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DP/ID/SER.A/923
12 November 1987
ENGLISH

RESTRICTED

EXPERT ASSISTANCE FOR THE ESTABLISHMENT OF A PESTICIDE PILOT PLANT UNDER A SOFT LOAN ADVANCE FROM THE ITALIAN GOVERNMENT

SI/URT/86/875

UNITED REPUBLIC OF TANZANIA

Technical report: Engineering, construction and commissioning of chemical plants

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

Based on the work of K. Szabo, expert in engineering, construction and commissioning of chemical plants

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United Nations Industrial Development Organization
Vienna

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V.87-91681

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1. The conversion of the unit of payment, from US$ to ECU, for the contract between NCI and TCM, requiring a series of administrative approvals, resulted in further delays in project implementation.

2. The revised financial analysis of the project, prepared by the previous UNIDO mission, indicated a large increase in local capital investment requirement, which in view of existing financial constraints may compel a rephased stepwise implementation of the project.

3. NCI needs UNIDO expert assistance for carrying out the relevant study on the rephasing of the project, giving priority to pesticide formulation units.

Part II

4. TCM displayed strong reluctance to provide true multipurpose flexibility to the formulation plants by insisting on using raw materials, also inerts, as specified in the annexes of the contract. This could be explained by lack of experience of the TCM staff in pesticide formulation and of agro-chemical experience on the part of BASLINI, the formulation know-how supplier. At the end TCM accepted the responsibility to develop formulations based on local carriers (Kaolin, lime stone, sand) with the cooperation of his know-how suppliers.

5. The status of the copperoxychloride know-how is even less convincing. It comes from GARBATO, a small consulting unit, who allegedly designed already several copperoxychloride plants. However there is no such plant in operation in Italy or anywhere else in the world for that matter. This raises profound doubts how to ascertain the reliability of the process.

6. TCM shall examine the possibility to increase the packaging flexibility to include at least as small as 1/2 kg units, designed for the small farmers' use. This is particularly important in the case of the wettable powder formulations, often containing various toxic materials.

7. TCM shall include facilities to dispose of smaller quantities of solid toxic pesticide materials (e.g. empty packaging materials).

8. The liquid effluent problem is critical in the case of the copperoxychloride and electrolysis plants. There seems to be need to revising the effluent specifications appended to the contract and to find technical improvements in the use and discharge of process water.

9. Training in pesticide formulation, except for the granular products, could adequately be provided by BASLINI as concerns the technical operation of the units and quality control. No training can be expected at this know-how supplier's plant in relevant agrobiological areas (e.g. toxicology, bioactivity, etc).

10. The know-how suppliers do not have operating facilities for the production of granular formulations and copperoxychloride, thus training of future technical staff in these fields cannot be construed as secured. In these instances the contractor should provide the training during and after

the start-up of the Moshi plant through placing and keeping an appropriate number of trainers at the plant site for six months.

11. The third coordination meeting between NCI and TCM should be so scheduled to allow the review of all detailed civil designs and the attendance of the meeting by a UNIDO pesticide consultant.

12. In view of the potential rephasing or reshaping of the project it is of great importance to obtain a valid break-down on the unit costs covered by contract.

Introduction

This mission was fielded to provide advisory assistance to the Government of Tanzania (National Chemical Industries, NCI) in connection with the establishment of a pesticide production and formulation plant at Moshi according to the Terms of Reference of the job description, as follows:

1) Review and assess the know-how and the facilities of the suppliers, offered by the contractor.

2) Ascertain the suitability of the know-how and technologies to produce all types of products included in the project in conformity with international standards and to possess multipurpose flexibility required from the formulation plant.

3) Evaluate the work programme and progress of suppliers as regards the use of Tanzanian raw materials in the formulation of the end products.

4) Draw up a training programme with the subcontractor for project personnel to run and maintain the plant.

5) Assist in reviewing the civil engineering designs in consultation with the UNIDO civil engineering expert.

Much of this work have been based on the inspection of the reference production units of the sub-contractor in Italy and consultations with the sub-contractor (TECNIMONT, TCM) and the suppliers of the know-how. The job description called for a split mission of one month, the first half in Dar-es-Salaam, the second in Milan, Italy. However, as it turned out, the programme in Italy was not adequately prepared and the visit was not considered timely because of the beginning of the summer holidy season, during which several key technical experts would have not been available for the necessary consultations. The second part of the mission to Italy had to be postponed till September at the suggestion of TCM.

Part I : Revised Scope of Mission

The first leg of the mission (Dar-es-Salaam) dealt with the following major items:

(a) the review of the progress of the project implementation, including the agreements reached at the second coordination meeting between NCI and Tecnimont from 7th to 13th of April 1987 in Dar-es-Saalam.

(b) the evaluation of the revised financial and economic analysis prepared by the previous UNIDO mission related to this project.

(c) redefining the scope of further UNIDO/UNDP assistance essential in the implementation of the project.

A Progress in Project Implementation

The second coordination meeting between NCI and Tecnimont (TCM) from the 7th to the 13th of April 1987 in Dar-es-Salaam (Annex 1) dealt with three groups of problems, as follows:

1. Matters arising from the first coordination meeting

Under this title preparation for securing and testing local raw materials and utilities (Water, Kaolin, Copper bars, Electricity, Fuel oil) were examined and considered.

2. Project Implementation

Both parties agreed that delays in the implementation of the project were caused to a large extent by the currency fluctuation resulting in an agreement between NCI and TCM to convert the currency of payment from US$ to ECU. The appropriately amended paragraphs were still awaiting final approval by the Italian and Tanzanian Governments and inclusion in the Financial Convention governing the funding of the project. However, no difficulties were anticipated in this process.

Another highly important subject discussed was the training programme offered by TCM for future technical staff. Discussions mainly centered on the timing of the in-plant training programme, NCI requesting the postponement of the training course by one year so that the newly trained staff could immediately begin work at the Moshi factory. The scope of the training programme offered by TCM (Annex 2) at this point appeared to be adequate, however, it would be desirable to specify the minimum duration of the practical training, the most important component of the programme.

3. Basic Civil Designs

The information concerning construction materials and design provided by TCM was in general considered adequate for preparing of dimension drawings by the local engineering firm. There will be some details of the civil works which shall finalize later and will be supplied by TCM by December 1987.

It was agreed that the main warehouse building is to be completed first so that TCM could use it for the storage of the plant equipment during the installation period. NCI agreed to start construction of the building in a few months, as soon as the final plans become available.

NCI has also been continuing the erection of housing units for project personnel. Four units have been completed last spring, another four units will be constructed as a follow up.

TCM agreed to modify the bar chart schedule concerning the civil engineering programme and implementation to suit the new situation caused by delays (Annex 3). Another bar-chart concerning the revised implementation schedule of the entire project was also adopted by the meeting (Annex 4).

B) Evaluation of the Revised Financial Analysis Prepared by the Previous UNIDO Mission

The relevant study indicated that while the viability of the project survived the rather drastic changes in the national and international currency and financial markets, the investment and working capital requirement in local currency increased about four-fold, which placed a heavy burden on the national capital and credit institutions participating in the financing of the project, particularly in the light of constraints imposed by agreements with the IMF. In view of this NCI, without giving up its global aim to implement the entire project, shall also consider a stepwise approach for carrying out the project. This would entail rephasing the project implementation giving priority to those units which offer the highest profitability, the least investment capital requirement and greatest ease in technical operation. As a rule of the thumb these should be the formulation units.

C. Revising The Scope of the UNIDO/UNDP Assistance

In order to chart the best course of action, considering the existing and potential stringent financial constraints, NCI would like to carry out a study with UNIDO expert assistance to set priorities in rephasing the implementation of the project, if and as required, with particular attention to establishing the formulation units, at first. The exercise shall also update the current pesticide use and demand data in the country. A draft SIS project proposal and the appropriate draft job descriptions were prepared. An official request for this new SIS assistance project was submitted to UNDP, Dar-es-Salaam, on the 16th of July 1987 by the Ministry of Industries and Trade (Annex 5). Regardless of the conclusions of this interim exercise (the above SIS study) there shall invariably be need for the large scale UNDP/UNIDO assistance programmes recommended by one of the earlier missions to be included in the present cycle of the country programme (i.e. DP/ID/SER.4/819). Accordingly UNDP/UNIDO shall first provide assistance in the start-up and early operation of the plant and in-plant training of the local management and technical staff. The second project would assist in the establishment of an R&D laboratory for pesticide formulation at the Tropical Pesticide Research Instistute (TPRI), Arusha Without the support of these two UNDP/UNIDO assisted projects the Moshi Pesticide Plant cannot be expected to successfully operate on a longer term. Therefore immediate attention and the highest priority in processing these two technical assistance project requests and proposals would seem to be fully justified.

Part II: Agenda of Consultation with Tecnimont

According to an agreement and a programme worked out between NCI and TCM the mission to Italy was scheduled for the end of August and first part of September (Annex 6). First a joint review of the current situation has been carried out, which confirmed that the properly amended soft loan convention, to reflect the switch from US$ to ECU, has been signed by both Governments and sent to the appropriate national banking institutions for implementation.

An agenda for the discussions was also prepared, which besides the inspection of the reference units of the know-how suppliers, dealt with outstanding issues, as follows:

i) Cooperation in shipping construction material and plant equipment

ii) Inspection and certification of equipment

iii) Start of erection of plant buildings/main werehouse

iv) Effluents treatment and pollution prevention

v) Local raw materials and formulations based on them

vi) Weighing and packaging

vii) Training

viii) Unit costs break-down

ix) Inspection of reference units and evaluation of the know-how of licensors' and TCM.

The mission was most interested in the issues under points iv, v, vi, vii and ix, but the report shall follow the above sequence of the agenda.

Shipping and Related Problems

TCM seemed to be most eager to talk about this subject, although neither member of the mission was a specialists of the field or authorized to commit the competent Tanzanian agencies. The great interest of TCM in this subject seemed to be motivated by concern:

(a) to avoid the need for preparing a detailed proforma invoice required for obtaining general import licence to cover every shipment.

(b) to avoid to provide a break-down of the cost related to various plant units or groups of equipment.

(c) to "ascertain" the availability of funds at the hands of Tanzania Central Freight Bureau for transport contracts.

In turn the mission informed TCM that formalities required to comply with national regulations on imports would have to be met by TCM but NCI and all his agents appointed will fully cooperate. The shipping company P. Scerni, headquartered in Genova, Italy, shall be the purchaser's shipping agent in Italy upon the choice of Tanzian Central Freight Bureau. The name of the purchaser's forwarding agent in Tanzania will be shortly conveyed to TCM. Obtaining a general import licence will be pursued by NCI at the appropriate agencies.

On concluding discussion on these subjects TCM prepared a draft "Operative Shipping Procedure", that was taken note of and decided to be submitted to the competent Tanzanian Agencies (NCI, Bank of Tanzania, Tanzania Central Freight Bureau) for consideration and comments.

Erection of the Main Warehouse

According to the concludions of the last coordination meeting between NCI and TCM early last April, NCI undertook the construction of the main warehouse building, to serve also as the storage area for equipment delivered by the contractor during the early phase of the project implementation. The design for the construction was provided by TCM but some details thereof concerning the ventilation of the building were questioned by authcrities in Tanzania. Justifications for the design, primarily concerning the location of the louvers were given by TCM and forwarded to Tanzania for approval. However, these have not been accepted by NCI, as indicated by a telex reply of 7 September 1987, suggesting alternate solutions. So this issue still remains to be settled between Tanzanian regulatory authorities, NCI and TCM, although it seems to be a matter of lesser importance. The Tanzanian position is that no louvers should be placed at ground level, as this would facilitate the escape of toxic material accidentally dispersed in the storage area, by strong air movements, potentially caused by stormy winds.

IV) Effluent Treatment and Pollution Control

The Ministry of Land Water, Housing and Urban Development of Tanzania decided that the feasibility study of TISCO shall be complemented in a number of areas concerning the safety and pollution prevention facilities of the future plant, as follows:

" 1) Details on how to avoid spreading of dust containing pesticides into the atmosphere. Handling of collected dust.

2) Details of waste-water treatment, design criteria for the waste-water treatment plant. Which waste water will be treated.

3. The processes, type of electrodes in the HCC plant (No mercury cells!).

4. Details on handling of waste liquids containing pesticides, for example washing water from cleaning processes".

TCM was requested to comment on these points in writing to NCI as soon as possible.

The mission reviewed one by one each processing unit as concerns safety and pollution control. A general provision valid for all formulation units is that all operations involving transfer and processing pesticide formulations and their components shall be carried out under suction. This is typically secured by fans of a capacity of 0.7 m^3/sec passing an air stream through filters (0.7 m^2/m^3 min) into the atmosphere with a maximum solid contents of 5mg/m^3 which conforms to Italian regulations according to TCM. The life cycle of filters (need to change cloths or trays) is one year. The amount of dust collected during this period shall be relatively small (a couple of kg's) and can be buried in a well contained form.

Each unit will have continuous, non permeable floor to facilitate collection of spills or deposits, and good house keeping. The liquid formulation unit will in addition have an underground container, with slanted floor leading to it, to collect accidental larger volume spills and thus prevent loss of material. This basin shall be equipped with a pump to return

the collected material into the appropriate processing step. With the exception of the copperoxychloride formulation plant all formulation units will have several programmes to carry out each year, involving the need to empty and clean the lines and the entire system. The operational manual shall contain full instructions how to carry out this without much loss of material. In the case of solids this is not expected to pose a serious problem since the small quantity of material in the system to be purged can be saved and recycled. The problem with the liquid formulation unit is somewhat more complicated as the flushing of the system will produce larger volumes to dispose of. Bottling up in drums and returning it into the system in the proper phase of the operation is the recommendation of the contractor.

TCM agreed to design and provide adequate facilities for the safe discharging of small quantities of solid wastes and packaging materials.

The pollution control in the copperoxychloride plant and the electrolysis plant appears to be a lot more complex problem mainly because of large volumes of water involved.

In the electrolysis there are three type of discharges. The solid waste, consisting of various metal salts is a relatively small quantity (2 kg dry material/hr) but large enough to require a safe solution for its disposal. TCM should consider this problem when designing the facilities for the disposal of packaging materials and small quantities of solid wastes in the formulation plant.

A more formidable problem in the disposal of a brine containing NaCl and some (1%) Na_2SO4. About 110 kg/hr of this brice is to be purged from the system, as the presence of Na_2SO4 would interfere with the proper operation of the electrolysis. Discharging this waste product into a fenced in open-pit evaporator would yield periodically salt containing some Na_2SO4 a use for which could be found.

A water-jet, operated to remove traces of chlorine from the brine, uses and wastes about 50 m^3/day of water. It would seem unwise to feed this aspirator from the well with water of high quality as the exact capacity of the well is difficult to assess. Therefore, it was suggested that the substitution of town or river water be considered, or other alternatives (e.g. substitution of a steam jet) examined.

As for the discharge of the water coming from the water jet, containing traces of chlorine, it was felt that in view of the normally high organic contents of the river, it should not pose a serious problem. However if other considerations prevail, it could be directly discharged into the town sewage system.

In many ways the disposal of waste water from the copperoxychloride plant is a more difficult problem. We are dealing here with a volume of 289 l/hr waste water coming from the stream which contains traces of copper, about 5kg $CaCl_2$ at a p_H of 9. This adds up to about 7 m^3 a day and 120 kg $CaCl_2$ for which no other solution for disposal has been envisaged than dumping into the Karanga river. TCM contends that the copper content of the stream is minimal (around 5 ppm) and as such should not represent environmental hazard. However, this copper concentration seems to be 30 times higher than the maximum copper concentration in the effluents permitted in Italy, according to information obtained during a visit to Farmoplant in Massa-Carrara.

TCM indicated that if only the good quality well water shall be used for process purposes, substantial savings could be arrived at by eliminating expensive water treatment and cooling equipment originally included in the copperoxychloride plant.

A write-up prepared by TCM entitled "Environmental Impact Evaluation on the New Pesticide Factory to be Erected in Moshi, Tanzania" is appended to this report as Annex 7.

V) Local Raw Materials and Pesticide Formulations Based on Them

Based on prior discussions, MCI shipped several local raw material samples to TCM during the last year for testing and developing pesticide formulations specified in the contract. As it turned out TCM did not even test these samples and had no intention to undertake development work to incorporate the local carriers (Kaolin, Limestone and Sand) into the various formulations envisaged by the contract because they did not feel obligated by the contract to carry out such work, although it was fully explained to them that operation of a pesticide formulation plant with all ingredients imported from overseas would be economically unthinkable. TCM's reluctance could be traced to the fact that their formulation know-how supplier (Baslini) is simply a custom formulator and has little development capacity. It has been pointed out that, regardless of contractual obligations or lack of that in this branch of industry the development of formulations using local raw materials to a maximum possible extent is considered part of the know-how package, and as such is the responsibility of the technology supplier. After lengthy arguments streching over several days TCM finally accepted the responsibility to carry out the required development work jointly with their know-how suppliers (Minutes-Annex 8)

VI) Filling and Packaging

The contract stipulates semi automatic equipment and rather sizeable package units (5 to 25 kg).

It has been pointed out earlier (DP/ID/SER/4/819) that these sizes are inadequate as regards the small farmers' requirements. This is particularly true and important in the case of wettable powders, most of which shall be insecticides. It is unthinkable tc sell such toxic products to the user in other form than original factory packaged and guaranteed units. Since the most desirable size for the local farmers is expected to be between 1/2 to 1kg it has been agreed that the WP filling and packaging line should be selected so to have a flexible capacity from 1/2 kg up to 5 to 10 kg. Should this be impossible to achieve in one line , a second one shall be installed for packaging smaller units. In the case of granular products and herbicides flexibility extending from 1 to 25 kg was considered acceptable. It was also agreed that whereever the filling is to be controlled manually appropriate alarm (soumd) shall be built-in into the system to protect against material loss and potential accidents caused by operator's (human) error.

Training

Future technical staff shall obtain in-plant training from the know-how suppliers in their production facilities. TCM provided an outline on this subject to NCI at their second coordination meeting in Dar-es-Salaam last April (Annex 9). Because of delays in project implementation caused mainly by adjustments required in the project financing system, the beginning of the six month training period has been postponed till end of 1988 at the request of NCI.

The mission established that in liquid and wettable powder formulation Baslini offers good facilities and adequate know-how. However there is no working training ground in the field of granular formulations and copper - oxychloride manufacture at the disposal of TCM or their licensors. In view of this it is suggested that in those fields the training be carried out at the Moshi plant site by trainers of the contractor to be assigned to this task for about six months as envisaged by the contract. Since Baslini is not in pesticide marketing, their laboratory activities are restricted to simple quality control operations (active ingredients not included), the laboratory training programme has to be broader than their routine activities and outlined in details before the training starts.

Unit Cost Break-down

Efforts to obtain individual cost figures for each plant unit from TCM, an information of potentially great importance if the project is reshaped or its implementation rephased, proved futile. However, it should be possible to extract these data from TCM in connection with the equipment import licence procedures.

Inspection of Contractor's Reference Units and Evaluation of the Know-how of the Licencors

It has been noted that the TCM team in charge of the Moshi project has no direct pesticide production or formulation experience. In view of this, the quality of licencors' know-how and operation should play a critical role in the execution of the project.

The mission was taken to three "so-called" reference plants, as follows:

FARMOPLANT (MONTEDISON) Massa Carrara
SARIAF (Enichem), Faenza
BASLINI, Treviglio

of which only the last one seemed to act as a know-how supplier to the project. This is rather strange as Farmoplant is a sister company of TCM and has full spectrum pesticide formulation programme, and so, it could have provided the formulation know-how at no cost. However, the purpose of the visit was to look at their flexible copper fungicide plant, allegedly the reference unit of the copperoxychloride plant according to TCM. Unfortunately this unit, built with GARBATO know-how about ten years ago, has never produced copperoxychloride. Furthermore, after all initial period of operation producing some copper sulfate, copper hydroxide and Bordeaux-mixture the plant is currently inoperative. In spite of this, the plant is listed in GARBATO's catalogue, side by side with NCI's Moshi plant, as reference units, which they are clearly not. According to information made available to the mission there is not a single copperoxychloride plant in the world working with GARBATO

technology. As the copperoxychloride plant represents the bulk of the cost of the Moshi project, its implementation should be carefully reexamined.

The effluents of the proposed copper fungicide plant in Moshi may also pose a serious problem if the limits of pollutants are not drastically reduced compared to those given in Annexure II of the contract. According to Farmoplant the copper content of the effluent is limited to 0.1 rpm in Italy, while in the contract this value is set 30 times higher. Similarly the chlorides and total dissolved solid contents of the effluent are much higher in the contract specifications than allowed in Italy. Should NCI go ahead with the construction of the copperoxychloride plant these points should also be carefully examined.

The SARIAF plant has been presented as a reference unit only in a very indirect way for the granular pesticide formulation unit, as SARIAF is not know-how supplier, but operates a similar plant to that proposed for Moshi by the their experts.

The actual licensor and know-how supplier seems to be BASLINI, although this company is not pesticide oriented in a true sense. They have got into the pesticide business in the sixties when Rohm and Haas (USA) approached them to produce and formulate some of their products for European markets. This partnership broke up long ago, since then BASLINI does only custom formulation work (flowable, wettable powder and dust) for large pesticide companies. The flowable facilities are rather of a pilot size, the rest of operations of full commercial scale. This explains why they have no laboratory activities, except for quality control, which is being done according to the instructions of the company who placed the order. It also gives an indication of the difficulties and inconvenience TCM is facing in carrying out their responsibilities in testing the local raw materials and developing formulations based on those inert ingredients. It is highly advisable to compile a list of products, based on local priorities, and give it to TCM along with raw material samples as soon as possible to avoid last minute uncertanities deriving from the low level of preparedness of Baslini to carry out the necessary development and testing programme.

An interview was arranged also with GARBATO, on the subject of copperoxychloride, although no competent technical staff was available. No new pertinent facts or aspects came to the attention of the mission in addition to what has already been learned in Massa Garrara and reported in connection with the visit to Farmoplant. Carbato is a small consulting firm, with a total staff (commercial and technical) of fifteen. They have never operated a copperoxychloride plant and their know-how should be regarded as untested. A copy of their brochure is attached as Annex 10.

PESTICIDES PROJECT

SECOND CO-ORDINATION MEETING 8/4/87 - 9/4/87

PRESENT:	MR. M. P. OLE PARESOI	-	NCI
	MR. H. M. KITILYA	-	NCI
	MR. G. S. MBANGI	-	NCI
	MRS. E. UNDIRI	-	NCI
	MR. G. JANDOLO	-	TECNIMONT
	MR. MASSARA	-	TECNIMONT
	MR. CARIT	-	TECNIMONT
	MR. VALLINI	-	TECNIMONT
	MR. MONGULA	-	MBEGA MELVIN CONSULTING ENG.
	MR. KAMUGISHA	-	Wagala Onyejeli & Partners Quantity Surveyors.
	MR. J. MSAKI	-	TISCO

A. Matters arising from the first co-ordination meeting:

(I) Information requested from NCI and MBEGA MELVIN:

(i) Water: It was confirmed that in order to ensure that there will be sufficient water for the use of the factory a borehole will be made at or near the site to supplement water from the Moshi town supply system. The information given to TECNIMONT by Mbega Melvin on water is based on an analysis of water from a borehole located near the projects' site. It is expected water from the borehole that will be drilled on our site will have similar characteristics.

(ii) Kaolin: TECNIMONT reported that the sample of Kaolin they received from NCI contained a lot of moisture. They asked for a sample of about 10 kg of sand which they will use for testing in a pilot plant. On the whole they are of the opinion that the Kaolin can be used if it is sufficiently dried. Final results of the tests will be communicated by telex within this month.

(iii) Copper bars:

TECNIMONT have received the specifications of the copper ingots that are produced in Zambia which will be the main source of supply of the material and now they are making inquiries for procurement of machines for shearing the

ingots. In order to be sure of the performance of the shearing machines that will be procured it is considered necessary for NCI to send one ingot to TECNIMONT for testing. NCI agreed to look into the possibility of procuring and sending the ingot to Italy. TECNIMONT depending on the results of the tests will have the option to include in the supply the necessary number of machines to ensure the guaranteed production.

(iv) Electricity:

TECNIMONT will furnish NCI with final details on transformers that will be required for the supply of electricity to the factory within June, 1987.

(v) Fuel Oil:

TECNIMONT confirmed that the type of fuel oil available in the country is of an acceptable standard.

(vi) Vendors list:

TECNIMONT is still making inquiries with prospective suppliers and they promised to furnish NCI with the final list of Vendors by June 1987. It is expected the final list will not be much different from the given in September 1986.

B. Implementation Progress:

(i) Contract for machinery supply:

Both NCI and TECNIMONT acknowledged the fact that the project has been delayed by several factors one of them being the issue of converting the currency of payment from US $ to ECU. It was also noted that both the Tanzania and Italian Government have approved changing the unit of payment from US $ to ECU as agreed between NCI and TECNIMONT in Ammendment No. 3 of the machinery supply contract. Considering the stage reached, NCI believes it will not take long for the relevant bodies to finalise ammendment of the relevant clauses of the financial convention. Although TECNIMONT was sceptical about NCI's optimism it was decided that in order not to delay the project both parties should continue to implement the project in

accordance to the provisions of the contract and the implementation schedule as amended in the second co-ordination meeting of 8/....13/April as attached herewith. Meanwhile employing all possible means to impress upon the Government Authorities the urgency of completing the remaining administrative procedures to amend the financial convention. When payment falls due TECHNIMONT as provided for in the contract should invoice NCI and accordingly NCI will make a determined follow up with the Ministry of Finance and Bank of Tanzania which will necessarily liase with their Italian Government counterparts to facilitate payment.

(ii) Performance Bond:

TECHNIMONT confirmed that they will extend the Performance Bond as provided for in the contract.

(iii) Application for import licences:

TECHNIMONT will contact SGS on required pre-shipment inspection procedures and soon as they get all the necessary information they will send to NCI proforma invoices for application of import licences from Bank of Tanzania. It is expected the proforma invoices will be sent in June 1987.

(iv) Letter of Credit:

Although Article 15:12:1 of the machinery supply contract requires NCI to open a letter of credit in the favour of TECHNIMONT for the supply of machinery and equipment, this provision now is unnecessary since the mode of payment for the said supply is governed by the provisions of the Financial Convention between the Italian and Tanzanian Governments.

(v) Training Programme:

TECHNIMONT submitted the training programme for production personnel. They indicated that the best training time for the personnel is between October and May when there is peak production in most of the pesticide factories in Italy. Their original proposal was that

the personnel should go for training between October 1987 and May 1988. Considering that the earliest time erection of machinery will begin is January 1989 according to the revised implementation programme, NCI proposed that it is better to send the personnel for training between October 1988 and May 1989. This will avoid having the trainees remaining iddle a factor which might force some of them to abscond. The trainees will miss the first few months of machinery erection but this is considered the best way to avoid the problem of using resources to train people who might not remain with the company. The personnel will be trained in a single group. On the content or coverage of the proposed training programme the first reaction from NCI is that it is adequate. However further reviews of the programme will be made and TECNIMONT will be informed in good time of any need to broaden or change some aspects of the programme. (Copy of the programme is attached as Appendix II).

C. Basic Engineering Designs:

(i) Process Buildings:

(a) Size of openings in floors not indicated on drawings. These may be scaled off for design and preparation of civil drawings. Actual size will be communicated to MM when TCM receives equipment drawings from manufacturers. Also foundation and holding down details will be communicated to MM as soon as TCM receives them.

(b) All metal deck indicated in the drawings in the process buildings must be built as indicated (steel beams and grantings). TCM will supply steel materials at a cost to be agreed.

(c) TCM will provide all hoists with their rails

(d) (i) Hoist in Herbicide buildings to have capacity of 2 tons.

(ii) Openings shown in walls in process buildings are optimum size to keep out rain and must stay so.

(e) Ridge pieces shown will be supplied by TCM and in detailing: across dimension of 500 mm at ridge should be allowed for this. A typical vent detail for process buildings and main store was given to MM. Actual will be similar.

(f) Ventilation louvres shown in bottom of walls in process buildings will be supplied by TCM; typical detail has been supplied to MM.

(g) All walling to be concrete block walls.

2) <u>Other Buildings:</u>

(a) Ridges and vents as in process buildings (only main warehouse).
(b) Wall to be concrete block
(c) Metal doors shown to have heavy wooden door substitution at the discretion of civil engineer
(d) Construction to be R.C. column, block walling and roof of steel truss and GCI sheeting.
(e) Main warehouse to be completed before arrival of TCM to be used as their store during erection.
(f) An office for two employees should be provided in the main store.
(g) In administration block separate toilets to be provided for the manager and for ladies. Mr. Msaki suggested toilets should be moved to one end of the building to avoid smell when there is no water for flushing and that for ease of drainage they should be against external wall.

(h) Louvre blocks for ventilation to be provided on top of bulk store. Provide concrete wall bottom 2.3 m.

(i) In ammenities block - provide lockers, showers and WC for ladies.

(j) HCL tank surrounding bund walls must be lined with acid resistant tiles.

D. Other civil engineering matters discussed and agreed.

(i) Programme on civil engineering works by civil engineers was discussed and agreed upon without modification: (copy attached)

(2) It was agreed that TCM will modify their bar chart to suit the programme prepared by civil engineers.

(3) TCM are unable to supply final information for civil works earlier than December.

(4) Civil Engineers to do design work using information already supplied todate by TCM.

(5) Two copies of dimension drawings for each processing building to be sent to TCM for approval (control to be limited to centre line position of equipments and their bottom level, control of anchor bolts excluded). One copy will be returned to Engineers with comments, the other copy will be retained by TCM.

(6) TCM will supply ventilation louvre units for main warehouse during the month of September 1987 provided the financial convention will have been finalised within July 1987.

(7) NCI will assist the contractor to secure sliding door gear which is not locally available.

(8) Fork lift trucks will be used in the main warehouse and therefore ramps and platforms to be provided at road side of the building.

(9) Application for railway siding to start as soon as possible.

National Chemical Industries
April, 1987

Distribution: Mbega Melvin - Arusha
TECNIMONT

PESTICIDES PLANT - MOSHI

TRAINING PROGRAMME

N.C.I. SPECIALIST:

- PRODUCTION MANAGER
- CHIEF ENGINEER
- PRODUCTION ENGINEERS (2)
- MAINTENANCE ENGINEERS (2)
- ELECTR./INSTRUMENTATION SPECIALIST
- LABORATORY SPECIALIST

TRAINING LOCATIONS

- BASLINI INDUSTRIE CHIMICHE - TREVIGLIO	- ITALY
- MONTEDISON PLANTS AND FACILITIES	- ITALY
- MANUFACTURERS FACILITIES	- ITALY

FOREWORD

Training activities will be divided into the following three main guidelines:

- **THEORETICAL SECTION**
- **PRACTICAL ACTIVITIES ON PLANTS**
- **THEORETICAL AND PRACTICAL ACTIVITIES AT MANUFACTURERS' FACILITIES**

A) THEORETICAL SECTION

In order to facilitate learning of subsequent steps of pratical activities, it will be given to all trainees, according to their professional skills and to the roles that they will play in the plant management, all general and detailed information necessary to allow a correct and completely autonomous performance of their future activities.
For specialists devoted to plant production, a particular care will be dedicated to the following topics:

1) Analysis of chemical processes related to the Project

2) Raw materials and chemicals as well as final products quality control

3) Determination of best storage conditions and displacements of raw materials and final products

4) Determination of proper operating conditions for all plant equipments with necessary information on their main mechanical, electrical and instrumental characteristics (ex:dryer, elctrolizers, filters, mills, pneumatic conveyors ecc)

5) Determination of best conditions for production campaign changings with regard to cleaning and plant preparing activities

6) Examination of toxicological characteristics of products related to production cycles with particular regard to safety conditions for plant operators

7) Study of general plant operating conditions for environmental pollution prevention

Production manager and Chief engineer will also be trained on the following matters on a general and detailed base:

- personnel management
- production programming and managing with elements of budget technics
- exemples of storage management (raw materials and final products)
- general criteria on scheduling and on methods for routine and conservative maintenance.

For all above listed arguments trainees will be supplied with examples of documentation actually emploied in the factories where the training is in progress, in order to allow all trainees to estimate possible utilization on the Moshi plant.

All main equipments belonging to the technological lines will be shown to the maintenance specialists utilizing, if necessary, shop drawings; all best maintenance technics will be illustrated as well, along with maintenance documentation examples (item cards, cycle scheduling forms, ecc). Said documentation could be utilized for future maintenace aims on Moshi plant.

Instructions for lines and equipments preparing for maintenance operations will be underlined with particular regard to safety conditions for maintenance operators.

The electrical/instrumental specialist will be trained with the same kind of information for plant maintenance described above, with obvious relation to his professional skill; instruments belonging to technological lines will be studied in their characteristics and a particular regard will be given to some alarms and interlocking blocks.

All maintenance specialists will be trained in a detailed way on all instruments requested for maintenance operations as well as on general criteria for workshop organisation.
Laborotory technician will be supplied with all instructions to performe controls related to Moshi plant productions; the importance of said controls to obtain final product will be underlined.

All laboratory equipments utilized during tests will be studied in a detailed way and relevant information of simple maintenance operations will be done as well.

B) PRACTICAL SECTION

After completion of theoretical training described in section "A", each trainee will have the possibility to verify in practice data already learned.

Each trainee, will be supported by corrisponding specialists belonging to factories operating in pesticides field and will attend day by day to all activities that are performed in the various plant functions and locations (production, maintenance, laboratory, ecc.). The above said activity will be performed, of course, without any interference with productions and programmes in progress.

According to single specialisations, trainees could perform themselves, under trainers supervision, field operations in order to complete their knowledge.

At the end of each week of practical experience, a short meeting will be held between trainers and trainees in order to examinate all major events occurred during the previous week.

Each trainee will present a weekly report with a description of said events along with possible requests of further learning.

These reports, together with all documentation supplied by trainers, will consist in the final booklet of training activities performed.

If, during training time, some equipments with the same characteristics of those foreseen for the Moshi plant will not be available or if said equipments will be under technological operating conditions similar but not equal to those foreseen for the Project, training will be performed on the available lines and equipments and trainers will illustrate all analogies between the two kind of lines and/or equipments.

Among all activities, a particular care will be done to training of laboratory specialist. This specialist will repeatedly perform all tests and controls foreseen during production, untill a perfect knowlege of the matter will be reached. At the end of training time, the laboratory specialist will execute several trial tests to allow trainers to give an evaluation of his learning level.

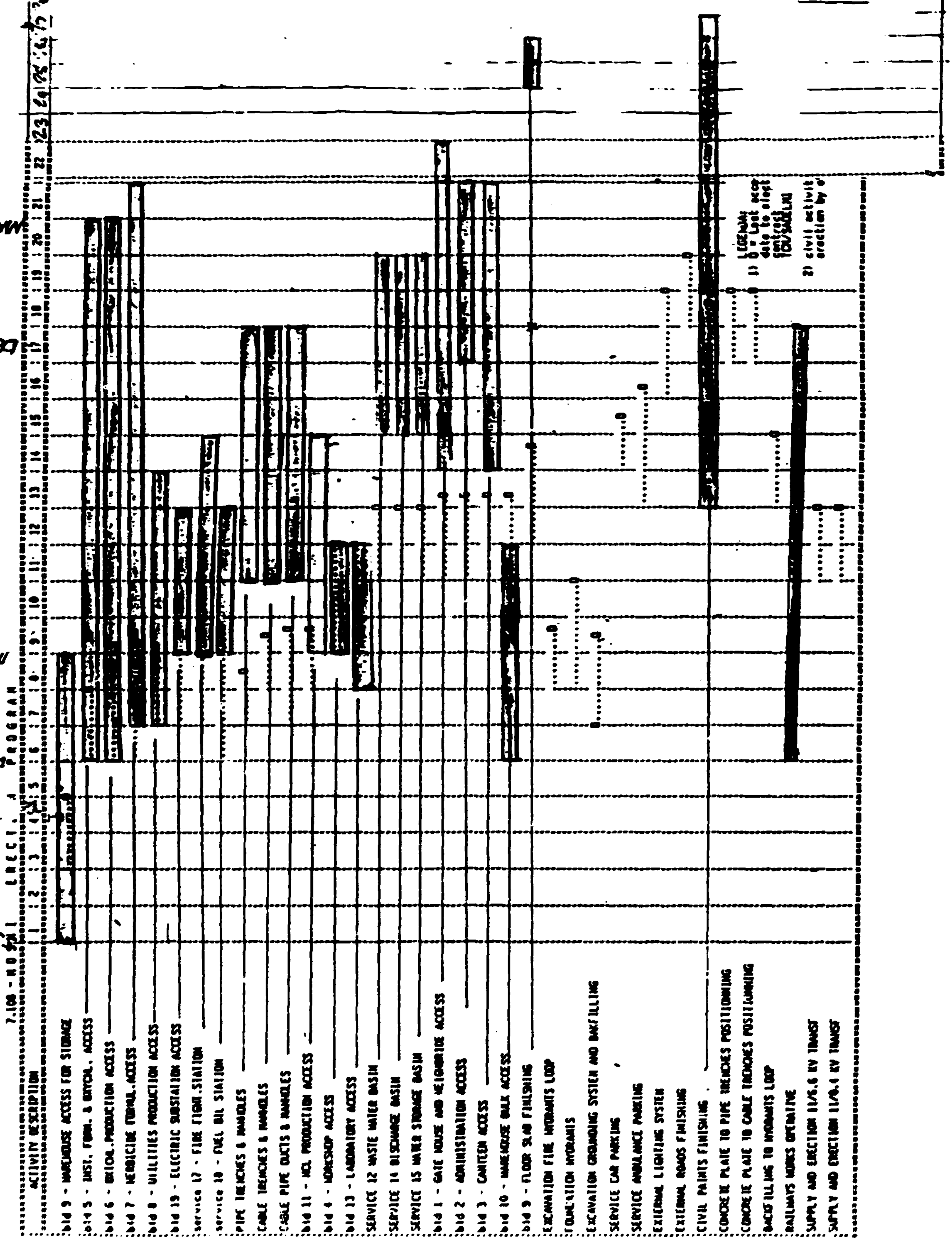
C) THEORETICAL AND PRACTICAL TRAINING C/O MANUFACTURERS

In order to complete theoretical and practical activities described in the previous sections and according to specific needs, trainees will spend an adequately long time c/o manufacturers of items destinated to Moshi plant.

By this mean, thay will directly verify manufactoring operating conditions of some equipments of special interest and importance, design codes adopted for their design and relevant tests execution.

Milan, April 6, 1987

Annex 3


7.100 - ERECT. PROGRAM
ACTIVITY DESCRIPTION
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
JULY
DEC
MAR
DEC
MAR
bld 9 - WAREHOUSE ACCESS FOR STORAGE
bld 5 - INST. FORM. & GLYCOL. ACCESS
bld 6 - GLYCOL.PRODUCTION ACCESS
bld 7 - HERBICIDE FORMUL.ACCESS
bld 8 - UTILITIES PRODUCTION ACCESS
bld 19 - ELECTRIC SUBSTATION ACCESS
service 17 - FIRE FIGHT.STATION
service 18 - FUEL OIL STATION
PIPE TRENCHES & MANHOLES
CABLE TRENCHES & MANHOLES
CABLE PIPE DUCTS & MANHOLES
bld 11 - HCL PRODUCTION ACCESS
bld 4 - WORKSHOP ACCESS
bld 13 - LABORATORY ACCESS
SERVICE 12 WASTE WATER BASIN
SERVICE 14 DISCHARGE BASIN
SERVICE 15 WATER STORAGE BASIN
bld 1 - GATE HOUSE AND NEIGHBORIDE ACCESS
bld 2 - ADMINISTRATION ACCESS
bld 3 - CANTEEN ACCESS
bld 10 - WAREHOUSE BULK ACCESS
bld 9 - FLOOR SLAB FINISHING
EXCAVATION FIRE HYDRANTS LOOP
FOUNDATION HYDRANTS
EXCAVATION GROUNDING SYSTEM AND BACKFILLING
SERVICE CAR PARKING
SERVICE AMBULANCE PARKING
EXTERNAL LIGHTING SYSTEM
EXTERNAL ROADS FINISHING
CIVIL PAINTS FINISHING
CONCRETE PLATE TO PIPE TRENCHES POSITIONING
CONCRETE PLATE TO CABLE TRENCHES POSITIONING
BACKFILLING TO HYDRANTS LOOP
RAILWAYS WORKS OPERATIVE
SUPPLY AND ERECTION 11/6.6 KV TRANSF
SUPPLY AND ERECTION 11/0.4 KV TRANSF
LEGENDA:
1) 0 = Last acce date to elect contract
2) civil activit erection by


TECHNIPONT
CLASSIFIC.
REV.
DESCRIZIONE Description
DATA Date
APPROV. Appr.
COMM. Job
1988
CONTRACT AWARD
FINANCIAL CONDITION REVISION
BASIC CIVIL ENGINEERING
PROCESS ENGINEERING
DETAILED ENGINEERING
CIVIL ENGINEERING (BY OTHERS)
MATERIAL REQUISITION FOR MEDIARY
PURCHASE ORDER
DELIVERY FOB
TRANSPORT TO SITE
CIVIL WORKS (BY OTHERS)
WORK. & TEMPORARY FACILITIES
EQUIPMENT INSTALLATION
PIPING FABR. ERECT. & TEST
INSTRUM/ELECTRIC WORKS
PAINTING & INSULATION WORKS
COMMISSIONING PERIOD
GUARANTEE TESTS
MECH COMPLETION
FINAL ACCEPTANCE
MANNING
PRODUCTION MANAGER
CIVIL ENGINEER
PRODUCTION ENGINEERS (2)
MAINTENANCE ENGINEERS (2)
ELECTRICAL/INSTRUMENTATION ENG.
LABORATORY TECHNICIAN
VARIOUS
SEPARATE AGREEMENT (CONTRACT 3.20)
AS BUILT DRAWINGS
LIST OF SPARE PARTS
DELIVERY SCHEDULE
LIST OF RAW MATERIALS (CONSUMABLES - OPERATIONS)

Annex 4

Annex 5

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF INDUSTRIES & TRADE

(Offices Co-operative Building, Lumumba Street)

Cables and Telegrams: "INDTRA, DAR ES SALAAM.
Telephone: 22773 — 9
(All official communications should be addressed to the Principal Secretary and not to individuals).

P.O. BOX 9503.
DAR ES SALAAM.

In reply please quote:

Ref No. MIT&C/I.130/2

N. C. I.
17 [illegible]
RECEIVED

16th July, 1987

The Resident Representative,
UN System,
P.O. Box 9182,
DAR ES SALAAM.

Dear Madam,

RE: PESTCIDES PROJECT

REQUEST FOR SPECIAL INDUSTRIAL SERVICES (SIS)
FROM UNIDO

We refer to a letter from our National Chemicals Industries Corporation (NCI), Ref. No. NCI/DDF/F/87 dated 19th June addressed to this Ministry and copied to you, in connection with the above mentioned subject.

In view of the revised financial analysis of the project and considering the financial capability of NCI, to effectively implement the project, under the current economic situation, the government recognises the need to rephase the implementation programme of the project. In order to establish an orderly and financially feasible way of rephasing the programme, it is also agreed that expert assistance in this respect is most relevant.

The government therefore requests UNIDO assistance on the basis of the project proposal submitted to you by NCI. Further the government supports the request to have the services of Dr. Szabo the UNIDO Consultant extended. Since he is already familiar with the project we feel that his participation in this project is important and necessary.

Thanking you in anticipation.

Yours faithfully,

E. E. Mangesho (Mrs)
for: PRINCIPAL SECRETARY

C.C. The General Manager
NCI,
DAR ES SALAAM.

87-08-10 10:35
●
133013 hajma a
41701 kemia tz

10/7/87

attn. dr. szabo
---

unido (tanzania) have arranged for mrs. undiri to depart dar es salaam on 26/8/87 by ethiopian airlines via rome and arrive milan on 27/8/87.

tentative programme as given by tecnimont is as follows:-

august 28	meeting at tcm offices detailed
august 31	examination of different sections
sept. 1,2,3,4	of the project
sept. 7,8,9,10	visit to production plants and manufactures workshops
sept. 11	meeting at tcm offices

1. sd you have any additions to the programme to enable nci maximize the usefulness of this trip, let us know in advance so that we can inform tecnimont accordingly.

2. mrs. undiri will also bring with her yr reports of the appraisal for clarification in some of the sections.

3. ministry of industries has already sent an application to unido (tanzania) for newsis. mnsundin will come with info on status.

regards,

h.m. kitilya/ddf/nci
---●
133013 hajma a
41701 kemia tz.....

via radio-austria
10/08/87 0843gmt

ENVIRONMENTAL IMPACT EVALUATION

ON THE NEW PESTICIDES FACTORY TO BE ERECTED IN MOSHI TANZANIA

Milan, September 11th, 1987
FLU/sw

1. FOREWORD

This report contains the information on the process characteristics of the various plants of the pesticides factory planned to be located in MOSHI, with the purpose of outlining the measures provided to minimize the environmental impact caused by any air, liquid or solid effluents.

2. COMPOSITION OF THE FACTORY

The factory shall consist of the following production and formulation plants:

- hydrochloric acid production
- copper oxichloride production
- copper oxichloride formulation
- wettable powders formulation
- liquid and flowable herbicides formulation
- granular formulations.

3. SUBSTANCES HANDLED IN FORMULATION PLANTS

The substances handled within the plants are:

3.1. Wettable powder:

- DDT	50%
- lindane	25%, 40%
- carbaryl	50%
- endosulfan	35%, 50%
- aldrin	40%
- dieldrin	50%.

3.2. Liquid and flowable herbicides:

- atrazine	50%
- simazine	50%
- atrazine/simazine	50% (20/30)
- ametryn/terbutryn	40% (20/20)
- paraquat/diquat.	

3.3. Granular formulations:

- endosulfan	4%
- lindane	6,5% gamma
- diazinon	5%.

4. MAIN PLANT CHARACTERISTICS AND RELEVANT EFFLUENTS

4.1. Copper oxichloryde production

4.1.1. Process description

Copper oxichloride production starts by attack of granular or copper scraps by means of copper chloride and simultaneous oxidation of the produced cuprous chloride by air insufflation.
A certain amount of hydrochloric acid is added to the suspension which is partially neutralized by the copper oxichloride itself.
Hydrochloric acid is added in such a way to prevent free acid presence in the suspension. Thus the air leaving the oxidation/reaction section of the plant is practically free of hydrochloric acid.
However the plant is provided with a washing tower where the acid traces in the oxidation air are eliminated.
Some calcium chloride production is involved in the process which must be purged as mother liquor in order to keep the concentration below 1,5 ÷ 2% by weight.

4.1.2. Consideration on streams leaving the plant

Four streams are identified according to previous process descriptions:

I Copper oxichloryde dry (final product): capacity 10 t/d.

II Air coming from the reaction/oxidation section:
flow rate : 5,500 Nm^3/h
temperature : 40°C.

III Air coming from the dryer of the products.

IV Water coming from the washing section of the rotary filter, contents:
water: flowrate 7 m^3/d abt.
$CaCl_2$: flowrate 120 kg/d abt.

Destination: this effluent is sent to the equalization basin provided in the factory.

4.1.3. Washing of equipment and pavings

The equipment washing waters are kept in circuit and reused within the process.
Also paving washing provided for casual splashing are sent back to the process circuit, no washing water comes out of the plant.
Ordinary cleanings of premises are provided as dry cleanings.

4.2. Formulation plants

4.2.1. Plant sections

Within their own specificity these plants show some main common sections:

- formulation
- milling
- mixing
- storage/homogeneization
- bagging

are operation common to all the plants.

4.2.2. Operation connected with air, liquid or solid effluent emissions

It is to be pointed out that the active principles come in the formulation section of the plants in definite quantity established by the formula.
This involves that charges are prepared to the formulation with a definite number of sealed standards-weight bags.
Therefore operators handle only the sealed bags of the toxic substances charging directly the integral bags into the hopper, while for the inert substances and the coformulants the charges are prepared proportioned to the number of integral bags of the active principles.

4.2.3. Charge of active principles and coformulants

These substances (powders) sealed in bags are charged into hoppers previously manteined under low vacuum in order to avoid the spreading of powders in the working environment.

4.2.4. Operations of the plants

The products are sent to various plant operations, such as mixing, milling, storage and bagging, by pneumatic haulages.
Therefore, the plants are provided with fans and filters to exhaust the air out of the systems.
The bags packaging the active principles and the coformulants are stored in a special device connected to the charging hopper from where will be disposed off in sealed containers.
Both the formulation section and the bagging section of the plants are provided with local exhaust systems.

4.2.5. Consideration on streams leaving the plants

Formulation plants show only gaseous streams consisting of the air coming out the bag filter collecting the pneumatic haulage exhausts, the local exhaust systems, the suctions for vacuum in charging hoppers.
As concern solid bags, they will be disposed off to appropriate treatment.
The air streams show a negligible amount of dust particles (about 5 mg/m^3).

4.2.6. Washing of equipment and pavings

The equipment are washed by means of inert materials which are reused in the succesive formulations, no water comes in the washings.
In case of splashings the substances are collected and sent back to the process.
Ordinary cleanings of premises are provided as dry cleanings.

4.3. Hydrochloric acid production plant

The process is based on the chlorine production by means of membrane cells (mercury cells are not used).

4.3.1. Streams leaving the plant

Products:
- HCl (water solution) 30% content
- caustic soda (water solution) 35% content
- sodium hypochlorite (water solution).

Other streams:

I Brine purge, flowrate abt. 110 kg/h
contents: NaCl abt. 20%
Na_2SO_4 abt. 0,3%.

The purge is required in order to control the content of Na_2SO_4 in the process brine.

Waste treatment

The brine purge is actually foreseen to be sent to the river.
The possible alternative in a total or a partial way is the evaporation by means of a natural evaporation basin with NaCl solid salt production.

II Water with traces of chlorine, flowrate abt. 2 m^3/h.

This water can be sent to the sewage system or directly into the river.

III Water solution of NaCl coming out from the regeneration of ionic resins, flowrate abt. 23 kg/h; NaCl content 1.3%.

This stream will join with the stream I.

5. GENERAL REQUIREMENTS OF PAVINGS

Pavings will be realized by impermeable materials and finishing in order to hold to spills coming out from the equipments, suitable slopes to collect the spills will be also provided.

Minutes of meeting held in Milan 28/8 - 11/9

Mrs Undiri	Mr. Massara
Dr. Szabo	Mr. Canti
	Mr. Vallin
	Mr. Capetti
	Mr. Corvasce
	Mr. Minnucci
	Mr. Folli
	Mr. Scaccianoce
	Mr. Bottoni

Major items of discussion were as follows:

1) Packaging
2) Raw materials test and formulation development
3) Effluents
4) Training
5) Shipment
6) Water supply
7) visits to plants

1) NCI ask TCM to foresee the possibility to pack powder and possibly granules starting from 1 kg bags, liquids starting from 1 lt bottles and from 0.5 kg in case of wettable powders.

   TCM will check with its suppliers the mininum size of bags and bottles that will be possible to use in the plant according to the packaging units type already foreseen (semi automatic type) and the total production required by the CONTRACT for each unit.
   (The bags capacity foreseen in the plant is as follows:
   - wettable powder 25 kg
   - oxychloride 25 kg
   - granular pesticides 5, 15, 25 kg
   - liquid and flowable pesticides from 5 to 25 lt)

2) NCI empnasizeo tne need of tne carriers to be local.
According to this, NCI has already given to TCM small samples of local raw materials to be checked and to be worked in local formulations if quality allows.
TCM confirms his willingness to perform this with his licensors.

3) Characteristics and quantities of the effluents of all units have been examined.
A report on this matter has been prepared and is annexed to the present report .

4) TCM and NCI have examined the possibility and the main characteristics of the training of NCI personnel to be performed starting within September 1988.
Finalization of the training will be done in time for the above said date.
In-plant training for the copperoxychloride plant is foreseen mainly at the Mosni plant.

5) NCI and TCM have discussed the shipping procedure proposed by TCM and here annexed.
Said procedure will be commented by NCI within September 1987.

6) NCI will confirm within September 1987 if the water coming from boreholes will be the only kind of water to be used in the plant.
If NCI so chooses, TCM will eliminate the water treatment equipments which will be unnecessary.
The analysis of borehole water is here attached and is as per tne report dated 25.11.86 and sent to TCM and NCI by Mbega Melvin on december 1986.

7) During the stay of NCI delegation the following plants have been visited:

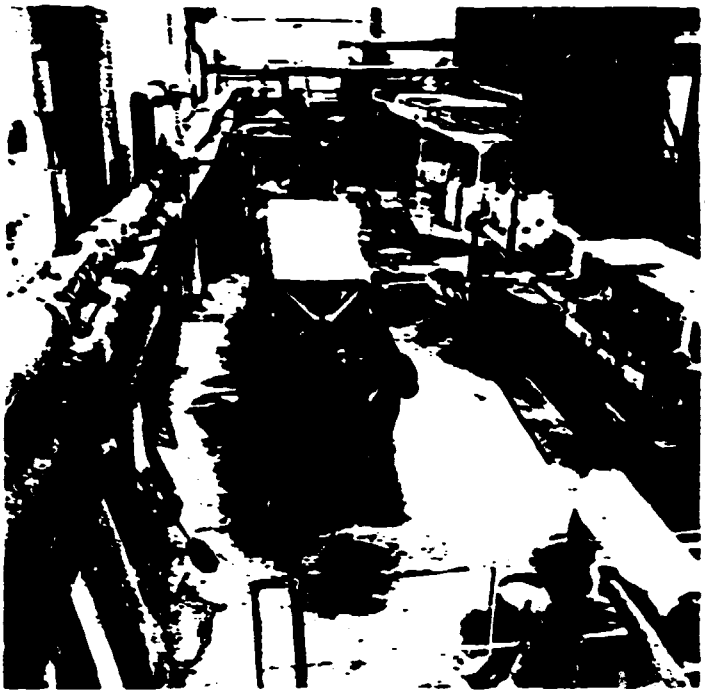
MONTEDISON plant in Massa Carrara
(wettable powders fromulation)

ENICHEM plant in Faenza
(granular pesticides formulation)

BASLINI plant in Treviglio
(wettable powders formulation
liquid and flowable pesticides formulation)

Milan, September 11, 1987
CNT/RG.

CHEMICAL PLANTS



Sodium silicate production plant

SULPHURIC ACID

Plant for the production of sulphuric acid, starting from elemental sulphur.

t/day

240	BASLINI	ITALY
80	SAFFO	ITALY
60	FABBRICA PERFOSFATI	ITALY
320	RUMIANCA	ITALY
200	MARCHI	ITALY
165	ENICHEM	ITALY
400	AEVAL	GREECE
100	DRURY INDUSTRIES	NIGERIA

SODIUM SILICATE

Plant for the production of sodium silicate by direct reaction of caustic soda and silica sand.

t/day

100	BASLINI	ITALY
42	MINTAX	TURKEY
60	PORT SAID INV.	EGYPT

SULPHUR GRINDING AND MICRONIZATION

kg/hr

800	SIARKOPOL	POLAND
2350	ROMCHIM	RUMANIA
4000	BASLINI	ITALY
2500	MONTEDISON	ITALY
1000	ZIRAI DONATIM	TURKEY

COPPER OXYCHLORIDE

Plant for the production of copper oxychloride.

t/day

36	MONTEDISON	ITALY *
10	N.C.I.	TANZANIA *

ALUMINIUM SULPHATE

Plant for the production of sulphate from alumina, bauxite and exhausted Al catalysts.

t/day

100	BASLINI	ITALY
30	ZORKA H.I.	JUGOSLAVIA
16	ENGELHARD	ITALY
100	DOSTEL	TURKEY
150	S.O.M.	IRAQ *

SODIUM SULPHIDE AND SULPHYDRATE

Plant for the production of sodium sulphide and sulphydrate.

t/day

32	UCHIMA	MOROCCO
36	SAMIM BARIO	ITALY *
10	SULFUROS DE VENEZUELA	VENEZUELA
70	S.A.B.E.D.	ITALY *

LIQUEFIED SO_2

Plant for the production of liquefied sulphur dioxide.

t/day

6	SO.CHI.MI.SI.	ITALY
15	T.N.C.P.	INDIA
10	ZORKA H.I.	JUGOSLAVIA

CAPROLACTAM RECOVERY

Plant for recovering caprolactam from nylon waste water

m^3/hr

9	STILON	POLAND
3	BEMBERG	ITALY *

BASIC CHROMIUM SULPHATE

Plant for the production of sulphate starting from sodium bichromate.

t/day

15	STOPPANI	ITALY
50	ZORKA H.I.	JUGOSLAVIA

DI-CALCIUM PHOSPHATE

Plant for the production of feed-grade calcium phosphate.

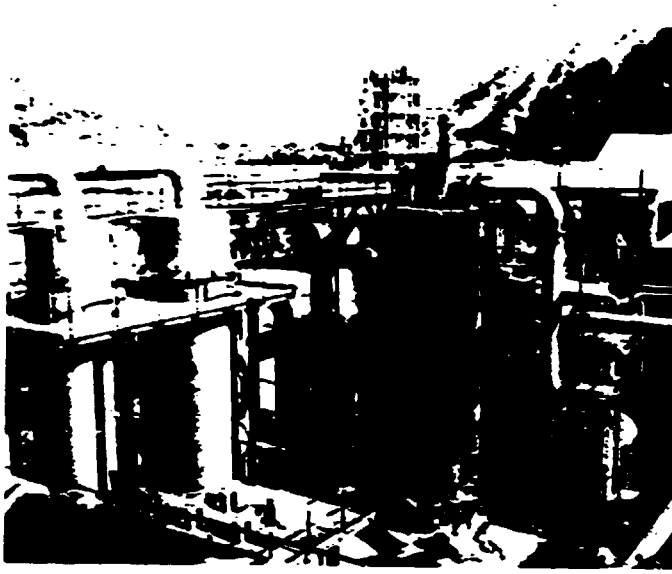
t/day

18	ZORKA H.I.	JUGOSLAVIA
20	FOSFITALIA	ITALY

EVAPORATION AND CRYSTALLIZATION PLANTS

t/day

- **TARTARIC ACID**
  - 24 ELBA — ITALY
- **AMMONIUM SULPHATE**
  - 33 CHIMICA DAUNA — ITALY
- **POTASSIUM CHLORIDE**
  - 4 SMIEL — ITALY ·
- **GLYCERINE**
  - 15 SIMEL — ITALY
- **ZINC SULPHATE**
  - 20 BASLINI — ITALY
- **BORIC ACID AND BORAX**
  - 190 ORINOCO — ITALY ·
- **SODIUM SULPHATE**
  - 10 TRAVANCORE RAYON — INDIA
- **MAGNESIUM SULPHATE**
  - 15 ZORKA H.I. — JUGOSLAVIA
- **COPPER SULPHATE**
  - 36 MONTEDISON — ITALY ·



Sulphuric acid plant

OTHER INDUSTRIAL PLANTS

t/day

- **CHLOROSULPHONIC ACID**
  - 10 BASLINI — ITALY
- **SODIUM SULPHATE**
  - 48 MARCHI — ITALY ·
  - 36 F.A.R. — ITALY ·
- **MAGNESIUM SULPHATE**
  - 15 ZORKA H.I. — JUGOSLAVIA
- **CALCIUM CARBONATE PRECIPITATE**
  - 20 BASLINI — ITALY
  - 5 PERGINE — ITALY
- **POTASSIUM CARBONATE**
  - 6 DE NORA — ITALY ·

· supply of know-how and engineering

Annex 10

Persons consulted on mission to Italy

TECNIMONT:

M. E. Massara, Project Manager
M. Scaccianoce, Manager of Traffic Department
G. Canti, Project Engineer
G. Cassaro, Procurement Coordinator
L. Folli, Environmental Protection and Safety Dept.
G. Corvasce, Process Engineer
G. L. Capetti, Process Engineer

SADELMI:(Subcontractor)

A. M. Bottoni, Traffic Manager
F. Balocco, Project Supervisor

FARMOPLANT

Dr. M. Cesana, Production Manager

SARIAF (Enichem)

Dr. R. Ricci, Production Manager
G. Tibaldo, Sales Manager

BASLINI (Know-how supplier)

C. Gajardelli, Vice President
D. E. Caggiati, Technical Consultant

GARBATO

Dr. S. Cozzi, Sales Manager

P. SCERNI

G. Fustagni, Sales Manager.