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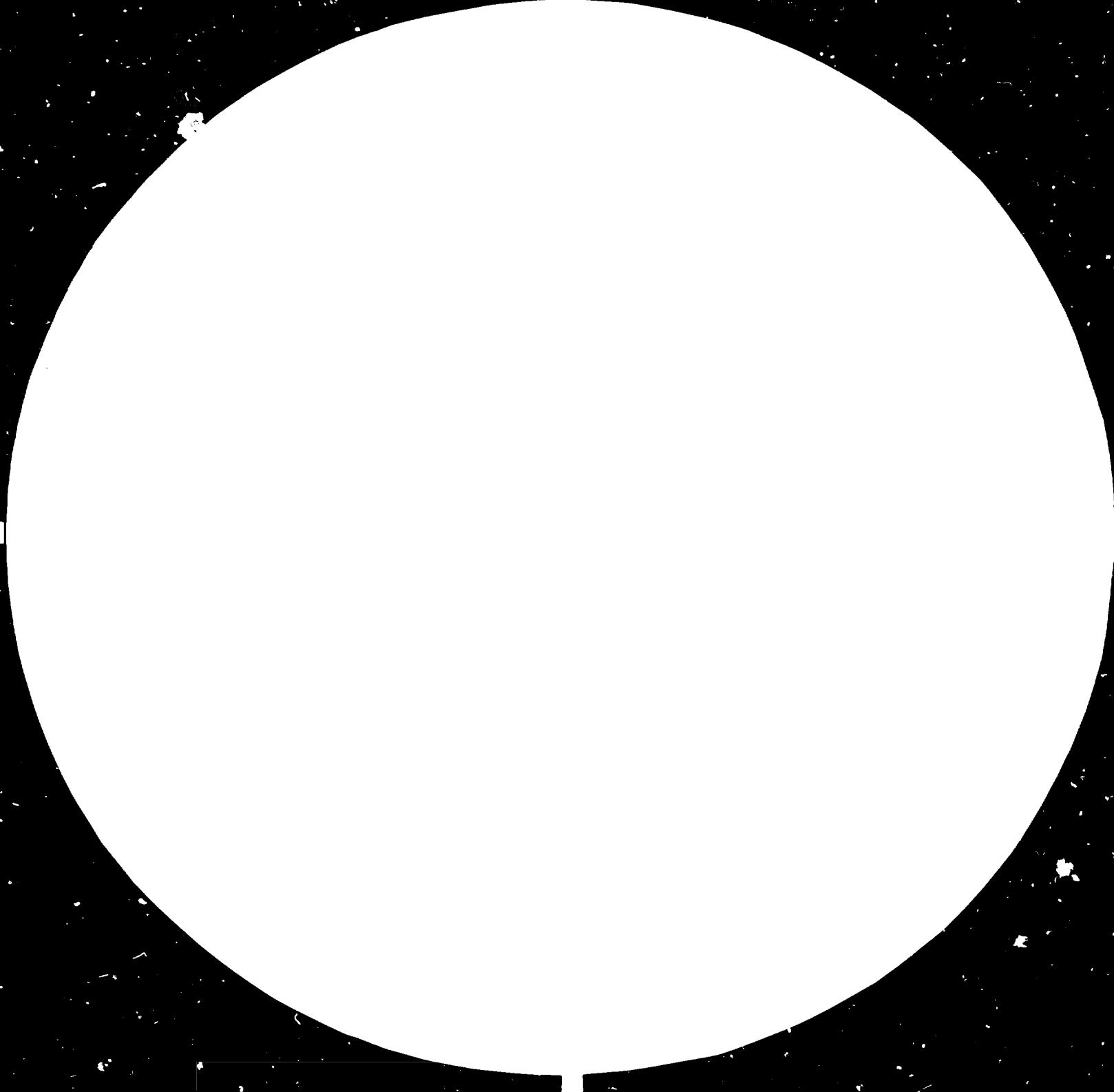


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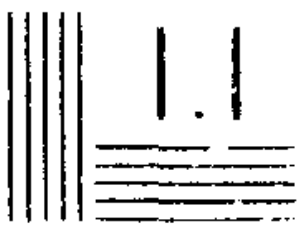
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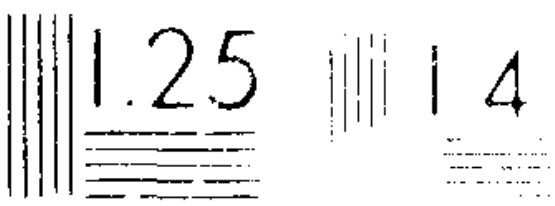
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COAL GASIFICATION

DP/IND/80/004

INDIA

Technical Report*

Prepared for the Government of India

by the United Nations Industrial Development Organization,

acting as executing agency for the United Nations Development Programme

Based on the work of K.H. van Heek,

Chief Technical Advisor

United Nations Industrial Development Organization

Vienna

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CONTENTS:

Summary

From February 23rd to March 4th I have visited the Regional Research Laboratories/Hyderabad in the capacity of a Chief Technical Advisor of the UNDP funded coal gasification project. Main items of discussion with the RRL members have been: status, commissioning, organization, and work programme of the pilot plant, status of supporting laboratory work, review of past and future programmes for training and experts. I have also taken part in the Review Meeting held on February 25th in the presence of representatives from UNIDO and the Indian Government. I was also briefed at the UNDP office in Delhi and payed a short visit to BHEL, R+D Division Hyderabad, who are interested in the RRL project.

Good progress has been made in the erection of the pilot plant, which is now ready for commissioning. First tests of the gasifier under simulated cold conditions are being performed using pressurized air. If the offer of Lurgi for sending engineers for commissioning will be acceptable, a contract with Lurgi is recommended in order to optimize commissioning and to train simultaneously the RRL staff. In case of unexpected obstacles for a contract with Lurgi, I would encourage RRL to start up the plant themselves. Obviously, good assistance has been received from the Central Fuel Research Institute in Dhanbad, who have operated the same type of plant in the past.

In the meantime the organization of the pilot plant is fully satisfying, especially since a responsible plant manager has been nominated. The main aim of 1983's work programme will be to achieve stable continuous operation over longer periods taking one coal, whereby only the gasification section is operated. Later - mainly in 1984 - trials with other coals, connection of the gas cleaning system and air-steam operation will be performed. On the whole, this programme to be done in the next two years seems to me realistic.

As to the supporting laboratory work studies on the kinetics of gasification, gas conversion and modelling are in preparation. The two apparatus requested will be ready for operation by the end of the year.

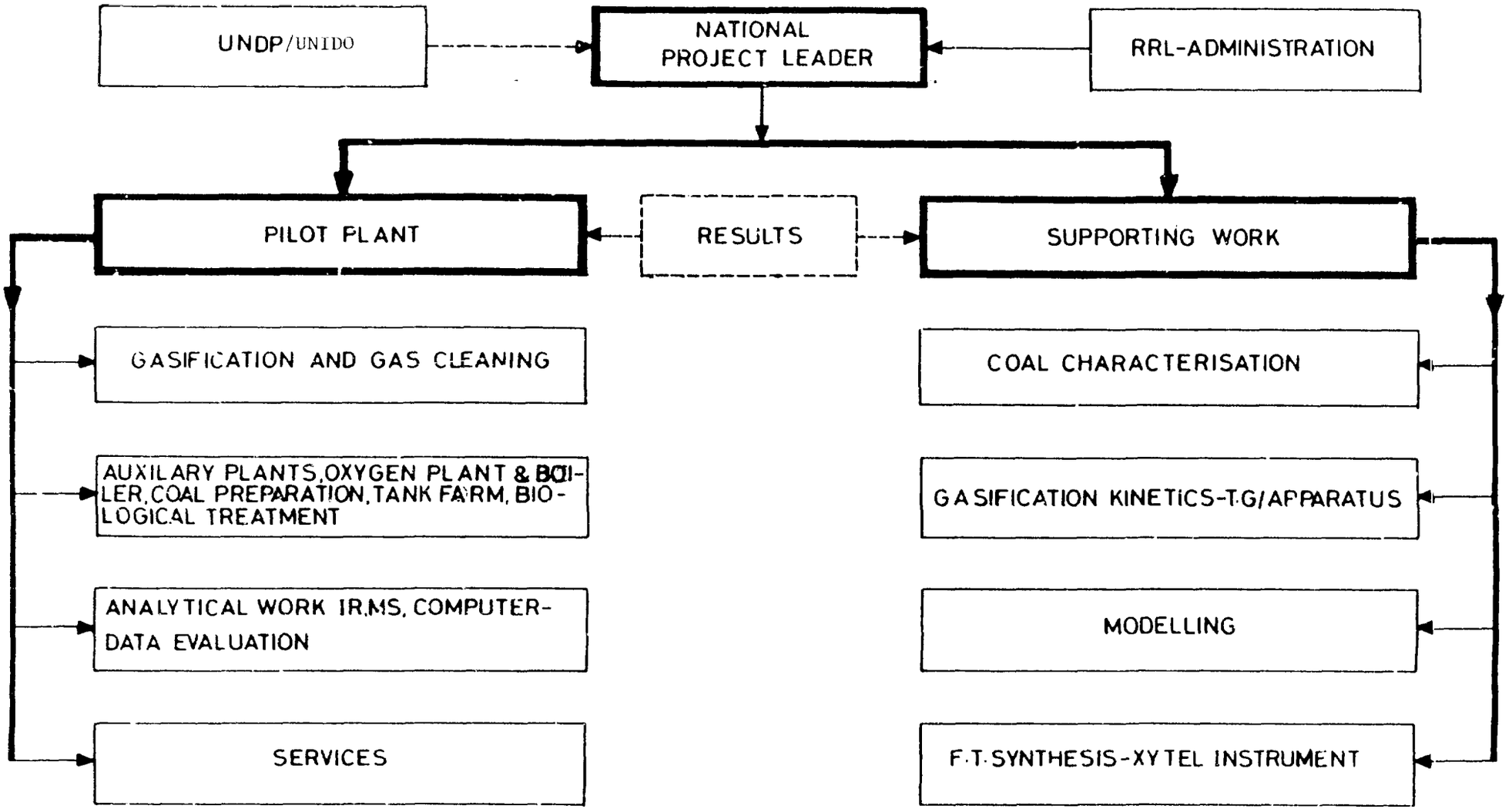
A review meeting has taken place with the UNDP trainees, who have been to Western Europe in 1982. I am convinced that the training has been of great value for the progress in project work and for personal development. As to this year, I have recommended that in addition to the possibilities already granted, one scientist should come to Bergbau-Forschung in June 1983 during assembling and testing of the TG apparatus.

Experts will come to RRL for installation and commissioning of the TG, for reactor modelling and for consulting in plant operation. For the 1984-programme especially practical problems connected with the pilot plant operation should be taken primarily into account.

I wish to express my sincere thanks to the director of RRI, the national project director and the colleagues of RRL for the open information and free discussion of status, problems, organization and future work connected with the project. The organization of my visit was excellent and the hospitality and kind assistance are very much appreciated.

STRUCTURE OF GASIFICATION PROJECT

DP/IND/80/004



Status of Feb. 1983

Time table of the mission

Date		Day		Action
18/19	Feb.	Fri/Sat		Travel from Essen to Delhi
21	Feb.	Mon	Morning:	Briefing at UNDP (Mr. T.R. Maakan, Mr. S. Ramamurthy)
			Afternoon:	Other business (ChemTech)
22	Feb.	Tue		Other business (ChemTech)
23	Feb.	Wed	Morning:	Briefing UNDP (Mr. Priestley)
			Afternoon/ Evening	Travel to RRL/Hyderabad
24	Feb.	Thur	Morning:	Visit to the pilot plant; inspection of installation; briefing with staff members.
			Afternoon:	Preparation of review meeting.
25	Feb.	Fri		Review meeting.
28	Feb.	Mon		Detailed review of pilot plant work: progress, commissioning and working programme.
	March	Tue	Morning:	Pilot plant organisation supporting work: discussion on TG-apparatus; visit to labs on coal characterisation and computer department.
			Afternoon:	Review meeting with the UNDP trainees; discussion of further training programme.
2	March	Wed	Morning:	Visit to the plant.
			Afternoon:	Discussion on the experts programme.
3	March	Thu	Morning:	Winding up discussion; lecture on coal pyrolysis.
			Afternoon:	BHEL/R&D
4	March	Fri	Morning:	Travel to Delhi; briefing UNDP (Mr. Krasiakov)
5	March	Sa		Travel to Essen
6	March	Su		Writing of the report

REPORT OF FINDINGS, DISCUSSIONS AND RECOMMENDATIONS

1. Status of the Pilot Plant

1.1 Coal Preparation

This section had been completed already in Jan. 1983. In the meantime it has been successfully tested with Godavari Valley coal which is going to be used in the plant. Adjustment of the jaw crusher has been set to give a product of 60 % in the particle size range between 6 and 25 mm, in the proportion of the demand of the gasifier (60 %) and the boiler (40 % below 6 mm). About 60 t of coal have been prepared till now.

1.2 Boiler

In Jan. 1982 the boiler had been hydraulically tested and was awaiting for the registration with the boiler authority. After clearance from the authority was obtained for commissioning, thermal insulation had been completed on steam drum and feed water pipelines carrying water at 100 °C from the gasifier section. Steam pipelines connecting boiler and gasification and gas cleaning section have been erected, hydraulically tested and thermally insulated. As earlier reported demineralisation plant was already commissioned and tested.

Boiler was fired in the month of Dec. 1982, pressure of steam was taken up to 15 bar and about 180 °C. Operation was done for 7 days under these conditions without any trouble, thereby flushing all the steam pipelines in the boiler, gasification and gas cleaning section. It was not possible to go further to 33 bar, because of failure of the electric motor of the boiler feeding pumps. In addition the inspectors of the authority were not available for witnessing the testing at the working pressure at 33 bar. The motor is now repaired and the feed water pump is ready and operation at 33 bar in presence of the inspector will be done immediately.

For future operation the plant has been provided with an alternative steam driven feed water pump already erected. This was available earlier but could not be tested due to lack of the lubricating system, which in the meantime has been procured and installed during the year.

1.3 Oxygen plant

Oxygen plant had already been commissioned and tested last year. The plant was not operated during 1982 for O_2-production. However the compressors have been operated for taking the air for pneumatic pressure testing at the gasification and gas cleaning section of the plant. Before plant commissioning the whole O_2-plant should be started up again to ensure proper operation.

1.4 Gasification

At the last visit the main pressure vessels had been erected and those necessary hydraulically tested. From then the following items have been performed:

- installation and assembling of all the vessels like coal-lock, chute, gasifier top, ash grate and drive units, ash lock, expansion vessel,

- installation of the high pressure process pipelines for gas, steam, oxygen and for the feed water to heat recovery units and jacket boiler,

- performance high pressure piping for tar liquor, oil liquor and the ammonia solution circulation in the wash cooler circuit,

- installatior of low pressure piping for cooling water and steam,

- thermal insulation of:

  - gasifier
  - wash cooler
  - waste heat boiler
  - low pressure steam drum
  - feed water tank
  - all high pressure pipelines

- installation and electrical connection of pumps for liquor circulation and high pressure water,

- installation of the O_2-steam mixing tube.

1.5 Gas cleaning

The erection of the main vessels had been completed in Jan. 1982. Since then the process pipeline connecting all the vessels such as high pressure gas lines for steam, alkaline solution and water have been installed. Also thermal insulation of the vessels and pipelines have been completed. Moreover the four pumps for alkaline solution circulation, regeneration, make-up and recycling were mechanically and electrically installed.

1.6 Tank farm and biological treatment section

In Jan. 1982 vessel installation and piping had been taken up. During 1982 thermal insulation of all vessels and the piping, where it was needed, is completed. Four handling pumps have been installed and electrically connected. The tank farm also has been connected with the main plant.

One of the two oxydation basins is completed, the aerator is to be erected, this being not critical for plant start up however.

1.7 Control and Instrumentation

One year ago all installations for measuring and control both in the gasification and gas cleaning section and the control room were missing. In the meantime the signal receivers have been erected for

- flow of O_2, steam, raw gas and pure gas,
- temperature,
- pressure,
- tank level gauge glasses and controllers.

Additional instrumentation for data logging for the above items are positioned. All these have been connected to the control room.

In the control room the panel board is fixed and the pneumatic signal lines from tne plant are connected to the various instruments. The inlet air for the controlling instruments is piped from the instrument air receiver.

The gas sampling lines both to I.R. analysis and MS are nearing completion. The A/D converters for data logging have been installed and connection wiring to the plant is in progress. The connection to the computer has to be done. These last items are not essential for commissioning of the plant however. For plant commissioning the IR analysers are sufficient, but necessary. These should be tested and calibrated as soon as possible.

The MS (Balzers) could not be started by the Balzers engineer who visited Hyderabad in November, 1982 because of instrument failures. An action of UNIDO would be helpful to accelerate commissioning, as also will be mentioned in the minutes of the Project Implementation Review Committee meeting held at RRL/ Hyderabad.

1.8 Electrical installation

Electrical installation to all the units are completed and tested. Plant lighting is also completed and tested.

2. Pre-commissioning testing of the pilot plant

Besides the testing work already mentioned in connection with coal preparation, boiler and oxygen plant main emphasis has been laid to gasifier section. The following items have been performed successfully:

- Mechanical performance.

- Calibration of the grate for ash discharge at atmospheric pressure. As solid material the boiler ash has been used.

- Hydraulic testing of the expansion vessel, the gasifier jacket boiler (for the differential design pressure at 2.5 bar), wash cooler and after cooler.

- Hydraulic testing of all high and low pressure pipelines.

- Pneumatic testing up to 8 bar especially to test the seals of the following equipment:

  - gasifier
  - ashlock
  - expansion vessel
  - coal lock

- Testing of the flow transmitters and level controllers and flow controllers.

Further points of the running programme for pre-commissioning are:

- testing of boiler for 33 bar,
- training of staff for the coal lock and ash lock operation under simulated cold conditions.

3. Commissioning of Pilot plant

As all the essential parts of the plant are supplied by Lurgi, F.R.G., in principle, it would be the best way for an optimal commissioning to get experts from them. Last year two obstacles existed:

- a secrecy agreement, which was unacceptable for RRLH,
- high costs of the assistance, which were far beyond the possibilities of the UNDP funds.

In the meantime UNDP received a reasonable revised offer from Lurgi. Two Lurgi engineers are to come on a subcontract basis 30 days and 60 days respectively on lumpsum basis ($ 55,000) (for details see Minutes of the Project Implementation Review Committee meeting).

I like to welcome this as besides an optimal and perhaps safer commission, the staff is trained by the best experts and RRL members can learn a lot concerning start up, and shut downs, trouble shooting, stable operation and plant organisation.

However as the contract is not yet signed unexpected obstacles may arise, especially that Lurgi is not in the position to provide their engineers by April, 1983, but much later. In this case I would in full agreement with Mr. Krasiakov (UNDP, Delhi) encourage RRL to start up the plant themselves with the assistance of the scientists and engineers of the Central Fuel Research Institute in Dhanbad, who have operated the same type of plant fo many years and have assisted RRLH already.

4. Working programme of the Pilot plant

As to the next steps of the experimental programme I have recommended that after commissioning of the plant and successful solutions of teething problems the first aim should be to come to stable continuous operation over longer periods - for some days. In this period gradually staff members are to be trained, whereby especially start up and shut down procedures have to be concerned, also emergency cases should be taken into account. It is quite agreeable that RRL plans to concentrate on the gasifier section during the first period and to connect the gas cleaning afterwards. As a next step it must be attempted to collect reliable data of the process such as gas composition, steam decomposition, oxygen consumption, carbon conversion and to establish mass and heat balances. Thereby the calibration of the gas metering should be tested using a volumetric gas meter if available. In any case the lock gas charging has to be taken into account, whereby it should be considered whether the pressuring gas can be measured directly.

I recommend that all these should be done first with <u>one</u> coal. I propose, after discussion with RRLH, that the entire 1983 programme should have the following items:

January - March	Precommissioning and training (as discussed earlier) including I.R. analysers.
April - May	Commissioning and training under full gasification conditions (Procedures to be guided by Lurgi engineers or by RRL itself under assistance of staff members of CFRI Dhanbad)
Starting from June	Gasification tests with Godavari Coal, excluding utilisation of gas cleaning unit
	- training of personnel
	- stabilising plant operation under steady conditions

- collecting of data
- mass and heat balance

Variable parameters:

- steam/oxygen ratio
- coal throughput

After completion of this work the other items of the plant operational programme should be performed gradually in 1983 and 1984, as listed below in some order of priority:

- trials with other coals
- hook up of gas cleaning system and biological oxidation
- data logging on the computer
- MS gas analysis and connection of the computer
- variation of particle size distribution
- measurement of vertical temperature and possibly also gas composition profile
- air-steam operation
- operation with coal distributor

5. Supporting work

5.1 Coal and Product analysis

The laboratory's coal analysis have been visited. Equipment and trained staff is there to carry out specific analytical work on coal such as:

- proximate analysis, being done according to ISO standards
- ultimate analysis:

  C and H determination by combustion and trapping CO_2 and H_2O

  S and N determination in combination with the calorific value device

  O_2 by difference
- ash fusion temperature determination with the microscopic device
- ash analysis to the main elements, such as Si, Al, Ca, in performance by wet analysis.

There is also available an apparatus for determination of the calorific value and a Gray King assay to measure coke - tar- and gas-formation during carbonisation up to 600 °C.

For the ultimate analysis especially concerning C and H determination - being necessary for the mass balances of the pilot plant - it is expected that about 3 to 4 samples can be examined per day.

5.2 Kinetics of gasification (TG apparatus)

Due to BF's schedule, the device will be assembled starting May 1983 and will be ready for shipping in September 1983. A number of questions concerning set up had been already answered by correspondence and during the visit of Prof. Jüntgen as expert.

As remaining details have been discussed and answered as follows:

- The walls are of brick construction, so that supports can be fixed.
- Electrical distribution can be made sufficiently by using the 440 V/3 ph system. A drawing of the general scheme was provided.
- The room was inspected and found suitable, a drawing of the plan and the cross section was provided.
- As recommended earlier, it would be useful to combine the TG with the HP gaschromatograph in order to measure also gas development during gasification.

5.3 Modelling

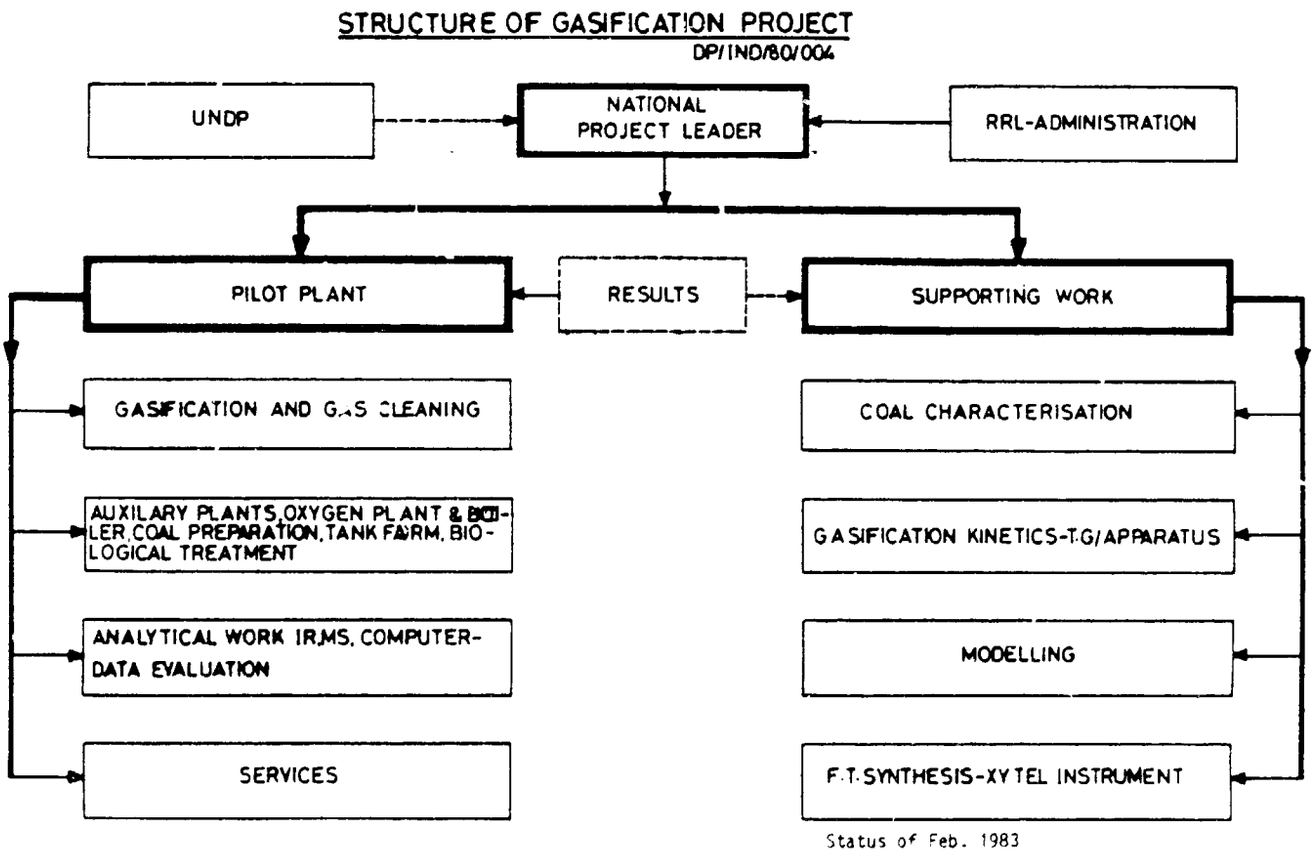
No detailed discussion has been performed on this subject. However I visited the department for simulation, optimization and control. This RRL group is well equipped with a big Univac Computer and has an highly experienced staff.

5.4 Gas conversion

The scientist who is appointed to perform the experimental work was absent for training at Xytel, Chicago/USA (see 7.2). The instrument will be sent to RRL after his visit.

6. Project Organisation

The structure of the gasification project and personal responsibilities have been discussed. The following plan shows the result:



The following persons are in charge for the different tasks and subtasks as given in the organisation chart.

1. NATIONAL PROJECT LEADER
   Dr. R. Vaidyeswaran

2. PILOT PLANT
   T.S.R. Anjaneyulu / K. Seshagiri Rao

   As to the responsibility for the pilot plant a plant manager - Mr. Anjaneyulu - has been appointed as recommended earlier, who is supervising all operational procedures. Mr. K.S. Rao is responsible for collection and evaluation of the data. - The pilot plant experiments will jointly planned and decided by Dr. Vaidyeswaran, Mr. Anjaneyulu and Mr. K.S. Rao.

2.1 GASIFICATION AND GAS CLEANING
   S.N. Reddy, K.V.R.S. Murthy, Akmel, Subrahmanyam

2.2 AUXILARY PLANTS, OXYGEN PLANT & BOILER, COAL PREPARATION, TANK FARM, BIOLOGICAL TREATMENT
   H.G. Ravindernath, Madhusudhan

2.3 ANALYTICAL WORK IR.MS. COMPUTERDATA EVALUATION
   Dr. M. Eshan, R.K. Venkataramana

2.4 SERVICES
   M.R.K. Murthy, S.V. Subba Rao

3. SUPPORTING WORK
   K. Seshgiri Rao

3.1 COAL CHARACTERISATION
   K.L. Narasimhan

3.2 GASIFICATION KINETICS - T.G./APPARATUS
   (To be nominated)

3.3 MODELLING
   M.M. Mallikharjunanan

3.4 F.T. SYNTHESIS - XYTEL INSTRUMENT
   A. Satyanarayana

7. Training Programme

7.1 Review meeting with the trainees

A Review meeting has been held with the RRL scientists Dr. M. Ehsan, Mr. R.K. Venkataramana, Mr. K.V.R.S. Murthy, Mr. S. Narayana Reddy, who have been to Western Europe for training in 1982 and Dr. R. Vaidyeswaran and Mr. T.S.R. Anjaneyulu in order to discuss experiences. Thereby I wanted to know such items as daily schedule, benefit of the experiences for the project, language problems, exspections and disappointment etc. On the whole I have the impression that all these visits have been of great value for the progress in project work and for personal development. In detail the following findings should be mentioned:

In July 1982 Dr. M. Ehsan (Chemist) and Dr. Venkataramana (electronic engineer) have visited Balzers, Liechtenstein, for a training programme on the M.S. ordered for the project. It consisted of lectures in the morning on such topics as function of single parts, maintenance etc. In the afternoon practical work was performed in Balzer's application laboratory. Special instructions were given on the software for the interpretation of the mass spectra by the PDP computer. - The daily time schedule was from 8.30 to 5 h, on some days the time was expanded.

The subject of training had been continued during the stay at Bergbau-Forschung, Essen. They have been instructed in measurements with the MS (Balzers) and have taken part in practical trouble shoots and maintenance during the normal working time (8 to 4.30 h).

Language problems did not arise as there was good communication in English from both sides. The trainees felt, that one more week in one place would have been even more helpful. All the training received is of direct value for the project and the personal job of the two scientists in the RRL team. Summarizing written reports of the two trainees have been received.

In Nov/Dec. 1982 Mr. Reddy (Chemical Engineer) and Mr. Murthy (Mechanical engineer) have been for training in the CSSR at Fuel Research Institute - FRI -, Bechovice and the gas plant of Usti and at BF, F.R. of Germany.

At the FRI Bechovice they have mainly seen the laboratory's work supporting the gas plants such as reactivity tests with CO_2, flue gas desulfurisation, boiling tests on tars, corrosion research. Their daily schedule was 10.30 to 14 h. Communication was done by interpreters. The knowledge received there has its value for the project and does indirectly meet the personal job requirements of the two engineers.

After this Mr. Reddy stayed 3 weeks and Mr. Murthy 4 weeks at the Usti gas work, where a plant with 14 full size fixed bed gas generators is operated to convert brown coal into town gas. Communication was done again by interpreters. Daily hours were 8.30 to 14 h.

In the first week an overview over the total plant had been received and the individual plants for oxygen, steam and power generation, for waste water handling and gas clean-up had been explained. In the following details of individual plants have been discussed on the spot on topic such as flosheets, critical points, spares, maintenance. Thereby also starting up and shut down procedures of the gasifier have been explained and demonstrated on request. Although it was felt that the total stay was something short and that especially more time would have been desirable in the gasification section, I have the impression that the direct value of this visit to the RRL project work is very high.

After that Mr. Reddy spent 10 days at Bergbau-Forschung, Essen, visiting the gasification laboratory for 1 day and the fluidized bed gasification pilot plant for 9 days. He was mainly concerned with the instrumentation of the plant and the study of components and elements such as coal feeding under pressure. Mr. Murthy was at Bergbau-Forschung for 5 days, where he was mainly introduced in to the materials related to the equipment for high pressure (40 bar) operation. Communication was direct in English, the daily working time was from 8 to 4.30 h. Also in this case the knowledge they got is directly used during their daily work at the RRL plant.

Unfavourable was the time of visit especially December because of the climate, preparation for Christmas and performance of the end-budgeting in German companies.

Both trainees have made extended daily notes about their findings and learnings being the basis for summary reports (ready in handwriting).

All trainees expressed their sincere thanks for the excellent opportunity provided by the UNDP funds. They are especially grateful to their hosts for all the information received and the kind hospitality both on official and private occasions.

7.2 Ongoing training and future proposals

For the time being Mr. A. Satyanarayana is in the USA mainly for training on the Xytel-F.T.-instrument. Payment of his stay and training has been granted in the supply contract.

It is already agreed that Mr. K.S. Rao will come for 2 weeks to Bergbau-Forschung in September, 1983. The object will be to study the scientific methods of kinetic measurements to be performed with the T.G. apparatus. He will also spend one week in Amsterdam to attend the Coal Technology Conference and another week in CSSR for study of large plant operation. Both is quite reasonable.

Moreover I have recommended that during assembling and testing of the T.G. apparatus the scientist, who will operate it at RRL should come to Bergbau-Forschung for 4 weeks. This is scheduled for June, 1983, whereby some flexibility must be allowed. This was agreed by the members of the Project Implementation Review Committee. The provisions shall be transferred from the 1984 budget.

After commissioning of the plant it is proposed that Mr. Anjaneyulu visits the USA to stay for 3 weeks in the Energy Research Center at Morgantown, W.V. where a fixed bed gasifier is in operation. I propose that in this study tour a 3 day's stay at Bergbau-Forschung in Essen is included for discussion of fabrication and

assembly at the T.G. This seems necessary to prepare the BF's expert's stay, RRL for the set up of the device, who has to be informed about the manufacturing possibilities at RRL. Moreover an exchange of information and ideas i- necessary at BF on the measurements of temperature pressure and gas composition profiles in the RRL-gasifier as BF is performing this in their pilot plant.

In addition Mr. M.A. Khaleel is proposed to visit the GDR plant 'Schwarze Pumpe', a town gas plant based on fixed bed pressurised gasifiers for 2 weeks and will also stay for 2 weeks with Prof. Klose, Freiberg/GDR, who is well-known for his work on fixed bed gasifier modelling. Mr. M.M. Mallikarjunan will join for 4 weeks the team of Prof. Denn, Cal State University/USA, to be trained in modelling and simulation of gasification reaction and pressurised gasifiers.

For 1984 in total 3 RRL members can be sent for training abroad. The needs and possibilities have been discussed:

One could be trained on computer modelling, with special regards to the preparing techniques. The two others should be plant engineers. The subject of training will be decided after the experiences of commissioning and first operation.

8. Expert Programme

For 1983 the visit of Dr. Prasek, Fuel Research Institute, Bechovice/CSSR, and or Prof. M. Denn, California Institute of Technology, Berkeley/Cal.USA has been finalised.

Dr. Prasek will come mainly to assist RRL in operation, planning and data collection. Since his institute operates a well instrumented large gasifier, he will be requested to give lectures on relevant instrumentation also. The visit of Prof. Denn is now scheduled for Dec. 1983. He has been invited to give lectures and assist the scientists in RRL in modelling.

It is proposed that during 1983/84 experts should come to RRL as follows:

- Members of Bergbau-Forschung's gasification group - either Mr. A. Sulimma or Mr. Mühlen - to install and commission the use of the T.G. as has been already agreed upon the UNIDO contract to BF (15.2.K0973). This visit will most probably be in Nov./Dec. 1983.

- Prof. Klose, Freiberg/GDR in continuation of the visit of Prof. Denn, RRL would like to get benefitted from Prof. Klose's work on modelling. The work by these two experts on modelling is complementary as Prof. Klose has developed his models based on data from big operating plants and Prof. Denn's work is based on literature data. For an optimal evaluation and use of the pilot plant data the visit of experts from the two different schools of fixed bed gasifier modelling will be very useful. Prof. Klose's visit will be scheduled in 1983.

- Expert for design and operation of bixed bed gasifiers as agreed in the Tripartite meeting. It has benn discussed, that after commissioning of the pilot plant and after the visit of Dr. Prasek, requirement must be reviewed. Thereby, it is to be considered, whether actual problems at plant operation or scale-up of the gasifier and other plant units have higher priority. The visit should be by end of 1983 or beginning of 1984.

For 1984 provisions exist for visits by 3 experts. The present tentative RRL proposal is that the subject should be modelling (revisit), data collection and evaluation and supporting work. Also alternative subjects especially dealing with practical problems, that may arise during the start up and operation of the gasifier and other equipment (MS, TR, computer) will be taken into account.

9. Meeting of the Project Review Committee

The meeting was held on February 25th, in the presence of a member of CSIR - representing Mr. Johry -, Mr. Krasiakov, UNIDO, Dr. Thyagarajan, RRL, Dr. Vaidyeswaran, RRL, Mr. Anjaneyulu, RRL, and Dr. van Heek, Chief Technical Advisor.

The following items have been discussed:

1. Action taken on the minutes of the project implementation Review Committee Meeting, held on January 22nd, 1982.

   Under this item mainly the work plan, status of ordering equipment and the experts and training program have been discussed. The results have been included in the earlier paragraphs of this report.

2. Report on the Tripartite Review Meeting held on December 14th, 1982.

   Under this item mainly the possible subcontract to Lurgi for commissioning has been reviewed. The Lurgi offer is quite acceptable. Negotiations shall be taken up immediately. The director and the National project director will visit Lurgi and UNIDO/Vienna by the end of March 1983, so that the Lurgi engineers possibly can come in April 1983. However, if unexpected obstacles may arise to come to this contract Mr. Krasiakov and I myself encouraged RRL to start up the plant themselves.

3. Progress of Work.

   A report was given from RRL on the work progress as has been described earlier in this report.

4. Program for 1983.

   The main guidelines of the working program for 1983 and 1984 including the program for training an expert as lined out in more detail in this report have been accepted by the committee members.

5. Any other Item.

   The next meeting of the Project Review Committee should be held December 1983 or January 1984 in the presence of the Chief Technical Advisor, whose visit is envisaged for this time.