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3. Review framework
4. Programma field visit 13-28 March 1998
5. Set up for an Environmental Management, health and safety Plan (EMP)
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7. TPC -Environmental audit
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# 1. INTRODUCTION

## 1.1 Motive and mandate for this advice

The Tanzanian sugar industry consists of five sugar factories and estates; the Kilombero Sugar Company (Kilombero), the Mtibwa Sugar Estates Limited (Mtibwa), Tanganyika Planting Company (TPC) and Kagera. Kilombero operates two estates and factories, Msolwa (Kilombero I) and Ruembe (Kilombero II). This advice deals with Kilombero I and II, Mtibwa and TPC. Kagera is not included.

The Tanzanian authorities are planning to privatise the four companies. In the present planning this will be the case in the summer of 1998. On request of the Netherlands Embassy in Dar es Salaam this advice has been prepared in order to assist the Tanzanian Authorities, in particular the Presidential Parastatal

Sector Reform Commission (PSRC), in their negotiations with the new company owners on possible and necessary adaptations of the company with respect to a better environmental management (see appendix 1).

Objective of the advice:

- ! to identify and assess potential environmental problems (including health problems) with respect to production and processing of sugar cane;
- ! advise on viable and affordable measures to improve environmental and health conditions.

The advice has been prepared by a working group of the Commission for Environmental Impact Assessment (EIA). The members of this working group are listed in appendix 2. The group represents the Commission and will therefore be referred to as the Commission. In the Commission the following disciplines are represented: agronomy, hydrology, process technology, environmental law and economics. The working group of the Commission visited Tanzania in the period 13-28 March 1998. For the programme of this visit see appendix 4.

Herewith, the Commission wishes to express its gratitude for the excellent support and courtesy extended to the Commission by the various organisations during the visit. The Commission would like to express special thanks to the Netherlands Embassy in Dar es Salaam, the PSRC and the staff of TPC, Kilombero and Mtibwa.

## 1.2 Justification of the approach:

For each estate the present environmental situation and autonomous development has been analysed. The aspects which have been selected for auditing are grouped into the following three categories (see appendix 3):

- ! agricultural production at the estate and, as far as relevant, of the outgrowers;
- ! processing of sugar cane;
- ! occupational health of the labourers and living conditions of labourers living at the estate.

The environmental problems are described on basis of a review of available information, interviews with key informants, annual reports and site visits. Most of the information gathered during the field visits is qualitative of character. This means that the severity of observed environmental problems have been assessed on basis of best professional judgement.

For each determined problem a measure for improvement is presented in the advice.

The following key questions have been considered for each company:

- ! What are the present and prospected environmental problems and what are the underlying causes?
- ! What is the autonomous development of the estate and factory and to what extent will this result in environmental problems?
- ! What are the opportunities/options for a sustainable solution of the environmental problems and what are the costs and benefits?
- ! What are the opportunities for a more efficient use of energy by the factories?

### 1.3 Outline of the advice

This advice consists of two parts. The first part contains the main advice and six appendices. In chapter 3 the main findings and recommendations are presented. In respectively chapter 3, 4 and 5 environmental problems and recommendations for TPC, Kilombero and Mtibwa are presented.

The second part contains appendices on TPC (appendix 7), Kilombero (appendix 8) and Mtibwa (appendix 9.1) in which all the environmental aspects are described. Recommendations for the Tanzanian authorities are presented in appendix 6. A pre-feasibility study is executed on: (i) opportunities for production of charcoal out of bagasse and (ii) opportunities for an efficient energy use in the factories. Furthermore, the above mentioned pre-feasibility study is presented in appendix 9.2 and 10.

## 2. MAIN FINDINGS AND RECOMMENDATIONS

The Commission is of the opinion that present sugar production at TPC, Kilombero I and II, and Mtibwa will not result in unacceptable environmental problems within and / or outside the boundaries of the estate.

The Commission is of the opinion that if the present production of cane will be increased (increase per hectare and / or increase of the area cultivated) within the present boundaries of the estate unacceptable environmental problems are not to be expected.

The Commission suggests that its recommendations could be used for the development of an Environmental Management, health and safety Plan (EMP) for the estates. An EMP could be incorporated into the negotiations with potential buyers, development of such a plan could be made a provision in the agreement. In appendix 5 an outline for an Environmental Management, health and safety Plan is presented.

The Commission has looked into options to solve identified problems, briefly. Two promising options to improve the inefficient use of energy and bagasse by the factories have been assessed more in detail:

- ! production of charcoal on basis of excess bagasse in the factory of Mtibwa ( see appendix 9.2); This option has only been studied for Mtibwa because this is the only factory which produces excess bagasse;
- ! increased electricity production based on bagasse fuel for substitution of purchased electricity and / or delivery surplus electricity to the grid (see appendix 10).

The pre-feasibility studies showed that these options are not economically viable.

In appendix 11 the results of the environmental audit for TPC, Kilombero I and II, Mtibwa are presented in tables. It is recommended to make use of these tables whilst reading the advice (and the appendices 7, 8 and 9.1).

### 3. TPC - ENVIRONMENTAL PROBLEMS AND RECOMMENDATIONS

#### 3.1 Agricultural production

Problem: Waterlogging and salinisation is adversely affecting cane production in several hundreds of hectare. A small acreage has gone out of production already.

It is reported that white grub infestation is highest in salinised light textured soils.

*Recommendation: A drainage survey should be carried out to establish the extent and severity of the twin problem of waterlogging and salinisation and to design appropriate remedial measures.*

*The proposed drainage survey comprises the collection of information on topography, soil and subsoil conditions and the water balance; the design of a drainage system including field and main drains; an analysis of costs and benefits; and an assessment of potential downstream effects of saline drainage water.*

Problem: A major pest, estimated to reduce cane yields by some 15%, is white grub (Chafer grub, *cochliotis melonthoides*). A mix of agro-chemicals is used in the combat of white grubs: EDB, Miral (an organophosphate) and Suscon Blue (Chlorpyrifos). The total amount applied is large, at the same time the management is not capable of reporting any success at all with regard to the control of the white grub pest. EDB is known to be an effective killer of all soil life. In the Montreal Protocol on ozone EDB is banned. This protocol has not been ratified by Tanzania.

*Recommendation: There may be several reasons for the Tanzanian authorities to impose a ban of EDB: (i) it is proven that EDB is not an effective pest controller with regard to the fighting of white grubs; (ii) the use of EDB potentially aggravates the pest problem by killing all soil life, including natural predators of the white grub, and; (iii) EDB is internationally banned as a pest controlling agent. Additionally, however, the Commission wishes to make note of the fact that it is not in a position to judge the relevance of the Montreal Protocol for the Tanzania government.*

*Instead of EDB the insecticides Miral and Suscon Blue can be (and already are being) used. Suscon Blue is claimed to remain effective for a period of up to four years. Use should be restricted - despite claims that in TPC the effectiveness lasts only one year - to one application per 3 to 4 years.*

*Novel strategies to combat the white grub, have to be developed. These strategies may comprise a mix of proper placement of insecticides, the control of salinisation and waterlogging, the use of pathogenes, crop rotation, and search for resistant varieties. Collaboration is needed for instance with the Sugar Research Institute at Kibabe and with the International Institute on Biological Control (Nairobi).*

#### 3.2 Processing

Problem: The inefficient use of bagasse. Due to the design of the factory and the poor technical state (in fact the factory is technically worn out) the available amount of bagasse is not used efficient. As a result the factory operations are not all self sufficient in energy, although the factory was originally designed according to that principle of energy self sufficiency (like a modern sugar factory). Hence considerable quantities of furnace oil, diesel oil fuel wood and even electricity have to be purchased under the present conditions. The reasons are the following:

- ! increased secondary energy demand<sup>1</sup>;
- ! raw cane is not supplied to the factory in a sufficiently regular manner due to lacking transport infrastructure;
- ! the sugar manufacturing process has become irregular due to the technical state of the sugar processing equipment;

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1 Primary energy is fuel, secondary energy is electricity and heat, resulting from the conversion of primary energy.

! decreased secondary energy supply. The energy plant of the factory observes an extensive amount of stoppages due to the technical state of the energy equipment.

All these frequent stoppages result in an increased specific primary energy demand. Under those circumstances the quantity of bagasse is simply not enough.

TPC is a large purchaser of grid delivered electricity for the purpose of irrigation. It is technically possible to install a bagasse fuelled energy plant by which TPC is able to generate all electricity currently purchased, including the electricity for irrigation. This technology is the state of the art and feasible under the prevailing Tanzanian technical infrastructure. A second step forward in energy efficiency - from self sufficiency of the sugar manufacturing process to self sufficiency of the entire estate - is therefore also an option. A preliminary financial assessment of this option was made by the Commission and it was concluded that this is not economically viable (see appendix 10).

*Recommendation: The entire operation, including cane transport infrastructure, sugar manufacturing and energy plant should be rehabilitated. While the*

*Commission was not able to identify an economically viable option to replace all purchased electricity, it is recommended that such a study should be executed once that plans for factory rehabilitation have been elaborated.*

### 3.3 Living conditions and occupational health

Problem: Occurrence of water borne diseases. The following diseases (prioritised) are reported:

- ! malaria due to occurrence of standing water caused by poor drainage;
- ! bilharzia due to poor maintenance of the drainage system;
- ! diarrhoea due to poor functioning of the sanitation and sewerage system, availability of clean drinking water is not always guaranteed;

*It is recommended to<sup>2</sup>]:*

- ! *improve the sanitary/sewerage situation;*
- ! *install door/window wire mesh and distribute mosquito nets;*
- ! *fumigate the residential areas against mosquitos;*
- ! *clean the drainage system regularly;*
- ! *repair the storage tanks for drinking water;*
- ! *regularly monitor the correlation between the activities and type of diseases;*
- ! *improve the biological control of Bilharzia with snails through better coordination between the health and agricultural section.*

Problem: Occurrence of respiratory problems which are said to be caused by working with chemicals in the field.

*Recommendation: distribution of protective means like, masks, shoes and clothes among people applying chemicals.*

### 3.4 Autonomous development

It is assumed that the present agricultural production of sugar cane can be increased up to 450,000 tons of cane per year without causing environmental problems. This increase can be reached by extension of the cultivated area by 500 hectares to a total of 7,000 hectares and an increase of the production per hectare. For the latter increase it is assumed that White grub can be controlled more effectively.

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2 The first four recommendations have been mentioned and ranked by the health officer and doctor.



## 4. KILOMBERO I AND II - ENVIRONMENTAL PROBLEMS AND RECOMMENDATIONS

### 4.1 Agricultural production

No major environmental problems have been encountered at the estate nor at the land of the outgrowers.

### 4.2 Processing

Problem: Msolwa factory at Kilombero I is not fitted with a collection unit to collect the filter mud (all other factories do collect the mud). Presently, the filter mud is flushed into to the Great Ruaha river. Filter mud is rich in nutrients and may be used as a manure. The total amount of mud which is flushed away is estimated at 6,250 - 7,500 tonnes per annum during the six months crushing season (2,5 - 3,0 % filter mud on cane).

The spilling of filter cake in the river results in biological pollution of the river water, the self cleaning capacity will take care of this pollution, given sufficient residence time and hence distance from the injection point. An assessment of the extent of this biological pollution and its balance with regards to the self cleaning capacity of the river could not be made by the Commission as it is not clear how many people living downstream make use of this water.

*It is recommended that the Msolwa factory should stop the spillage of filter cake in the river. The obvious alternative is the concentrated disposal of filter cake and its subsequent use as fertilizer, either for gardening or cane production.*

Problem: The available bagasse is not used efficiently due to several reasons:

- ! increase secondary energy demand. The sugar manufacturing process has become irregular due to the technical state of the energy equipment.
- ! decreased secondary energy supply:
  - the energy plant of the two factories observe an extensive amount of stoppages due to the technical state of the energy equipment;
  - the cane supplied is too much contaminated with soil which is not being removed by an effective cane washing plant. As a result the bagasse is strongly contaminated with soil. This leads to a highly increased ash content (estimated at six times higher than design values) to which the boilers are not fit. Subsequently the contaminated bagasse is rejected and furnace oil is used instead.

This results in a substantial use of furnace oil.

*Recommendation: The powerhouse of Msolwa (K1) should be rehabilitated. Along with the preparation of rehabilitation plans it is recommended to look for improved energy efficiency by the factory and utilization of bagasse to substitute for grid delivered electricity. This alternative has been studied (see appendix 10).*

Problem: At Kilombero II a large deposit of excess bagasse (approximately 100.000 ton) is stored at a dump next to the factory and causes choking smell hindrance. Furthermore, spontaneous fires in the dump, which have occurred several times, are a potential danger to the people living adjacent to this site.

*It is recommended to incinerate the bagasse dump at Kilombero II (K2) at a safe site away from the residential areas. Preparation of charcoal from this excess bagasse is not viable for financial reasons.*

### 4.3 Living conditions and occupational health

Problem: Occurrence of water borne diseases. The following diseases (prioritised) are reported:

- ! malaria due to occurrence of standing water caused by poor drainage;
- ! diarrhoea due to poor functioning sanitation/ sewerage system and supply of biologically polluted drinking water from the river;

Problem: Respiratory problems due to, agricultural application of chemicals, contact with sulphur in the factory (K1)

*It is recommended to<sup>3]</sup>:*

- ! *maintain the drainage system;*
- ! *treat the drinking water regularly;*
- ! *finalise the drinking water supply scheme which is presently under construction;*
- ! *improve the sanitation and sewerage system at the estate;*
- ! *monitor the correlation between the activities and type of diseases;*
- ! *install door/ window wire mesh and distribute mosquito nets;*

Problem: Occurrence of respiratory problems which are said to be caused by working with chemicals in the field and contact with sulphur in the factory of K1<sup>4]</sup>.

*Recommendation: Distribution of protective masks, shoes and clothes to people applying chemicals in the field. The sulphur section in the factory should be adapted, applying screens to minimise the emission of sulphur particles. This adjustment is preferred above rotation of labourers as recommended by the doctor. the problem should be solved instead of mitigated. If necessary, after adjustments have been made, protective masks should be distributed.*

Problem: Squatter settlements at the gate of the estate at K2 are a source of epidemic diseases like cholera and tuberculosis due to insufficient and poor sanitation and sewerage facilities.

*Recommendation: District authorities, see annex 6.*

### 4.4 Autonomous development

It is assumed that the present agricultural production of sugar cane can be increased within the boundaries of the estate. There are opportunities to enlarge the area cultivated with cane.

### 4.5 General remarks

Problem: Recently a problem of river bank erosion occurred taking away some 5 hectares of cane land at K2. Tanesco is running a reservoir and a hydropower plant on the Great Ruaha river. An extremely high rainfall event forced Tanesco to spill a large amount of water to avoid a damburst. The rainfall event is reported to be caused by 'El Niño'; information on the frequency of the occurrences, however, would have been of more interest.

*Recommendation: The reservoir run by TANESCO is for hydropower generation, not for flow regulation or retention. Nevertheless in order to minimize future damages Tanesco should be requested to timely inform the company on emergency operations in case of extreme rainfall/ hydrological events.*

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3 The first four recommendations are mentioned and ranked by the health officer and doctor.

4 Ruembe (K1) is the only factory of the visited factories where they work with sulphur. Sulphur is used to prepare white sugar.

## 5. MTIBWA- ENVIRONMENTAL PROBLEMS AND RECOMMENDATIONS

### 5.1 Agricultural production

Problem: Waterlogging and salinisation is adversely affecting cane production in several hundreds of hectares. This land was taken out of production due to these problems and is almost irreversibly lost for cane cultivation.

*Recommendation: A drainage survey should be carried out to establish the extent and severity of the twin problem of waterlogging and salinisation and to design appropriate remedial measures.*

*A drainage survey comprises the collection of information on topography, soil and subsoil conditions and the water balance; the design of a drainage system including field and main drains; an analysis of costs and benefits; and an assessment of downstream effects of saline drainage water.*

### 5.2 Processing

Problem: While only consuming a relatively limited quantity of furnace oil (reaching a cost value of about 30,000 US\$ annually), the Mtibwa factory is nearly self sufficient in energy. This is related to the undersized boiler plant in combination with a set of relatively inefficient turbines. The brief assessment made by the Commission indicated that the energy plant has not been sufficiently covered by the nearly finalized rehabilitation efforts.

While energy self-sufficiency is a basis feature of a sugar plant, increased energy efficiency for the sales of surplus electricity poses an environmental opportunity which may eventually result in improved resource utilization on national level.

*Recommendation: A preliminary estimate of the profitability of increased electricity production at Mtibwa showed that this option is not financially viable. However, this is based on a number of estimates and conditions which may be subject to change of refinement. It is recommended that this matter is further studied along with further rehabilitation of the Mtibwa factory (see appendix 10).*

Problem: Mtibwa produces annually 15,000 ton of surplus excess bagasse. This excess is incinerated. The occurrence of this excess is not an environmental problem as such, but it poses an environmental option as it may be either (i) avoided by an improved utilization for surplus electricity production or, alternatively; (ii) may be utilized as a raw material for charcoal production (substituting wood/traditional charcoal). For these options see respectively appendix 10 and 9.2.

*Recommendation: As stated above the Commission is not convinced of the financial viability of increased electricity generation on the basis of bagasse (under the option that current existing annual excess of bagasse would be avoided). However, future consideration of this option is recommended. Two alternatives for charcoal production based on the full amount of 15,000 tonnes of mill run bagasse per year have been assessed. Focussing on a distribution to respectively urban and local consumers. Neither of these alternatives is sufficiently promising to propose further study. In appendix 9.2 these alternatives are further elaborated.*

Problem: Untreated waste water from the factory is discharged into an open drain and channelled beyond the estate border in south-eastern direction. It is reported to disappear somewhere in the bush (evaporation or point recharge of ground water) or said to flow into a riverine marshy area. The sewage water has a high BOD content. Every month several tons of Na<sub>2</sub>CO<sub>3</sub>/NaOH are being discharged as well, this salt being the waste product of cleaning tanks with caustic soda.

*It is recommended to determine the place and the extent of discharge and the severity of the problem. On basis of this information it could be required to take mitigating measures, treatment of waste water prior to discharge.*

### 5.3 Living conditions and occupational health

Problem: The most important water borne diseases are the following:

- ! malaria due to occurrence of standing water; The following services are provided to fight malaria; fumigating of the houses of the temporary labourers at the beginning of the cutting season and the weakly provision of profylax to labourers from areas where they are not used to malaria.
- ! diarrhoea, typhoid, cholera due to poor functioning sanitary and sewerage system;

*It is recommended to improve the sanitary situation (number of facilities and state of the system);*

Problem: Occurrence of respiratory problems (pneumonia & bronchitis) and skin diseases are said to be caused by use of agro-chemicals in the field.

*It is recommended to distribute protective means like masks, boots and clothes.*

### 5.4 Autonomous development

It is assumed that the present agricultural production of sugar cane can be increased up to 360,000 tons of cane per year, mainly by increasing the field per hectare without causing environmental problems.

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