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STRENGTHENING OF ESSENTIAL OIL INDUSTRY IN KOREA

DP/DRK/88/001

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

Technical report: Part one, findings and recommendations*

Prepared for the Government of
the Democratic People's Republic of Korea
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Mr. Siegfried Langner, UNIDO consultant

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Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

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* This document has not been edited.

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C O N T E N T S

S u m m a r y

Project title: **Strengthening of the essential oil industries in Korea**

Project No.: **DP/DRK/88/001/A/01/37**

Number of mission : DP/DRK/88/001/11-01

Description of Job-mission : Chemical Technologist

According to the order description the chemical technologist has the "special responsibility for the support at the installation of the equipment for the destillation and extraction and the control of their start operation". Special task of the present activity was

- to explain to the Korean partner the offer of the company veb agro-consult dresden (acd)/GDR, on the supply of equipment, submitted to the UNIDO in April 1989;
- to analyse the local conditions at the installation site of the project in the Korean People's Democratic Republic with regard to the securing of its installation, the sure functionality and the technical safety.

The present part report I contains mainly the results of this analysis as well as some details to several other actual matters of the a.m. project

Introduction

This part report No. 1 serves for the partial fulfilment (because split mission) of an activity of the common development project between the government of the P.D.R. of Korea and the UNDP/UNIDO of May 1988 with the project No. DP/DRK/01/37 and under the title "Strengthening of the essential oil industries in Korea".

This project activity is as follows:

"II.G project activities, 1 international personell, 11-01 Chemical Technologist with actual experiences in the processing of essential oils incl. field destillation, which supervises the installation of new equipment in the PEORC and the start with production of fractions".

The subject for the activities of the chemical technologist is contained in the project description with the number DP/DRK/88/001/11-01 (see project document for a.m. development project, annex A). The period of employment of the technologist, mentioned there, is three months. According to the UNIDO's decission the employment has been splitted into two parts:

- one month in November 1989
- two months in May/June 1990

On 6.11.89 the consultant has got from the UNIDO in Vienna the following oral subject for the first part of the mission:

- the offer of agro-consult dresden/GDR from April 1989, for the supply of equipment, available at the UNIDO, should be explained to the Korean part;

- the local conditions at the installation site of the pilot plant (part 1 of the offer) in the PDRK should be verified with regard to the securing of its installation, sure functionality and technical safety.

The Korean part has accepted this subject and has mentioned some further actual problems concerning the project development, on which it should be informed in the present report,too. In the final phase of the mission the consultant has acted as UNIDO-representative in technical negotiations between the offerer of the pilot plant (part 1 of the offer), represented in Phjongjang by two planning engineers, and the Korean part. The minute of these negotiations has been attached as Annex 3 of the present part report.

The specific scope of the present document is

- to inform on the results of the fulfilment of the subject for the first part of the activities and

- to make recommendations as well as to draw conclusions for the partners working at the project

The present part activity has started on 6th of November and has ended on 5th of December. Time schedule , see Annex 2.

In result of the discussion of 4.12.89 in Phjongjang between the head of the UNDP-office, Mr. Karcher and the representative of the government of the PDRK, Mr. Han, concerning the development of the present project, the national project coordinator has confirmed the fulfilment of the consultant's mission.

I. Generals

The discussions and activities for the fulfilment of the a.m. subject, between the Phjongjang Essential Oil Research Center (PEORC) and the consultant, as well as the technical discussions with the offerer's representatives have taken place in the building of the PEORC and in the "Taedonggang"-Hotel in Phjongjang. The managing personell of the partner, their names and qualifications - see Annex 1.
At the beginning the following aspects of the report of December, 1988 (see project activity DP/DRK/88/001/11-02, Designer of chemical equipment) have been discussed:

- vacuum generation by water-jet vacuum pumps,
- equipment of refrigerating drying,
- analysis results 1988 of supplied essential oil samples.

The PEORC has informed about the progress of the project implementation:

- laboratory buildings constructed, fitted out and taken over

- vacuum fall-film evaporator further developed at bench scale (laboratory sight glas at the head etc.), enlarged (innertube 20 mm diameter/ evaporator pipe length 1.5 m), 5 of stainless steel finished and operate in the laboratory. Its capacity has been extended from to two to five-fold. The oil quality has been improved.

- development of an bench scale adsorption technology on the basis of active coal from the PDRK to remove the n-hexane vapours from the air.

Basis for the consultant's work was the offer No. 106/23/7/50/89 of 8.4.1989 from acd/GDR as well as the procedures scheme elaborated by the offerer, (submitted after offering), equipment sketches and calculation results.

Conclusions and recommendations

a) Part 1 of the offer from April 1989, - Pilot plant-

The present offer is complete regarding to part 1 -bench scale pilot plant- as to the project documentation annex III, equipment list, category 2 - pilot plant No. 10, 11 as well as in accordance with the UNIDO-tender DP/DRK/88-001/89/1 of 2nd of March 1989. In result of the technical discussions of November/ December 1989 in Phjongjang between the offerer, the Korean part and the consultant the followings have been observed:

- All the technical solutions for the technological main and auxiliary units of the pilot plant have been agreed upon by the offerer, the Korean part and the consultant.

- The local conditions at the site of the pilot plant allow its installation, the sure functionality and the technical safety under the condition that the preconditions, agreed upon between the offerer and the Korean part, with regard to civil works, technical changes at the electric power system (see annex 3) should be created by the Korean part.

- The input and output systems (electric power, cooling water, waste water), available in the PEORC, ensure the supply and operation of the pilot plant to be installed on the basis of a rough evaluation regarding its capacity.

Recommendation No. 1:

UNIDO is recommended to start the contract negotiations with the offerer in short time, on the basis of the technical solutions for the pilot plant agreed upon between the offerer, the Korean part and the consultant.

Recommendation No. 2:

The Korean part is recommended to prepare and to realize before the supply of the pilot plant, the technical measures fixed in annex 3 (erection of a new equipment hall, changes in the electric power system etc.).

With regard to the mounting of the pilot plant the PEORC does not dispose of the welding protective gas Argon which is necessary for a quality in welding of pipelines, fittings etc. of stainless steel.
The offerer will check the possibility to weld the units of these two technological main-systems in his own workshops. But this will increase the costs of the offerer in comparison with the presented offer.

Recommendation No. 3:

The offerer and the UNIDO is requested to find a solution with regard to the financing of the supplementary costs, arising for the offerer at carrying out the weldings.

b) Part 2 of the offer from April 1989,
- Laboratory and analytical equipment -

This part contains the following items of the a.m. equipment:

1. Gas-liquid-chromatograph
2. Rotary evaporator
3. Laboratory polarimeter
4. Abbe Refractometer
5. Analytical balance, and
6. Laboratory top load balance

According to the project documentation, annex III, equipment list, category 1 the following positions are not offered:

Pos: 6.	Thin layer chromatography
Pos: 7, 8, 9.	Laboratory glas etc.
	Laboratory materials and appliances.

The offerer arguments this as follows:
- For position 6 it was not possible to get in short time a supply-offer from manufacturers in acc. to specification.

- Position 7, 8 and 9 are not contained in the UNIDO-tender DP/DRK/88-001/89-1 from 2nd March 1989, may be because of the nonavailability of detail specifications for these positions.

Recommendation No. 4:

The UNIDO and the offerer are requested to inform the consultant and the Korean part on position 6, thin layer chromatograph.

Recommendation No. 5:

UNIDO is recommended to delegate for two weeks to the PDRK a Chemist for Laboratory Analytic with experiences in the field of essential oils inclusive their analysis as consultant, acc. to the project documentation -job description DP/DRK/88/001/11-51, to support the Korean part at the preparation of a detailed specification for the a.m. positions 7, 8, 9. It will be better if this chemist will come from the country which will supply these positions. After supplying the equipment for the bench scale pilot plant laboratory and analytical equipment, the chemist should assist during one month the starting operation of these laboratory equipment in Pyongyang.

c) Offer from April 1989. Time of delivery of the equipment

In the offer a time of 15 - 18 months from contract conclusion is stated for the supply of the equipment. The Korean part requires short supplying times, especially for the laboratory and analytical equipment. These analytical equipment are in series produced apparats which are required urgently for the quality control of the essential oils in the PEORC. This will permit a soon start of the export of these oils.

Recommendation No. 6:

The UNIDO and the offerer are requested to start the supply of these equipment in two steps to an early term:

- laboratory and analytical equipment as first partial supply with shortest times of delivery

- pilot plant as second partial supply.

d) Further equipment

According to the project documentation, annex III, equipment list, category 3, general administration equipment, the utilization of a computer and of a photocopier in the PEORC is foreseen.

- The computer, Fa. IBM, 16 bit
- The photocopier, Fa. Canon.

Recommendation No. 7:

UNIDO is requested to checkup and to confirm the possibility that the Korean part can buy the a.m. equipment of category 3 by using the planned costs stated in the project (5.000,--US-Dollars) and to provide the Korean part with this amount in short time after a positive decission.

e) Further actual matters in connection with the project development:

The PEORC has informed the consultant on the results of the group training programme carried out in China in summer 1989. Especially the group for extraction and destillation, which has worked in Peking, could not gain sufficient knowledge and experience to these processes in pilot and industrial plants. The offerer of the pilot plant finds it necessary that the Korean part should participate in the next contract negotiations with the UNIDO.

Recommendation No. 8:

UNIDO is recommended to organize a study tour of three weeks to the GDR, for two specialists of the Korean part (national project coordinator and his deputy, at the same time experts for extraction and destillation) if possible and to finance it from the project. Basis should be the respective offer from February 1989 of acd/GDR. The term of the tour should correspond to the period of the contract negotiations, but not later than March/ April 1990.

The Korean part and the consultant are of the opinion that the Chemical Technologist should participate at the putting into operation of the supplied pilot plant. According to the offered time of delivery of 15 to 18 months for the pilot plant the installation will be fulfilled not earlier than in 1991.

Recommendation No. 9:

UNIDO is recommended to subdivide in two parts the second mission of employment of the Chemical Technologist. His next mission (one month) should take place in May or June 1990. After the installation of the plant in 1991 the third mission (one month) should start. The activities of the second mission should contain:

- clarification of the technical problems in the phase of construction, planning and manufacturing of the pilot plant;

- practical works for the extraction and destillation at the site;

- preparation of regulations for the putting into operation of the pilot plant.

The Korean part consideres the consultant even as the "Chief Technical Adviser/CTA", which also should have the responsibilities of the planning adviser according to the project documentation - job description No. DP/DRK/88/001/11-51. The consultant (author of this report) should be in the position and prepared to bear the responsibilities of a Planning Adviser with the remark that he cannot fulfill as engineer the tasks of a chemist resp. analytics.

Recommendation No. 10:

As proposed by the Korean part the UNIDO is requested to verify if the tasks of the Planning Adviser could be supplementary carried out by the Chemical Technologist, by extending his periods of mission.

II. Offer No: 106/23/7/50/89 of April 1989

A. Part 1 of the offer - Pilot equipment

1. Final technical solutions for the Main System No.1 / No. 2 and Auxiliary Systems of the pilot equipment

The following essential technical changes, supplements and precisations have been determined with the following certification (see annex 3, appendix 2, point 1):

a) to process scheme

see offer, drawing No. 6080.01 - 02.2:1(03) and annex 3, drawing No. 0134.01 - 02.1(0).

- pos. 1V1 (supply PEORC) is a 200 l barrel (diameter 600 mm, staying) wherefrom the n-hexane/wax mixture is exhausted over an hose and stopping device;

- flow measuring FI for feed mixture is not necessary, as for the present conditions (low intake height, vacuum) no technical solutions are available;

- capacitor 1C1 will be subdivided into the following two devices:

. pos. 1C1 (staying nest of tubes - heat transferer) condenses the n-hexane vapour

. pos. 1H1 (staying spiral heat transferer) undercools the n-hexane condensate to about - 10 °C.

Certification: The necessary undercooling of the liquid cannot be realized in the staying nest of tubes - heat transferer.

- utilization of the apparatus 1V7 as lock for the product from 1V3 to enable a continuous operation of the evaporator 1E1.

- replacement of the automatic pressure regulation PIC by pressure measuring PI with pressure regulation by mean of a manual fine regulation valve to simplify the system.

Further statements - see annex 3

b) to the equipment

- special construction executions of the head of the evaporator 1E1 according to the data of the PEORC (see annex 3, drawing No. 0134.00 - 00.4(4)).
Especially with regard to the diameter of the head (data from PEORC is 200 mm) the consultant is of the oppinion that a small diameter, e.g. 80 to 90 mm, is more favourable to achieve a better distribution in the evaporation pipe, by a higher rotative velocity of the liquid.

- installation of an "inspection glass" in the evaporator head as well as of an "inspection and light glass" in the height of the product exit from the evaporator pipe of pos. 1E1 for observing the product flow and supplementary regulation of the product flow volume.

- construction pos. 1V5 with "cooling jacket" in the soil area, removal of the cooling spiral .

Justification: The necessary insert of an inspection and light glass in the vessel jacket does not allow the mounting of a cooling spiral because of sight impact.

Further statements - see annex 3.

Main System No. 2 - Discontinuous vacuum rectification

The following essential technical changes, supplements and precisations have been made with the following justifications (see annex 3, appendix 2, point 4):

a) to process scheme

See offer drawing No. 6080.02 - 02.2:1(04) and annex 3, drawing No. 0134.02 - 02.2(0).

- insert of a direct steam feeding in the batch still over an insert pipe in order of the periodical cleaning of the system at assortment changes;

- for the improvement of the separation effect the 2C1 will be fitted with cooling agent (pre-flow temperature - 15 °C not with cooling water;

- pos. 2V2 is not valid as separate apparatus. Herefore additionally a vertical pipe with large diameter will be provided for discharge. Thus the connection of 2V2 to 2V1.1/2V1.2, inclusive inspection glass, is removed.

- the transfer of the vacuum pipe of 2C1 directly to the vacuum pump, as pos. 2V2 is removed;

- utilization of an inspection glass additionally in the distillation line of 2H1 to 2V1.1/2V1.2 for the observation of the product flow.

Further statements - see annex 3

The DPRK-side has the intention to use the present system even for the distillative cleaning of the solvent n-hexane under normal pressure. The offerer of the pilot equipment and the consultant have shown that the system is provided for the separation of natural essential oils under vacuum. No guarantee can be given for the functionality by use of the system for n-hexane distillation.

b) to the equipment

- pos. 2V1.1 and 2V1.2 get additionally a "light and inspection glass" each for the control of the filling level (LI).

Further statements - see annex 3.

Auxiliary system No. 1 - Vacuum generation

Vacuum generation for the Main System No. 1

The vacuum generation for this main system is very problematic, as with the air to be removed from the system even n-hexane vapours should be partly exhausted (under present conditions about 1 kg/h n-hexane per 1 kg/h air). This n-hexane share requires special operation conditions of the selected vacuum generating device and can come into the environment (sewage, waste-air). Detailed discussions have been held to the following technical possible variants of vacuum generation:

- water ring pump according to the offer but with cold water feeding and water circulation;

- water-jet vacuum pump by feeding with n-hexane-free water;

- mechanical vacuum pump with pre-switched adsorption step for the removal of the n-hexane before the pump-unit.

The PDRK-side expresses its readiness to provide this adsorption step on the basis of own development results at laboratory scale as a unit consisting of three adsorbers.
The offerer supplies on request of the PDRK-side the fittings for this adsorbtion-step. The utilization of an oil lubricated mechanical vacuum pump, pos. 1P2 has been decided on this basis. The selected variant has the advantage, that at a proper operation of the adsorption step, no n-hexane comes into the environment.
For further detail information, especially on the construction of the adsorption-step, see annex 3.

Vacuum generation for the Main System No. 2

The "more-step vacuum generating aggregate", mentioned in the offer will be replaced by an "oil lubricated mechanical vacuum pump", pos. 2P1, with respective capacity, because for energy saving measures and because of the technical improvement of the main system (utilization of the condensor 2C1 as cooling trap). The lubrication oil of such a pump polutes at long-time use, as minimal remains of distilled matters come into the pump together with the exhausted air, even due to the cooling trap.
The offerer supplies therefore a unit for fresh oil dozation or a resp. for the quick lubrication oil change.

Auxiliary System No. 2 - Cold generation

See annex 3, drawing No. 0134.01 - 02.1(0)

The form of the auxiliary system, stated in the offer, remains unchanged. It will be supplemented by a second centrifugal pump, pos. 1P1.2, which cnveys the cooling agent from the vessel for cooling agents, pos. 1V1, to the cooling trap 2C1 and back into this vessel.

Auxiliary System No. 3 - Steam generation

See annex 3, drawing No. 0134.02 - 02.2(0)

An electric steam automate, pos. 2N1, will be used for steam generation, which heats the batch still of column 2K1 and which is feed with drinking water. The second steam generator mentioned in the offer will be eliminated, as the second larger steam consumer - the steam operated vacuum generating device, mentioned in the offer - has been eliminated.
Because of the low drinking water quantity (=/smaller than 50 l/h) necessary for steam generation, no recirculation of the condensate to the steam generator takes place. The condensate should be led to the sewerage system. The condensate cooler, pos. 2H2, is not necessary.

Auxiliary System No. 4 - Control air generation

See annex 3, drawing No. 0134.02 - 02.2(0)

The technical solution stated in the offer remains, generally.
The capacity of the auxiliary system (compressed air quantity, installed electric capacity of the compressor) will be reduced, adapted to the control air demand. The new data will be mentioned later by the offerer.

2. Investigation of the site conditions for the pilot equipment with regard to its installation, functionality and technical safety

Installation of the equipment

See annex 3, appendix 1, plant conception.

The most favourable place "the Plant Site" for the installation of the pilot equipment is at the north side of the laboratory building of PEORC (see annex 3, layout, drawing No. 0134.00 - 00.1(2)). The necessary surface is available at this place. There already exists a technical shed with the machine room and the most important power connections (electricity, cooling water).
The conception for the installation of the pilot equipment, proposed by the offerer (see annex 3, draft of the installation plan of the whole equipment, drawing No. 0134.00 - 00.2(3)), envisages:

- the installation of the equipment of the two main systems in a shed to be newly erected by the PDRK-side;

- the installation of the equipment of the auxiliary systems in the existing machine shed and in an existing room of the laboratory building;

- the arrangement of the two filling stations for raw materials and final products under open air, next to the new shed.

This conception ensures:

- the operation of the pilot equipment during the winter period;

- the transport and the installation of the equipment, e.g. in the new shed, by mean of assembly bearers and pulley block and

- the technical safety of the pilot equipment.

PEORC steted that it disposes of the necessary skilled workers to carry out any assembly work. The PDRK-side informs that she cannot provide the protectie gas Argon, necessary for the quality welding of the stainless steel. See hereto chapter "Conclusions and recommendations", point a).

Reliable function of the equipment

Essential element of the reliable function of the pilot equipment is their sufficient supply with regard to power, operating means, sewage, exhaust gas etc.

Electric power

- the installed capacity of the transformer available at the PEORC is 115 kW;

- at present 10 to 15 kW are used at the PEORC;

- available capacity for the operation of th pilot equipment: about 100 kW;

- capacity demand according to the offer: 105.7 kW.

The capacity demand according to the offer cannot be covered at present by the PEORC.

In result of the final technical solutions agreed under point A.1. the necessary total capacity of the pilot equipment has been decreased. It is composed as follows (installed capacity):

main system No. 1		0	kW
main system No. 2		0	kW
auxiliary system No. 1	about	6	kW
auxiliary system No. 2	about	12	kW
auxiliary system No. 3		54	kW
auxiliary system No. 4	≈	12	kW
total	≈	84	kW

This new determined capacity demand of electric power can be covered by the supply system installed at the PEORC. It should be precisized on the basis of the offers of the equipment suppliers.

Several technical adaptation works should be carried out by the PDRK-side in the electric power system of the PEORC, as stated in annex 3, appendix 4, electrical equipment.

Hot water

The supply of the hot water is provided by the PEORC. It should be generated during the summer period by electrical heating. The necessary parameters of the hot water have been submitted by the PDRK-side to the offerer.

Cooling water

The main supply line of cooling water, with drink-water quality, to the PEORC object has a diameter of 100 mm, which becomes smaller and remains to 50 mm in the object after the main switch valve. If a flow velocity of the water, of 1 m/s, is supposed in this pipe, the following water output would be achieved:

diameter 100 mm	27 m^3/h
diameter 50 mm	7 m^3/h

The water pressure will be ensured by a water tower (15 to 20 m height) in the vecinity of the object.

The exact cooling water demand of the pilot equipment can be determined only after getting all the supply offers for these equipment. In result of the final technical solutions agreed under point A.1. (utilization of oil lubricated vacuum pumps, resp. utilization of air cooled cooling agent compressors) it will be estimated that the new total cooling water demand will lie below the value stated in the offer (about 9 m^3/h).

Thus the pilot equipment can be sufficiently provided with cooling water. If there are difficulties at the cooling water supply the PEORC will install a supplementary water tank with pump.

The PDRK-side has provided the offerer of the pilot equipment with the parameters concerning the cooling water quality.
See hereto annex 3.

Drinking water, processing water

The demand for these water sorts is stated under the position cooling water (drinking water).

Sewage

Sewage is:

- the heated cooling water backflows from all processing waters;
- the hot condensate from the heating jacket of the batch still of the main system No. 2 (40 kg/h);
- the hot sludge water from the steam generator of the auxiliary system No. 3 and
- the condensate from the separator of the adsorption step for n-hexane.

All these sewage streams are collected and led to the comunal sewage pipe of the city which is in the immediate vecinity of the PEORC object (the Plant Site) and which muzzles in the city sewage disposal cleaning-plant. PEORC sees no problems in getting the authorization for the in-connection of its technological sewage into the comunal net.

Exhaust gases

Exhaust gases are those gas quantities exhausted by the mechanical vacuum pumps from the two main systems. The gas leakage line of the two pumps should be led over roof.
No n-hexane comes to the atmosphere because of the utilization of the adsorption step for n-hexane.

Technical safety of the pilot equipment

The technical safety of the pilot equipment at the site will be ensured by

- the spacial seperated installation of the equipment which contain dangerous substances (main system No. 1 and 2 in new devices shed) and by the equipment which do not process dangerous substances (auxiliary systems in the machine room and in the laboratory building);

- explosion-proof execution of the electrotechnical equipment (driving motor, local illumination) in the new device shed, whose contact with dangerous substances (n-hexane) could be possible;

- the arrangement of the filling station of dangerous substances outside the building;

- installation of respective safety switches in case of energy break-down;

- installation of safety valves in the steam and control air system against undue interior pressure.

3. Supply and services of the seller and of the client

Supply and service of the offerer

This amount, contained in annex 2 and 4 of the offer, has been explained by the consultant and by the offerer. The technical changes and supplements to annex No. 2 of the offer are presented in point A.1.

Supply and service amount of the PDRK-side

This amount is contained in annex 3 and 5 of the offer. Both annexes have been discussed by the offerer and the PDRK-side. The results and the necessary data of the PDRK-side are contained in annex 3.

All the transfer- and connection-points for any energy and media sort have been agreed in detail between the offerer and the PDRK-side.

Presently there are no open or divergent problems for the supply and service amount of both sides, which can imped the continuation of the works and the start of the contract negotiations.

B. Part 2 of the offer - Laboratory and analytical equipment

The most important statements to this section are contained in the chapter "Conclusions and recommendations", point b. With regard to position 7, 8, 9 laboratory glass, laboratory consumer material and auxiliaries, according to the project document of UNIDO, annex III, equipment list, category 1, it should be mentioned, that the offerer veb agro-consult dresden (acd/GDR) has submitted to the consultant a preliminary specification of these three positions in German language before travel start (see annex 4). The consultant has translated this specification into the English language in Pyongyang and handed it over to the PDRK-side, who has confirmed this as first draft.

This preliminary specification can be used herewith as basis for the activities of the proposed chemist (UNIDO-consultant) in the PDRK.

C. Final Remarks

The present remarks refer to the delivery times of the equipment and the further equipment according to the project document of UNIDO , annex III, equipment list, category 3.
See hereto chapter "Conclusions &.recommendations", point c.and d.

The realization time of the civil works to be carried out by the PDRK-side - see annex 3, appendix 5, implementation.
According to the statements, contained there, the civil works of the PDRK-side will be fulfilled within six months after contract signing.

Any preconditions have been created, in result of the technical discussions between the offerer and the PDRK-side under participation of the consultant in Phjongjang, for an early start of the contract negotiations between the UNIDO and the offerer.

III. Further actual tasks in connection with the present development project

See hereto chapter "Conclusions and recommendations", point e.

Members of the PEORC have participated in three groups in the period May to July 1989 at a training programme in China, according to the UNIDO's project document, II.C., project activities (b), 2., training. The heads of the group "plant cultivation" and "distillation and extraction" have informed the UNIDO-consultant in detail about the results and the problems of the training programmes.

A copy of the report of the group-heads is at the UNIDO so, that a detailed report should not be necessary. It must be mentioned that the group "plant cultivation" has achieved the best training results. This group has visited a series of cities in China, e.g. Bejing, Shanghai and Hwangzoe.

The Institute Of Perfume Sciences of the Ministry of Consumer Goods has been proofed to be the most suitable for carrying out training programmes and for exchange of experiences. The group has visited this institute only one day. The PDRK-side has expressed its interest to visit again this institute
(2 to 3 specialists for 10 working days).

A joint meeting took place on 4.12.89 in Pyongyang between the head of the UNDP-office, Mr. Karcher, and the representative of the Government of the PDRK, Ministry of Foreign Trade, Mr. Han, and with the participation of the director of the PEORC and of the representative of the offerer and of the consultant. At this meeting it has been fixed to prepare a progress report on the fulfilment of the project outputs till 31.12.1989 and to submit this to the UNDP-office at Pyongyang.
This report will be analized by the parts till 31.1.1990 and will be discussed in February 1990.

Annex 1

The management personnel of the partner, their names and functions/jobs

The management personnel of the partner in the scientific-technical activities:

Choi Dung Gwang	- Director of the PEORC national project coordinator
Li Myong Ho	- Head of the PEORC laboratory, partner of the consultant
Mr. Mun	- Interpreter

The management personnel of the partner for principle tasks:

Yong Chang Hak	- Director of the head department for science and technology in the Ministry of Consumer goods and the chemical industry of the PDRK
Mr. Han	- Director of the general office for cooperation with international organizations in the Ministry of Foreign Trade of the PDRK
Ko Jul Chol	- leading Member in the a. m. general office
Mr. Karcher	- Head of the UNDP office in Pyongyang
Mrs. Rieger	- Leading Member in the UNDP-office in Pyongyang

Annex 2

Time schedule of the activities

Activities in November/December 1989:

6.11. 1989	flight Berlin - Vienna and briefing at the UNIDO/Vienna
7.11. 1989	flight Vienna - Moscow with 24 h stay in Moscow because of no flight of the Korean Airways
8./9.11. 1989	flight Moscow - Phjongjang
10.11. 1989	first contact and negotiations with the UNDP-office and the Korean partner
11. - 23.11. 1989	technical discussions with the PEORC
24.11. - 3.12. 1989	participation at the technical discussions between the offerer of the pilot equipment and the PDRK-side
4.12. 1989	final meeting between the PDRK-side, the UNDP-office, the offerer of the pilot equipment and the consultant
5./6.12. 1989	fly-back Phjongjang - Moscow - Berlin.

Pyongyang 1989-12-06

Minutes of the meeting about the project
Essential Oils UNIDO-DPRK
from 89-11-35 to 89-12-06

1; Participants:

Mr.Langer	UNIDO-consultant
Mr.CHOI	director of P.E.O.R.C.DPRK
Mr.Li	head of essential oil laboratory of P.E.O.R.C. DPRK
Mr.om	electrical researcher P.E.O.R.C. DPRK
Mr.Dr.Eng.Hlecke	project chief KCA DRESDEN. GDR
Mr. Mancke	specialist projectant of electrical equipment and automatization KCA DRESDEN GDR
Mr.Mun	interpreter

2. Place of the meeting:Pyongyang. DPRK

3. Fixing and aims were the examination of the GDR-side offer under the actual local conditions by the GDR-side and first technical discussions beteen the DPRK-side and GDR-side in preparation of the contract meeting.

4.Documents and samples which were handed over

4.1 Documents handed over by the side DGR-side to the DPRK-side

- technological scheme (draft)
  vacuum film evnporation plant
  drawing number 0134.01-02.1(0)
- technological scheme (draft) bench scale vacuum rectification
  drawing number 0134.02-02.2(0)
- connecting points (draft) table 1:localization

4.2 Documents and samples handed by the DPRK-side over the GDR-side

- design sketch
  top of the vacuum evaporation 1V1
  drawing number 0134.00 -00.4(4)
- data for electrical equipment
- characterising values of water
- sample for tube DN25 which will be used fir filling by the DPRK-side

4.3 Documents elaborated together by the DPRK-and GDR-side

- site plan, drawing number 0134.00 -00.1(2)
- installation plan of the total plant
  drawing number 0134.00 -00.2(3)

-scheme adsorption (proposal of the DPRK-side)
drawing number 0134.00-00.3(3)

5. Results

The results are contained in Appendix 1-5.

6. Measures

Both sides have to do the following measures in preparation of the contract negotiation. The documents will be handed over and willbe agree during the contract meeting.

6.1 Measures of the DPRK-side

- appendix 3, point3
- appendix 3, point 11

6.2 measures of the GDR-side

- appendix 3, point3
- appendix 3, point4
- appendix 3, point5

7. This minutes consists of 13 pages.

Part of this minute are also

- appendix 1:	plant conception	1 pages
-appendix 2:	technology	5 pages
- appendix 3:	machines and equipment/ pipes	3 pages
- appendix 4 :	electrical equipment/measurement and control	1 pages
- appendix 5:	realization	1 page

8. This minute is made in 4specimens written in English language, of them

- 1 specimen for UNIDO
- 1 specimen for DPRK-side
- 2 specimens for GDR- side

DPRK-side

GDR-side

UNIDO-side

Appendix 1: Plant Conception

1. The site plan, drawing number 0134.00-00.1(2), is the basis for the contract talks, the following projecting by the GDR-side and the activities by the DPRK-side.

2. The DPRK side declares, that the experimental plants have also to work in winter. Especially by reasons of the technical safety the installation of the experimental plants of vacuum-evaporation and vacuum-distillation is not possible in the laboratory building. So an equipment hall must be built.

3. The installation plan of the total plant, drawing number 0134.00-00.2(3) is the basis for the contract talks, the following projecting by the GDR-side and the activities by the DPRK-side.

4. All construction performances, for example the erection of the equipment hall, constructive changes of the machine room and the pulling down of the cement store, will be made by the DPRK-side.

5. The GDR-side will hand building terms for construction planning and execution to the DPRK-side after the sign of the contract, which consist data for the equipment hall and the machine room.

6. The GDR-side has follow demands on the erection of the equipment hall, which will be executed by the DPRK-side:
   - minimal temperature in the room 5°C
   - ventilation
   - normal lighting installation in the hall

7. The GDR-side has follow demands on the execution of the machine room, which will be executed by the DPRK-side:
   - minimal temperature in the room 5°C
   - normal lighting installation in the room

8. Especial technological lighting installation (for example for sight glasses) will be delivered by the GDR-side.

9. The GDR-side will hand terms for ventilation planning and execution of the equipment hall to the DPRK-side after the sign of the contract.

Appendix 2: Technology

1. Vacuum-evaporation

1.1 The DPRK-side certifies the part vacuum-film evaporation the technological scheme, drawing number 0134.01-02.1(0) with the remarks according to point 1.2 to 1.9.

1.2 For the control of the flow conditions in the evaporator the DPRK-side demands each a sight glass at the top and at the under part of the evaporator 1E1. The GDR-side will investigate the realizability.

1.3 The valve in the product pipe between the vessel 1V2 and the evaporator 1E1 will installed in the operative region (level ± 0m).

1.4 The measurement PI (far) is not applicable in the vapor pipe between evaporator 1E1 and condenser 1C1.

1.5 The vessel 1V7 will installated deeper than the vessel 1V3.

1.6 The DPRK-side demands the following changes to the vessel 1V5:
- cooling jacket at the bottom
- lateral installated measurement TI (local).
The GDR-side will investigate the realizability.
There is not any cooling coil in the vessel 1V5.

1.7 According to point 1.6 the cold water goes in follow order to the equipment:
vessel 1V6 - vessel 1V5 - cooler 1N1 - condenser 1C1

1.8 On the basis of experimental experiences the DPRK-side demands the erection of the top of the evaporator 1E1 according to the sketch, drawing number 0134.00-00.4(4).
The GDR-side has opposite experiences of the erection of the evaporator top.
Under the reservation of the welding technical realizability, the GDR-side is willing to do the erection of the evaporator top according to the demands of the DPRK-side.
Both sides agree that for the reason the GDR-side does not guarantee for the distribution of the liquid in the evaporator pipe and so far the performance of the evaporator.

1.9 The measurement LI (local) at the vessels 1V5 and 1V7 will be made as two opposite oblong sight glasses (with technological lighting).

1.10 The value HB is not applicable in the air pipe to the vacuum pump.

1.11 A measurement TIS and a control valve will installated in the pipe of the warm water supply.

1.12 The GDR-side will investigate the realizability of a cooling coil in the vessel 1V6 to minimize the loading of the vacuum pump 1P1 with n-hexane.

2. Vacuum generation 1 for the vacuum evaporation

2.1 The GDR-side has not any offer of a producing firm of pumps for this case of application.

2.2 On the basis of the experiences of the DPRK-side with this system of mediums both side come to an agreement to the follow technological solution.

-Series connection of a adsorption plant for the removal of vapors of n-hexane from the exhausted air and a mechanical vacuum pump with oil lubrication according to the sketch, drawing number 0164.00-00.3 (3).

- Active coal in the adsorbers. The desorption will be made by steam and following drying with compressed air. Both mediums will taken from the plant of the GDR-side.

-The exhausted air that gets to the mechanical vacuum pump is free of n-hexane.

2.3 The DPRK-side has got some experiences of the adsorption of n-hexane by active coal under vacuum.

2.4 The adsorption plant with a base surface of $1x2m^2$ will installated in the equipment hall at the south wall.

2.5 The complete adsorption plant is not in the deliveries and services of the GDR-side.

2.6 Both sides agree follow connection points for the adsorption plant :

-vacuum pipe at the pipe connection of the vessel 1v6.

-vacuum pipe at the recoil valve of the vacuum pump 1p1

-compressed air pipe at the pipe connection in front of the dryer 1T1

-steam pipe at the pipe connection in front of the rectification 2K1

The reduce of the pressure of compressed air and steam to the valves that are necessary will be made by the DPRK-side.

2.7 The GDR-side will deliver the connecting vacuum pipe between the vessel 1V6 and the vacuum pump 1P1 and the valves between the vacuum pipe and

and the adsorption plant according to sketch, drrawing number (total 16 valves).

2.8 The GDR-side will deliver a mechanical vacuum pump with the possibility of continious charging of fresh oil.
Analogous with appendix 2, point 5.2 the GDR-side will give follow proof of guarantee during the performance operation:
- vacuum and exhausted quantity that are necessary with air without any other products.
- continious charping of fresh oil during air operation with air without any other products.

3. Cold generation

3.1 The DPRK-side verifies the part cold generation of the technological scheme, drawing number 0134.01-02.1(0).

3.2 According to the actual situation an air-cooled compressor will be delivered.

4. Vacuum rectification

4.1 The DPRK-side verifies the part discharged vacuum rectification of the technclogical scheme, drawing number 0134.01-02.1(0) under the remarks according to the points 4.2 to 4.7.

4.2 The DPRK-side did not set the exact compound of the fracticnating natural essential oils and of the producing fractions. So the GDR-side has designed the rectification plant as a vacuum rectification of essential oils processed in the GDR.

4.3 Both sides come to an agreement to a packing high of the column =4m.

4.4 The DPRK-side demands a direct charging of steam into the bottom of the column for the cleaning of the plant when the products will be charged.
The GDR-side will consider this demand of the DPRK-side. The exact technical solution will be decided by the GDR-side in agreement with specialists of the GDR.

4.5 The measurements P1 (local) are not applicable at the vessels 2V1.1 and 2V1.2.

4.6 Each of the vessels 2V1.1 and 2V1.2 get a measurement PI with a technical

realization according to appendix 2 , point 1.9.

4.7 The DPRK-side demands the installation of a sight glasses under the cooler 2H1. The GDR-side will investigate the reallizability.

5. Vacuum generation 2 for the vacuum rectification

5.1 According to appendix 2, point 4.2, it isn't known exactly, which mediums can get into the vacuum pump 2P1. Therefore the GDR-side can't select exactly this vacuum pump.

5.2 Both sides come to an agreement to use a mechanical vacuum pump with oil lubrication and the possibility of continious charging of fresh oil.
The GDR-side will give follow proof of guarantee during the performance operation:
-vacuum and exhausted quantity that are necessary with air without any other product.
-continious charging of fresh oil during an operation with air without any other product.

6. Steam generation

6.1 The DPRK-side verifies the part steam generation of the technological scheme, drawing number 0134.02-02.2(0) under the remarks according to the points 6.2 and 6.3.

6.2 The condensal return into the steam generator 2N1 and so the cooler 2H2 are not applicable.

6.3 The use of steam generator 2N1 depends on the quality of the charging drinking water. The GDR-side will investigate the use of the steam generator 2N1 after the handling of analysis of drinking water to the GDR-side by the DPRK-side.

7. Control air generation

7.1 The DPRK-side verifies the part control air generation of the technological schame , drawing number 0134.02-02.(0) under the remarks according to the points 7.2 and 7.3.

7.2 The compressed air for regeneration of the adsorbers (see appendix 2, point 2.2 and 2.6) will taken in front of the dryer 2T1.

7.3 The compressor 2P2 with without oil. Therefor the oil separator 2F2 is not applicable.

Appendix 3: Machines and equipment/pipes

1. The products will filled in standing bands:

height	0.0 mm
diameter of the band	600 mm
diameter of the opening	57 mm

2. The experimental plants vacuum evaporation and vacuum specification particularly be made from stainless steel. There are a lot of difficulties in the way to provide argon which is necessary for welding of the stainless steel. Relays of the schedule can not be excempted. The GDR-side is willing to deliver the called experimental plants in compact units largely mounted and welded in the GDR. The GDR-side has so a higher expenditure of coals, which are not calculated in the offer.

3. In opposite to the original terms the DPRK-side changes the temperatures of the warm water for heating of the evaporator 1E1. With that the DPRK-side can use the vacuum evaporator in a broader field of purposes.

   The GDR-side accepts this change of the terms.
   Both sides agree that in connection with appendix 2, point 1, 8 the GDR-side only guarantees for the mechanical function but not for the performance of the evaporator.
   Both sides decide the following way of the agreement of the design documents of the evaporator 1E1 that will be designed and contracted by the GDR-side on the basis of the DPRK-side:

   - investigation of the realizability of the demands of the DPRK-side according to the sketch, drawing number 0134.00 - 00.4 (4). Both sides agree at the contract negotiation.
   - final agreement and confirmation of the design drawing of the evaporator 1V1 after the contract sign but before the beginning of the construction of the equipment. Unitl this time insignificant change proposals of the technical design by the DPRK-side are possible.

4. The list of connecting points handed by the GDR-side over the DPRK-side is the basis of the further activities of the both sides. The next agreement to this will be at the contract negotiation. The final decision will be after the sign of the contract.

5. The GDR-side will hand a draft of a detailed installation plan over to the DPRK-side at the contract negotiation. During this meeting the exact localization of the adsorption plant of the DPRK-side in the equipment hall will be made.

6. The data of drinking/cooling water handed over by the DPRK-side to the GDR-side are the basis for the design and projecting of the plant.

   The DPRK-side will hand the obligate analysis data of warm water over the GDR-side at the contract negotiation.

7. The DPRK-side declares the reliability of cooling water supply is 100%.

8. Viscosities of the products:

   - CP3 : the viscosity of the mixture wax/hexan is not much higher than the viscosity of water at 20°C.
   - CP4-6 : the viscosity of the products is similar to the viscosity of water at 20°C.

9. The DPRK-side uses a bowl of 300mm high gor the reception of the refuse of the rectification column 2C1.

10. The put out of the refuse from the rectification column 2C1 (see CP9) is vertical by a valve DN80.

11. At the contract negotiation the DPRK-side calls the stream flow at the CP12 that the GDR-side has to deliver.

12. There is not a danger of earthquake in Pyongyang.

13. Main wind direction: NW in winter
SE in summer

14. Maximum velocity of wind: 15m/s in summer
5_7m/s in winter

15. Air temperature and relative humidity

Tmax=32'C in summer
R.humidity =90% according to 32'C
Tmin= -17'C in winter

Appendix 4: Electrical equipment/measurement and control

1:The DPRK-side verifies the conception of the electrical equipment of the GDR-side with the remarks according to the points 1 to 11. and 14.

2. The connecting point of the electrical energy is in the electri - cal cell of the GDR-side.

3. The DPRK-side has to put the following wire to electrical connecting point :

- 3phase
- 1 neutral wire
- 1 protective wire

4. The voltage between 2 phages must be 380v.
The voltage between the neutral wire and each of the phages must be 220v.

5. The DPRK-side has to earth the star point of the transfor- -mator.

6. The DPRK-side has to reset the transfomator of the power station in star connection.

7. The DPRK-side has to design the earth connection.
The DPRK-side has to put the constructivave foundation earth to the electrical cell of the GDR-side.

8. The DPRK-side calls a maximal voltage range of +10% and -15% at the electrical connecting point.

9. The GDR-side has to guarantee that the electrical plant will be switched off at excess voltage or undervoltage.

10. THe switch on of the electrical plant must only be by hand.

11. The normal lighting of the equipment hall and the machine room including the electrical cell will be delivered by the DPRK-side. Especially technological lighting will be delivered by the GDR-side.

12. TheDPRK-side verifies the measurement and control conception of the GDR-side with the remarks according to point 13.

13. The DPRK-side wants to get preverious ball valve as control valve.

14. The data for electrical equipment of the DPRK-side is the basis for the contact talks, the following projecting by the GDR-side and the activities by the DPRK-side.

Appendix 5: Realization

1. The DPRK-side judges, that all construction services will be finished approximately 3 months after receiving of the building terms for construction planning and execution by the GDR-side, which will be given to the DPRK-side 3 months after the sign of the contract.

2. The installation of the compact units vacuum evaporation and vacuum rectification will be made by pulley blocks hanging at mounting girders. Pulley blocks and mounting girders will be delivered by the DPRK-side. The GDR-side will call the position and site of the mounting girders and the maximal weight.

Data for electrical equipment:

max. voltage : 230 V

max. voltage : 200V ... 210V

min. voltage : 180V

resistance to earth: lower 5 Ohm

breaks: about 10 ms., 3... 4 times/week

max. frequency : 60Hz

norm. frequency: 58 - 59Hz

min. frequency : 55Hz

max. current : 220A

Annex 4

Preliminary specification according to the project document, annex III, equipment list, category 1, for the position 7, 8 and 9 laboratory glass, laboratory-materiels and consumer-inputs

to point 7:

Laboratory glas devises

beakers	different sizes (20 ml to 1 l)
Erlenmeyer	different sizes
1-nose, 2-nose, 3-nose round flasks	
boiling capillaries	
reducers	
reflux condenser	
titrate flasks	
pipettes	different sizes
graduated cylinders/ measuring glass	10 ml to 000 ml
funnels	
plugs	
gravity glasses	
beaker covers	
test tubes	
glass rods	
porcelain crucibles	
frits	
suction flasks	
volumetric flasks	
exceeders	
burettes incl. micro burettes	
pycrometer	different sizes
Cleveneer apparate	

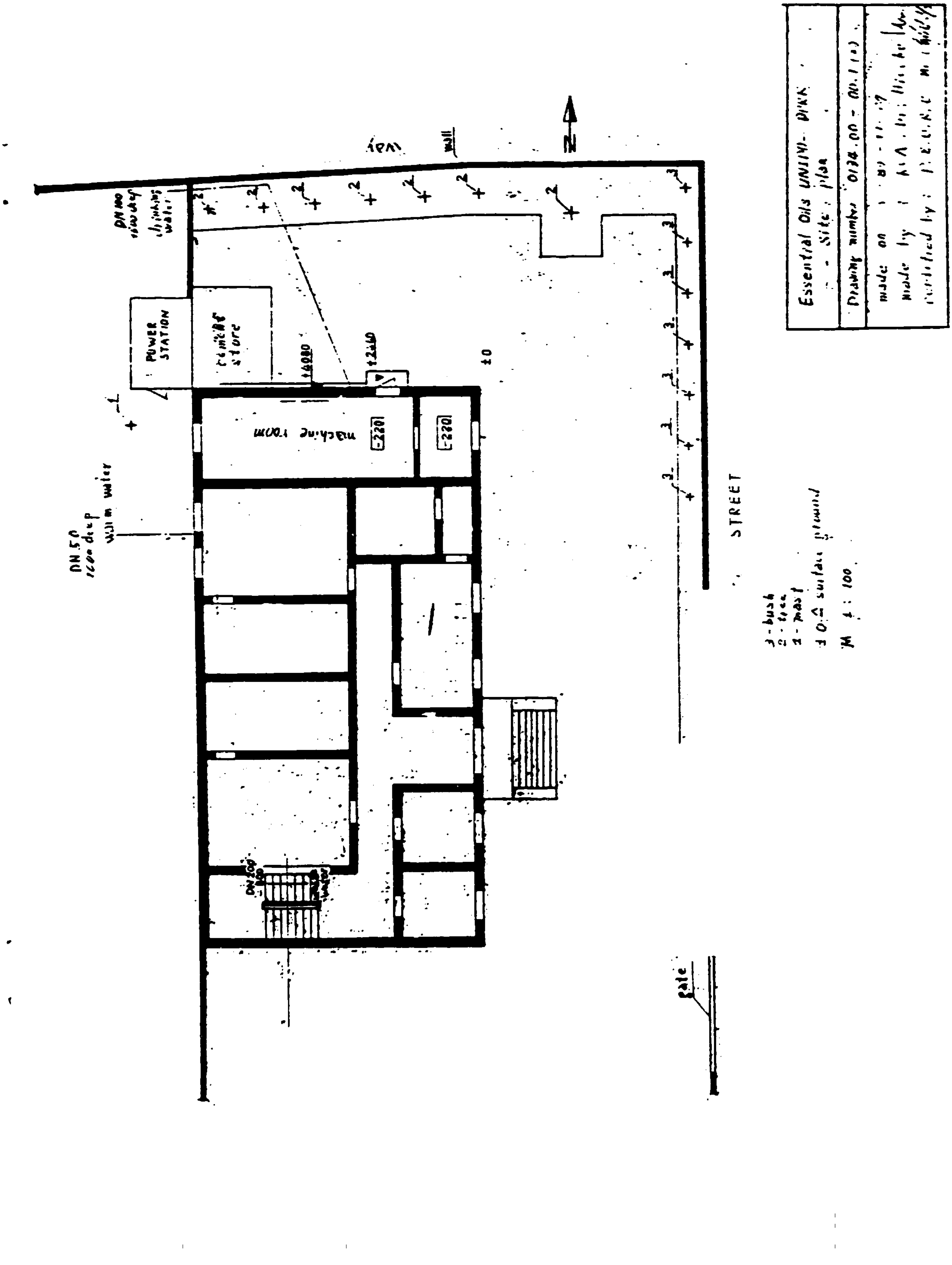
to point 8

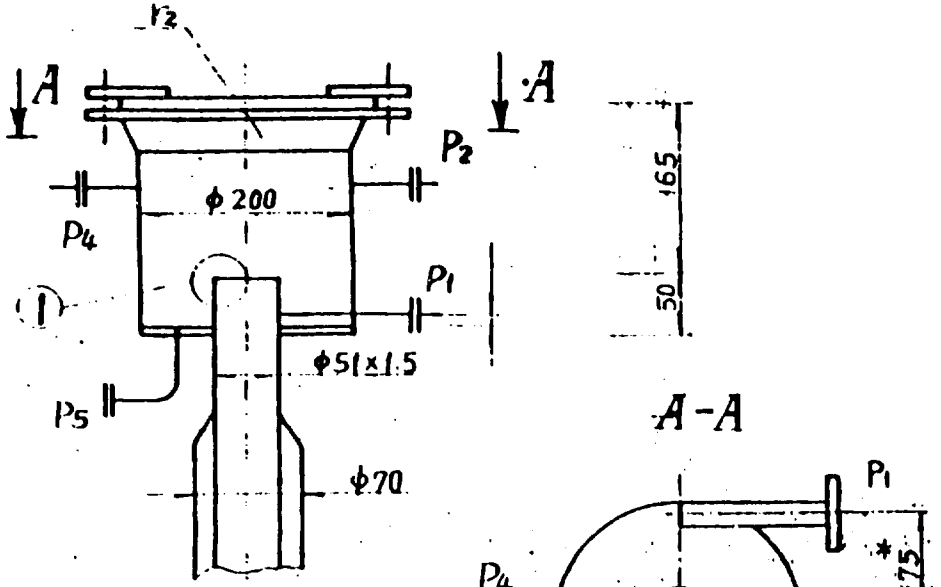
hexane	acetic anhydride
benzene	sodium acetate
ether	hydroxyl amine chlor hydrate
ethanol	bromthymol blue
silica gel for chromatography	
alumina for chromatography	
original titer substance for n/2 KOA, H2SO4	

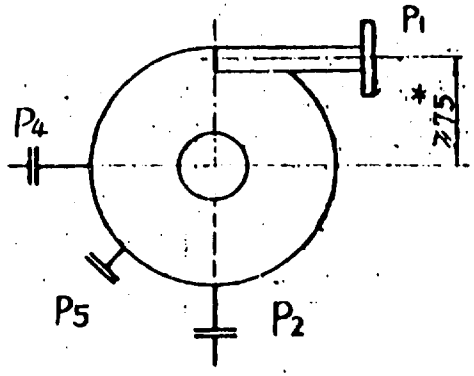
Advice on the supplier of chromatographic reference material: Bergakademie Freiberg / GDR.

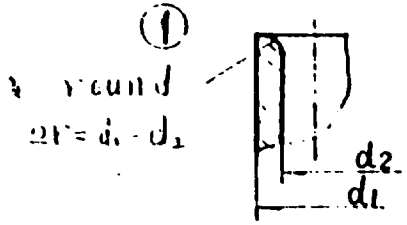
to point 9 other proposals

subsidence balance (acc. to Mohr or Westphal)	
heating bathes	
spatula	
thermometer	
hose of cooler	


Essential Oils
Site : plan
Drawing number
STREET
POWER STATION
machine room
-220
-220
wall
N
gate
3 - bush
2 - tree
1 - mast
M 1 : 100



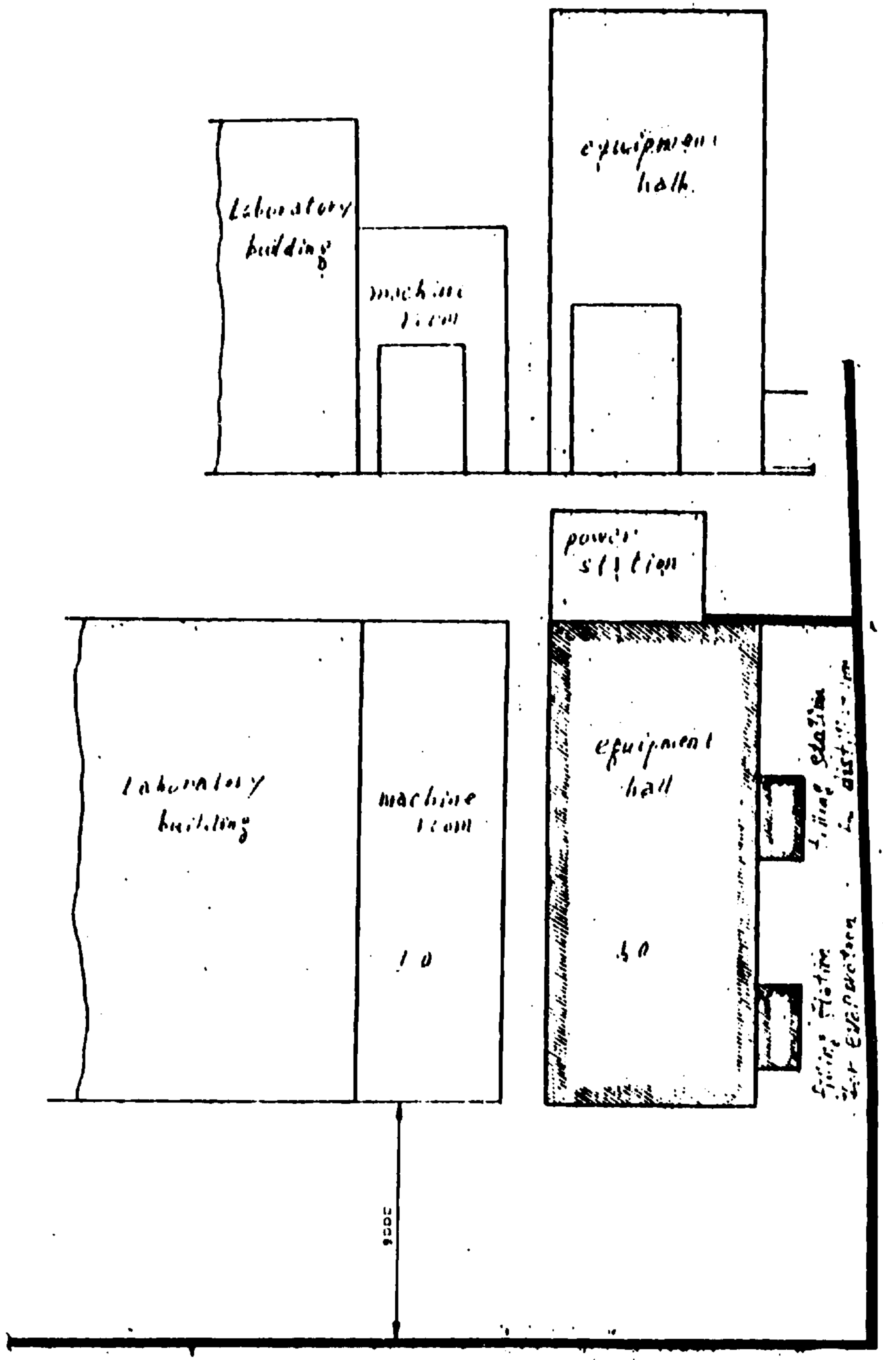




P1 - Product inlet . DN 10
P2 - Vapor outlet . DN 50
P4 - reserv . DN 20
P5 - rest outlet . DN 10
r2 - sight glass

* as near as possible to the wall

Essential oils UNIDO - DPRK
Design sketch Top of the vacuum evaporator IEI
Drawing number 0134.00 - 00.4 (.1) made on : 89 - 11 - 30 made by : Mr Langner certified : Mr. Choi



± 0 ≙ surface ground
M 1:100

Essential Oils UNIDO DPRK
Installation plan (outline)
of the total plant

Drawing number 0134.00 - 00.2 (3).

made on : 83 . 11 . 29
made by : KCA , Dr. Hucke
Certified by : P.E.O.R.C. Mr. Choe