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

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

INDUSTRIAL OPERATION DIVISION

STUDY

on the improvement of [illegible] programme in the USSR for training engineering personnel from developing countries in the field of iron and steel industry

This study has been prepared by the Soviet specialists Dr.V.V. [illegible]ovsky [illegible] Dr.[illegible]

[illegible] 1[illegible]

ABSTRACT

The report of the IV General conference of UNIDO (Vienna 1982) stressed repeatedly that training of personnel is an important link in creating the iron and steel industry in developing countries.

Training of personnel for the iron and steel industry occupies a prominent place in the UNIDO activities. One of the main trends in this activity is the organization and carrying out of group personnel training programmes in the USSR.

The main aim of this paper is to make a study for the improvement of UNIDO courses programmes in the USSR for training engineering personnel from developing countries in the field of ferrous metallurgy.

Examination of materials and documents of the UNIDO courses in Vienna and Zaporozhye showed that the programme on the whole embraces properly the main trends of the iron and steel industry and production activity of metallurgical engineers. However, to eliminate drawbacks that have been exposed during the examination a number of alterations have been made in the system of studies, structure of training term and forms of training. A draft programme has been also prepared for training specialists and a metallurgists'group from developing countries.

More than 50 different UNIDO documents and a number of Soviet published materials concerning personnel training problems have been used in writing down this report. More than 10 meetings to discuss this problem have been organized and held by the authors of this report in Vienna, Moscow and Zaporozhye.

This report has been prepared in accordance with the UNIDO Secretariate assignment by the Soviet specialists Dr.V.V.Serozovsky, and Dr. I.I. Yrianin.

Contents

Page

1. Introduction

The creation of the United Nations Industrial development Organization(UNIDO) according to UNO General Assembly decision and the reorganization of UNIDO in 1985 into a specialized agency-shows that this organization has been given the central role in coordinating the activities of the UNO system in the field of industrial development.

Training of industrial personnel occupies an important place in the activity of UNIDO and one of the main trends in this activity is planning and conducting group personnel training programmes.

An active part in carrying out industrial group personnel training programmes within the framework of UNIDO is played by the USSR who well surpasses other countries in the scale of training work it does.

A characteristic feature of UNIDO programmes for group personnel training in the USSR is that they are carried out on a continuous basis (annually). Some of the programmes are carried out twice a year, i.e. in two batches. One of the most important programmes is the UNIDO international seminar - practical work on the iron and steel industry.

During the first group programme which has been carried out in 1965 in the Soviet Union 25 metallurgical engineers from developing countries have been trained, The programme is conducted in two batches (spring and autumn). The number of participants is 20 persons. The head organization is the Ministry for iron and steel of the Ukrainian Soviet Socialist Republic at present time. The base for conducting the programmes is the Zaporozhstal iron and steel works in Zaporozhje. The programme is carried out on a continuous basis. Till now about 800 specialists from 50 develo-

ping countries have been trained. Working language-English so far.

The aim of the seminar is to give developing countries assistance in training national specialists able to control the metallurgical industry. The training programme includes refresher courses for participants, study of progressive experience of Soviet metallurgists in effective utilization of metallurgical equipment, modern industrial organization and improvement of the products' quality.

Besides Zaporozhstal works training is carried out at other industrial facilities: Krivorozhstal iron and steel works, Krivorozhsky Central mining equipment repair plant, North mining-dressing works and other works.

A distinctive feature of the seminar is that it can be conducted in 9 specialities depending on the profession of participants:

-sinter production;
- blast furnace process;
- metallurgical furnaces repair;
- steelmaking;
- rolling process;
- foundry process;
- metallurgical processes mechanical equipment;
- instrumentation and automation;
- electric equipment.

The number of specialities is gradually increasing which improves the seminar's flexibility in achieving its objectives. However, this involves principal organizational problems which have to be solved.

The iron and steel seminar is being carried out at a good technical level, however, a number of participants and UNIDO officials called for an improvement and updating of the courses' prog-

ramme. For this perpose the present study is being conducted to improve the programme of the UNIDO courses in the USSR for training developing countries' engineering personnel in the field of the iron and steel industry.

2. Main trends in the development of the iron and steel industry

In the world practice the ferrous metals remain as before the main structural materials contributing to the development of the machine building, power, oil, automobile and other industries.

The most important current and for the visible future, task set before science and engineering is to provide varicus industries with high quality metal.

In industrially developed countries the tendency for constructing and building high unit capacity and highly productive metallurgical units is still continuing.

Boosting the efficiency of the iron and steel industry remains as before one of the main tasks to be solved in many countries. This can be achieved by increasing the dimensions of metallurgical units together with the industrial concentration and specialization, intensification of the production process with the use of resources-saving technologies, automation, mechanization and wide use of modern electronic computing facilities.

In the production of iron the main tendencies are intensification of the blast furnace process aimed at boosting blast furnaces output, reduction in coke consumption, maximum utilization of furnace useful volume, improving hot metal quality and the lowering of sulphur and phosphorus contents.

The efforts of blast furnace specialists are concentrated first of all on the improvement of burden quality, increase of blast temperature to 1350-1400°C, blast enrichment with oxygen up to 35-40%, injection of natural gas and pulverised coal with the blast increase of top pressure up to 3 atm. and others.

In the world practice the coke free metallurgy has been de-

veloping in recent years, in particular, the direct iron reduction process.

The process of direct reduction of iron from ore in the solid state at 700-1000°C is a principlly new and innovative technology.

Steelmaking is carried out currently in open-hearth, basic oxygen and electric furnaces. The most innovative and economical method is the basic oxygen steelmaking method which is widely used in all developed countries.

Basic oxygen furnaces made it possible to boost the steelmelting process and in view of this the open-hearth furnaces became less efficient and lately no such furnaces are build.

More than half of the world's steel is currently being melted in basic oxygen furnaces, while in such countries as Japan, France, the FRG, Italy and England the open-hearth process is completely discarded. Japan, the FRG and France increased the ratio of basic oxygen steelmaking up to 80 % of total steel production.

The main trends in the development of the basic oxygen process are the increase in converters capacity, boosting metal blowing rate and shortening melting time.

Most of converters being installed in recent years have a nominal capacity of 300-350 t and a high output.

Shortening the metal blowing time is an important trend in boosting the output of basic oxygen furnaces. Numerous studies and accumulated experience in various countries show the real possibility of increasing the unit metal blowing rate from 3-3.5 Nm^3/min.t. up to 5-7 Nm^3/min.t. This makes it possible to shorten the blowing time from 16-18 min. down to 10-11 min., and the whole heat time down to 25-30 min.

An innovative method has been developed and is being used for the flame gunning of converter lining to increase their service

life. In recent years the converter processes with bottom and combined oxygen blowing are developing in a number of countries.

The electric furnace steelmaking with the use of 100-t, 200-t and higher capacity furnaces is rapidly developing for the production of high quality and extrahigh alloy steels. Electric furnaces for the vacuum-arc remelting, electron-beam melting, etc., are in wide use.

Secondary steelrefining processes are widely used worldwise for improving the quality of steel. The use of such processes enabled to solve such problems in the steelmaking process as he hydrogen removal, elimination of flakes formation, improving steel inclusions and gas cleanness and homogeneity, deep decarburization and desulphurization of metal and homogenization of composition and temperature of molten metal in the ladle.

Secondary steelrefining includes three main groups: vacuum treatment, ladle treatment of metal with inert gases (powders) and treatment with synthetic slags. Various combinations of secondary steel refining processes are used in the world practice.

The most innovative and resources-saving technology in the iron and steel industry is the continuous steel casting process which enables not only to greatly improve metal quality and yield, but to combine the casting and rolling processes. All newly built steelmelting shops in the USSR, Japan, USA, the FRG and other countries are therefore equipped with continuous casters. It should be mentioned that the ratio of continuous cast steel in Japan is more than 85 % and in the FRG is more than 70 %.

In the USSR continuous casters are operating successfully at a number of iron and steel works, including Novolipetsk iron and steel works where all the steel is cast in such casters.

One of the future trends in the further improvement of the

continuous casting technology is the combination of this process with rolling and achieving perfect designs of casting and rolling facilities.

Combining continuous casting with rolling in one process allows to reduce heat losses due to repeated heating and cooling and to reduce costs of building and operating heating furnaces.

This combined process allows to abolish facilities for the disposal, handling and storing of cast metal and also to considerably decrease shop areas used for such purposes.

Combined casting and rolling facilities operating in USA, Austria, the FRG, Japan and the USSR allows to produce both billets and finished rolled products.

They are characterized by a large variety of equipment configuration layouts and the size range of produced billets.

A combined facility for the production of 5-12 mm dia. wire rod is successfully operating in the USSR at Electrostal electric steelmaking plant.

The facility comprises a single-strand radial continuous caster, a planetary mill with double-side reduction and a continuous mill for wire rod rolling.

In the FRG a casting-rolling facility has been developed for the production of steel rod at sufficiently high casting speeds that match rolling speeds.

In the USA Southwire company, Caroltown, has developed another method for steel casting in rotary casters.

At Daison Seiko and Tokuyama industries plants direct rolling of continuous cast billets is carried out in facilities supplied by Hitachi company.

There is no doubt that the above mentioned combined casting and rolling process has a great future.

The development of the rolling process is characterized by higher rolling speeds and mill production rate, high automation level and the use of electronic computing facilities.

The rolling rate depends largly on the length and mass of initial billet. Therefore, together with the use of high rolling speeds it is usual in the world practice to find methods for rolling heavier ingots, slabs and coils.

Rolling with high-reduction ratios is rapidly developing in recent years.

The operation of high-reduction rolling mills is based on the principle of cyclic metal working. According to this principle the billet moves forward during each individual cycle for an equal amount (feed) and is subjected repeatedly to specific or individual reduction in each of its cross sections.

The high-reduction rolling is carried out in pendulum swing-forging, planetary cross roll, helical rolling and universal planetary mills.

One of the promising trends in rolling is endless rolling.

In endless rolling the rolling of separate billets is replaced by a continuous billet butt welded from separate billets.

Endless rolling practically eliminates all troubles associated with roll biting of strip front end: dynamic impact in the working stand line, damage of working roll drive parts, strips jamming, etc.

In endless rolling there are no pauses between separate strips and rolling conditions are stable.

In the USSR the endless rolling process is used in 250 mm small-section mill at Zapadno-Sibirsk iron and steel plant and in 250 mm mill at Makeyevka iron and steel plant.

Double rolling which is used for the production of shapes

and strips is achieving world-wide use.

Company of Steel, Canada, for example, has developed a double rolling schedule for small round sections followed by slitting of worked part. This method is very suitable for producing reinforced bars.

Rolling in prestressed mill stands which greatly increases the accuracy of rolled bar geometrical dimensions is spreading widely.

Continuous and semicontinuous wide-strip mills the development of which is characterized by the production rate growth, widening the range of products and improvement of their quality is developing further.

The innovative endless rolling method is used in continuous cold-sheet rolling mills.

New methods of metal heat treatment are developing rapidly. Interrupted quenching or quenching with self tempering directly in mill lines is widely used for improving mechanical properties of rolled products.

Accelerated cooling of reinforced sections is widely used for achieving high mechanical properties through the whole cross section of rolled products, higher plasticity, corrosion resistance and fatigue strength.

In the production of hot rolled sheets controlled rolling is used. This process is based on the structural transformations behaviour of steels during hot deformation, where high set of properties of sheets is obtained without subsequent heat treatment.

Today the controlled rolling process is an important trend in developing the technology of sheet production for gas pipelines.

In our opinion the UNIDO seminar-practical work programme for

metallurgists from developing countries should be made taking into consideration the main trends of the iron and steel industry development.

3. Tasks set before UNIDO courses for improving the skills of specialists from developing countries in the field of iron and steel industry

Economic growth and the drastec economic and social changes brought about by scientific and technical progress have been and continue to be the cause of an enormous problem of adaptation for developing countries. Against this background a concrete formulation of industrialization objectives was articulated in the Lima Declaration and Plan of Action which emerged from the Second General Conference of UNIDO in 1975. The Lima Plan called for, inter alia, national and international efforts to achieve a target figure of at least 25% of the world industrial output by developing countries by the year 2000.

A number of resolutions in the United Nations General Assembly and Industrial Development Board, and the Lima Declaration and Plan of Action have been concerned with the expansion of activities for training personnel for industrialization. The New Delhi Declaration and Plan of Action adopted in January 1980 provided high priority to the development of human resources. It made a number of mutually supporting recommendations for action by the developing and developed countries as well as UNIDO. The quest for a new technological order forms a part of this development effort.

For the developing countries, a new technological order would imply the promotion of technology as a development variable. A variable in the sense that there are alternatives and options; a variable in the sense that it should be an objective entailing the acquisition of skills of competence and know-how that will

guarantee a certain degree of independence and enable self-determined needs to be met.

The shortage of skilled work force in many developing countries is the main obstacle to the development of industry. This, most propably, determines the low rate growth of normative scenarios made by UNIDO for 1990. The first scenario provides for the creation in 33 countries of 75 projects with a capacity of 63.5 million tons, and the second scenario-138 projects with a capacity of 117 million tons in 65 countries. About 32 countries, for which the iron and steel making was a new industry, are trying to build miniplants with a total capacity of 4 million tons, which is only a very small share of the world's steelmaking production (900 million tons in 1990). The report of the IY UNIDO General conference in 1982 stressed repeatedly that personnel training is an important and crucial factor in creating an iron and steel industry in developing countries.

This situation sets new tasks before the UNIDO courses in Zaporozhye, USSR, for training metallurgists from developing countries, namely:

1. To systematically study the state, prospects and problems of the development of the iron and steel industry in developing countries, their need to train personnel of a certain level and specialization and to take all these factors into account while drafting the programme and selecting participants in the seminar.

2. To intensify and improve the quality of training by means of an optimum selection of participants for group training and by cutting the number of specialities to be taught simultaneously as well as by a wide use of technical means and active methods of teaching.

3. To improve the selection and training of the courses'

teaching staff and interpreters and to better the ties between the courses and the organizations and branches of the iron and steel industry and related industries.

4. To provide training in order to raise the qualification not only of practical engineers but also of the managerial staff and organizers of the metallurgical production as well as the system of training personnel at different levels.

5. More wider invitation of specialists from universities, higher eductional instiurions and research institutes to teach at the courses.

6. Systematic updating of the training programme with the help of up-to-date materials and technical means.

7. Use of visual aids.

8. Introduction of new courses in robotics, heat treatment, products quality control with the use of modern instruments .

9. Conducting discussions and business games.

10. Exchange of industrial experience between participants of courses.

Fulfilment of these tasks will help considerably improve the quality of training.

It appears expedient to introduce narrower specialization in groups by reducing the member of specialities in order to cut the member of subgroups to the minimum. This will reduce the cost of the programme as it will make possible both to cut the number of interpreters and to optimize the selection of participants as to their member in each speciality and their professional level.

4. Analysis of the existing UNIDO courses programmes in the USSR for training personnel from developing countries in the field of iron and steel making and proposals for their updating

Analysis of the programmes for those who studied in Groups 29 and 30 in 1985 and for those who will study in Groups 31 and 33 in 1986 enables one to draw the conclusion that for the most part the programmes cover correctly the basic trends in the iron-and-steel industry and in the activities of engineers and specialists of middle managerial level at iron-and-steel works. Review lectures on various aspects of ferrous metallurgy are given to participants to the seminar, groupwise training is conducted and practical work is done at industrial enterprises. Visits (practical studies) are organized to advanced Soviet iron-and-steel works.

Analysis of the actually completed curriculum for Group 30 which studied from September 2 to November 25, 1985 and the curriculum for Group 32 which will study from February 17 to May 16, 1986 in the city of Zaporozhye is shown in Table 1.

Table 1

	Group 30 Septem.2-Novem. 25, 1985		Group 31 Febr.17-May 16, 1986	
	Number of classroom and shop hours	%	Number of classroom and shop hours	%
1	2	3	4	5
1. Review lectures for the whole group	32	8	87	19,3
2. Lectures on specialities (for subgroups)	75	17		

1	2	3	4	5
3. Practical work at the shops of the Zaporozhstal iron-and-steel works	72	16	93	21
4. Practical studies at Soviet advanced iron-and-steel works	165	37	165	37
5. Visits	23	4.6	24	5,3
6. Russian language classes	30	6,2	28	6
7. Consultations	15	3,5		
8. Preparation of technical papers	15	3,5	30	6,2
9. Defence of technical papers	8	1.7	8	1.7
10. Opening and closing ceremony	15	3,5	15	3,5
	Total: 450	100	450	100

In our view, the existing curriculum has a number of shortcomings and requires some modification.

The Timetable of Studies

According to the practice established at the seminar in the city of Zaporozhye, for example, for Group 30 the classes lasted from 8.45 to 13.45 with a dinner-break from 14.00 to 15.00 and continued from 15.00 to 16.45. With a 10 minute break after each teaching period (1 teaching period lasts 45 minutes), the total number of classroom hours was 7.5 teaching periods a day.

Group 31 will study from February 17 to May 16, 1986. Classes will begin at 8.30 and end at 16.30 with a dinner-break from 13.30 to 14.30.

In our view, it is necessary to establish the uniform timetable of classroom hours and reduce them to 7 teaching periods a

day. The following timetable of classroom hours appears to be highly rational:

9.00 - 9.45	1st teaching period
9.55 - 10.40	2nd teaching period
10.50 - 11.35	3d teaching period
11.45 - 12.20	4th teaching period
12.40 - 13.25	5th teaching period
13.30 - 15.00	Dinner-break
15.00--15.45	6th teaching period
15.55 - 16.40	7th teaching period

This timetable of classroom hours will relieve the trainees burden and will help improve and concentrate their attention on the subjects taught.

Estimate of the Timetable of Studies

The timetable of studies for a group having 7 teaching periods a day in the course of a 5 day-week for 3 months, will be

7 x 5 x 4 x 3 = 420 teaching periods

The total timetable includes opening and closing ceremony = 434 teaching periods.

The Timetable of Classroom and Shop Hours, and the Types of Instruction

As is evident from Table 1, the types of instruction are as follows:

1. Review lectures to be given to the whole group

2. Lectures on specific specialities to be given to sub-groups (blast furnace workers, steel makers, etc).

3. Practical work at the shops of metallurgical enterprises

4. Practical studies at Soviet advanced iron-and-steel works in Lipetsk, Krivoy Rog, Zhdanov, etc.

5. Visits

6. Russian language classes (Optional)

7. Preparation of technical papers

8. Defense of technical papers

9. Onening and clasing ceremony

It follows from the curricula for Groups 30 and 31 that the number of classroom and shop hours for instruction(types 4-9) remains practically the same. Types 1-3 have substantial distinctions.

For example, 32 hours were allocated for review lectures in Group 30, whereas 87 hours, i.e. 2.5 times more, are allocated for review lectures in Group 31.

The number of classes and shop hours in subgroups and practical work at metallurgical enterprises for Group 30 was 149 hours, and only 93 hours for Group 31.

Taking into account the experience acquired in the isinstruction of metallurgists from the developing countries at various refresher courses, including UNIDO seminars (courses on electrowelding, in Kiev) the following timetable of classroom and shop hours and types of instruction appear to be highly rational:

Review lectures on the basic trends in ferrous metallurgy to be given to the whole group	80 hours 19 %
Lectures (talks and calculations) to be given to subgroups, individually for blast furnace workers, steel-makers, etc	40 hours 9 %
Practical work at the shops of the Zaporozhstal iron-and-steel works	50 hours 12 %
Practical studies at Soviet advanced iron-and-steel works	150 hours 35 %
Active methods of instruction (business games, discussions, critical interpretations of specific production	

situations, seminars)	22 hours	5%
Optional learning of the Russian language	30 hours	7%
Visits	18 hours	4%
Preparation and defence of technical papers	28 hours	6%
Opening and closing ceremony in the group	14 hours	3%
Total	432 hours	100%

This timetable of classroom and shop hours appears to be reasonable due to the following facts, there are some subjects which present interest and are essential for all specialists in ferrous metallurgy (blast furnace workers, steelmakers, rolling-mill workers, etc). Such review lectures cover the present state and perspectives in the development of blast-furnace practice, steelmaking and rolling-mill practice, powder metallurgy, environmental protection, automation and mechanization of metallurgical enterprises, etc.

Such lectures (50 hours) should be given to the whole group.

The other part of instruction should be conducted for specialists in subgroups where specific material is studied which is essential for a given specialization. The material is presented in the form of lectures, talks or individual calculations made by the trainees (for example, calculation of burdens, roll pass designs, reduction pass designs, etc). The scope of such type of instruction should not be too large and should include 8 or 9 subjects or amount to 40 to 50 hours. Each subject should be strictly defined and stated in the curriculum.

One of the most effective means for improving skills of specialists who have some industrial experience is practical studies at the best or advanced enterprises where trainees become familiar with modern equipment and advanced technology, methods and processes

for carrying out production processes in a rational and efficient manner. Therefore, preference should be given to prfctical studies at metallurgical enterprises and this form of instruction should cover approximately one third of the whole teaching period or 150 hours.

To retain particular skills acquired in the course of instruction in subgroups, each trainee should do practical work directly at the shops of metallurgical enterprises. The number of shop hours should approximately correspond to the classroom hours in subgroups.

In our case, 40 classroom hours in subgroups should be complemented by 50 shop hours.

Active methods of instruction, which have been employed for a long time in many developed countries, appear to be an advanced form for acquiring and especially retaining skills by trainees at refresher courses.

Experience shows that acquisition of skills by active methods of instruction makes it possible to retain 90% of information obtained by trainees, whereas for the lecture methods reduces this percent is several times smaller.

There exists the following classification of active methods of instruction:

discussions (group discussions, "round table" discussions, "intelligence test", etc);

situation methods (incidents, analysis of specific situations);

imitation methods (business games, playing roles, dramatization of situations);

practical methods (probation periods, practical studies, development of specific projects).

Business games and analysis of specific production situations play a most significant role among the active methods of instruction. The latter may be regarded as an independent method of instruction and as a source or component of business games.

It is therefore suggested to increase the total share of active methods of instruction in a new curriculum in the form of business games at managerial level, discussions, seminars and critical interpretations of specific production situations to at least 20 hours.

Modern computer facilities are being used lately on an ever increasing scale in the iron-and-steel industry. At present practically the whole of modern equipment and technological processes are being introduced with the elements of computer facilities. It is therefore suggested in a new curriculum to give not only theoretical knowledge of the fundamentals of coumputer facilities applications, but also practically to teach trainees to learn how to use displays using FORTRAN and ASSEMBLER languages. To this end, the curriculum should include hours used by the trainee in a display class so as to teach him to obtain the required data and also to use computer facilities to solve the simplest optimization problems in accordance with his practical activity.

The existing curriculum does not make provision for some important subjects which should be taught to metallurgists, such as "Robotization and Robot Facilities", which is being used very extensively in the world at metallurgical enterprises of the USSR included.

Taking into account that nowadays in the epoch of scientific-technological revolution the metallurgist should work creatively, be able to improve something, suggest new ideas, and make proposals to upgrade the existing methods, the course " Methods of

Search for New Technical Ideals and Solutions" is being taught at many educational centres. It is suggested that such a course should be included in the curriculum of the seminar.

The problems of quality of the manufactured products have attracted great attention in the whole world over the last few years. The course "Quality Control of Manufactured Products" is being taught in most refresher centres in Japan, the USA, the FRG, the USSR and other countries. The trainees of this seminar acquire skills in the methods, means and processes aimed at improving quality of the manufactured products. It is suggested that the new curriculum should include the course "Quality Control of the Manufactured Products" and practical work which would help the trainees to personally evaluate the properties and quality of metallurgical products (hardness, rupture strength, the yield poin the macro- and microstructure of metal, the nature and amount of non-metallic inclusions, and the like). The new curriculum should also include a course on the problems of applying statistical techniques for quality control. These techniques are being used extensively at metallurgical enterprises in the USSR, Japan, the USA and other industrially developed countries.

In view of the analysis of the existing curriculum and the above-listed remarks, it is suggested that a new curriculum of the UNIDO seminar should be drafted for metallurgists from the developing countries. The new curriculum has been drafted for Group 33 which will study in the city of Zaporozhye from September 15 to December 13, 1986.

5. A Draft Training Programme of the International UNIDO Seminar for Group 33 for Metallurgical Engineers from the Developing Countries General

The main purpose of the seminar is to improve skills of specialists from the developing countries. The participants in the seminar have an opportunity to become more familiar with the theory and practice at metallurgical enterprises on the basis of the modern achievements of science and engineering and an advanced experience in the performance of Soviet metallurgical enterprises.

The 3-month curriculum agreed upon with the UNIDO is designed for group training of metallurgical engineers of the middle managerial level, who have at least 3-years' work experience at metallurgical enterprises.

Classes are conducted for the following specialities:

blast-furnace practice;

steelmaking;

rolling-mill practice;

foundry practice;

mechanical equipment of metallurgical shops.

The curriculum is based on the newest achievements in ferrous metallurgy and includes theoretical and practical studies, practical work and also practical studies at Soviet advanced metallurgical enterprises.

Basically, instruction of the participants in the seminar is given in the city os Zaporozhje, and practical studies are organized in Zhdanov, Lipetsk, Kiev, Krivoy Rog, Nikopol and Novomosskovsk.

The classes are held every day except Saturdays, Sundays and national holidays, 7 teaching periods a day (a teaching period lasts 45 minutes) with a 10-minute break after each teaching pe-

riod. Saturday and Sunday are days off.

The Timetable of Classroom Hours

1st teaching period	9.00 - 9.45
2nd teaching period	9.55 - 10.40
3d teaching period	10.50 - 11.35
4th teaching period	11.45 - 12.30
5th teaching period	12.40 - 13.25
Dinner-break	13.25 - 15.00
6th teaching period	15.00 - 15.45
7th teaching period	15.50 - 16.40

The timetable of Classroom and Shop Hours is as follows:

Theoretical studies	120 teaching periods	28 %
Practical studies at Soviet advanced metallurgical enterprises	150 teaching periods	35 %
Practical work at workshops	50 teaching periods	12 %
Business games, discussions, seminars	22 teaching periods	5 %
Russian language classes (Optional)	30 teaching periods	7 %
Visits	18 teaching periods	4 %
Preparation and defence of technical papers	28 teaching periods	6 %
Opening and closing ceremony	14 teaching periods	3 %
Total	432 teaching periods	100 %

In the course of instruction the participants in the seminar prepare technical papers on the subjects chosen personally.

After the completion of the course of studies, the trainees defend technical papers in the presence of the examining board.

Each trainee should, for about 30 minutes, tell the examiners the basic subject matter of his technical paper and be ready to answer all the questions asked by the members of the examining board within the scope of the lectures, theoretical and practical studies, and also practical work at shops.

After the completion of the curriculum, each participant in the seminar is recommended to prepare and hand in an account not more than 3 type written pages long to the course management. The account which is to be forwarded to the UNIDO should contain a brief evaluation of the curriculum from the point of its subject matter, timetable, methods of instruction, the degree of usefulness and the use of the trainee's skills in his practical activities, and also any other issues at the trainee's discretion.

English is the working language of the seminar: classes are conducted in Russian and subsequently translated into English.

Since the curriculum is designed for groupwise training, it is the trainees' duty to attend all types of studies. If the participant in the seminar fails to arrive in time to attend classes due to some excusable reasons, he should immediately inform the seminar management about it by phone.

The participants in the seminar are taken from the hotel to the place of studies and back and also for excursions by bus.

The participants in the seminar are taken by air or rail to the cities where practical studies are to be organized.

In compliance with the requirements of the Soviet legislation and UNIDO's recommendations, the participants in the seminar should maintain discipline at classes, practical studies in the shops or, in the hotel. They should avoid breaking public order, observe the Soviet laws and the rules of residence and travel of foreign citizens in the USSR.

September 8 - 15

Arrival of the participants in the seminar in the city of Zaporozhje, registration and accommodation in the hotel, and acclimatization.

The Timetable of Studies

Time	Subject	Lecturer's surname, post	Lecture-room No.
1	2	3	4
10.00-13.25	September 15, Monday Opening of the international UNIDO seminar on metallurgy		
13.25-15.00	Dinner-break		
15.00-17.00	A tour of the city of Zaporozhje		
	September 16, Tuesday		
9.00-10.40	Lecture, "Zaporozhstal" iron-and-steel works. History and perspectives of development		
10.50-13.25	An visit to the museum of history of the "Zaporozhstal" iron-and-steel works		
13.25-15.00	Dinner-break		
15.00-16.40	Lecture. Labour protection, safety measures and rules of moving about the iron-and-steel works		
	September 17, Wednesday		
9.00-13.25	Lecture. The Soviet iron-and-steel industry, its state, problems and development		
13.25-15.00	Dinner-break		
15.00-16.40	The Ressian language classes		
	September 18, Thursday		
9.00-13.25	Lecture, Blast-furnace practice, its state and basis		

1	2	3	4
	trends of development		
13.25-15.00	Dinner-break		
15.00-16,40	The Russian language classes		
	September 19, Friday		
9.00-13.25	Lecture. State and basic batrends in the development of steelmaking		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	September 22, Monday		
9.00-13.25	Lecture. Rolling-mill practice, its state and basic trends of development		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	September 23, Tuesday		
9.00-13.25	Group training 1.For-blast-furnace workers Subject No.1.Raw materials for iron-making.Preparation of raw materials for blast-furnace melting 2.For steelmakers Subject No.1.Open-hearth furnace steelmaking 3.For rolling-mill workers Subject No.1.Range of rolled products. Light-weight types of rolled products. 4.For foundry men Subject No.1.Equipment for foundry shops 5.For mechanics Subject Np.1.Structure and organization of repair facilities at metallurgical enterprises 6.For refractory makers Subject No.1. Equipment used for manufacturing refractory rproducts used in metallurgy		

1	2	3	4
13.25-15.00	Dinner-time		
15.00-16.40	The Russian language classes		
	September 24, Wednesday		
9.00-13.25	Practical work to be done in compliance with Subject No.1 given to subgroups on September 23 For blast-furnace workers: in the blast-furnace shop at the "Zaporozhstal" iron-and--steel works For steelmakers: in the open-hearth shop at the "Zaporozhstal" iron-and- steel works For rolling-mill workers in the roll formed shapes shop and the cold rolling shop at the "Zaporozhstal" iron-and-steel works For foundry men: in the foundry shop at the "Zaporozhstal" iron-and-steel works For mechanics: in the chief mechanic's department shops at the "Zaporozhstal" iron-and steel works For refractory makers: The Zaporozhje refractory making plant		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	September 25, Thursday		
9.00-13.25	Groupwise training 1. For blast-furnace workers		

1	2	3	4
	Subject No.2. Modern construction of blast furnaces. Blast furnaces of large unit capacity		
	2. For steelmakers		
	Subject No.2. Oxygen furnace steelmaking is the basic trend in the development of steelmaking		
	3. For rolling-mill workers		
	Subject No.2. Manufacture of billets		
	Bloomers and slabbers. Equipment and technological processes for manufacturing billets		
	4. For foundry men		
	Subject No.2. Equipment and technological processes for manufacturing shaped castings		
	5. For mechanics		
	Subject No.2. Repair and maintenance of metallurgical equipment. Scheduled maintenance and overhaul		
	Receiving the equipment after repairs		
	6. For refractory makers		
	Subject No.2. Basic types of refractory raw material. Methods for evaluating quality of the raw materials. Modern methods for raw materials beneficiation		
13.25-15.00	Dinner-break		
15.00-16.40	Practical work at the ferroalloy plant		

1	2	3	4

September 26, Friday

9.00-13.25	Groupwise training 1. For blast-furnace workers Subject No.3. Travel of the materials and gases in blast furnaces 2. For steelmakers Subject No.3. Electric furnace steelmaking. Types of electric steelmaking furnaces. Peculiarities of making high-quality and high-alloy steel grades 3. For rolling-mill workers Subject No.3. Section rolling. Modern equipment and technology of section rolling. Pre-stressed stands 4. For foundry men Subject No.3. Processes for manufacturing castings from special steels and alloys 5. For mechanics Subject No.3. Mechanical equipment of blast-furnace shops 6. For refractory makers Subject No.3. Refractory lining of metallurgical units. Types of methods of refractory lining gunning
13.25-15.00	Dinner-break
15.00-16.40	The Russian language classes

September 29 - October 3
Practical studies at the Zhdanov "Azovstal" iron-and-steel works. The curriculum of practical studies is given in Supplement 1.

1	2	3	4

October 6, Monday

9.00-13.25	Lecture. Modern computer facilities and their application in the iron-and-steel industry
13.25-15.00	Dinner-break
15.00-16.40	A visit to the data-processing computer center of the "Zaporozhstal" iron-and-steel works

October 8, Wednesday

9.00-13.25	Practical studies in the display class of the data-processing computer center of the "Zaporozhstal" iron-and-steel works in order to acquire skills to operate computer facilities
13.25-15.00	Dinner-break
15.00-16.40	The Russian language classe

October 9, Thursday

9.00-13.25 Groupwise training

1. For blast-furnace workers
   Subject No.4. Physico-chemical processes for making iron in blast furnaces
2. For steelmakers
   Subject No.4. Ladle metallurgy of steel
3. For rolling-mill workers
   Production of hot-rolled sheets and strips
4. For foundry men
   Subject No.4 Modern processes for the production of molds
5. For mechanics
   Subject No.4. Mechanical equipment of steelmaking shops

1	2	3	4
	6. For refractory makers Subject No.4. Methods of maintenance of refractory linings		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	October 10, Friday		
9.00-13.25	Groupwise training 1. For blast-furnace workers Subject No.5. Practical work. Blast-furnace burdening 2. For steelmakers Subject No.5. Continuous steel casting 3. For rolling-mill workers Subject No.5. Production of cold-rolled sheets and strips 4. For foundry men Subject No.5. Practical work. Gating system design 5. For mechanics Mechanical equipment of rolling-mill shops		

1	2	3	4
	6. For refractory makers Subject No.5. Refractory lining of metallurgical lunits		
13.25-15.00	Dinner break		
15.00-16.40	The Russian language classes		
	October 13 - 17		
	Practical studies at the "Krivorozhstal" iron-and-steel works in Krivoy Rog. The curriculum of practical studies is given in Supplement 2		
	October 20, Monday		
9.00-13.25	Lecture. Modern methods for improving strength and plastic properties of ferrous rolled products. Heat treatment and hot machining of ferrous metal products		
13.25-15.00	Dinner break		
15.00-16.40	A visit to the automobile works in Zaporozhje		
	October 21, Tuesday		
9.00-13.25	Business game, "Methods for improving performance efficiency of the main shops at metallurgical enterprises"		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	October 22, Wednesday		
9.00-13.25	Practical work in the shops of the "Zaporozhstal" iron-and-steel works in comliance with Subjects No 2 and 3		

1	2	3	4

13.25-15.00	Dinner-break
15.00-16.40	Practical work in the shops of the "Zaporozhstal" iron-and-steel works in compliance with Subjects No 2 and 3

October 23, Thursday

9.00-13.25	Lecture. Powder metallurgy
13.25-15.00	Dinner-break
15.00-16.40	Practical work in the shops of the "Zaporozhstal" iron-and-steel works in compliance with Subjects No 2 and 3

October 24, Friday

9.00-13.25	Groupwise training 1. <u>For blast-furnace workers</u> Subject No.6. Practical work "Calculation of the amount of blast and top gas in the blast-furnace process 2. <u>For steelmakers</u> Subject No,6. Coke-free metallurgy 3. <u>For rolling-mill workers</u> Subject No.6. Practical work. "Roll pass design" 4. <u>For foundry men</u> Subject No.6. Methods for stripping iron castings 5. <u>For mechanics</u> Subject No.6. Methods for improving wear resistance and serviceability of metallurgical equipment

1	2	3	4
	6. For refractory makers Subject No.6. Refractory materials usable for the maintenance of metallurgical furnaces		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	October 27-31		
	Practical studies in Kiev. The curriculum of practical studies is given in Supplement 3.		
	November 3, Monday		
9.00-13.25	Lecture. Economics and planning in the iron-and-steel industry		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	November 4, Tuesday		
9,00-13.25	Lecture. Automation and mechanization in the iron-and-steel industry		
13.25-15.00	Dinner-break		
15.00-16.40	A visit to the transformer-making plant in Zaporozhje		
	November 5, Wednesday		
9.00-13.25	Practical work in the shops of the "Zaporozhstal" iron-and-steel works in compliance with Subjects 3 and 4		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		
	November 6, Thursday		
9.00-13.25	Lecture. Robot facilities and their applecation in the iron-and-steel indu try		
13.25-15.00	Dinner-break		
15.00-16.40	The Russian language classes		

1	2	3	4
	November 10, Monday		
9.00-13.25	Lecture. Power supply facilities at metallurgical enterprises. Methods for saving power resources		
13.25-15.00	Dinner-break		
15.00-16.40	Critical interpretations of production situations in subgroups		
	November 11, Tuesday		
9.00-13.25	Practical work in the shop of the "Zaporozhstal" iron-and-steel works in compliance with Subjects 5 and 6		
13.25-15.00	Dinner-break		
15.00-16.40	Practical work in the shops of the "Zaporozhstal" iron-and-steel works in compliance with Subjects 5 and 6		
	November 12, Wednesday		
	Practical studies at the tube making plant in Novomoskovsk. The curriculum is given in Supplement 4		
	November 13, Thursday		
9.00-13.25	Lecture. Environmental protection		
13.25-15.00	Dinner-break		
15.00-16.40	Practical work at the refractory-making plant in Zaporozhje		
	November 14, Friday		
9.00-13.25	Groupwise training 1. <u>For blast-furnace workers</u> Subject No.7. Intensification of ironmaking in blast furnaces 2. <u>For steelmakers</u> Subject No.7. Methods aimed at making steelmaking units more durable 3. <u>For rolling-mill workers</u> Subject No.7. Practical work		

1	2	3	4

"Reduction pass design"

4. For foundry men

Subject No.7. Special types of casting

5. For mechanics

Subject No.7. Antifriction and friction bearings in metallurgical units

6. For refractory makers

Subject No.7. Methods for improving quality and wear resistance of refractory products

13.25-15.00 Dinner-break

15.00-16.40 Discussions in subgroups in compliance with Subject No 7

November 17 - 22

Practical studies at the Novolipetsk iron-and-steel works in Lipetsk. The curruculum is given in Supplement 5

November 24, Monday

9.00-13.25 Lecture. Quality control of finished products at metallurgical enterprises

13.25-15.00 Dinner-break

15.00-16.40 Subject "Methods for quality control of finished products at metallurgical enterprises"

November 25, Tuesday

9.00-13.25 Practical work in the shops of the "Zaporozhstal" iron-and-steel works in compliance with subject No.7

13.25-15.00 Dinner-break

15.00-16.40 Critical interpretations of specific production situa-

1	2	3	4
	tions in subgroups in compliance with Subject No.7		
	November 26, Wednesday		
	Practical studies at the tube-making plant in Nikopol. The curriculum is given in Supplement 6		
	November 27, Thursday		
9.00-13.25	Lecture. Statistical methods of quality control of finished products at metallurgical enterprises		
13.25-15.00	Dinner-break		
15.00-16.40	Practical studies on statistical methods of quality control of finished products at metallurgical enterprises		
	November 28 Friday		
9.00-13.25	Practical work in the laboratories where finished products of the "Zaporozhstal" iron-and-steel works are tested		
13.25-15.00	Dinner-break		
15.00-16.40	Practical studies at the "Dneprospetsstal" electrometallurgical works		
	December 1, Monday		
9.00-13.25	Lecture. Methods for search of new engineering ideas and solutions		
13.25-15.00	Dinner-break		
15.00-16.40	An excursion to the Dneproges hydroelectric station in Zaporozhje		
	December 2, Tuesday		
9.00-13.25	Groupwise training		
	1. For blast-furnace workers		
	Subject No.8. Methods for reducing harmful sulphur and		

1	2	3	4
	phosphorus impurities in iron 2. For steelmakers Subject No.8. Methods for intensifying steelmaking processes and improving steel quality 3. For rolling-mill workers Subject No.8. Finishing of finished rolled products 4. For foundry men Ironmaking in cupoles and production of iron castings 5. For mechanics Subject No.8. Manufacture of changeable equipment and spares. Modern numerically controlled metal-working machine tools. Metal-working centers 6. For refractory makers Subject No.8. New types of refractory products for intensified metallurgical processes	
13.25-15.00	Dinner-break	
15.00-16.40	Practical studies at the "Dneprospetsstal" electrometallurgical works in Zaporozhje	
	December 3, Wednesday	
9.00-13.25	Practical work in the shops of the "Zaporozhstal" iron-and-steel works in compliance with Subject No.8	
13.25-15.00	Dinner-break	
15.00-16.40	Practical work in the shops of the "Zaporozhstal" iron-and-steel works in compleance with Subject No.8	
	December 4, Thursday	
	An excursion to the atomic station in Zaporozhje	

1	2	3	4

December 5 , Friday

9.00-13.25 Discussion on the problems of introduction of new technology and reequipment of metallurgical enterprises

13.25-15.00 Dinner - break

15.00-16.40 A meeting with the management of the "Zaporozhstal" iron-and-steel works in Zaporozhje

December 8 - 10

Consultations on preparation of technical papers. Preparation of technical papers and accounts to UNIDO

December 11, Thursday

Defence of technical papers in the presence of the examining board

December 12, Friday

Official closing session of Group 33 of the UNIDO seminar

December 13, Saturday

Departure of the participants in the seminar for Moscow

December 14 - 20

Departure of the participants in the seminar from Moscow to their countries

6. The Zaporozhye meeting on improving the teaching procedure and the UNIDO courses programme in the USSR for training engineering personnel from developing countries in the field of iron and steel industry

Materials obtained from the UNIDO industrial operations department in July 1985, were carefully studied which allowed to set forth main directives for perfecting the programme for the courses of metallurgists from developing countries in Zaporozhje.

Thorough examination of the collected materials showed the necessity of getting acquainted with the educational process, the teaching staff of the courses and technical means in Zaporozhje. That is why in January 1986 the authors of the report were sent to the plant "Zaporozhstal" and to the UNIDO courses organized there.

"Zaporozhstal" is one of the greatest Soviet metallurgical giants created on the basis of the Krivoy Rog iron ore, Donetsk coal and electrical energy of the Lenin Dneprovskaya hydro-electric station. The development of technological process is accomplished at the plant by means of improveng technology of production at all the main conversions.

Reconstruction and modernization of metallurgical units and equipment, intensification of processes of production, automation and mechanization of working operations, improvement of production and labour organization allowed them to exceed the scheduled capacities of the units, to increase efficiency and culture of production. All this creates favourable conditions for practical training of engineers-metallurgists from developing countries.

A tour of the plant and a number of meetings on the problem of improning the programme of the UNIDO courses in the USSR in the iron and steel industry were organized during the stay.

A meeting held by comrade A.A.Gerasimenko, the director of "Zaporozhstal", allowed to discuss in detail all problems facing the courses and to draw the main guide-lines in improving conditions of education by meand of creating a basis for renewing technical means.

A meeting was held by comrade A.V.Grebenjukov, the engineer-in-chief of "Zaporozhstal" which was ateended by comrade V.I. Movshovich, Deputy engineer-inchief on modern technology (a teacher at the courses), comrade E.V.Prokopenko the chief of the technological control department (a teacher at the courses), comrade V.I.Larjushkin the Director of the UNIDO courses and the authors of the report. Methods of teaching and the new programme of the UNIDO courses in Zaporozhje were discussed in detail and recommendations on improving the educational process for engineers-metallurginsts from developing countries were worked out at this meeting. It was disided to select and train leactures at the courses from "Zaporozhstal" more thoroughly and invite more teachers from universities and institutes of Kiev, Zaporozhje and Moscow to teach at the courses. A wish to update the programme by introducing new courses on modern subjects was expressed. Participants in the meeting think it useful to introduce into the educational process some business games and debates between participants on practical topics.

Problems of perfecting the material and technical base of the courses were discussed at a meeting held by comrade A.V.Golovko, Deputy director of "Zaporozhstal' on problems of commerce and finance, and a decision on its further improvement was taken.

A meeting held by comrade N.P.Tarapurov, Deputy Minister of the UkSSR iron and steel industry allowed them to discuss in detail the existing situation in the sphere of training staff from

developing countries and to workout ways of solving the problem.

Numerous meetings and talks with comrade Larjushkin V.N., director of courses and comrade Evtushenko L.G. his deputy, as well as thourough acquaintance with documents and materials of the UNIDO courses in Zaporozhje showed that it was necessary to establish order in documents for which purpose it is necessary to think over and determine a uniform size of paper and definite forms of all documents (synopsis of lectures, programmes, papers) both in the Russian and English languages.

Acquaintance with the documents showed that not all the work done is always reflected in reports sent to SCEC and UNIDO. Very often short reports and programmes sent to these organizations, do not reflect the whole volume of work carried out at the UNIDO courses in Zaporozhje. On the whole the check-up of documents and materials showed that this is done satisfactorily.

One of the main difficulties at the courses is a selection of a completely homogeneous group. This difficulty arises because of different professional levels of would be participants. To solve the problem it is necessary to select trainees at the I stage (in the section of staff training of the UNIDO industrial department in Vienna) more thoroughly so that it would be possible to admit to the courses in Zaporozhje specialists of no more than 2-3 professions. This will make it posseble to teach theory and organize practical training more effectively. At present, specialists of 5-6 different professions arrive, and sometimes it becomes necessary to create 1-2 men groups which impedes the process of training and disperses the efforts of the teaching staff. In should also be borne in mind that the UNIDO courses on welding in Kiev train specialsts in one technological speciality, while the UNIDO courses on the ferrous metal industry in Zaporozhje

train specialists in 9 different specialities, which, no doubt, impedes the process of training and demands teachers of different subjects.

That is why we think it necessary, in order to reach higher efficiency, when selecting candidates for courses to include in draft documents a provision annual 3-4 day visits of 2 Soviet representatives to the UNIDO in Vienna (UNIDO, SCEC or SCST courses) for organizing a meeting in the section of staff training of the industrial department to form more homogeneous groups of participants.

The expediency of holding in 1986 in Zaporozhje a conference of a group of experts on improving the programme of the UNIDO courses it the USSR and modern trends in training engineers from developing countries on the basis of the UNIDO courses in this city was discussed and coordinated when one of the authors of the report visited Vienna (UNIDO) in July 1985 and met with the administration of the industrial department (A.A.Vasiliev), of the staff training section (I.Lorenzo) and section of metallurgy (E.Balazs). The authors of the report discussed this problem at all meetings and received full support and reached mutual understanding. Much preparotory work to organize this conference is being done at the plant. The agenda of the conference and some organizational activities have already been planned. The administration of the plant and of the UNIDO courses, as well as the authors of the report think that such a conference would allow them to exchange experience, discuss and considerably improve the process of training specialists from developing countries.

The agenda of the conference and topics of the reports to be made were discussed with V.N.Lariushkin, the Director of the UNIDO courses and other representatives of the plant and adopted and approved of.

7. Trends for further improvement and development of UNIDO courses programme in the USSR for specialists from developing countries in the field of iron and steel industry

The propesed programme is aimed for the next 5 years and takes into account the main trends of ferrous metallurgy development in the world practice.

The programme, which has been made as a result of studies, is a universal one, since it enables to carry ont simultaneous training both of several categories of specialists (blast-furnace operators, steelmakers, rollermen, etc.) and a group of single category specialists, for example only blast-furmace operators (in the latter case studies in subgroups will not be done).

It should be noted that the present practice of simultaneous training of various professions (blast-furnace operators, steelmakers, rollerman, mechanics, foundry men, refractory makers, etc.) leads to great difficulties in the organization and fulfilment of the training process.

In fact such a practice is a deviation from the group training principle, since lessons have to be made with 2-3 listenevs, and some times with one trainse, which is already an individual training, Individual training is very expensive and is practiced only for very high categories of adminstrators, such as ministers.

The propesed programme can be the basis for training industrial instructors so thar when the specialists from developing countries return to their enterprises can pass the knowledge that they got at UNIDO courses to their subordinates and colleagues.

For this it is proposed to increase the training time for a group to 460 teaching periods and to add the following subjects to lectures delivered to the whole group:

	Teaching periods
1. Training and skills improvement of personnel	4
2. Psychological and pedagogical principles of training	4
3. Module approach for training programmes forming	4
4. Frame and content of programmes	4
5. Concepts about industrial teaching, training process, principles and methodes of training	4
6. Linguistic culture of the instructor	4
7. Methodic issues of using technical training means in teaching	6
8. Procedure for using active training methods	6
9. Evaluation of training results	4
Total	40

At the present time only managers of low and medium management levels in the iron and steel industry are being trained at UNIDO courses in Zaporozhje. We think that on the basis of Zaporozhye courses it is possible also to train the managment staff of metallurgical works from developing countries. A special programme should be needed for that which can be considered in the future.

For improving the efficiency and quality of the training process at UNIDO courses in Zaporozhje for specialists from developing countries in the ferrous metallurgy field a clear methodic provisions should be made.

The following materials should be prepared and given to each trainee at the courses:

1 - Lectures synopses

2 - Text books

3 - Methodic calculations

4 - Training subjects plans

5 - Training schedule

6 - Methodic instructions for the laboratory work

7 - Methodic instructions for industrial practice

8 - Methodic instructions for visit tours

9 - Methodic instructions for preparing, writing, and defending technical papers

10 - Methodic instructions for preparing UNIDO report

For these purposes the UNIDO courses in Zaporozhje should be provided with modern multipliers (copying devices "xeroprinting", etc). Currently there are no such equipment at UNIDO courses in Zaporozhje.

For a better learning of delivered lectures the courses should be equipped with modern technical means for training which are now practically lacking.

We think that for conducting lectures it is necessary to have:

1. Cinematographic equipment for showing technical films (or videorecorders with screen projection).

2. Slide projector for showing slides, drawings and diagorams.

3. Calculating and computer facilities for making calculations at laboratory work.

It is very important to provide UNIDO courses in Zaporozhje with moder computer facilities.

The courses should have their own display room which are connected to computer or have ДВК-2М orИскра 226 models personal computers. It is possible to use other computer facilities.

8. Conclusion and recommendations.

1. Information necessary to carry out the activities in question, has been selected and processed together with the UNIDO staff. All the recommendations of the UNIDO industrial department staff have been taken into account when preparing the report and carrying out the preparatory work.

2. The analysis of the collected materials, as well as the meetings in Vienna, Moscow and Zaporozhje showed that this work is most urgent and topical since it allows to introduce positive changes in the UNIDO courses programme aimed at training engineers from developing countries.

3. A review of the main trends in the development of the iron and steel industry allowed to specify the main guide-lines in reading new lectures courses in the Programme of training metallurgints from developing countries in accordance with the latest achievements of science and technology. The Programme should take into account the main tendencies in the development of metal production.

4. Acquaintance with the documents and materials of the UNIDO courses in Zaporozhje showed that on the whole the Programme quite well embraces the main directions in metal production and activities of specialists- administrators of the middle level of metallurgical enterprises. However, in order to eliminate a number of shortcomings revealed as a result of a detailed analysis, it is necessary to introduce changes into the time table, structure of training and types of training as well as to prepare a draft Programme of training a group of metallurgists.

5. The improvement of the process of training, the improvement of the quality of the Programme and training efficiency will be achieved due to a more concrete composition and realization of

the Programme with special division into sections, courses and lectures with concrete mentioning of the number of hours in theoretical, seminar and practical studies.

6. Reasons for having one programme for all the groups, which can be slightly modified in problems of training in subgroups depending on the speciality of newly admitted trainees have been given.

7. Visits to the best plants where participants can get acquainted with new technology, methods and ways of rational and effective organization of production processes should be recognized as one of the most effective forms of improveng the business qualification of specialists. That is why such a form of training as visits to other plants must constitute not less than one third of the educational process' time.

8. Topics of participants' techical papers are too general and their level is rather low. It is necessary to work out these topics and suggest concrete subjects of investigation. Trainees should be given special assistance when writing their technical papers so that they could use knowledge obtained while preparing and defending their papers after returning to their native countries.

9. Active methods of training are a progressive form of obtaining and retaining one's knowledge in the system of advanced training of the staff. The new Programme suggests that the volume of active methods of training in the form of business management games, discussions, seminars and concrete industrial situations analysis should be increased.

10. The new Programme well not only give a theoretical knowledge in the sphere of computer application, but also teach them how to use displays with the help of FORTRAN and ASSEMBLER.

11. It is necessary that a number of modern topics:"Robotization and robot techniques", "Methods of searching for technological ideas and solutions", "Quality Control of Manufactured Products" which will broaden the partisipants' outlook and give them the necessary information, should be included in the new Programme.

12. To organize practical seminars , the educational and scientific potential of enterprises and educational institutions of Zaporozhje is mainly used. It is recommended that teachers should be selected and trained more thoroughly and teachers from universities and institutes located in the neighbouring metallurgical centres as well as in Moscow should be invited to work at the courses.

13. The unification of the form of all methodical documents and materials for the courses (programmes, papers, synopsis of lectures) will facilitate the work and standardize the documents.

14. In order to solve the problem of making groups more homogeneous as to their specialities it is necessary that every year 1-2 Soviet representatives should be sent to the UNIDO for 3-4 days which would enable them to select candidates more thoroughly.

15. At practical seminars the technical means (films, slides, etc.) are still used very little. In order to improve the training efficiency it is necessary to provide the courses with additional organizational technical means.

16. It is considered expedient that a conference of a group of experts on the problems of improving the UNIDO courses programme in the USSR and modern trends in training engineers from developing countries should be held in June 1986 in Zaporozhje on the basis of the UNIDO courses.

20.03.86

20.03.86г.

Appendix 1

Programme of

UNIDO workshop metallurgists'group
practical studies at the Azovstal
Steelworks, Zhdanov, September 29 - October 3 1986

Date and Time	Item
29.09.86	
9^{00} - 10^{00}	Lecture on the history, the present state and future development of the Zhdanov Azovstal Steelworks
10^{00} - 11^{00}	A visit to the Steelworks museum
11^{00} - 12^{30}	Safety precautions briefing
13^{00} - 14^{00}	Lunch
14^{00} - 17^{00}	A tour of the Steelworks, BOF, sheet mill and rail and structural steel mill shops inclusive
30.09.86	
9^{00} - 17^{00}	Practical studies in the Steelworks'shops are carried out for: BF engineers - in the BF shop Steelmakers - in the open-hearth shop Rollers - in the primary mill shop Refractory engineers - in the metallurgical furnace maintenance shop Mechanical engineers - in the machine shop Foundry men - in the foundry shop

Date and Time	Item
01.10.86	
9^{00} - 17^{00}	Practical studies in the Steelworks' shops are carried out for: BF engineers - in the BF shop Steelmakers - in the open-hearth shop Rollers - in the rail and strictural steel mill shop Refractory engineers - in the metallurgical furnace maintenance shop Mechanical engineers - in the metallurgical equipment maintenance shop Foundry men - in the foundry shop
02.10.86 9^{00} - 17^{00}	Practical studies in the steelworks'shops are carried out for: BF engineers - in the BF shop Steelmakers - in the BOF shop Rollers - in the sheet mill shop Mechanical engineers - in the rail sand structural steel mill shop Refractory engineers - in the metallurgical furnace maintenance shop Foundry men - in the foundry shop
03.10.86 9^{00} - 17^{00}	Practical studies in the Steelworks'shops are carried out for: BF engineers - in the BF shop Steelmakers - in the BOF shop Rollers - in the merchant mill shop Foundry men - in the foundry shop Refractory engineers - in the metallurgical furnace maintenance shop

Date and Time	Item
	Mechanical engineers - in the open-hearth shop

Notice: The list of actual subjectmatter of the practical studies is worked out by the management of the workshop and is coordinated with the Azovstal Steelworks management.

Appendix 2

Programme of
UNIDO workshop metallurgists'group
practical studies at the Krivorozhstal
Steelworks, Krivoy Rog Ocrober 13-17, 1986

Date and Time	Item
13.10.86	
9^{00} - 10^{00}	Lecture on the history, the present state and future development of the Krivorozhstal Steelworks, Krivoj Rog
10^{00} - 12^{00}	A visit to the Steelworks museum
12^{00} - 13^{00}	Lecture on safety protection and movement at the Krivorozhstal Steelworks
13^{00} - 14^{00}	Lunch
14^{00} - 17^{00}	A tour of the Krivorozhstal Steelworks, including BF No 5, open-hearth, Primary mill and merchant mill shops
14.10.86	
9^{00} - 17^{00}	Practical studies in the Krivorozhstal Steelworks shops are carried out for: BF engineers - in the BF shop

Date and Time	Item
	Steelmakers - in the open-hearth shop
	Rollers - in the primary mill shop
	Foundry men - in the foundry shop
	Refractory engineers - in the metallurgical furnace maintenance shop
	Mechanical engineers - in the machine shop
15.10.86 9^{00} - 17^{00}	Practical studies in the Krivorozhstal Steelworks shops are carried out for:
	BF engineers - in BF No5
	Steelmakers - in the BOF shop
	Rollers - in the merchant mill shop
	Foundry men - in the foundry shop
	Refractory engineers - in the metallurgical furnace maintenance shop
	Mechanical engineers - in the machine shop
16.10.86 9^{00} - 17^{00}	A visit to the "Krivbasruda"
17.10.86 9^{00} - 17^{00}	A visit to the Southern and Northern Ore dressing mills

Appendix 3

Programme of
UNIDO workshop metallurgists'group
practical studies in Kiev, October 27-31 1986

Date and Time	Item
27.10.86 9^{00} - 10^{00}	Lecture on the history, the present state and future development of the Paton

Date and Time	Item
	Electrowelding Institute
10^{00} - 13^{00}	Study of Institute laboratories
13^{00} - 14^{00}	Lunch
14^{00} - 17^{00}	Study of Institute laboratories
28.10.86 9^{00} - 17^{00}	Practical studies at the Powder metallurgy Plant in Brovari
29.10.86 9^{00} - 17^{00}	Practical studies at the Kiev Wire products plant
30.10.86 9^{00} - 17^{00}	A visit to the Kiev Polytechnical Institute
31.10.86 9^{00} - 17^{00}	Sight-seeing in Kiev

Appendix 4

Programme of
UNIDO workshop metallurhists'group practical
studies at Moscow Tube Plant November 12, 1986

Date and Time	Item
12.11.86 9^{00} - 10^{00}	Lecture on the history, the present state and future development of the Moscow Tube Plant
10^{00} - 10^{30}	A visit to the Plant Museum
10^{30} - 11^{00}	Lecture on safety protection and movement at the Plant shops

Date and Time	Item
11^{00} - 13^{00}	Practical studies in electrowelded pipe shop No1
13^{00} - 14^{00}	Lunch
14^{00} - 16^{00}	Practical studies in Electrowelded pipe shop No2
16^{00} - 17^{00}	A visit to the enemalled ware production shop

Appendix 6

Programme of
UNIDO workshop metallurgists'group practical
studies at the Southern Tube Plant,
Nikopol, November 26, 1986

Date and Time	Item
14.11.86	
9^{00} - 10^{00}	Lecture on the history, the present state and future development of the Southern Tube Plant, Nikopol
10^{00} - 10^{30}	A visit to the Plant museum
10^{30} - 11^{00}	Lecture on safety protection and movement at the Plant shops
11^{00} 13^{00}	Practical studies in the tube-rolling tools production shop
13^{00} - 14^{00}	Lunch
14^{00} - 15^{30}	Practical studies in tube-rolling shop No2
15^{30} - 17^{00}	Practical studies in tube-rolling shop No7

Appendix 5

Programme of
UNIDO workshop metallurgists'group practical
studies at the Novolipetsk Steelworks,
November 17-21, 1986

Date and Time:	Item
17.11.86	
9^{00} - 10^{00}	Lecture on the history, the present state and future development of the Novolipetsk Steelworks
10^{00} - 11^{00}	A visit to the Steelworks museum
11^{00} - 11^{30}	Lecture on safety protection and movement at the Steelworks shops
11^{30} - 13^{30}	A visit to the product coke shop
13^{00} 14^{00}	Lunch
14^{00} - 15^{30}	A visit to the Steelworks' Sintering plant
15^{30} - 17^{00}	Lecture on the environmental control at the Steelworks
18.11.86	
9^{00} - 17^{00}	Practical studies in the Steelworks shops are carried out for: BF engineers - in BF shop No1 Steelmakers - in BOF shop No1 Rollers - in sheet mill shop No1 Foundry men - in the mould making shop Refractory engineers - in the metallurgical furnace maintenance shop Mechanical engineers - in BOF shop No1

Date and Time	Item
20.11.86 9^{00} - 17^{00}	Practical studies in the Steelworks shops are carried out for: BF engineers - in BF shop No2 Steelmakers - in the electric steel melting shop Rollers - in sheet mill shop No4 Foundry men - in the foundry shop Refractory engineers - in BOF shop No2 Mechanical engineers - in sheet mill shop No3
21.11.86 9^{00} - 13^{00} 14^{00} - 17^{00}	Practical studies at the Lipetsk Iron and Steel Plant "Svobodni Sokol" Sight-seeing in Lipetsk

The list of officials with whom the consultants met during the preparation of the report:

Vienna (UNIDO)

A.A.Vasiliev - Director of the Industrial operations department

I. Lorenzo - Manager of Persommel training section of the Industrial operations department

I.A.Loginov - Specialist of Personnel trainig section

B.Nidzhavan - Senior interregional councillor

A.Balazs - Manager of Metallurgical section

G.D.Surgutchev - Specialist of Metallurgical section

I.Velev - Specialist of Metallurgical section

Yu.G.Grebtsov - Specialist of Metallurgical section

A.P.Shevchenko - Assistant manager of UNO International workshop on electrowelding

Moscow (The USSR State Commettee on Science and Technology. The USSR State Commettee on External Economic Relations):

I.K.Kukin - Deputy chief of the International Economic and Science and Technical Organizations Department, The USSR State Commettee on Science and Technology

B.F.Chuprikov - Specialist of the International Economic and Science and Technical Organizations Department, The USSR State Commettee on Science and Technology

B.V.Kurotchenko- Specialist of the International Economic and Technical Organizations Department, The USSR State

Commettee on Science and Technology

Yu.S.Shevchenko - Deputy chief of the Technical Aid for UNO division, The USSR State Commettee on External economic Relations

V.V.Vlasov - Specialist of the Technical Aid for UNO division, The USSR State Commettee on External Economic Relations

Zaporozje (Zaporozhstal)

N.P.Tarapurov - Deputy Minister of Iron and Steel Industry, Ukranian Soviet Socialist Republic

A.A.Gerasimov - Director of the Zaporozhstal Steelworks

A.V.Grebenukov - Chief engineer of the Zaporozhstal Steelworks

A.V.Golovko - Deputy director of the Zaporozhstal Steelworks

E.V.Prokopenko - Chief of Technical control division of the Zaporozhstal Steelworks

V.I.Larushkin - Director of the UNIDO Iron and Steel Courses

L.G.Evtushenko - Assistant manager of the UNIDO Iron and Steel Courses

V.V.Anankov - Head of Steelmaking group of the UNIDO Iron and Steel Courses

L.G.Podguyny - Head of Blast furnace group of the UNIDO Iron and Steel Courses