meet the market requirements;

assess the training needs of the personnel in management, quality control, ware house maintenance, safety and in waste management and effluent control:

- give list of equipment needed to improve quality control, effluent control at the plant;
- visit the Research Institute at Arusha to make recommendation in order to improve their facilities and they could co-ordinate their work to support Moshi plant to increase the use of locally available raw materials during formulation, packaging and long term storage stability tests and in carrying out bio-efficacy trials.

Before his mission, he will be given all details available in UNIDO based on previous technical assistance and based on the reports and his own assessment of the plant at Moshi and facilities available at Arusha Research Institute, he is expected to submit a comprehensive report and assist in preparing draft project document for future assistance to the pesticide plant. This part is to be carried out in Vienna.

Qualifications

Chemist or chemical engineer with extensive experience in the manufacture and formulation of pesticides. Should have handled formulation plant at a supervisory/managerial position and be familiar with all aspects related to operating/maintenance according to international standards including waste management/effluent treatment. Experience in multi-national company is advantageous.

Background Information

Through cooperation with the Government of Italy the Moshi pesticide plant was constructed with the intention of producing various pesticides and in particular:

Copper oxychloride (Coffee fungicide)	3000 t/year
Wettable powders (insecticides)	3000 t/year
Herbicide flowables (weed killers)	1500 t/year

In addition set up include a captive plant for the production of Hydrochloric acid an input in the production of copperoxychloride.

UNIDO, at the request of the Tanzanian government carried out feasibility studies, getting know-how from well known producers of copper oxychloride, civil design modifications and advice on effluent/quality control. It was evident that the National Chemical Industries still needed assistance in proper management of the plant, observe overall safety factors and make sure that effluent limitations are properly met

The complex, being the first of its kind in Tanzania, the Government anticipated the need for technical assistance from International Institutions with experience in the Agrochemical Industries. UNIDO were therefore requested to assist in the set up of R&D facilities at TPRI Arusha and also assist by sponsoring technical staff from specific fields to assist in training the staff during start up and commissioning, and the initial period of production. Project documents for the two projects under DP/URT/91/ have been prepared for review and possible implementation.

Probe on Moshi Plant saga takes off

From Daily News Reporter

THE 11-man team of experts formed recently to study the environmental impact of the controversial 4.2bn/- pesticide plant under construction in Moshi Municipality has started its work.

The team, formed by the Minister for Industries and Trade, Ndugu Cleopa Msuya, following public outcry over the likely environmental damage that the proposed plant could cause, was expected to convene in Moshi on Tuesday for its first meeting.

Residents of the Moshi Municipality have expressed worries that the proposed plant was a threat to the environment, particularly plant and animal life in that densely populated area.

Formal complaints were registered last September, during a meeting of the Kilimanjaro Regional Development Committee (RDC). At the meeting two senior academicians with the University of Dar es Salaam warned that the plant was likely to cause adverse effects to plant and human life after some few years.

The experts, Dr. George Mhehe, the Head of Chemistry Department at the University of Dar es Salaam, and Dr. Michael Kishimba, a senior lecturer in chemistry at the same institution, suggested that the plant should have been located in a sparsely populated area, near an ocean or a lake where poisonous effluents could be easily disposed into.

According to a source in the Ministry of Industries, the proposed plant project was approved by the Government in 1980 and in 1984, an Italian firm, MS Technimont was contracted to construct the plant. Civil works started in 1989 and trial runs were scheduled for next month, before its commissioning later this year.

The plant would have an installed capacity to produce 3,000 tonnes of copper oxychlorides a year, 3,000 tonnes of other insecticides, including lindane, endosulfan, aldrin and dieldrin a year and 1,500 tonnes of herbicides. It would also be producing other chemicals such as hydrochloric acid.

The main observations raised

by Dr. Mhehe and Dr. Kishimba were on the location of the plant, sustainability of the technology which the project will employ, handling and disposal of effluents and containers.

They said that Kilimanjaro Region, and Moshi District in particular, is one of the most densely populated areas in the country. Kilimanjaro Region ranks third after Dar es Salaam and Mwanza in population density.

According to the 1988 census there are about 83 people per square kilometre in Kilimanjaro Region. Mwanza has 96 and Dar es Salaam 977. Kilimanjaro Region, whose area is 13,309 square kilometres is the second smallest region after Dar es Salaam city.

Another fact pointed out by the two lecturers were on the routes which toxic raw materials to be used in manufacturing process would pass. Apparently the imported raw materials would come through either Dar es Salaam or Tanga ports on the way to Moshi. "Nobody knows

how the containers of the toxic raw materials would be handed and later disposed of," they said.

They also questioned on the feasibility of the technology in the country, where many factories are now closed down or operating at manifestly low capacity due to lack of spares for worn out machinery. The two insisted that pesticides plants were complicated and even highly industrialised countries have witnessed frequent accidents.

The team formed by Minister Msuya is to be chaired by Pro C. L. Migiyo, the head of the Institute of Production Innovation (IPI) at the University of Dar es Salaam. Its secretary is a principal pollution control officer with the National Environmental Management Council (NEMC), Ndugu S. Mkuula. The team also includes an industrial engineer in the ministry of industries and trade, Ndugu F.B. Marwa.

Others are Ndugu K. Mkasa (Tanzania Bureau of Standards), Ndugu J.F. Msaki (Tanzania Industrial Service and Consulting Organisation-TISCO), an expert

in pollution control with NEMC, Mr. Andress Hojiund, Ndugu M.P. Macha (Tropical Pesticides Research Institute—(TPRI)), Ndugu Valerian Mosha, the Kilimanjaro Regional Health Officer, Ndugu G.S. Mrutu, Moshi Municipality health officer and Ndugu K.C.J. Kuyonza, a sanitary engineer with the Moshi municipality.

The team also includes Mr. Keith Johnson, who is from the international group of national association of agro-chemical manufacturers (GIFAP) which is based in Brussels, Belgium.

Sources close to the team say that it has been assigned to examine in detail the extent to which worries raised on the plant are genuine and evaluate the extensive pollution control measures that have been incorporated in the plant. The team has also been asked to suggest additional measures required if necessary.

According to Ndugu Msuya the report should be presented to the Government as soon as possible and directed that it have to be made public.

Mixed views greet Moshi probe team

From Daily News Reporter

SEVERAL residents of Moshi have mixed views over the composition of a team of experts picked recently to probe environmental impact of the proposed 4.2bn/- pesticide plant under construction in the municipality.

While some have preferred to wait for the findings of the 11-man team picked recently by the Minister for Industries and Trade, Ndugu Cleopa Msuya, several others including experts in chemical and pesticides industry are not happy with the composition of the team.

One expert said that most of the experts were drawn from public owned institutions, including the Ministry of Industries, Tropical Pesticides Research Institute (TPRI) and the National Environmental Management Council (NEMC) which are interested parties.

In his opinion, the team had few highly qualified chemists

and chemical engineers. "Chemical process engineers were needed to verify safety mechanisms that would be employed," he said.

"In pesticides plant, highly toxic raw materials are handled. This calls for highly reliable safety mechanisms to minimise chances of accidents, therefore, well trained and experienced chemical engineers could be better placed to give a sober advice," he argued.

Another source said that he was surprised to see chemistry experts with the University of Dar es Salaam, Dr. George Mhehe and Dr. Michael Kishimba out of the team. These, he said, were the ones who warned on the likely dangers of the proposed plant.

The team is chaired by Prof. C.L. Migiro from the Institute of Production Innovation (IPI) of the University of Dar es Salaam, its secretary is a principal pollution control officer with NEMC, Ndugu S. Mkuula, an expert with pollution control with NEMC, Mr. Andress Hojund, Ndugu M.P. Macha from TPRI and Ndugu K. Mtasa from the Tanzania Bureau of Standards (TBS).

Others in the team are an industrial engineer in the Ministry of Industries, Ndugu F.B. Marwa, an engineer with the Tanzania Industrial Services Consulting Organisation (TISCO), Ndugu J.E. Msaki, the Kilimanjaro Regional Health Officer, Ndugu Valerian Mushi, Moshi Municipality health officer, Ndugu G.S. Mruvu and municipality sanitary engineer, Ndugu

K.J. Kuyonza

A source said that TBS and TISCO were parastatals under the Ministry of Industries, while NEMC was responsible for advising the Government to endorse the project at early stages. "Why should the same people be asked to do the same job again?" he asked.

Another source said that he understands that TPRI sits in the Board of Directors of the National Chemical Industries (NCI) which is the one executing the disputed project. "Would Mrs. Macha really escape from a trap of her employers interests?" asked the highly informed source.

One agricultural expert criticised the whole project, saying that pesticides that would be manufactured were the ones that are currently being phased out in other parts of the world.

He said it is known in many parts that chlorinated hydrocarbons like aldrin, dieldrin, DDT and copper oxychlorides were highly toxic and dangerous to the environment. He said the chemicals were not easily soluble and traces of them end up in the food chains.

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3	CONDIZIONE	3	500	1500	3	CONDIZIONE	1500
4	CONDIZIONE	4	500	2000	4	CONDIZIONE	2000
5	CONDIZIONE	5	500	2500	5	CONDIZIONE	2500
6	CONDIZIONE	6	500	3000	6	CONDIZIONE	3000
7	CONDIZIONE	7	500	3500	7	CONDIZIONE	3500
8	CONDIZIONE	8	500	4000	8	CONDIZIONE	4000
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000/100/1/3

23rd Octo.

The General Manager
National Chemical Industries
P.O. Box 9643,
DAR ES SALAAM

Dear Sir,

RE: UNIDO ASSISTANCE FOR THE ESTABLISHMENT OF R AND D
FACILITIES AT TPRI - ARUSHA PROJECT NO. DP/URT/91/
XXX/A/01/37

Introduction

Following discussions on the above mentioned project held at TPRI on 17/10/91 between TPRI/MCI/Ministry of Industry and Trade, the Institute has agreed to provide the following inputs in addition to salaries and utility costs:

- Laboratory building
- Project Coordinator, Mr. J.B. Chogo
- Some of the Quality Control Laboratory (QCL) staff will be used to start up the R and D laboratory but as soon as practical additional analysts and technicians will be recruited by both TPRI and MCI to work on permanent basis in the new facility.

Present status of the QCL at TPRI

- Staff: Analyst - 1 (3 vacancies)
Technicians- 2 (6 vacancies)
- Equipments:
 - Dani 6800 Gas Chromatograph (EC detector) needs a new detector.
 - Varian Aerograph series 2800, out of order and obsolete
 - Pye-Unicam SP 8000 UV-Spectrophotometer, out of order and obsolete.
 - Pye-Unicam Sp 1100 IR-Spectrophotometer, out of order and obsolete.
 - Mettler H30 Balance in working order but very old.
 - Mettler PE 1600 Top loading balance, in working order.

Addition Equipment Required in the QCL

1. A Gas Chromatograph with FID detector and accessories.
2. Hydrogen generator.
3. A High Performance Liquid Chromatograph with accessories.
4. An analytical balance.
5. A pH - meter.
6. An assortment of glassware and other laboratoryware.
7. A stand-by generator
8. A set of sieves and a sieve shaker.

Equipment for the R and D Laboratory

Since we are not experts in this line we shall depend entirely on UNIDO to provide the list of equipment which will be needed.

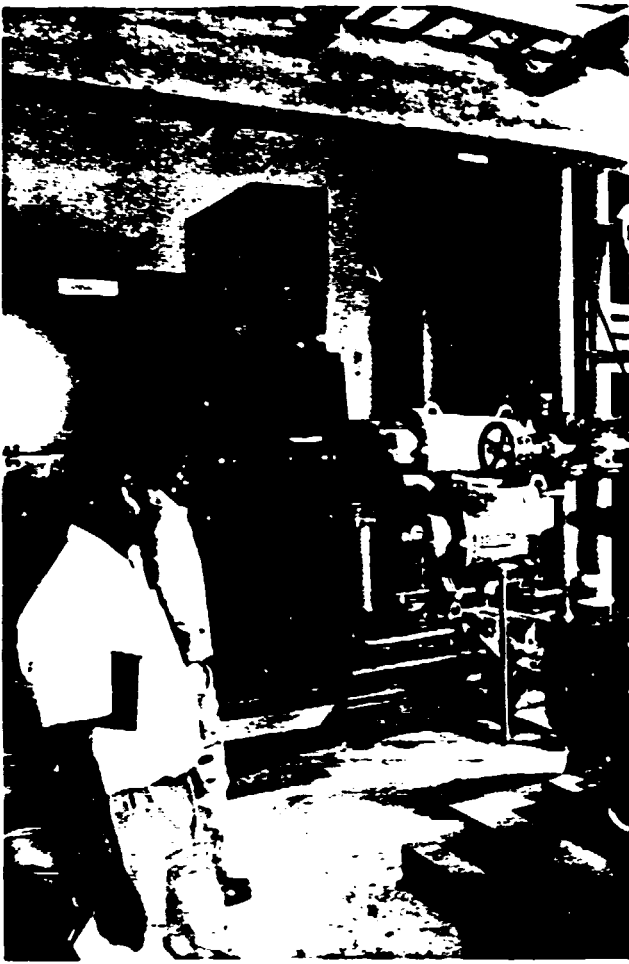
We hope this information will facilitate further discussion on the proposed project.

Yours faithfully,

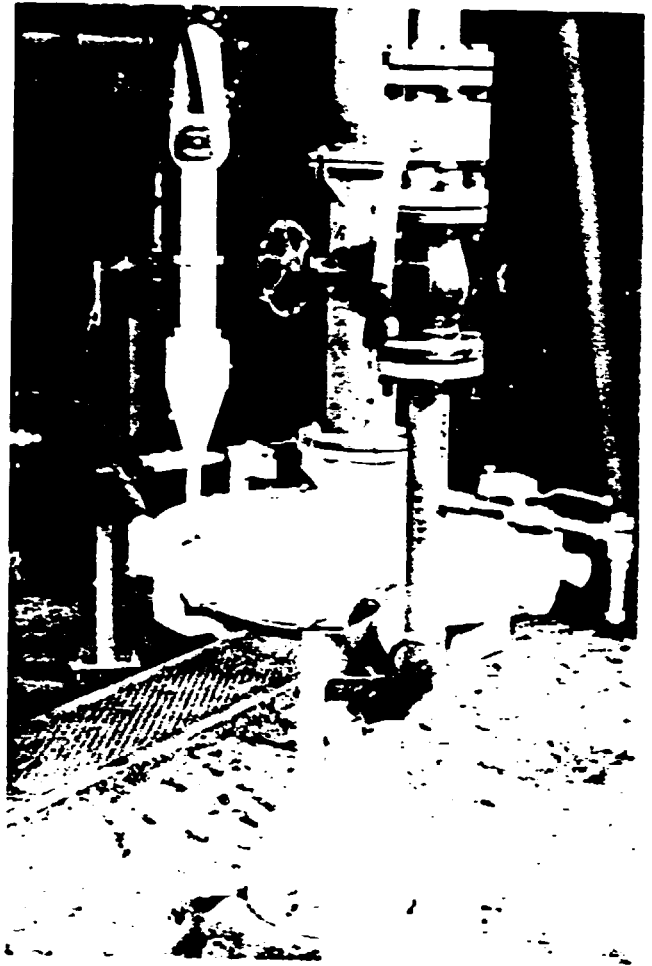


J. B. Chogo
CHIEF SCIENTIFIC OFFICER
FOR: DIRECTOR

c.c.: Principal Secretary,
Ministry of Industries and Trade,
P. O. Box 9503,
DAR -ES -SALAAM



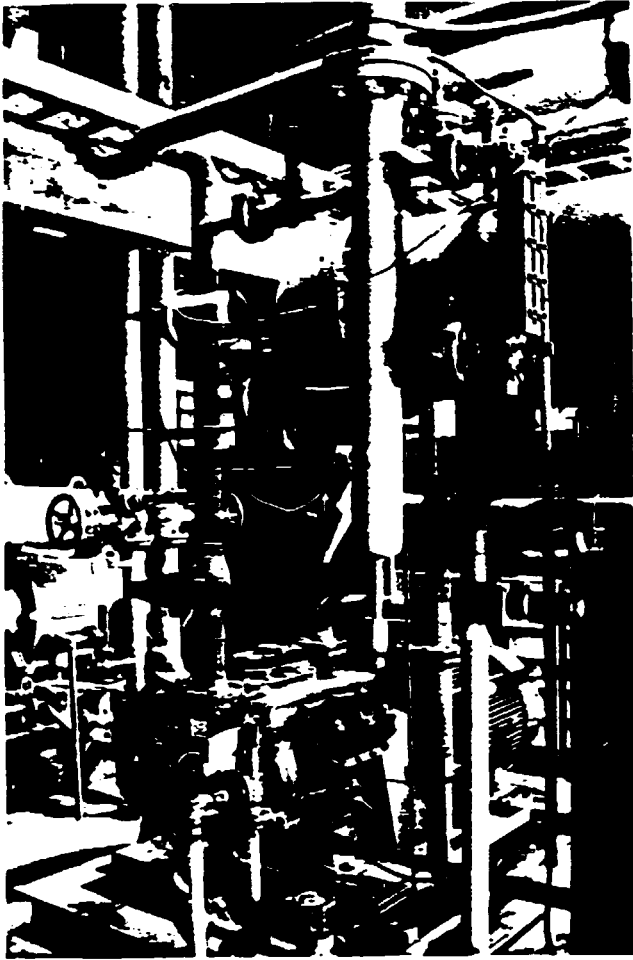
COMPRESSOR FOR WETTABLE
POWDER PLANT



AIR-MILL



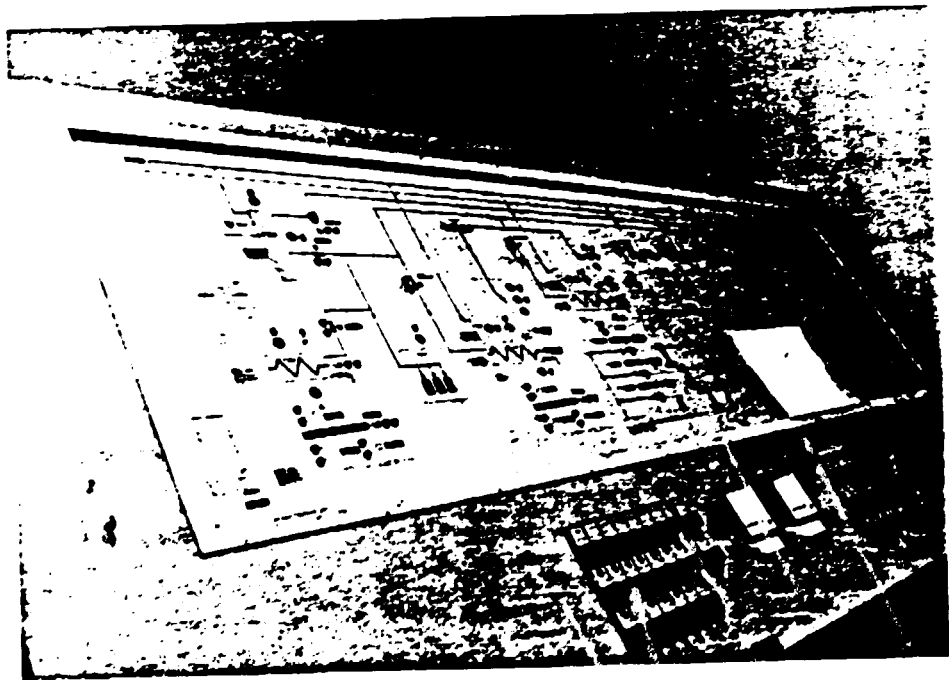
CCH - (P) PRODUCTION PLANT



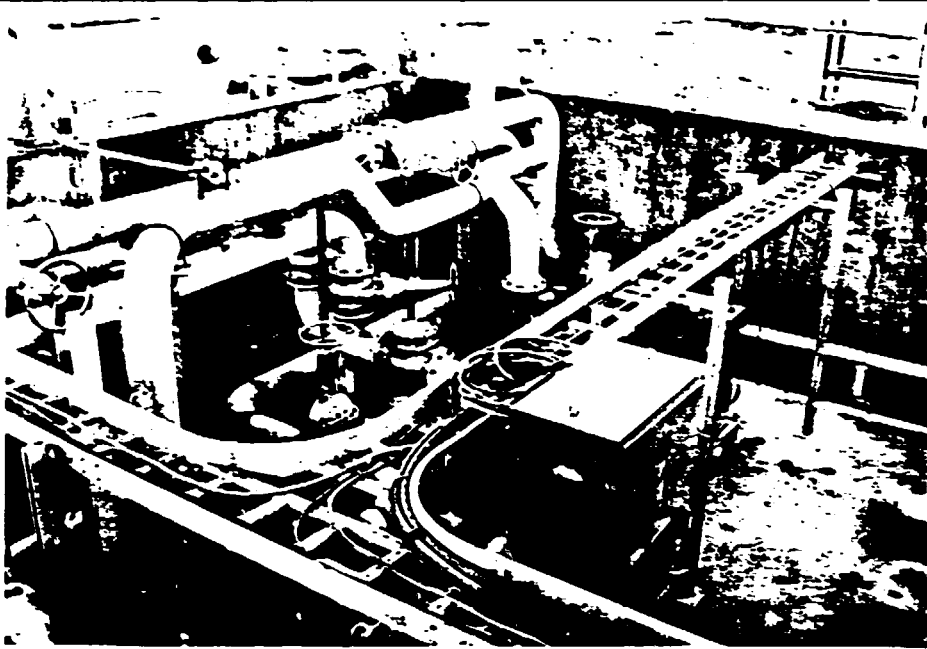
COPPER OXICHLORIDE PRODUCTION



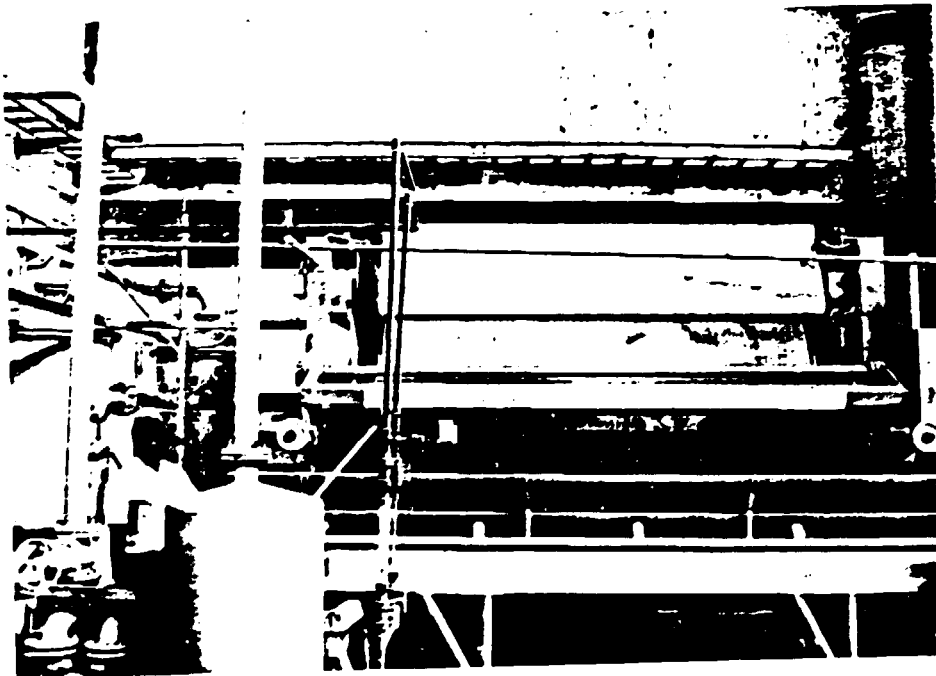
SPRAY DRYER FOR COPPER OXICHLORIDE



CONTROL ROOM FOR WETTABLE POWDER



GENERAL VIEW OF CONNEXIONS IN WETTABLE
POWDER PLANT



FILTER FOR COPPER OXICHLORIDE

- 1 -

SPECIAL TECHNICAL ADVISORY SERVICES

TO THE PESTICIDE FORMULATION PLANT AT MOSHI, TANZANIA

UNIDO COMMENTS
on the report of Mr. Gimeno

Mr. Gimeno's debriefing took place in Vienna after his short mission to Tanzania to assess the status of the pesticide plant at Moshi. We discussed in detail:

- (i) location and quality of the plant:
- (ii) transport problems:
- (iii) the technology know-how provided by the sub-contractors:
- (iv) the product portfolio:
- (v) the environment issues taken up by prominent people of the community and the Government:
- (vi) additional requirements for the plant/laboratory:
- (vii) training of personnel:
- (viii) modifications to the project document:
- (ix) requirements to Research Institute at Arusha and its linkages with Moshi:
- (x) enterprise to enterprise co-operation:

His report gives a brief account of his findings and recommendations. In addition UNIDO provides hereunder its comments to various points raised above.

(i) Location and quality of the plant

According to Mr. Gimeno the plant with its lay-out and the quality of the material supplied is in accordance with the international standards. The location of the plant is about 5-6 km from the town of Moshi. Ideally it could have been more but with strict precautions by not allowing residential areas close to the plant, it could be operated safely. The most important aspect is the storage of chemicals in the warehouse and the operation of the chlorine plant. According to Mr. Gimeno, safety precautions for chlorine plant is already provided for, but the warehouse might need additional safety measures.

(ii) Transport problems

Any country which formulates or simply imports finished formulated products will have to transport pesticides to the places where they are needed. Transportation of large quantities of active ingredients and formulated materials should have a close security regarding transport means, route planning and trained drivers with emergency instructions. Once they reach the distributing points to farmers and co-operatives, additional precautions in storage and distribution should be according to FAO guidelines. These will be smaller quantities compared to products leaving the plant.

(iii) Technology know-how supplied by the sub-contractor

The product constituents and quantity per batch with some physical properties are given in a tabular form. These are attached in Mr. Gimeno's report. It is expected that the sub-contractors should provide for each product step-by-step operation procedure with quality control methods and results expected according to specifications. If these are not yet provided by the sub-contractors, they should be asked to provide the same so that during product test runs, these steps could be followed under the supervision of the sub-contractors.

(iv) Product Portfolio

The products given in the sub-contract is the same as it was presented in 1984-1985. The major concern would be the organo-chlorines. But it should be easy to change product profile since it is a formulation plant and hence very flexible in changing active ingredients. Obviously while buying active ingredients, the plant management should insist the vendors to supply standard recipe and declaration that they are registered elsewhere.

(v) Environment

It is gratifying to see prominent people in the community taking interest in the safety of the environment with respect to the plant dealing with hazardous chemicals. Talking to Mr. Gimeno we are wondering, whether or not the issue has been taken out of proportion relative to the plant which is only a formulation plant. In a plant of this type there is no danger of run-away reactions. The main dangers are overflow, spillages, leakages, warehouse fire, security/safety failures. These risks are normal in any chemical plant and if managed properly, the risks would be minimal or eliminated. The suggestion "the plant should have been located near an ocean or a lake where poisonous effluent could be easily disposed into" is not correct because according to-day's standards, in a formulation plant, all effluents should be treated to international standards and cannot be dumped into lakes or in ocean. Community and workers' right to know must be followed regarding operations and wastes and the plant should become transparent.

The question raised about plants being closed due to lack of spare parts is very valid in many developing countries and there should be a firm commitment on the part of the Government to release foreign-exchange in time to purchase raw materials and also spare parts. It should also provide sufficient staff to operate the plant and they should not be transferred until suitable replacements are found.

(vi) Additional Requirements for the plant/laboratory

Additional equipment for the laboratory and effluent control have been included in Mr. Gimeno's report.

(vii) Training personnel

Continuous training of personnel is an essential part of proper operation of the plant. It is needless to emphasize this aspect in a country where the staff is not used to handling such a plant. International experts on a long term basis should be hired to provide on the job training and the staff should be trained abroad both in operation of plant and in quality control. UNIDO could link up quality control and R & D training with the UNDP/UNIDO project in New Delhi under a separate TCDC project if funds are made available.

(viii) Modifications to project document

The recommendations of the consultant will be incorporated at the appropriate places in the project documents.

(ix) Requirements to Research Institute at Arusha and its linkage with Moshi

According to Mr. Gimeno there are laboratories available in the Institute but most of the expensive items of equipment are not operational. It is very important that Moshi and Arusha maintain close links so that R & D and quality control laboratories at Arusha could be strengthened to provide services for Moshi plant and charged, if necessary, for its services.

(x) Enterprise to Enterprise co-operation

UNIDO can make necessary arrangements for enterprise to enterprise co-operation including financial partnership by having discussion with interested parties and inviting a team from the Tanzanian Government. It is advantageous to go through UNIDO, so that the interests of NCI are maintained and they do not lose out in any negotiations.

Conclusion:

The pesticide formulation plant is an economically viable operation provided it is operated according to standard operation procedure, good manufacturing practice, shrewd management and promotion policies and link up with companies having good products. They should not adhere to same products but should aim for product diversification to include environmentally and user friendly products. UNIDO can provide long term technical advisory services and if properly organized could become a model plant for rest of Africa.