OCCASION

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

DISCLAIMER

FAIR USE POLICY

CONTACT

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

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

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

Vienna, 8. Dec. 1991

19785

Technical Report:

Review of the Preparatory Work of Phase I of PTA-METALLURGICAL TECHNOLOGY CENTRE in HARARE/Zimbabwe and of the Assistance Needs of PTA and SADCC in the field of metallic mineral processing.

Based on the work of F. LOB
Industrial Mineral Specialist.

Backstopping officer: Dr. Tamas Grof, Industrial Development Officer - Metallurgical Branch

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
VIENNA

TABLE of CONTENTS

I N T R O D U C T I O N

The purpose of the fact-finding-mission was to review the preparatory work of phase I of the planned METALLURGICAL TECHNOLOGY CENTRE (MTC) by the Preferential Trade Area Member States (PTA) - with special emphasis on ore processing - and to assess the facilities and human resources of the Institute of Mining Research (IMR) in Harare.

The second task was to identify the assistance needs in the field of mineral processing of PTA Secretariat and SADCC Mining Sector Coordination Unit.

There had to be investigated whether both, PTA and SADCC objectives might be streamlined to serve both organizations.

The fact-finding-mission was carried out by Mr. Fridtjof Lob, Vienna, as Industrial Mineral Specialist and Consultant for UNIDO from 15. November 1991 to 1. December 1991.

The proposed duties of the mission were in detail:

1. Review the preparatory work of the first phase of PTA MTC.
2. Assess the testing facilities, human resources and range of services available at IMR, Harare.
3. Check accomodation possibilities at IMR for the first phase of the PTA MTC.
4. Establish contacts with the management of IMR, PTA Secretariat, SADCC Mining Sector Coordination UNIT and responsible authorities in Zimbabwe and Zambia.
5. Collect information on priority needs of Member States.
6. Identify assistance needs of PTA Secretariat and SADCC in the field of metallic mineral processing.
7. Prepare a report on findings and recommendations, scrutinizing the equipment list and international expert input of the first phase of the PTA MTC in light of the findings. (See Annex I UNIDO Job Description).

I. CHAPTER

PREFERENTIAL TRADE AREA - METALLURGICAL TECHNOLOGY CENTRE

HARARE / REDCLIFF / ZIMBABWE

Phase I

A. Review of the preparatory work of phase I of PTA-MTC project

There were delays in phase I of the project caused by the death of the PTA-MTC project coordinator Mr. Bungu in April 1991. According to Mr. A. Opio, Senior Industrial Expert of PTA, Lusaka, PTA is looking for a successor of Mr. Bungu.
The planned time schedule for the start of phase I is already delayed. Mr. Opio hopes, that the new project coordinator will be engaged in January 1992. Phase I operations should start very soon after funding has been secured.
The actual commencement of phase I will very much depend on the qualification of the new project coordinator, the pressure from PTA-Board and the financing arrangements with PTA Member States, the clarification of foreign funding by UNIDO and the assignment of the necessary experts. Unfortunately the next donor meeting is planned not before end of March 1992. This could bring further delay for the project.
The Institute of Mining Research (IMR) of the University of Zimbabwe is reasonably well equipped and can provide assistance regarding staff, existing analytical, mineralogical and to a certain degree beneficiation equipment for phase I, it also can provide some laboratory and office space.
Until now no real evaluation of existing metallic mineral deposits and beneficiation plants in the various PTA Member States has been done.

Unfortunately the assignment of the Chief Technical Adviser (CTA), a metallurgical expert, has been delayed too. He should have started with his work on phase I of the PTA-MTC project in Harare in November 1991.
Taking into account the above mentioned delays and calculating realistically, phase I of the project will not start before April 1st, 1992.

8. Assessment of testing facilities, human resources and range of services available at IMR (Institute of Mining Research)

The best approach to get phase I of the PTA-MTC project going is to start with beneficiation testing at the IMR.
The major part of the necessary equipment is already available at the IMR, also some trained staff for chemical and mineralogical analyses, beneficiation testing, hydrometallurgical and pyrometallurgical work.
As a first step PTA-MTC could assist IMR with some supplementary equipment, which is not available at IMR. Later on a complete beneficiation laboratory could be installed on a larger scale, as projected initially.
Dr. Roberts, Deputy Chairman of IMR pointed out, that much more analytical work can be carried out in the IMR-laboratories. He further mentioned that it might not be too difficult to contract additional staff, whenever needed. Staff can be trained by IMR and international experts to come.
IMR already has trained students and engineers of other African countries.
Local and international staff could be supplemented on a step-by-step basis according to growing workload and the availability of space for accomodation of laboratories and offices. Presently there are only two offices and one laboratory available. Additional laboratory space is planned for 1992. Without it the accomodation of the proposed technical staff (see UNIDO project report for establishing the MTC) of 24 engineers and technicians would be impossible.
According to Dr. Roberts a maximum of 10 people (4 engineers + 6 technicians) can be accomodated by IMR at present. (See Annex III).

The work undertaken by IMR (Institute of Mining Research) for the time being covers economic geology, geochemistry, applied mineralogy, coal chemistry, mining geology, rock mechanics, mineral processing, pyrometallurgy and mineral economics. The Institute is quite well equipped with following facilities:

- Analytical chemistry: instrumental and classical analysis and analysis of coal.
- X-ray fluorescence analysis (SIEMENS SRS 200).
- Geochemical exploration and environmental Geochemistry .
- Mineralogy: electron microprobe analysis, scanning electron microscope (JEOL JXA 50A), EDX (Kevex) X-ray diffraction analysis (PHILLIPS), optical microscopy (ZEISS) and image analysis.
- Mineral processing: flotation, gravity concentration. (See ANNEX III).
- Metallurgy: hydrometallurgy, pyrometallurgy.
- Mineral economics: feasibility studies, import substitution data bases and regional (SADCC) mining and mineral processing data bases using micro computers.
- Library Services: Library with international earth sciences, mining and metallurgy bibliographic database (IMMAGE)
  Microcomputer modeling and ore reserve software (DATAMINE & SURPAC).

In manpower development IMR offers already postgraduate training in applied geochemistry, applied mineralogy, economic geology, rock mechanics and extractive metallurgy.

The analytical facilities of IMR are available to outside users. In 1991 approx. 45.000 chemical analyses will be carried out, up to 200.000 p.a. could be done with additional staff.

The Institute carries out research for small scale miners, large mining companies, governmental related projects and industry in general.

Further on I visited the DEPARTMENT of METALLURGY of the Ministry of Mines in Harare; it has its own chemical and mineralogical analytical, beneficiation and pyrometallurgical laboratories and pilot plant facilities for ore processing. (See ANNEX III).

The equipment and the laboratory facilities of the Metallurgical Department are supplementing the IMR-facilities to a certain degree. They can be utilized also, if wanted by PTA-MTC.

In particular the pilot plant facilities of the Department of Metallurgy can be used more frequently by the industry and also by PTA-MTC, at least as long as the proposed METALLURGICAL TECHNOLOGY CENTRE in Redcliff has not been established.

C. Assistance needs of PTA - MTC - Project

An international mineral processing engineer should be engaged as soon as possible to start phase I of the project step-by-step.

Following laboratory devices for the establishment of the future MTC/phase I will also supplement the present beneficiation equipment of the IMR in the initial stage of operation:

1 Cone crusher	10.000	US $
1 Rod mill	10.000	US $
1 Ball mill	10.000	US $
1 Vibrating screener	10.000	US $
1 Mineral jig	10.000	US $
1 Hydrocyclone	20.000	US $
1 Hydraulic classifier 1 Air classifier)	15.000	US $
1 HUMPHREY spiral	15.000	US $
1 Autoclave with stirrer	18.000	US $
2 Drying stoves	10.000	US $
1 Sample riffle	6.000	US $
1 SARTORIUS moisture analyser	3.000	US $
1 Ultrasonic disintegrator	5.000	US $
1 DENVER flotation cell + accessories	6.000	US $
1 pH-meter	1.000	US $
1 Sedimentograph	5.000	US $
1 Magnetic separator	10.000	US $
1 Electrostatic separator	15.000	US $
1 Lab. high intensity magnetic separator	15.000	US $
1 DOPPLER ultrasonic flowmeter	5.000	US $
1 Stereomicroscope	3.500	US $
	202.500	US $

D. Mining and mineral processing database for PTA-countries

For the PTA-Member-States no own database in the mining and metallurgical fields does exist, in contrary to the SADCC countries where at least a mineral deposit and mining project database is available. Only very little information has been collected until now about projects in the individual PTA-countries.
In the course of my investigations I was able to collect only very few new information about the industrial minerals sector regarding industrial mineral deposits in ZIMBABWE.
There was shown interest by Mr. Nhachi, General Manager of G & W Industrial Minerals (Pvt) Ltd., Harare, to get assistance in beneficiation of mica from Karoi, silica (quartz) from Kadoma Midlands, magnesite from Kadoma and vermiculite from East Dorowa.
Mr. Nhachi was also interested in beneficiation technology for the following minerals: kaolin, corundum, bentonite, lime, dolomite, kyanite and graphite. (See ANNEX VI).

ZISCOSTEEL, The Zimbabwe Iron and Steel Company at Redcliff is interested in limonite ore beneficiation and sintering to substitute the hematite ore which is being processed at present.
The limonite, a low grade iron ore, is very friable, but can be exploited in the immediate vicinity of the steel works, thus saving costs for transportation. (See ANNEX VII).

E. Conclusions and Recommendations regarding phase I of PTA-MTC-Project

Phase I of the MTC-project has been delayed by the death of the project coordinator Mr. Bungu in April 1991.
A new project coordinator is supposed to be assigned in January 1992.

The next PTA donor conference is planned for March 1992; this brings further delay for the funding of the project.

All efforts should be made to begin with phase I as soon as possible.

In the initial stage (phase I) the MTC will be hosted at the IMR.

At least one international expert in ore processing should be assigned in the beginning for the PTA-MTC project. He should organize phase I in cooperation with the newly appointed local project coordinator.

The technical work should start with project data acquisition in the various PTA-Member-States.
In parallel the international expert should:

- organize laboratory work at IMR,
- select the proposed supplementary equipment
  submit tenders
  order the laboratory equipment after comparing the various quotations,
- organize, select and engage the necessary local staff in accordance with the progress of the project,
- report the requirements for international experts to UNIDO, Vienna.

During the first year of operation personnel should be increased according to the requirements, depending on funding, availability of accomodation, demand by the industry and the mineral market of the region.

II. CHAPTER

SADCC - MINING SECTOR COORDINATION UNIT

MINERAL PROCESSING PROJECT

Lusaka / Zambia

A. Identification of assistance needs of SADCC - Mining Sector Coordination Unit (MCU) in the field of metallic and industrial mineral processing

SADCC-MCU is seriously looking for an international mineral processing engineer for data collection on beneficiation projects, who at the same time should act as consulting engineer for mineral processing facilities in the region. This position should be filled as soon as possible.

Compared to the MTC-project in Harare the task of the above mentioned processing engineer for SADCC-MCU, Lusaka, would be a different one. He will assist the SADCC-MCU in project evaluations and advise the mineral industry in rationalizing existing processing facilities. He should provide data on the existing mineral processing facilities with emphasis on capacity utilization. He should study and comment on the present and future possible mineral processing methods and recommend a regional strategy of utilization and development, taking into consideration production and transportation costs and market trends. This strategy will take into account the possibility of sharing existing regional mineral processing facilities when economically feasible.

The main objectives according to SADCC-MCU are:

- Harmonize the utilization of existing plants.
- Establish new processing metallurgical plants with economical justification on a regional level.

The background for this is that some mineral deposits in the SADCC region are not properly exploited because of lack of availability of processing facilities. On the other side,a number of processing facilities are working under their capacity because of lack of supply of minerals.

The optimal use of mineral resources in the SADCC region needs a first assessment of existing mineral processing facilities and routes to establish a regional strategy for further development.

There does exist a very good cooperation between SADCC-MCU and the Geological Department of the MINISTRY of MINES, Lusaka, where analytical, mineralogical and beneficiation facilities are used frequently for beneficiation testing.
According to Mr. Sweta, Director of SADCC-MCU and Chief Mining-engineer of the Ministry of Mines, Lusaka, SADCC is interested in the assignment of an international mining engineer with special experience in beneficiation and industrial minerals, beginning next year. In connection with the proposed assignment there was no request for the supply of beneficiation equipment by SADCC-MCU.

However the donation of some additional analytical equipment as one

	XRD-Roentgen Diffractometer	120.000 US $
a	Distillation Unit	3.000 US $

and some XRF-SIEMENS spare parts, at a later stage to improve the analytical capacity at the chemical laboratory of the Geological Department would be very much appreciated, but is not a condition.

The Geological Department itself is relatively well equipped regarding analytical, mineralogical and beneficiation facilities for testing of metals and industrial minerals.
Recently GTZ-Germany has donated additional mineral processing equipment for about 180.000,-- DM.
Apart from qualified national staff SADCC-MCU has engaged some experienced international experts as consultants:

- Mr. Phillipe Bosse, Technical adviser in Mining geology from France.
- Mr. Björn Skoglund, adviser on international projects regarding mining and exploration equipment, from Sweden.
- Dr. Taupitz, Technical adviser on small scale mining (GTZ-Germany).
- Mr. Tschoepke, adviser in mining economics and project finance (GTZ-Germany).

Most analytical, mineralogical and beneficiation testing for SADCC-MCU is being carried out utilizing the facilities of the Geological Department of the MINISTRY of MINES, Lusaka; both are located within walking distance.

Some testing and analyzing work has been performed for SADCC-MCU by the Institute of Mining Research (IMR) in Harare according to Mr. Sweta (SADCC) and Dr. Roberts (IMR).

(See ANNEXES IX, X, XI)

B. Overview of SADCC-MCU Mining Program including Beneficiation

The SADCC Mining Program consists of approx. 54 projects in the various member countries.

Several studies in geology and mining have been conducted, other studies are still in progress:

- Development of small scale mining and beneficiation (metallic ores).
- Development of industrial minerals.
- Processing of lime and limestone in SADCC region.
- Development of gypsum in SADCC region.
- Development and processing of fertilizer-minerals.
- Assessment of heavy mineral sand deposits from the eastern coasts of Africa: ilmenite, rutile, zircon oxyde; and feasibility study on establishing a titanium dioxyde plant in the region.
- Integrated exploitation and processing of the Mulanje- (Malawi), Monica- (Mozambique) and Tanzanian bauxite deposits and establishment of alumina/aluminium industry in the region.
- Assessment of vermiculite production and processing in the region.
- SADCC gemstone buying, processing and marketing.
- Establishment of a Gemological Institute in Tanzania.
- Regional coal exploitation and processing.
- Establishment of a refractory industry inclusive investigation of rawmaterials in the region.
- Metallurgy of ores from alcaline complexes.
- Manufacture of activated carbon.
- Study on local production and manufacturing of mining equipment, beneficiation machinery and spare parts.

C. Beneficiation Projects in ZAMBIA and ZIMBABWE according to SADCC-database

1. Exploitation and beneficiation of Munali Nickel Deposit in Zambia.
2. SADCC gemstone buying, processing and marketing in Zambia.
3. Kaolin and feldspar processing in connection with gemstones in Zambia.
4. Rehabilitation phase II Maamba Coal Deposit in Zambia.
5. Study on the feasibility of an increased production of Kamativi tin mines (including beneficiation) in Zimbabwe.

There are several other exploration projects which need processing testing at a later stage.

Many existing beneficiation plants for copper, lead, zinc, nickel, chrome, gold in the copper belt and elsewhere need assistance to solve their problems caused by outdated processing equipment, lacking maintenance and spare parts.

D. Beneficiation Projects in the SADCC - Region
(other than Zambia and Zimbabwe)

1. Establishment of a Gemological Institute in Tanzania.

2. Manufacture of coke at Moatize Colliery in Mozambique.

3. Production of fertilizer from the Zaire Province in Angola.

4. Quihita kaolin project in Angola.

5. Development of the production of Boane Bentonite Mine in Mozambique.

6. Integrated exploration for ceramic and chemical industry raw materials in South West Swaziland.

7. PUGU kaolin project in Tanzania, projected processing plant.

8. Feasibility study on compaction and granulation of Minjingu phosphate in Tanzania.

9. Assessment of iron ore deposits, mines and beneficiation plants in Angola and Swaziland.

E. Conclusions and Recommendations regarding SADCC - MCU

SADCC-MCU would like to engage an international expert in mineral processing as soon as possible.
The expert should be assigned for a three years period to ansure useful results for the entire SADCC region.

He will need at least one year for collecting data of existing mineral processing facilities in SADCC countries, with special emphasis on their capacity utilization.

He will have to study and comment on the present and future possible mineral processing methods, including rationalization of existing plants.

He should recommend a regional strategy of utilization and development of mineral processing facilities in the various areas like metal and industrial minerals.

It is quite understandable that SADCC-MCU prefers to use as far as possible the mineral processing facilities at the Geological Department in Lusaka because of difficult communications between governmental organisations, customs etc. across borders.

There is also the additional possibility of using facilities of the SCHOOL of MINES in Lusaka.

SADCC is not against the establishment of a modern Metallurgical Technology Centre in Harare/Redcliff. But this new institution still has a long way to go after being implemented to serve all PTA- and SADCC-member-countries. Later on SADCC is prepared to delegate research and testing work, which cannot be carried out in Lusaka, to the future PTA-Metallurgical Technology Centre.

ANNEXES I

ANNEX I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

US/RAF/88/263

Post Title: Industrial Mineral Specialist

Duration: 2 weeks

Date required: 10-24 November 1991

Duty Station: Harare, Zimbabwe and Lusaka, Zambia

Purpose of project: Assist the Member States through SADCC Mining Sector Co-ordinating Unit and PTA Secretariat in evaluation of metallic mineral deposits, testing of minerals, setting up the mineralogical Department of the PTA MTC.

Duties:

1. Review the preparatory work of the first phase of PTA MTC.

2. Assess the testing facilities, human resources and range of services available at IMR, Harare.

3. Check accommodation possibilities at IMR for the first phase of the PTA MTC

4. Establish contacts with the management of IMR, PTA Secretariat, SADCC Mining Sector Co-ordination Unit and responsible authorities in Zimbabwe.

5. Collect information on priority needs of the Member States.

6. Identify assistance needs of PTA Secretariat and SADCC in the field of metallic mineral processing.

7. Prepare a report on findings and recommendations, scrutinizing the equipment list and international expert input estimates of the first phase of the PTA MTC in light of the findings.

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. BOX 300, Vienna, Austria

List of Organisations/Institutions, Ministries and Companies visited and Persons met

Following contacts have been established in Harare regarding PTA - MTC - Project:

18.11.1991 HARARE	Meeting with Mr. J.A. Alele OPIO, Senior Industrial Expert of PTA at Holiday Inn/Harare
19.11.1991 HARARE	Meeting at Ministry of Mines: Mr. C. Chipato, Deputy Secretary (Mining Promotion and Development) Mr. Rambo, Ministry of Industry & Commerce Mr. J.A. Alele OPIO
19.11.1991 HARARE	Visit to the Institute of Mining Research University of Zimbabwe, Harare : Dr. E.A. Roberts, Deputy Chairman and Senior Economic Geologist (see ANNEX III)
19.11.1991 HARARE	Visit to the Department of Metallurgy Ministry of Mines, Harare : Mr. V. Vera, Deputy Director Mr. L.G. Ohliwaya, Principal Metallurgist Mr. J.A. Alele OPIO, PTA (see ANNEX IV)
20.11.1991 HARARE	Coordinating Meeting at the Ministry of Mines: Mr. C. Chipato, Mr. V. Vera) Ministry of Mines Mr. Rambo — Ministry of Industry & Commerce Mr. J.A. OPIO — PTA Dr. Roberts — Institut of Mining Research (IMR) of the University of Zimbabwe (see ANNEX V)

21.11.1991
HARARE

Visit to Dr. Nikolaus Seiwald
Commercial Councellor at the Austrian Embassy,
in Harare, Globe House

21.11.1991
HARARE

Visit to G & W Industrial Minerals (Pvt) Ltd.
Southerton/Harare :

Mr. Philemon Nhachi, General Manager

Mr. R.M. Busangabanye, Sales Representative

(see ANNEX VI)

22.11.1991
REDCLIFF

Visit to ZISCOSTEEL, The Zimbabwe Iron & Steel
Company Ltd., Redcliff :

Mr. K.T. Brightman, General Manager

Mr. Damon, Chiefmetallurgist

Mr. M. Gavhura, Manager Technical Services

Mr. P.C.C. Moyo, Administration Manager

(see ANNEX VII)

Following contacts have been established in LUSAKA :

25.11.1991 LUSAKA	Visit to PTA-Office: Mr. J.A. Alele OPIO, Senior Industrial Expert
25.11.1991 LUSAKA	Visit to Metallurgical Department of the SCHOOL of MINES, Lusaka : Dr. C. Chame, Head of Metallurgical Dep. Dr. Simukanga Inspection of laboratories including beneficiation laboratory and pilot plant. (see ANNEX VIII)
26.11.1991 LUSAKA	Visit to UNDP, Lusaka: Mr. Kim Jorgensen UNIDO / IPO
26.11.1991 LUSAKA	visit to SADCC - Mining Sector Coordinating Unit: Mr. Sweta, Director SADCC-MCU and Chief-engineer of MINISTRY of MINES Mr. Phillipe Bosse, Technical Advisor, Geologist Mr. Bonard Kumwenda, Geologist (see ANNEX IX)
27.11.1991 LUSAKA	Visit to National Council of Scientific Research : Dr. S.M. Silangwa, Director (ceramic laboratory inspected)
27.11.1991 LUSAKA	Meeting with Mr. Amon Sibande Re-United Engineering Comp. Lusaka Box 32653 - Tel. 286225 (Interest in corundum processing)
28.11.1991 LUSAKA	Visit to SADCC - MCU : Dr. Karl Taupitz, Consultant for Small Scale Mining (GTZ-Germany) (see ANNEX XI)

28.11.1991
LUSAKA

Meeting at the Geological Department of the Ministry of Mines, Lusaka :

Mr. Banda, Chiefmetallurgist

Mr. Phillipe Bosse, SADCC-MCU

(inspection of the laboratories including beneficiation and pilot plant)

(see ANNEX X)

29.11.1991
LUSAKA

Meetings at SADCC - MCU :

Mr. Sweta, Director of SADCC-MCU and Chiefengineer ofMINISTRY of MINES

Mr. Phillipe Bosse, Technical Advisor, Geologist

Mr. Björn Skoglund, Expert Mining Equipment

Dr. K. Taupitz, Consultant for Small Scale Mining

Dr. Sinkala, Regional Advisor on Mining Equipment.

ANNEX III

Report on visit to the IMR Institute of Mining Research, University of Zimbabwe, HARARE
(Dr. A.E. Roberts, Deputy Chairman and Senior Economic Geologist)

19.11.1991

Statements about facilities and accomodation available at IMR:

A major problem is the accomodation of technical personnel as proposed in the project report for establishing a Metallurgical Technology Centre for PTA Member States (24 engineers + technicians). According to Dr. Roberts (Deputy Chairman and Senior Economic Geologist) a maximum of 10 people (4 engineers + 6 technicians) can be accomodated by IMR.
2 offices and 1 - 2 laboratories might be available soon. Extension of office space is planned in the second half of 1992. A new block will be completed and ready for occupancy in the end of 1992. At the moment there is one building (15 m x 7 m, one-storied) empty.

Proposal: As few people as possible should be engaged in the beginning. Start-up only with the beneficiation laboratory; for analytical and mineralogical work the existing laboratories of IMR can be used for the time being.
Much practical assistance can be given by the present staff of the Institute itself; additional staff can be trained according to the volume of work.

The following chemical equipment is at IMR available:

3 Atomic absorption spectrometers	yes	
X-ray flourescence analyser	yes	
Direct reading spectrometer	yes	
Inductively-coupled plasma emission spectrometer	planned	
Optical emission spectrometer		no
Oxygen-nitrogen analyser (coal laboratory)	yes	
carbon-sulphur analyser	yes	
fast hydrogen determinator		no
automatic titrator		no
wet chemical facilities	yes	
Pulveriser	yes	
METTLER electronic analytical balances	yes	
METTLER (Delta track) high speed balances	yes	

Top loading precision balance-electronic	yes	
Thermostatic bath	yes	
Centrifuges		no
Ovens	yes	
pH meter	yes	
magnetic stirrers/hot plate	yes	
digital thermometers	yes	
washability test apparatus	yes	
gas analyser	yes	

- Gold and Chrome are the main minerals being analysed and tested, also Molybdenite.
- Coal laboratory quite well equipped.
- Coals, briquettes ashes, oils are being investigated.
- High quality research is done in mineralogy, petrography, mineral economics.
- The chemical labaratory can handle up to 200.000 analyses p.a.; at the moment approx. 45.000 p.a. are being carried out.

Mineralogical equipment at the IMR (Institute of Mining Research) University of Zimbabwe

Electron probe X-ray micro analyser (old)	yes	
Metallographic optical microscope with image analyser)	yes	
Porosimeter		no
Drilling machine	yes	
Sample cutting machine	yes	
Grinding machine	yes	
Polishing equipment	yes	
Micro hardness tester VICKERS	yes	
Bond index grinding test machine	yes	
Mineralogical microscope	yes	
Scanning Electron Microscope	yes	
Petrografic Microscope	yes	

Equipment for Beneficiation of Minerals at the IMR (Institute of Mining Research) University of Zimbabwe

Jaw crusher 6 inch 50 mm	yes	
Cone crusher		no
Ball and roller crusher		no
Rodmill		no
Ballmill		no
Vibrating screener		no
Mineral jig		no
Hydrocyclone		no
Hydraulic classifier		no
Airclassifier		no
Humphrey spiral		no
Autoclave with stirrer		no
pH-meters	yes	
Drying stoves (maybe not enough)	yes	
Sample riffles " " "	yes	
Satorius moisture analyser		no
ALPINE airjet screening device		no
Particle size analyser	yes	
Heavy media separator	yes	
WILFLEY shaking table	yes	
BARTLES MOZLEY separator (super panner)	yes	
Ultrasonic disintegrator		no
Flotation cell + accessories (1 small one)	yes	
Sedimentograph / DAVIES tube tester		no
Filter (pressure and vacuum)	yes	
Magnetic separator		no
Electrostatic separator		no
Lab. high intensity magnetic separator		no
Doppler ultrasonic flowmeter		no
Pulp density scale	yes	
Stereomicroscope for grain samples	yes	
Dry testmagnet		no
Hydraulic press (1 small one)	yes	
Sintering furnaces - 1600° C	yes	
Muffle furnaces	yes	
Tube furnaces		no

Following additional equipment and facilities are also available for Beneficiation and Metallurgy at the IMR (Institute of Mining Research) University of Zimbabwe

- 3 Crushers
- 1 DENVER flotation machine
- 1 WEMCO -"-
- A new building is being equipped with column flotation cells.
- A new hydro metallurgical laboratory is under construction.
- A well-equipped laboratory for analyzing and testing of gold is available.
- 2 big leaching roller devices for cyanide leaching.
- 2 screen shakers
- tumbler grinding mills
- 1 big induction furnace) both for chromite melting
- 1 plasma furnace 1600° C)
- 1 molybdenum furnace
- 1 heavy liquid separation
- mineral preparation room
- 1 logitec machine for polishing
- 2 hand polishing machines
- 1 cutter
- 1 grinder
- X-ray diffractometer

ANNEX IV

Report on Visit to the Department of Metallurgy, MINISTRY of MINES, HARARE
(Mr. V. Vera, Deputy Director, Mr. L.G. Dhliwaya, Principal Metallurgist)
19.11.1991

Chemical Analysis Laboratory (List of equipment)

Atomic absorption spectrophotometer	yes	
X-ray fluorescence analyser		no
Inductively-coupled plasma spectrometer	yes	
Optical emission spectrometer	yes	
Oxygen-nitrogen analyser		no
Carbon sulphur analyser		no
Fast hydrogen determinator		no
Automatic titrator		no
Wet chemical facilities	yes	
Pulveriser	yes	
METTLER electronic analytical balances	yes	
METTLER (Delta track) high speed balances	yes	
Top loading precision balance electronic	yes	
Thermostatic baths	yes	
Centrifuges		no
Ovens	yes	
pH meter	yes	
Magnetic stirrers/hot plate		no
Digital thermometers		no
Muffle furnaces program-controlled		no
Washability test apparatus		no
Gas analyser		no

ANNEX IV

Mineralogical equipment at the Department of Metallurgy, MINISTRY of MINES, HARARE

19.11.1991

Electron probe X-ray micro analyser		no
Metallographic optical microscope with image analyser	yes	
X-ray diffractometer	yes	
Porosimeter		no
Drilling machine	yes	
Sample cutting machine	yes	
Grinding machine	yes	
Polishing equipment	yes	
Micro hardness tester	yes	
Bond index grinding test machine		no
Mineralogical microscope	yes	
Scanning electron microscope		no
Petrografic microscope	yes	

ANNEX IV

Equipment for Beneficiation of Minerals at the Department of Metallurgy MINISTRY of MINES, HARARE

19.11.1991

Jaw crusher	yes	
Cone crusher		no
Roller crusher	yes	
Rod mill	yes	
Ball mill	yes	
Vibrating screener	yes	
Mineral jig	yes	
Hydrocyclone		no
Hydraulic classifier	yes	
Airclassifier	yes	
Humphrey spiral	yes	
Autoclave with stirrer	yes	
pH meter	yes	
drying stove	yes	
Sample riffle	yes	
SARTORIUS moisture analyser		no
ALPINE airjet screening device		no
Particle size analyser		no
Heavy media separator	yes	
WILFLEY shaking table	yes	
BARTLES MOZLEY separator (super panner)		no
Ultrasonic disintegrator		no
FAGERGREEN, DENVER flotation cells	yes	
Sedimentograph /DAVIES tube tester		no
Filter (pressure/vacuum) old	yes	
Magnetic separator small	yes	
Electrostatic separator		no
Lab. high intensity separator		no
DOPPLER ultrasonic flowmeter		no
Pulp density scale	yes	
SARTORIUS/METTLER weighing machines	yes	
Stereomicroscope for grain samples	yes	
Hydraulic presses		no
Sintering furnace 1200^{o} small	yes	
Tube furnaces		no

Laboratory facilities at the Department of Metallurgy
MINISTRY of MINES, HARARE

19.11.1991

Metallurgical lab. :

11 Gold and silver melting ovens, coke fired

1 FRITSCH pulveriser

several crushers

Analytical lab. :

3 METTLER balances, mechanical and digital

Carbon-sulphur analyser

Drying ovens

EFCO furnaces 1200° C

2 Absorption spectrometers, Spectr. AA
(all elements in solution below 10 %)

small UV-Spectrometer below 1 %

ARL analyser

Metal analyser ICP

2 petrographic microscopes

2 metallographic microscopes

XRD- Roentgen diffractometer

Rotap-sieve shaker

Attrition machine

Vacuumfilter

Roller attrition

Mixer

pH-meter

4 DENVER flotation machines

agitators

density scales

Pilot Plant Equipment at the Department of Metallurgy, MINISTRY of MINES, HARARE

19.11.1991

Roaster

Magnetic separator

High intensity magnetic separator

Grinding mill

Ball mill

Roller mill for clay minerals

Leaching devices

Disc vacuum filter

pressure filter

Drying devices

GALLAGHER table with riffles for gold

3 shaking tables

1 Rodmill

1 Ballmill

1 Spiral classifier

Rougher
Cleaner) DENVER flotation cells, 2 banks 16 cells, 1 t / 24 hrs.

Tumbling mill for remix

HUMPHREY spiral

Conditioner tanks

1 Super panner

2 Jigs

1 Autoclave MCE

4 Jaw crushers

1 Cone crusher

1 Pulveriser

1 Stamp mill for gold processing

1 riffle

Mainly gold/silver melting and analysing.

ANNEX V

Report on the Meeting regarding PTA - MTC - Project with:

Mr. Chipato - Ministry of Mines, Harare / Zimbabwe
Mr. Rambo - Ministry of Industry & Commerce, Harare
Mr. V. Verga - Department of Metallurgy, Ministry of Mines, Harare
Mr. Roberts - Institut of Mining Research, University of Zimbabwe, Harare
Mr. A. Opio - Senior Industrial Expert of PTA, Lusaka

20.11.1991
Harare / MINISTRY of MINES

We discussed the coordination and further steps to be taken concerning the PTA - MTC - Project.
Mr. Opio gave an overview of the project. There were delays in phase I of the project at least caused in part of the sudden death of the project coordinator Mr. Bungu in April 1991. They hope to find a successor for him in January 1992. One application was rejected. A successor should be elected out of a shortlist of 3 metallurgists.
After 5 years of planning PTA want to start phase I very soon.

According to Mr. Roberts the IMR can provide 2 offices and 1 - 2 laboratories for MTC soon. With some beneficiation equipment PTA - MTC could supplement the processing facilities of IMR. Mineralogical and especially chemical analytical work could be done by IMR. They can handle up to 200.000 samples p.a., at the moment approx. 45.000 p.a.
IMR is very much engaged in laboratory testing and processing of gold, silver, chrome, molybdenite, phosphate. According to Mr. Roberts 6 - 8 people of the MTC (maximum 10) can be accomodated by IMR. Mr. Roberts is able to assist with the necessary personnel. It makes no sense to host a too big crew at the IMR at the initial stage of operations of the MTC, Dr. Roberts said. Some supplemental equipment would be useful. IMR and MTC could work hand in hand.

It was agreed upon by all participants to start phase I of the project with a small team as soon as possible.
There was no consent about phase II. The representatives of the involved ministries believe that there might be difficulties to provide the necessary funds for the construction costs of the proposed building of the future MTC. Mr. Opio on the contrary thought that funding was agreed upon by the Ministry of Industry & Commerce and PTA-Member-States. However, there seem to be still problems with the funding of costs for infrastructure and construction of the MTC building in Redcliff. A further Committee meeting on a higher level was planned for the end of November 1991.

Report on Visit to G & W Industrial Minerals (Pvt) Ltd.
"Early Worm Mine", Tilbury Rd. Southerton.

21.11.1991

Mr. P. Nhachi, General Manager

Together with the General Manager I visited the processing plant of G & W Industrial Minerals (half privately, half governmental owned), the biggest company for crushing, grinding and micronising industrial minerals in Zimbabwe. Following minerals are being processed:

ballclays
barytes
bentonites
calcites
dolomites
feldspar
fluorspar
kaolin
kyanite
limestone - lime
magnesite
talc
iron ocker

The company owns a lime hydration plant, an industrial processing centre, a limestone calcination plant,

2 Jaw crushers, 1 Pulveriser,
1 heated hammermill for milling ballclays and kaolin,
3 ball mills with airclassifiers
1 HARDINGE mill without classifier for dry grinding only.

The company is interested in the development of new processes for

- mica from Karoi (North of Zimbabwe)
- silica (quartz) from Kadoma/Midlands
- magnesite from " "
- vermiculite from East Dorowa
- corundum

ANNEX VII

Report on Visit to ZISCOSTEEL, The Zimbabwe Iron & Steel Comp. Ltd. in Redcliff/Zimbabwe

Mr. P.C.C. Moyo, General Manager
Mr. K.T. Brightman, Managing Director
Mr. D. Damon, Chief Metallurgist, M.Sc.
Mr. M. Gavhure, Manager Technical Services

22.11.1991

Together with Mr. Damon (Chiefmetallurgist) I inspected the various facilities :

Blast furnace
Coke ovens
Lime kilns
Sinterplant
L.D. converters
Soaking pits
Continuous casting mill
Gogging & Billet mills
Medium mill
Light mill
Bar rod mill

Labaratories:

Testhouse
Metallography Section
Non-destructive Section

Mr. K.T. Brightman (Managing Director) is supporting the MTC in Redcliff, but ZISCO cannot support the project financially, because the company itself has a 3 billion rehabilitation program, including a big new sintering plant. Maybe lateron ZISCO intends to work mainly with sintered limonite ore.

ZISCO is interested in beneficiation and sintering of iron ore. -

There are restructuring efforts, ZISCO will lay off 1500 - 2000 people (presently 6.000) to reduce operating costs and losses, because of difficulties on the market.

Metallurgical Services Department at ZISCOSTEEL, The Zimbabwe Iron & Steel Company Ltd. in Redcliff /Zimbabwe

The Metallurgical Services Department has a complement of approximately 60 personnel. A number of these are highly qualified metallurgists, who are backed up by metallurgical technicians, etc.

The equipment available for use is similar to that possessed by most metallurgical laboratories and includes:

Test House

The Test House is comprehensively equipped to determine the mechanical properties of iron and steel products to international specifications.

3 Universal Tensile Testing Machines of 100 kN; 500 kN and 1.000 kN capacities.

The mechanical properties of a full range of steel products from wire to 40 mm diameter bars can be determined using these testing machines.

Charpy Impact Tester

A pendulum-type single blow impact test in which the specimen, usually notched, is supported at both ends as a simple beam and broken by a falling pendulum. The energy absorbed, as determined by the subsequent rise of the pendulum, is a measure of impact strength or notch toughness. Another important function is to establish the ductile/brittle transition temperature which is of paramount importance of the steel is to be used where sub zero temperatures are a feature of the normal climatic conditions.

Hardness Testing

Three standard methods of hardness testing are in daily use: the BRINELL test which is used for determining the hardness of the larger "as rolled" and normalised steel products; the ROCKWELL test which is used for determining the hardness of thin products and also components which have been heat treated; the SHORE Sceleroscope which is mainly used for determining the hardness of the rolls used in the Rolling Mills.

Metallography Section

This section is equipped to carry out macro and microscopical examinations; works technical photographic assignments and 35 mm black and white film processing.

Microspecimen Preparation

Specimen for microscopical examination are prepared using very modern equipment which include 3 Discotom cutting machines, 1 Abraplan for rough grinding and 2 Abrapol polishing machines.

Microstructures can be photographically recorded. These microscopes are an indispensible tool for failure analysis and product development. Besides these microscopes a stereo microscope with magnifications of up to 40X is available. This is used for three dimensional viewing of surface irregularities and fracture surfaces.

Photography

The department has a 35 mm SLR Camera and accessories including darkroom processing facilities for technical photographic assignments. Technical reports are always well illustrated and other typical assignments include the photographic recording of furnace lining wear, plant damage and industrial accidents.

Non-Destructive Testing Section

This section utilises non destructive techniques to determine the surface and internal soundness of steel products and engineering components.

Ultrasonic Tester

This instrument is used to locate structural discontinuities within a material by means of ultrasonic sound waves. The wave pattern is displayed on an oscilliscope for interpretation.
Particularly useful for inspecting weldments.

Thickness Meter

The meter is based on the ultrasonic sound wave principle and it is extremely useful for checking the wall thickness of air, gas and water pipe lines, both for safety and replacement reasons.

Vitometer

An instrument used for the electromagnetic sorting of steels of varying compositions.

Penetrant Dye

This penetrant dye exposes and demarcates surface hailine discontinuities which are invisible to the eye.

Electrical Conductivity Meter

A magnaflux instrument which is used for measuring thermal conductivity. It is especially useful in determining the conducting efficiency of copper tyres, flat coolers and concast moulds.

Heat Treatment Section

Internal engineering components and castings are heat treated to ensure maximum service lives. The section is equipped with electric furnaces of various sizes, oil, water and forced air quenching facilities. The max. weight of component which can be hardened is 750 kg.

In addition to the above, the department is also responsible for the following areas of metallurgical activity:

Service failure investigations
Metallurgical investigations
Material quality assessment
Material selection
Reclamation
Cost Reduction Exercise
Customer complaints and liaison
Rope and lifting tackle inspection.

It is worth noting that this service is supplied not only to ZISCO but to outside organisations as required.

The major problem facing the department is the servicing of instruments and equipment, as highly sophisticated equipment may have to be repaired externally and sometimes abroad.

Achievements

Training of metallurgical cadets and graduate metallurgists is an ongoing process and, annually, approximately 10 Metallurgical Cadets enroll at the BULAWAYO TECHNICAL COLLEGE for the National Diploma in Industrial Metallurgy.

As the result of regular lifting rope and tackle inspection, the number of accidents resulting from breakages has been minimal.

A large number of engineering components such as railway tyres, wheels and broken rolls have been reclaimed. Particular success has been scored in reclaiming cast iron components.

Future Plans

The future plans and development of the department are determined to a large extent by the present rehabilitation programme. Provision is being made for facilities for testing of plate and strip. A new 500 kN tensile testing machine has already been budgeted for.

Role of the Departement

The role of the departement can be briefly summarised as ensuring that ZISCO's product meet customers specifications and satisfies customer expectations, working of course in conjunction with Quality Control.

Equipment in the Metallurgical Services Department at ZISCOSTEEL, The Zimbabwe Iron & Steel Company Ltd. in Redcliff / Zimbabwe

Test House

1 x 100 kN Universal Tensile Testing Machine
1 x 500 kN Universal Tensile Testing Machine
1 x 1000 kN Universal Tensile Testing Machine
1 x Charpy Impact Tester
1 x BRINELL Hardness Testing Machine
2 x ROCKWELL Hardness Testing Machine
1 x Shore Sclerescope Hardness Testing Machine
1 x KING Hardness Testing Machine
1 x Avery DENISON Hardness Testing Machine
1 x Zwick Portable Hardness Tester

Metallography Section

1 x Polyvar Met microscope with 1 x 35 mm and 120 roll film cameras
1 x Leitz Met microscope with 1 x 35 mm camera
2 x Olympus 8061 microscope
3 x Struers Discotom Cut-off wheels
2 x Primopress Mounting Presses
1 x Abraplan grinding machine
1 x Abrapol fine grinding machine
1 x Abrapol polishing machine
2 x Specimen holders
2 x Specimen levellers
2 x Nikon Sterozoom macroscopes
1 x 35 mm Olympus camera with flash Unit
2 x Air conditioning units
1 x Dryer
1 x DP-20 manual polishing machine

Non-Destructive Section

3 x Krautkramer Ultrasonic Testers
1 x Crack depth meter
1 x Copper Conductivity meter
1 x Vitometer
2 x Contact Pyrometers
2 x Infra-red thermometers
1 x Wall thickness meters
No of Dye-penetrant inspection sprays

Analytical Services Department at ZISCOSTEEL, The Zimbabwe Iron & Steel Company Ltd., Redcliff / Zimbabwe

Chemical analysis is an essential part of the processes of making iron and steel and is controlled by the Analytical Services Department, which basically consists of a Sample Preparation complex and three virtually separate laboratories using both the most up to date instrumental and the usual classical methods of analysis.

The Sample Preparation section is equipped with numerous machines and is capable of preparing many different types of samples. Crushers, sample dividers and pulverisers are used in the preparation of rock and slag samples, while metal-working machines are used for steel and iron samples.
In addition to the latter an inert gas fusion machine is used for making "buttons" from drillings of iron or steel for presentation to analysing instruments. Rock and slag samples are pulverised to -150 or -200 mesh screen size before pelletized or fused for presentation to the instruments or being analysed chemically.

The Shift Laboratory is manned by a Shift-leader Chemist and two Laboratory Assistants on a 24-hour basis. Using the new ARL 3560 optical emission spectrometer and an X-ray fluorescence spectrometer, for the most part, this Laboratory handles the routine analysis for the Iron and Steel Plants.
This includes sinter, ores and limestone, iron and slag for the Blast Furnace and burnt limestone , steel and slag for the Steel Plant.
Additional analysis of sundry materials and by-products of a non-routine nature are also analysed, either by the shift staff or during the normal day, depending on the requirements of the department which sends in the samples.

Another laboratory, working normal day hours handles all samples pertaining to the Coke Ovens. This includes incoming coal, coke, benzole, tar and gases.
This laboratory staffed by a Supervisor, a Chemist and a Laboratory Assistant also handles all water analysis. Incoming water and effluents are constantly monitored.
Throughout the plant waters are used for varying purposes, principally cooling and for the Power Station. It is essential that these waters are treated to avoid corrosion and sealing and these too are analysed on a regular basis. Gas analysis is also done by this laboratory.

The third section is for non-routine analysis, development analysis, check analysis and special analysis. It is staffed by a Supervisor.
This laboratory is also responsible for the initial training of new assistants. Among the constant load items of this laboratory are ores from the Mining Department and these consist of Exploration Samples and Drill-hole Samples from all three of ZISCO's mines.
In addition to using chemical methods both the emission spectrometer and the X-ray spectrometer are used by this laboratory when available as well as an Atomic Absorption Spectrometer and various other instrumental methods.

Among the sundry items frequently analysed are broken machine parts from all over the works, refractories, ferro-alloys. Quality check analysis is done on various incoming materials and components.
On average the Department handles some 10.000 samples per month and reports between 40/50.000 determinations.

Visit to the Metallurgical Department SCHOOL of MINES, LUSAKA / Zambia
(Dr. C. Chama, Head of Metallurgical Department
Dr. Simukanga)

25.11.1991
LUSAKA

Chemical Analysis Laboratory:

Atomic absorption spectrometer (2)	yes	
X-Ray fluorescence analyser	yes	
Direct reading spectrometer		no
Inductively-coupled plasma emission spectrometer		no
Opetical emission spectrometer		no
Oxygen-nitrogen analyser		no
Carbon-sulphur analyser (expected)		no
Fast hydrogen determinator		no
Automatic titrator		no
Wet chemical facilities	yes	
Pulveriser	yes	
METTLER electronic analytical balances	yes	
METTLER high speed balances		no
Top loading precision balance electronic		no
Thermostatic baths		no
Centrifuges	yes	
Ovens	yes	
pH meter (digital)	yes	
Magnetic stirrers/hot plate	yes	
Digital thermometers		no
Muffle furnaces, program-controlled		no
Washability test apparatus		no
Gas analyser		no

Metallurgical Department — SCHOOL of MINES, LUSAKA / Zambia

Evaluation and Characterization of Minerals

Electron probe x-ray micro analyser		no
Metallographic optical microscope	yes	
-"- -"- -"- with image analyser		no
X-Ray diffractometer	yes	
Porosimeter		no
Drilling machine	yes	
Sample cutting machine	yes	
Grinding machine	yes	
Polishing machine	yes	
Micro hardness tester		no
Bond index grinding test machine		no
Mineralogical microscope	yes	
Scanning Electronmicroscope		no
Petrographic microscope	yes	

Metallurgical Department

SCHOOL of MINES, LUSAKA / Zambia
(25.11.1991)

Beneficiation of Minerals:

Jaw crusher	yes	
Cone crusher	yes	
Roller crusher (with balls)	yes	
Ball/Rod mill	yes	
Vibrating screener	yes	
Mineral jig	yes	
Ball mill	yes	
Hydrocyclone	yes	
Hydraulic classifier	yes	
Air classifier		no
HUMPHREY spiral	yes	
Autoclave with stirrer		no
pH-meter	yes	
Drying stove	yes	
Samples riffles	yes	
SARTORIUS moisture analyser		no
ALPINE air jet screening device		no
Particle size analyser		no
Heavy media separator		no
WILFLEY shaking table	yes	
BARTLES MOZLEY separator		no
Ultrasonic disintegrator		no
FAGERGREEN DENVER flotation cells + accessories	yes	
Sedimentograph/DAVIES tube tester		no
Vacuum filter	yes	
Pressure filter		no
Magnetic separator	yes	
Electrostatic separator		no
Lab. high intensity magnetic separator	yes	
DOPPLER ultrasonic flow meter		no
Pulp density scale		no
SARTORIUS/METTLER weighing machines		no
Stereoscopic microscope for grain samples	yes	
Hydraulic presses		no
Sintering furnaces 1200°C, muffle and tube furnaces with gas		no

Metallurgical Department

SCHOOL of MINES, LUSAKA / Zambia
(25.11.1991)

Additional facilities :

2 small jaw crushers
1 " ball mill
1 " hammer mill
2 Pulverisers
1 small cone crusher
1 FRITSCH pulveriser
3 Screening machines
1 RETSCH sample divider
4 Flotation machines
1 Roller mill with various drums
1 Cutting - grinding - polishing room
1 Rock mechanics test room
1 Pyrometallurgical laboratory
1 Hydrometallurgical laboratory
1 small mixer

Pilot Plant Machines:

2 big jaw crushers
1 big ball/rod mill
1 double decker screen
1 hopper with vibratory feeder
1 HUMPHREY spiral
1 WILFLEY shaking table
2 mixer
1 mobile conveyor
4 x 2 flotation cells
1 drumfilter
1 dryer

1 tensil compression tester

ANNEX IX

Visit to SADCC Mining Sector Coordinating UNIT (MCU) in LUSAKA /ZAMBIA:

Mr. Sweta, Director SADCC, Chiefeng. MINISTRY of Mines
Mr. Bosse Phillip, Technical Advisor, Geologist
Mr. Kumwenda Bonard, Geologist

26./27.11.1991
LUSAKA

According to Mr. Sweta MCU would like to engage a mineral processing engineer for inventory and optimization of regional mineral processing facilities.

SADCC/MCU is looking for an organization which will provide funds for the above mentioned position.

The terms of reference are:

1. Provide data on the existing mineral processing facilities with emphasis on their capacity utilization, and find the technical reasons of this status.

2. Study and comment on the present and future possible mineral processing methods including rationalization in the SADCC countries.

3. Recommend a regional strategy of utilization and development of mineral processing facilities, taking into consideration production and transportation costs, and market trends. This strategy will take into account -if economically feasible- the possibility of sharing existing regional mineral processing facilities.

SADCC has at least one advantage : compared with PTA it has already a well established MINING SECTOR Coordinating UNIT (MCU) placed in LUSAKA.

The main functions of SADCC/MCU are inter alia :

to carry out administrative obligations;

to administer mining projects, to recommend and review new projects;

to obtain funding for selected projects;

to provide information on mine geology, mine statistics, products, markets and existing and planned facilities and capacities;

to provide specialized consultancy and advisory service.

The SADCC/MCU is working closely together with the ZAMBIAN Mining Department and Geological Department.

ANNEX X

Visit to the Geological Department of the Government of Zambia /LUSAKA
met Mr. Banda, Chiefmetallurgist
(The Director of the Department Mr. Amon Sibande was not present)

28.11.1991
LUSAKA

Chemical Analysis Laboratory :

Wet chemical facilities	yes	
Pulveriser (RETSCH)	yes	
METTLER electronic analytical balances	yes	
Centrifuges	yes	
pH-meter	yes	
Ovens	yes	
Simple spectrometers	yes	

Especially needed:

X-Ray diffractometer XRD	120.000 $
Distiller	3.000 $
XRF SIEMENS spare parts	

Evaluation and Characterization of Minerals:

ZEISS Metallurgical microscope for petrographic and mineralogical work with camera coupled	yes	
Stereoscopic microscope	yes	
XRF (spare parts missing)	yes	
Drilling machine	yes	
Grinding machine	yes	
Polishing machine	yes	
Micro hardness tester		no
Bond index grinding machine	yes	
Scanning mineralogical microscope		no

ANNEX X

28.11.1991

Geological Department of the Government of ZAMBIA / LUSAKA

Beneficiation of Minerals:

Jaw crusher	yes	
Cone crusher		no
Roller crusher	yes	
Rod mill		no
Vibrating screener	yes	
Mineral jig	yes	
Ball mill	yes	
Hydrocyclone	yes	
Hydraulic classifier		no
HUMPHREY spiral	yes	
Autoclave with stirrer	yes	
pH-meter	yes	
Sample riffles	yes	
Super panner, very small	yes	
SARTORIUS moisture analyser		no
ALPINE air jet screening device		no
Particle size analyser		no
Heavy media separator		no
WILFLEY shaking table	yes	
BARTLES MOZLEY separator		no
Ultrasonic disintegrator		no
Flotation cell DENVER	yes	
Sedimentograph		no
Filterpress		no
Magnetic seperator	yes	
Electrostatic separator	yes	
Lab. high intensity magnetic separator		no
DOPPLER ultrasonic flowmeter		no
Pulp density scale	yes	
SARTORIUS/METTLER weighing machine	yes	
Drytest magnet	yes	
Small oven for gold fire assays	yes	

ANNEX XI

Report on the Meeting with Dr. Taupitz (Mining Consultant) SADCC MINING Sector Coordinating UNIT (MCU)

28.11.1991
LUSAKA

Dr. Taupitz is working as mining consultant for SADCC (Mining Sector Coordinating Unit) in Lusaka on behalf of GTZ (Gesellschaft f. Technische Zusammenarbeit, Germany) to support the development of small scale mining in order to improve efficiency and production. GTZ has supplied some beneficiation equipment for about 180.000,-- Deutschmark to the Geological Department of the Government of Zambia/Lusaka:

1 HAZEMAG hammer mill
1 Roller mill
1 Ball mill
1 Jig KLÖCKNER HUMBOLDT
1 JAMES shaking table
1 KNELSON centrifugal separator for gold
1 FRANTZ magnetic separator
1 Magnetic crossbelt separator
2 Flotation cells (1 5-10 l DENVER cell)
Leaching tanks
Hydrocyclone

The laboratories of the Geological Department in Lusaka are working quite well within their limits.