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HIGH LEVEL ADVISORY ASSISTANCE IN ENVIRONMENTAL MONITORING FOR ALUMINIUM CAST PLANT IN PLEVEN

SI/BUL/90/801

PEOPLE'S REPUBLIC OF BULGARIA

Terminal report*

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

Prepared by UNIDO consultants

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*This document has not been edited.

V.91-21650

INTRODUCTION

Due to the Project concept and logistics, the accumulation of knowledge about the situation at the Pleven plant and elaboration of the multi-criterial assessment of this situation was done in a step-wise manner:

- identification of the most serious problems at the Pleven plant on the basis of the documents and information received from Bulgaria, identification of the specialties of required experts and of the nature and range of the in-plant direct measurements to be carried out in order to provide experts with objective information;

- compiling of the team of experts (11-51 Environmental Engineering, 11-52 Environmental Impact Assessment, 11-53 Aluminium Casting Technologies and 11-54 Industrial Safety and Occupational Toxicology) and identification of optimal contractor firm;

- mission of the first group of experts (11-51 - Mr. W. Gaubinger, 11-53 - Mr. I. Stankovich and UNIDO staff member Mr. M. Boutoussov to Pleven plant, results of which are reflected in Annex 1 (see);

- mission of the working team of contractor ALPENCONSULT with its mobile laboratory and elaboration of the set of full scale real-time measurements at the most decisive points within and outside the plant (report of contractor can be received in full additionally but excerpts from it are presented in the Annex 2.);

- mission of the second group of experts (11-51, 11-53, 11-52 Mr. A. Jarnelov nominated also as a team leader, 11-54 Mr. H. Friza), the individual work of which is reflected in corresponding reports (see Annexes 3, 4 and 5)

- working visit of counterparts from the Pleven plant (Ms. T. Shoumkova, Ms. E. Vankova and Mr. V. Ekov) to the laboratories of ALPENCONSULT in Munich, factories of MAN in Germany and Alu-Guss in Austria, organized by the contractor team leader Mr. H. Meisterhofer from ALPENCONSULT.

- Expert Group Meeting in UNIDO where all mentioned consultants, national counterparts, contractor team leader and UNIDO relevant specialists in environmental project activities took part.

The consolidated approach was elaborated during the extensive discussions at this meeting in line with the Integrated Quality Concept (see this Terminal Report) and conveyed to the Plant authorities and personnel by Mr. A. Jernelov for finalization of the main findings and suggestions.

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1. Description of Project Idea

An Integrated Quality Concept was elaborated as a tool for comprehensive assessment of three main components of industrial activities i.e. production, environmental impact and occupational conditions, at the level of medium-size enterprise. The concept is based on the assumption that even with the unsatisfactory environmental situation that exists in many countries and regions, it is not realistic to close down the middle-sized factories, which, on one hand, contribute to the local and regional pollution problems, but on the other - render employment for many persons. The concept also assumes that, unlike the alrge scale plants, the medium-sized industries are not so profitable or heavily state-supported as to order a comprehensive professional external audit to be provided to them with all three components of their activities taken into objective consideration.

The concept indicates a way how to combine the efforts of specialists experienced in close, but different areas of environmental studies and applied techniques in order to derive an optimal solution which may be applicable to many cases of a similar nature. Thus, the idea of the project was to perform a case study at the plant of medium size, typical for Eastern Europe and other regions, in order to provide the local and state authorities with the comprehensive picture of the positive and negative sides of its activity evaluated in comparable, i.e. economically depicted terms.

2. Pleven

The town of Pleven is located in the central part of the Danube plain in Northern Bulgaria. The altitude is 600 - 700m above sea level. The population of the town, including the surroundings, is approximately 200,000 inhabitants.

Pleven is an industrial town situated in well developed agricultural region where grain, beetroot, sunflower, vegetables and grapes are grown. Animal husbandry is also well developed: poultry, farming, calf and hog-breeding etc. The continental character of climate is well expressed. The winter is cold with average January temperature about two degrees below zero. The summer is usually rather hot with absolute max. temperature reaching 40 deg.

Inversion is a typical phenomenon for the town and the valley especially in winter where both residential and industrial zones are located. The predominating winds are westerly.

The aluminium casting plant located in the eastern industrial area is surrounded by at least 25 factories in the west and three plants in the east. These facilities within a distance of 10 km include an oil refinery, a cement plant, a glass workshop, a power station and several machine-building plants. These facilities cause a high level of environmental pollution which is transmitted directly to the residential districts of Pleven to the west, the suburbs and agricultural lands to the east.

3. Aluminium Casting Plant-Present Conditions

3.1 Physical Conditions

The plant is located practically in one major building with an area of approximately 17,000 m^2. In addition, a few smaller buildings (painting, future electroplating and waste water treatment, etc) are in the vicinity of the main building. The plant was built approximately 15 years ago.

3.2 Plant Capacity and Production

The plant was originally designed to produce 6,000 tons/year of castings. The plant can produce more than 5,000 different type of products, including car wheels, parts for electrical motors for lift trucks, defense products, etc.

The production for 1990 is projected to be 3,000 tons of castings.

The production rate for 1991 is uncertain. The plant management believes they will be able to sign a barter contract with the Volgograd, Tractor Plant, USSR to produce 2,000 t of castings for a small (privately owned) tractors. The payment for the final production will be in primary aluminium. In addition, the plant is planning to export in 1991 400t of castings to France and, if possible, produce 2,000 t of castings for the domestic market.

3.3 Technology

The basic casting technique used in the plant is the "VP" counter-pressure casting machine developed in the parent company "Metal Technology".

From a production angle the main disadvantage with the factory is the relatively low degree of mecanization and automation, mostly due to the wide spectrum of produced castings.

From an emission point of view the core producing machines and core casting machines lack installations for containment and worker protection.

3.4 Employees

In early November 1990 the plant manpower was 600 persons. A lay-off of 200 of them is scheduled for December 1990.

The plant utilizes the engineering services from "TECHMET" in Sofia, servicing the whole corporation.

3.5 Total sale

The sale of products is varying during the last years with a tendency of decline. If we estimate the plant sale as 4,000 T/year at $3.00/kg of casting, then the total sale may be estimated as equivalent of $12M/year. From this, the cost of raw materials will be equivalent to $8M/year.

3.6 Main Markets

Until recently the main market for plant products was the USSR, East European countries and some developing countries, as for instance, Iraq. A large part of the products was for defense purposes. The raw material was supplied basically from the USSR.

In 1990 the situation has drastically changed. More changes are expected in 1991. The company is trying to diversify and find new markets, primarily in West Europe.

4. Occupational health

4.1 Immissions on working places.

The main occupational health hazards on working places in the plant are formaldehyde, phenol, hydrocarbons, carbonoxide, quartz sand, noise, cold and heat, and others like UV, Gamma-, Infraredradiation and asbestos.

4.2 Ranking of emittants according to their health risks sum:

Core machine:	++++++	(noise, hydrocarbons, formaldehyd, carbonoxid, phenol and quartz dust)
Core casting machines:	+++++	(noise, hydrocarbons, formaldehyd, carbonoxid, phenol)
Sand blasting	+	(quartz dust)
Core dryer:	+	(hydrocarb.)
Thermic treatmt.:	+	(hydrocarb.)
High lift truck:	+	(hydrocarb.)
Saw machine:	+	(noise)
Product finish.:	+	(noise)

Additional health risks observed:

- No heating and local heat radiation
- Danger of accidents with high lift truck
- Sawing machine dangers
- Ultraviolet and infrarared light in melting section
- Handling of radioactive material and x-rays
- Asbestos materials

4.3.1 Influence of hazardous immissions on observed disease rate.

4.3.1.1. The main diseases which were observed and may be caused by occupational exposure in Pleven Plant are: Neurastema, Gastroenteritis, Back disorders, Pharyngitis, Conjunctivitis and Optitalumcus Neuralgia.

All the symptoms and diseases are connected with occupational exposure, for instance with the emissions from the core production and the casting section of the plant but also with other working places within the plant.

4.3.1.2 The age distribution of internal diseases indicates the possible exposure of chronic occupational risk factors (in this case possibly formaldehyde, phenol and cold). The lower figure in the age group over 55 years indicates drop-outs.

4.3.1.3 Exposition time

People who worked more than 15 years and are in the age-group between 45 and 55 years of age can be defined as high internal diseases risk group. More than 40% of persons with these characteristics are internally diseased. If one adds the chronical neurological diseases to this group, the percentage of diseased persons in this category exceeds for sure 50% of the workers population.

4.3.1.4 Sick leaves

The average sick leave duration in the last years in the plant was 8,7 days, the incidence of sick spells per 100 workers had an average of 135 days per year (normal value 80 100 days), which means 35% more sick spells in the factory in comparing with the Bulgarian average; the prevalence of the numbers of days sick leave hand an average of 1118,4 days/100 workers/year, which is 11% over the Bulgarian average.

4.4 Economic estimate of health damages

In the Pleven Aluminium Plant, about 4 - 10% of salary costs are lost per year due to plant-specific sick spells and drop-outs. This makes a loss of about $40,000 to $100,000 per year per 100 workers (counted as west-european salary of 1000 $/m). Due to the fact, that a drop-out goes out of work 5 - 10 years before pension and there is a prevalence of 10 occupational diseases in the plant, one can estimate the real costs to be about 0,2 to 0,5 million $ per year per 100 workers. Due to the latency of chronic diseases, one will see positive health effects only 10 years after intervention. The costs to Pleven town respectively Pleven district are calculated as to be the same sum, the resulting all over health costs due to the Aluminium Plant being therefore at least 0,5 million $ per year per 100 workers (At the time of the study 133 persons worked in the production section).

5. Environmental Situation

Air

Air pollution in the form of dust and photochemical mist is visible at most times. The conditions are particularly severe during cold winter days when inversions occur over the deep valley where the industrial zone of Pleven is situated and over the residential areas of the city.

Plant damage from air pollution is visible in many ways. Lichens are totally absent within an approximative radius of 15 km from Pleven and average age of pine-needles drop from some four years at a distance of 20 km to one year or less at the industrial sites. Damage is also correlated to elevation with most damage in the Pleven valley and much less 200 m higher up.

In total an area of some thousand km^2 show damage to vegetation that could translate to a 50% reduction of growth rate for connefer trees. (The only ones that could be studied in October).

Water

The streams passing through Pleven are quite clear 15 km upstream of the city with clean water crustaceaus like Asellus present.

Downstream of Pleven the river is severely polluted, totally anaeobic and thus without fish and other higher life forms for more than 30 km till the Danube. The estimated river-flow in autumn was 5-10 m^3/s which could mean a yearly average of some ten m^3/s.

Ground water in Pleven is being depleated with resulting water-shortage e.g. for the Aluminium Casting Plant. Some analytical results also indicate that ground water is contaminated with industrial wastes, possibly from a waste dumping site.

6. Economic Assessment of Damages

Damage to plant production, assuming a 50% growth loss, 50% agricultural land within a radius of 15 km from Pleven and a production value of \$.05 per m^2 is calculated to amount of \$10 - 15 million per year.

Corrosion, in most studies of industrial areas of larger economic value than plant production, is in Pleven estimated to be in the same range of \$10 - 15 million per year.

Water pollution at $10m^3/s$ and a value of $\$1/m^3$ for clean water is assessed to result in losses of \$35 million per year.

Thus the environmental damage from the industries and the city of Pleven could amount to \$60 million per annum. The contribution of the Aluminium Casting Plant is estimated to be less than 5% of the total.

A chosen figure of 3% gives an assessed environmental damage caused by the Aluminium Casting Plant of \$1.5 - 2 million per year.

Added to that the cost of occupational health injuries of \$0.5 million and the non-assessed damage of pollution to public health the total extent of economic loss is estimated to be in the range of \$3 million annually.

7. Recommended Actions

Phase 1

To get a general impression of all facilities of the plant a detailed lay out, including all aspirators, ventilators and hoods have to be worked out.

Modification and improvement of present aspirators and ventilators with central control host at

- core machines
- core drying facilities
- core casting machines
- melting furnaces

The height of the stacks should not be more than 10^m above ground level, because if it is higher, the emitted pollutants are directly transmitted at the level of housing area.

Personal noise protection in areas with high noise level.

Personal protective masks.

Replace of fock - truck by electro driven vehicles.

Replace of asbestos materials by alternative products.

Personal protection against ultraviolet and infrared light in the melting section by wearing glasses and special working clothes.

Permanent controlof health of workers and of working place conditions and emissions by use of analysing tubes (DRAGER or equivalent) and photometric measurement device.

Definition of risk for each working place.

Personal protection by wearing working clothes and safety protection tools (glasses, respiratory filter) or high standard, quality and function.

Considerations on the replacement of resin bound core sand by alternative products.

Repair of sand blasting machines by renewing the sealings.

Automatic lock at sand blasting machines to increase the time between finishing work and opening of the machine.

Regarding the planned car wheel painting facilities the use of powder coating should be considered.

Installation of shower cabins for cleaning of the employees under use of special cleaning material (protective soap) to reduce phenol resorption through the skin.

Phase II

Separation of plant sections with different operations by high brick walls of decrease dust and noise transmission specially in the area of

- core section
- core drying section
- core casting section (Pollak machines)
- counter pressure cast section with use of core
- welding section (with noise reducing roof)
- finishing section (with noise reducing roof)

Installation of new aspiration and ventilation systems with central control host to collect the pollutants at the place of generation and exhaust them into the atmosphere.

Use of better sand quality to reduce emission improve product quality and reduce reject rate.

Introduction of Quality control circles including health and environment.

Introduction of incentives for risk reduction rather than risk acceptance.

Noise reduction device at machines and tools with high noise generation as

- saw machines
- core machines

Plant management concept to optimise the logistic of production and reduce internal transport.

Transportation and storage of mould and core sand in closed systems and tanks - "no open handling"

Permanent control of the waste water treatment facility in respect of the purification efficiency. If needed a more advanced system like ion-exchange should be installed.

Continuous detection of emission concentrations out of the installed stacks.
If found feasible in the studies in Phase I clean technologies in the form of replacement of

If found feasible in the studies in Phase I clean technologies in the form of replacement of resin bound sand with water glass or other alternative products as well as powder coating for wheel painting should be introduced.

<u>Phase III</u>

Installation of emission reducing systems to reduce emissions into the atmosphere in accordance to emission substances and regulations.

core section;	dust filter
core drying section:	Absorption or after burning facility to reduce organic emissions heat recovery systems
core cast section:	dust filter absorption or after burning facility to reduce organic emissions
welding section:	dust filter
melting section:	dust filter heat recovery system
painting section:	after burning units against solvent emissions with heat recovery system

The height of the stacks should not be more than 10^{m} above ground level, because if it is higher, the emitted pollutants are directly transmitted at the level of housing area.

Automation of product transportation between the several stages of production.

Continuous detection of emission concentrations out of the installed stacks.

8. Economic assessment of technical measures
Estimated investment requirements

With reference to the tree phases of measures presented in the previous chapter the associated investment requirements are estimated as follows.

Costs in millions of US $.

Phase nr	End-of-pipe technologies		Clean technologies
1	0.3	0.3	
2	1 - 1.5		2 - 3
3	3 - 5	2 - 3	
Sum	(4.3 - 6.8) approx 5.5		(4 - 6.3) approx 5.2

The estimated investment costs can also be related to the types of pollutants

Dust		1
Formaldehyde		1.5) 2.2 with a
Hydrocarbons		1.5) combined solution
Noise		0.2 -0.5 (with domestic material and prices 1-3 M $ in west-european prices.
Solid waste		1
	Sum	5.2 - 5.5

The distribution of investment costs in relation to some major processes:

Melting	0.1
Core-casting	2 - 3
Non-core-casting	-
Finishing	0.2
Painting	1 - 1.5
Electroplating	0.5 - 1
Sub sum	3.8 - 5.8
General, (e.g. ventilation, wall-construction, etc.)	0.5 - 1
Sum	(4.3 - 6.8)
	approx 5.5

It is apparent from the problem description and the investment costs that core-casting is responsible for a large part of the occupational and environmental problems and that half the investment required would be devoted to the solution of problems associated with this process.

Yet, the products from core-casting account only for 10 - 15% of the volume and value of the factory out-put.

Two-options present themselves:

(1) Stop the production of core-casting.

(2) Increase prices of core casting products to pay for introduction of clean technologies or adequate environmental end of the pipe solutions.

It is also to be noted that no specific environmental problems were identified with the non-core casting and that no specific environmental investment was proposed for this process.

A comparison between investment requirements for "end-of-the-pipe" solutions versus "clean technologies" show that over the three phases the total cost would be very similar - actually probably a little lower for the clean technologies. Thus this alternative is strongly recommended. A short-term draw-back is the higher investment requirements in phase two- that is at an earlier time.

A comparison between environmental damage - assessed to be in the range of $3 million a year - and investment cost to avoid damage - estimated at some $5.5 million - shows that the investment would have a pay-back time of two years or less.

9. Alternative scenarios for the future

Due to rapid and unforseen economic changes in Eastern Europe and the Soviet Union the Aluminium Casting Plant in Pleven, Bulgaria is about to lose its supply of aluminium and energy as well as it's main markets.

The management of the company hopes to establish an export to the Soviet Union of some 2,000 tons of aluminium casting product also for 1991 which would pay for the import of 3000 - 4000 ton of aluminium and allow the company to maintain its position as monopoly producer and supplier on the Bulgarian market. This scenario means more or less "business as usual" and is the base for the recommendations above.

However, as uncertainties remain, some alternative scenarios have been studied. In one a market organization for car wheel rims and hab-cap in Western Europe is created and one for aluminium heat-radiators in eastern Germany. An agreement is reached with a Brazilian producer of aluminium and aluminium rolled products to buy casting machines in exchange for aluminium.

The production is concentrated to wheels and radiators and a few other non-core casting products to facilitate management and the company is privitized with substantial ownership for west-european and Brazilian partners. Most environmental problems would be avoided.

Another alternative scenario is based on the fact that several west european aluminium casting companies have found core casting too difficult from an environmental and occupational point of view, and thus have decided to stop that line of production. Thus competition on this market segment will be reduced and consequently the Pleven plant would have a chance to capture a hard currency market with good prices. A resulting good profitability would allow for investments to control environmental and occupational exposure and possible the exchange of formaldehyde and phenol coated sand for coatings with water-glass or other environmentally benign silicon compounds.

Also in this scenario concentration on fewer products would facilitate management and allow concentrated efforts on sale.

10. Recommended Actions - Alternatives

General

1. Perform a joint Bulgarian - UNIDO study on plant and business modernization. The study shall include the three scenarios described in Section 9.

2. Start a separate and efficient (reporting to the plant manager) marketing department. The department shall be staffed with qualified people speaking western languages. Locate it in Pleven.

3. Reinforce and provide additional training to the "TECHMET" engineers involved in plant modernization and in particular in environmental control and plant ventilation.

4. Reorganize the plant manpower structure in accordance with the business level.

5. Improve worker's incentive.

6. Alternative 1 - Near future

6.1 Try to continue the business relations, based on barter trade, with East European countries and the USSR. These relations may be not on a level of ministries, but on the level of plants, cooperatives and even newly formed private enterprises.

6.2 Try to continue and even expand the existing business relations with western countries.

6.3 Continue and establish new domestic business contacts.

7. Alternative 2 - Mix of New and Existing Marketable Products

7.1 Try to market more agressively such products as car wheels to car manufacturers in West Europe and USSR, and to secondary market in the USA. Improve product quality.

7.2 Market central heating batteries, with emphasize of former East Germany.

7.3 Market new products such as parts for air pollution control industry (venturis, butterfly valves, etc) in the West, Eastern Europe and especially in the Soviet Union.

8. Alternative 3 - Castings related to use of Cores

8.1 Market sophisticated products made with use of cores worldwide. The price of such items will probably go up due to decrease of such production in the West.

8.2 Modernize casting production to meet the occupational health and environmental requirements as described in previous sections.

Annex 1

HIGH LEVEL ADVISORY ASSISTANCE IN ENVIRONMENTAL MONITORING FOR ALUMINIUM CAST PLANT IN PLEVEN

Technical report: First evaluation mission

The report of the First Evaluation Mission
by W. Gaubinger and I. Stankovich
was issued under symbol DP/ID/SER.A/1431

<u>Annex 2</u>

MEASUREMENTS OF EMISSION AND IMMISSION CAUSED BY THE ALUMINIUM CASTS PLANT IN PLEVEN
27 August - 31 August, 1990

by

UNIDO Contractor

AlpenConsult

I INTRODUCTION

The order for the provision of services related to the "High Level Advisory Assistance in Monitoring for Aluminium Casts Plant in the People's Republic of Bulgaria, Proj. No. SI/BUL/90/801 was given by :

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

with contract No. 90/122.

ALPENCONSULT performed in the time between 27 August 1990 and 31 August 1990 the direct measurements of the pollution factors caused by the activity of the Aluminium Casts Plant in Pleven.

Recommendations concerning the measuring points and the type of analyses were given by the UNIDO EXPERTS :

- Dipl.-Ing. Dr. W. Gaubinger, UNIDO-Consultant 11 - 51
- Ivan Stankovich, P.E., UNIDO-Consultant 11 - 53

in their technical report concerning their visit to the plant 1/8 - 4/8/1990, chapter VIII. Changes of these recommendations concerning the measuring points and analyses were made in discussions by the management of the Pleven Plant.

GENERAL INFORMATION CONCERNING THE ALUMINIUM CASTS PLANT IN PLEVEN AND THE AIM OF THE PROJECT

The plant for Aluminium Casts is situated in the east industrial area of Pleven town. Three other plants are situated in the immediate vicinity of it - the machine-building plants "N. Vapzarov" and "Llinden" and a steel-making plant.

The plant ist designed for aluminium alloys casts production obtained through the gas counterpressure method. The annual production program amounts in the moment to 4000 tons of good casts.

A detailed description of the plant is given in the technical report by the UNIDO consultants Dr. Wolfgang Gaubinger and Ivan Stankovich concerning their visit August 1990 .

The aim of the UNIDO project is to provide an environmental impact-assessment and optimal rehabilitation scenario for decision-makers to reduce the environmental hazards at the Pleven plant for aluminium casts.

III EMISSION AND IMMISSION MEASURING POINTS

The UNIDO Experts recommend after their first fact finding mission in Pleven August 1990 24 measuring points. After discussions with the management of the plant in Pleven changes were made, because of broken installations, changes in production and because parts of the workshops will be closed in the near future (for example the painting workshop). The numbering of the measuring points was also adapted to the wishes of the plant management in Pleven (following the Pleven production flow).

Measurements were performed on the following places :

New identification number	UNIDO experts-identification number	description of the measuring points
A	M 9	working place in the cole machine section
B	M 10	working place in the cole machine section
C	M 16	working place at core dryer section
D	M 4	in front of melting furnace section
E	M 19	working place in front of the mixer, wheel rim furnace section
F	M 2	working place in casting section VP 1300
G	M 3	working place between casting machines VP 100/3
H	M 18	working place between casting machines for wheel rims (strontium !)
I	M 8	working place beside high pressure casting machine Pollak 1000
J	(instead of M5)	working place in casting machine section VP 400/40
K	M 11	Aspirator of VP 400 casting machine section
L	M 1	BMD-Filter

New identification number	UNIDO experts-identification number	description of the measuring points
M	M 17	working place in thermic treatment section in front of Ebner
N	---	working place in thermic treatment section
O1	M 14	fitter's shop
O2	M 14	saw machine
O3	M 14	saw machine
O4	M 14	radial saw machine
P1	M 20	working place sand blasting machine fitter's shop
P 2	---	working place sand blasting machine wheel rim production
Q	M 6	working places product finishing beside welding section
R	M 7	working place welding section
S	---	diesel high lift truck
T	---	ventilator near computer room
U	M 12	Laboratory : working place
V	M 21	Sporting area
X	M 22	Area between mainbuilding and electro plating plant
Y	M 23	in front of building, where painting was performed in the past
Z	M 14	ground water analysis

IV MEASURING METHODS

IV/1 **Dust**

IV/1/1 *Dust immission*

VDI 2266 Blatt 3

"Messung der Staubkonzentration am Arbeitsplatz, Messung der Teilchenzahl, Messen unter Benutzung von Membranfiltern", Dezember 1971

IV/1/2 *Dust emission*

VDI 2066, Blatt 1

"Messen von Partikeln, Staubmessungen in strömenden Gasen, Gravimetrische Bestimmung der Staubbeladung - Übersicht", Okt. 1975

"Particulate matter measurement. Measuring of particulate matter in flowing gases. Gravimetric determination of dust load - Fundamentals", Oct. 1975

VDI 2066, Blatt 2

"Messen von Partikeln, Manuelle Staubmessung in strömenden Gasen, Gravimetrische Bestimmung der Staubbeladung, Filterkopfgerät", June 1981

"Measurement of particulate matter in flowing gases. Manual gravimetric method. In-stack dust sampling and precipitation", June 1981

IV/1/3 *Analysis of dust*

VDI 2066, Blatt 2

(see IV/1/2 and Appendix 4)

VDI 2268, Blatt 1

"Stoffbestimmung an Partikeln, Bestimmung der Elemente BA, Be, Cd. Co, Cr, Cu, Ni, Pb, Sr, V, Zn in emittierten Stäuben mittels atomspektrometrischer Methoden", April 1987

"Chemical Analysis of Particulate Matter, Determination of Ba, Be, Cd, Co, Cr, Cu, Ni, Pb, Sr, V, Zn in Particulate Emissions by Atomic Spectrometric Methods", April 1987

IV/2 Hydrocarbons (TOC .. Total organic carbon)

VDI 3481, Blatt 1 - 3

"Messen gasförmiger Emissionen, Messen von flüchtigen, organischen Verbindungen, insbesondere von Lösemitteln, mit dem Flammen-Ionisationsdetektor (FID)", April 1980

"Gaseous emission measurement. Determination of volatile organic compounds, especially solvents. Flame ionization detector (FID)", April 1980

IV/3 **Phenol**

VDI 3485, Blatt 1

"Messen gasförmiger Immissionen, Messen von Phenolen, p-Nitroanilin-Verfahren", Dezember 1988

"Ambient Air Measurement, Measurement of Gaseous Phenolic Compounds, p-Nitroaniline Method", Dec. 1988

IV/4 **Formaldehyde**

VDI 3484, Blatt 1

"Messen gasförmiger Immissionen, Messen von Aldehyden, Bestimmen der Formaldehyd-Konzentration nach dem Sulfit-Parasanilin-Verfahren", Jänner 1978

"Gaseous Air pollution measurement, measurement of aldehydes, determination of formaldehyde concentrations, sulphite Pararosaniline Method", Jan. 1978

IV/5 **Chloride**

VDI 3480, Blatt 1

"Messen gasförmiger Emissionen, Messen von Chlorwasserstoff, Messen der Chlorwasserstoff-Konzentration von Abgas mit geringem Gehalt an chloridhaltigen Partikeln", Juli 1984

"Gaseous Emission Measurement, Measurement of Hydrogen Chloride, Measurement of the Hydrogen Chloride Concentration in Waste Gases with a Low Content of Particulate Chloride", July 1984

IV/6 **Fluoride**

VDI 2452, Blatt 1

"Messen von Immissionen, Messen der Gesamt-Fluorid-Ionenkonzentration, Impinger-Verfahren", März 1978

"Air pollution measurement, measurement of total fluoride ion concentration, Impinger method", March 1978

IV/7 **SO_2**

DRÄGER Test-Method based on the reaction :

$SO_2 + J_2 + 2\ H_2O \dashrightarrow H_2SO_4 + 2\ HJ$ (Appendix 11)

IV/8 **NO_x**

DRÄGER Test-Method based on the color reaction of NO_2 with o-Tolidine

IV/9 **Noise**

ÖNORM S 5004

"Noise immission measurement", Nov. 1985 (Appendix 13)

IV/10 **Water**

DEV

"Deutsches Einheitsverfahren"

V MEASUREMENT EQUIPMENT

V/1 Dust

V/1/1 *Dust immission*

Sampler Desaga GS 050

Analytical Balance WA 34, Type PRL TA 14

Hygrometer

Barometer

V/1/2 *Dust emission*

STROEHLEIN - Dust measuring system

Analytical Balance WA 34, Type PRLTA 14

Hygrometer

Testotherm 9010

Barometer - Micromanometer Eberhart Müller

V/1/3 *Analysis of dust*

- AAS Type Thermo Jarrell ASH
- Dionnex - HPLC

V/2 **Hydrocarbons (TOC)**

Flame ionization detector Ratfisch RS 53

Chartrecorder ABB Goerz SE 430

Hygrometer

Testotherm 9010

Prandtl's Pitot tube

V/3 **Phenol**

Gassampler Desaga 312

Photometer Beckmann Model 25

V/4 **Formaldehyde**

Gassampler Desaga 312

Photometer Beckmann Model 25

V/5 **Chloride**

Gassampler Desaga 312

V/6 **Fluoride**

Gassampler Desaga 312

Beckmann Photometer Model 25

V/7 **SO_2**

DRÄGER Tube Sulfur Dioxide 20/a

DRÄGER Gas detector pump mod. 21/31

V/8 **NO_x**

DRÄGER Diffusion Tube Nitrogen dioxide 10/a-D

V/9 **Noise**

Sound Level Detector Brüel & Kjaer 2232

Calibrator Brüel & Kjaer 4230

Chart-Recorder ABB Goerz SE 430

V/10 **Water**

HPLC - Ion-Chromatograph Dionnex

Gas-Chromatograph HP 5890 A

VI MEASURING RANGE (LIMITS OF DETECTION AND ACCURACY OF MEASUREMENT)

VI/1 Dust

VI/1/1 *Dust immission*

Limit of Detection .... 5 mg/m^3

Accuracy .... +/- 1 %

VI/1/2 *Dust emission*

Limit of detection .... 5 mg/m^3

Accuracy depends on waste gasflow (turbulences, speed, etc.)

VI/1/3 *Analysis of dust*

See table VDI 2268, Blatt 1

VI/2 **Hydrocarbons (TOC)**

measuring range	limit of detection	accuracy
0 - 10 ppm	≤ 0,2 ppm	≤ 0,3 ppm
0 - 100 ppm	≤ 2 ppm	≤ 3 ppm
0 - 1000 ppm	≤ 20 ppm	≤ 30 ppm
0 - 10000 ppm	≤ 200 ppm	≤ 300 ppm

VI/3 **Phenol**

Limit of detection .... 12 $\mu g/m^3$

Accuracy .... +/- 6 $\mu g/m^3$

VI/4 **Formaldehyde**

Limit of detection .... 4 $\mu g/m^3$

Accuracy .... +/- 2,5 $\mu g/m^3$

VI/5 **Chloride**

Limit of detection	....	2,5 mg/m^3
Accuracy	....	+/- 2 mg/m^3

VI/6 **Fluoride**

Limit of detection	....	1 $\mu g/m^3$
Accuracy	....	+/- 0,5 $\mu g/m^3$

VI/7 **SO_2**

Measuring range with 10 strokes	....	20 - 200 ppm
Accuracy	....	+/- 15 %

VI/8 **NO_x**

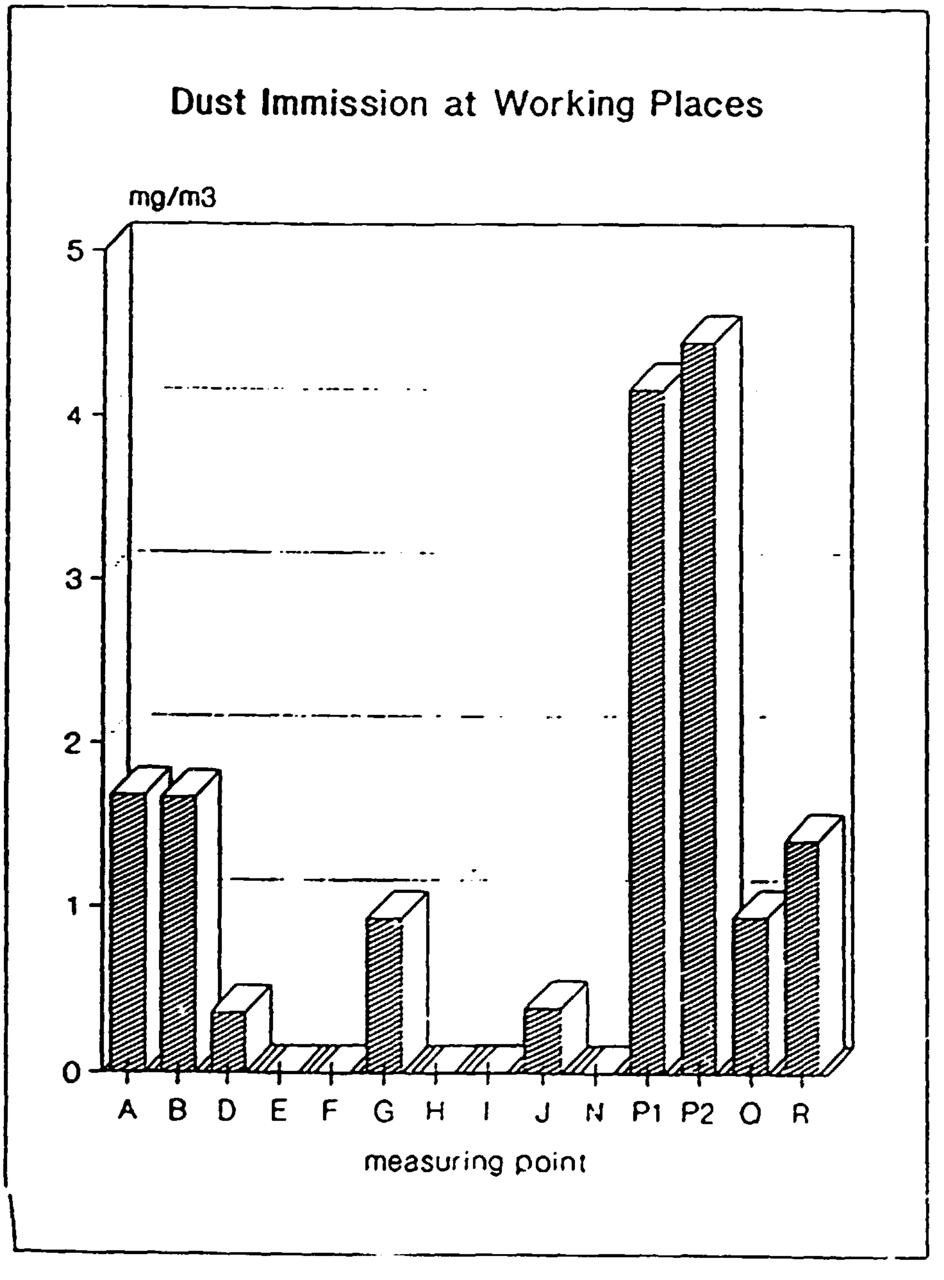
Measuring range	....	10 - 200 ppm x h
Accuracy	....	not specified by DRÄGER

VI/9 **Noise**

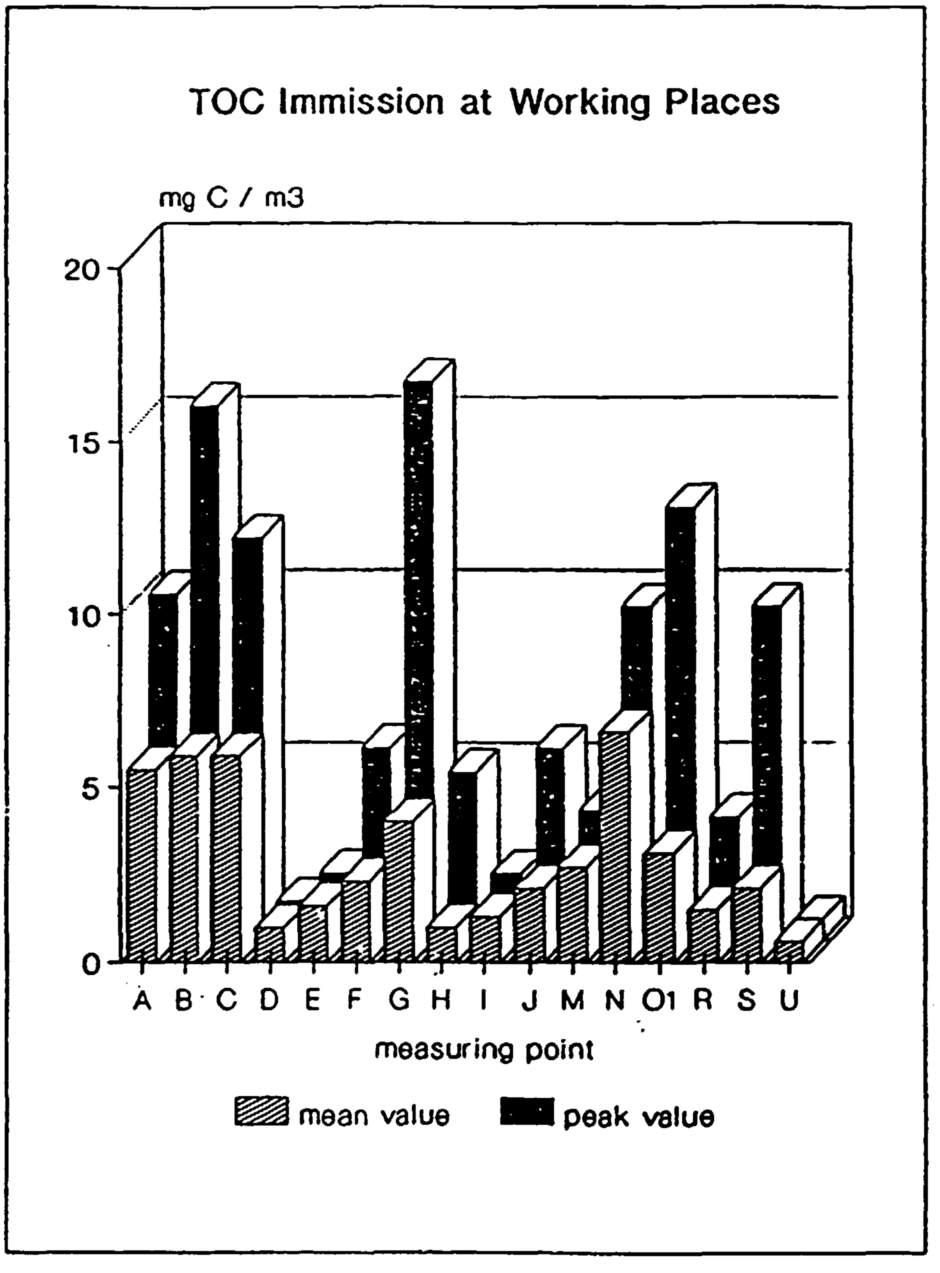
Measuring range	....	34 - 130 dB(A)
Accuracy	....	according to DIN IEC 651
		class 1 sound level meters

VIII GRAPHICAL SURVEY OF THE MEASUREMENT RESULTS AT WORKING PLACES

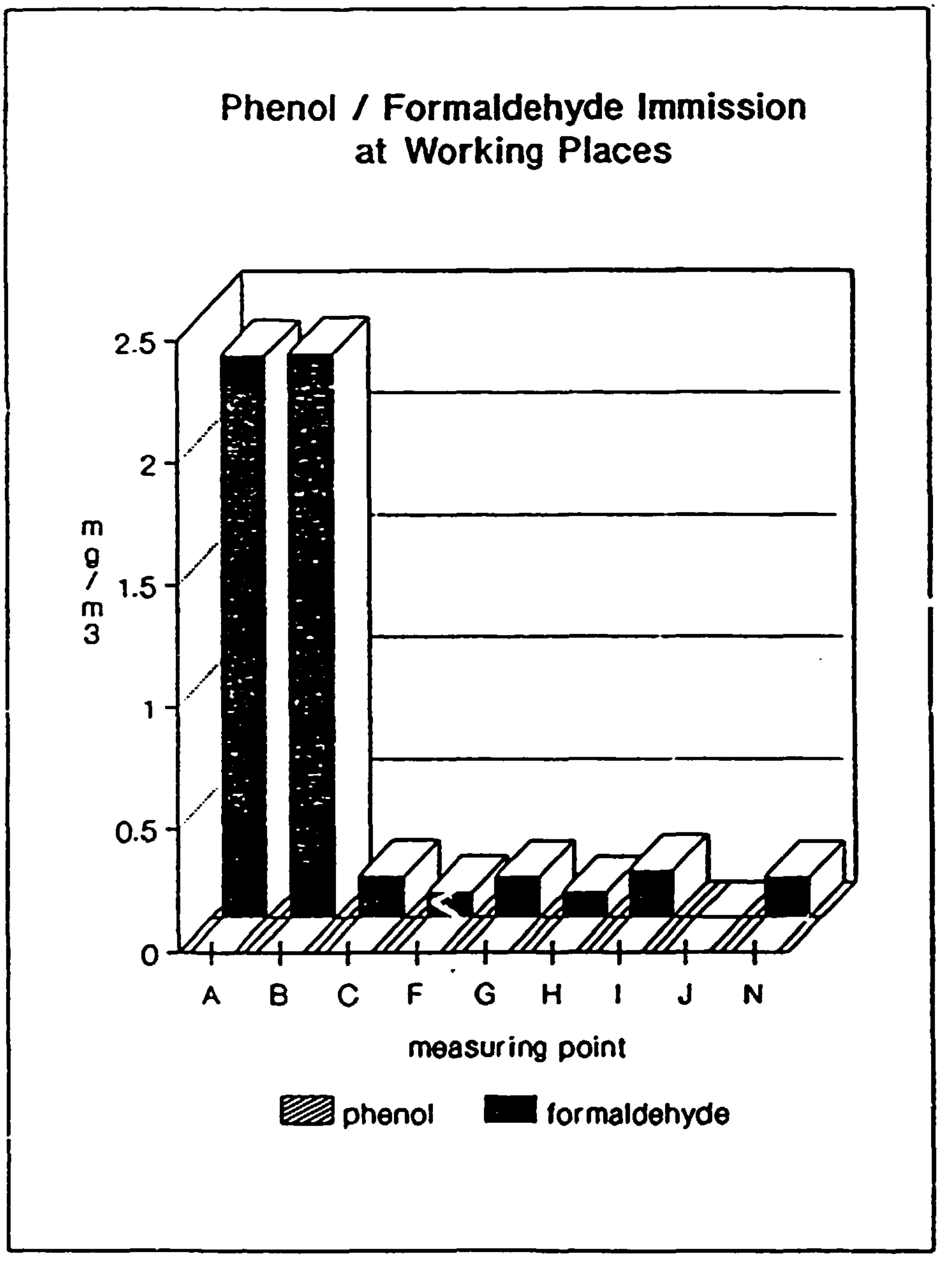
VIII/1 Dust



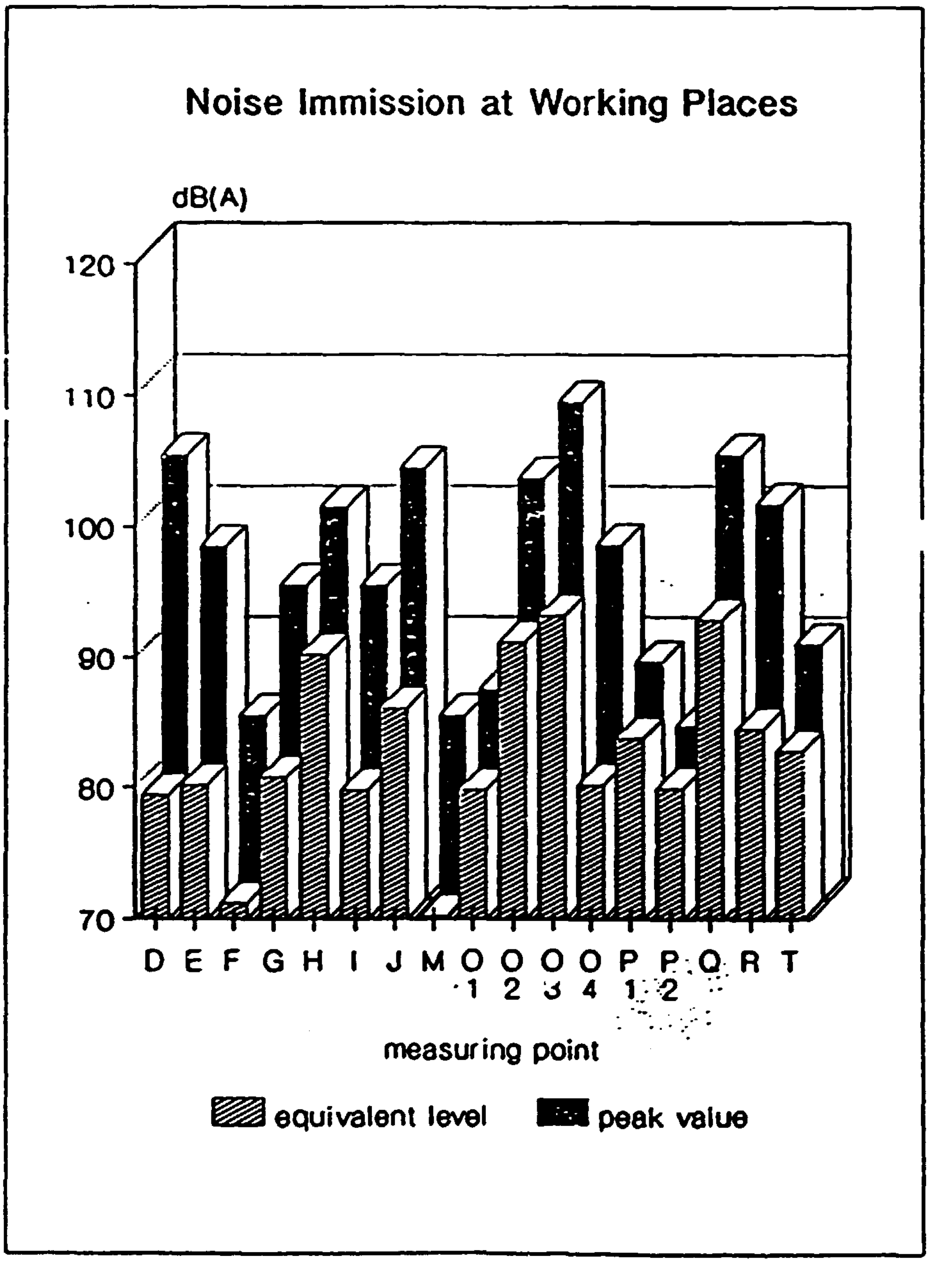
VIII/2 **Hvdrocarbons (TOC)**



VIII/3 **Phenol and Formaldehyde**



VIII/4 Noise


Noise Immission at Working Places
dB(A)
120
110
100
90
80
70
D E F G H I J M O 1 O 2 O 3 O 4 P 1 P 2 Q R T
measuring point
equivalent level
peak value

IX RECOMMENDATIONS

To improve environment and working place conditions of the Aluminium Casts Plant in Pleven ALPENCONSULT recommends :

- to collect all air pollutants directly on the working place by ventilation system and to conduct the polluted air to the atmosphere.

  In most cases there would be no need of filtersystems because of low pollutant contents in the air.

- to isolate the cole machine and core dryer section from the rest of the workshop and to install a strong ventilation system in the area.

  These recommendations lead to a lower dust and hydrocarbon immission in the workshop.

- separation of the product finishing and welding section from the rest of the workshop by using absorbing ceilings and well panels to reduce the noise. Employees in the finishing and welding section and employees working with the saw- and sand blasting machines should use noise protection equipment (like earmuffs, earplugs or others).

  The following table shows the risk of hearing damage within 5 and 10 years for workers exposed to equivalent sound levels of 80 - 200 dB for 8 hours per day.

equivalent sound level	risk of hearing damage within 5 years	within 10 years
80 dB	0 %	0 %
85 dB	1 %	3 %
90 dB	4 %	10 %
95 dB	7 %	17 %
100 dB	12 %	29 %

According to international standards the equivalent noise level at working places should not exceed 85 dB if the worker is exposed for 8 hours per day. Otherwise the time of exposure has to be reduced or hearing protectors have to be used.

- to replace diesel high lift trucks by electro high lift trucks in order to reduce the hydrocarbon immissions in the workshop

- to examine the soil pollution in the plant area, which can be responsible for groundwater pollution in the future.

Detailed recommendations will be the subject of further discussions between the Bulgarian-, UNIDO- and ALPENCONSULT-experts.

X OTHERS

ALPENCONSULT thanks the following mentioned Bulgarian experts for their valuable help in the measurements performed in Pleven :

- WANKOWA Evangelitza, Certificated chemical engineer
- SCHUMKOWA Tanya, Expert in joint ventures
- POPOWSKI Georgi, Technical Director
- DIAKOW Iwan, Director
- EKOW Nedieltscho, Engineer
- POPOV Teofil, production manager
- TRIVONOV Todor, President

Annex 3

VISIT TO THE PLANT 22/10 - 26/10/1990

SPECIAL FINDINGS, RECOMMENDATIONS TO THE PLANT MANAGEMENT.

by

Dr. Wolfgang Gaubinger

TABLE OF CONTENTS

I. INTRODUCTION

By the purpose of the project, to help the plant for aluminium casts in Pleven, Bulgaria, with the elaboration of the environmental sound and economically efficient guidlines the expert 11-51 , as described in the project document, for the second part of mission visited the plant to get further informations about the present and future situation.

The visit at the plant in Pleven took place from 22/10 to 26/10/1990 with arrival insite on 22/10/1990 and departure on 26/10/1990.

The mission was done and the report of the second part of mission was written by:

Expert 11-51: Consultant in Environmental Engineering
Dipl.-Ing. Dr. W. Gaubinger
Vienna, Austria

The expert had to discuss the results of the contractors report, find out more detailes about the technological standard of the plant equipment and future facilities concerning the general environmental status of the project area.

In respect to the technological situation and equipment as well as the identification of the most hazardous units of the plant by the contractor he had to detail the recommended general possibilities to solve the existing technical and environmental problems.

II. CONCLUSION AND RECOMMENDATIONS

As a result of the analyses of the aluminium cast plant at Pleven it may be stated. that from the view of environmental status this plant is not a main producer of dangerous pollutants in the area.

By the results of the contractor, pollutants are emitted into the environment by two "defined" sources but mainly "diffuse" through windows and doors.

Health diseases occure in a very high range and must be lowered by improving the working conditions in several departments of the production.

The following general technical recommendations, based on the fact that production will not change in the near future, can be made:

Priority I:

* To get a general impression of all facilities of the plant a detailed lay out, including all aspirators, ventilators and stacks has to be worked out

* Modification and improvement of present aspirators and ventilators with central control host at

  - core machines
  - core drying facilities
  - core casting machines
  - melting furnaces

The height of the stacks should not be more than 10 m above ground level, because if it is higher, the emitted pollutants are directly transmitted at the level of housing area.

* Personal noise protection in areas with high nois... ...el

* Replace of fock - truck by electro driven vehicles

* Permanent control of working place conditions and emissions by use of analysing tubes (DRÄGER or equivalent) and photometric measurement device.

* Personal protection by wearing working clothes and safety protection tools (Glasses, respiratory filter) of high standard, quality and function

* Considerations on the replacement of resin bound core sand by alternative products

* Repair of sand blasting machines by renewing the sealings

* Automatic lock at sand blasting machines to encrease the time between finishing work and opening of the machine

* Regarding to the planned facilities for car wheel painting the use of powder coating should be considered

Priority II:

* Separation of plant sections with different operations by high brick walls to decrease dust and noise transmission specially in the area of

  - core section

  - core drying section

  - core casting section (Pollak machines)

  - counter pressure cast section with use of core

  - welding section (with noise reducing roof)

  - finishing section (with noise reducing roof)

* Installation of new aspiration and ventilation systems with central control host to collect the pollutants at the place of generation and exhaust them into the atmosphere

* Noise reduction device at machines and tools with high noise generation as

  - saw machines

  - core machines

* Transportation and storage of mould and core sand in closed systems and tanks - "no open handling"

* Permanent control of the waste water treatment facility in respect of the purification efficiency

Priority III:

* Installation of emission reducing systems to reduce emissions into the atmosphere in accordance to emission substances and regulations

core section:	dust filter
core drying section:	adsorption or after burning facility to reduce organic emissions heat recovery systems
core cast section:	dust filter adsorption or after burning facility to reduce organic emissions
welding section:	dust filter
melting section:	dust filter heat recovery system
painting section:	after burning units against solvent emissions with heat recovery system

The height of the stacks should not be more than 10 m above ground level, because if it is higher, the emitted pollutants are directly transmitted at the level of housing area.

* Automation of product transportation between the several stages of production

III. DESCRIPTION OF FACILITIES:

Additionally to the description of facilities in the report of first part of mission the following detailed informations are given.

A. Area extent of sections:

Revising the dimensions of the main plant building those are given with:

Length:	144	m
Breadth:	120	m
Height:	18	m

By these dimensions the total volume of the building can be eveluated as V = 311.040 m^3.

By this new volume the calculation of the theoretical air exchange rate of the first report (Chapter V.A.) has to be reviced.

Theoretical aspiration volume:	582.000	m^3/h
Volume of building:	311.040	m^3
Air exchange rate:	1,87	h^{-1}

As the ventilators are not in use, the air exchange rate is normally caused by open windows and doors, with different value between summer and winter.

As during the cold period all windows and doors are closed, the natural air exchange will be approx. 2 h^{-1}, whereas this air exchange rate will increase up to 10 h^{-1} during the summer period.

This fact also causes higher concentrations of generated pollutants at working places during the cold period which can be more than 5 times higher than in summer.

Considering a separation of the several sections with high interest in pollution, those have the following area extent and volume.

	ground area m^2	volume m^3	plan section
Melting furnace	720	12960	7
Core section	612	11016	7
Core cast section	375	6750	8
Core drying section	108	1944	7
Finishing section	432	7776	9
Welding section*	144	504	9
Wheel casting	432	7776	5
CP core cast section**	864	15552	5
Degasification section	1008	18144	1
Thermic treatment	864	15552	1
CP casting section	1944	34992	4

* .... H = 3,5 m

** ... CP = counter pressure cast machines using cores

B. Painting:

A new facility for painting of several products, except car wheels is in construction in a separate building north of the main building.

The painting workshop was designed for

15.840	rolles p.y.
15.840	lids p.y.
15.840	labyrinth lids p.y.

Operation time should be 16 hours a day (2 shifts).

B.1. Technical equipment:

This painting workshop will consist of the following installations including aspiration systems.

Equipment	Number	Aspiration volume m^3/h each	Aspiration volume m^3/h Σ
painting cabin I	4	12.000	48.000
evaporation cabin	3	2.000	6.000
pre - dryer	3	1.800	5.400
painting cabin II	1	15.000	15.000
drying oven	2	300	600
aspiration hood	4	2.500	10.000
Total sum			85.000

There neither is an equipment to reduce solvent emissions comming from the different- stages nor a heat recovery system for the exhausted air of drying ovens.

C. Future Facilities:

Concerning air pollutants there are two facilities planned to be errected in the near future.

C.1. Electroplating

In the building north of the main building, where future painting should be operating (B.) facilities for electroplating, mainly for steel parts, but not specially for car wheels, are in construction.

It is including pickling with HCl and NaOH and plating with Zn, Cr, P and Cu.

Copper is also considered to be applicated on aluminium wheels as a basis for chromatizing.

The constructed equipment is of bulgarian origin, the basins of plating process, exept washing steps, are closed, aspirated and equiped with exhaust system to the atmosphere without filter.

C.2. Painting for wheels:

This painting shop is designed for coating of 200.000 car - wheels per year.

There are no spezial ideas about the detailed technical equipment of this stage at the moment.

In general solvent paintings should be used, but also powder coating is considered. The used technology depends on the quality requirements of the customers.

IV. SOURCES OF EMISSIONS:

A. Main building:

The contractor for the environmental measurement will make an evaluation of the pollution quantity, based on the results of the measures of working place concentrations under conditions of natural air exchange rates.

Main pollutants are dust, hydrocarbons and formaldehyde. Phenol was not found in high concentration, which may be caused by thermal splitting of phenol during core pressing.

Using the area and volume extent from chapter III.A., an average air exchange rate of 10 h^{-1} and the mean concentrations of the contractors measures, the following average emissions per hour can be calculated:

	dust	hydro-carbons	formal-dehyde	phenole
		g/h		
Melting furnace (D)	4,6	129,0	<<	<<
Core section (A,B)	164,0	650,0	253,0	<<
Core cast section (I)	<<	162,0	12,8	<<
Core drying section (C)	<<	115,0	3,2	<<
Finishing section (Q)	73,0	<<	<<	<<
Welding section (R)	7,1	7,6	<<	<<
Wheel casting (H)	<<	77,8	7,8	<<
CP core cast section** (K,J)	11,3	499,3	126,7	0,011
Degasification section (L)*	570,0	27,4	<<	<<
Thermic treatment (M)	<<	420,0	<<	<<
CP casting section (F)	<<	805,0	36,0	<<
	830,0	2893,1	439,5	<<

(...) contractors measure point
* ... additionally 84,4 g chloride/h
** ... CP = counter pressure cast machines using cores

8. Painting section:

In this section the following coatings and solvents will be used at operation on full capacity.

Coatings:

Basic coating I	3.600	kg/y
Basic coating II	3.600	"
Basic coating III	1.000	"
Cover coating	9.000	"
Nitrocellulose coating	500	"
Total	17.700	kg/y

Solvents:

Solvent I	560	kg/y
Solvent II	1.200	"
Benzine	500	"
Solvent III	200	"
Xylole	200	"
Total	2.660	kg/y

Beside these coatings and chemicals a degreasing agent with an amount of 200 kg/y will be used.

The coatings normally include an average solvent concentration of about 60 % . By this the total amount of solvent emissions from this painting shop can be evaluated with

$$M_s = (17.700 \times 0,6) + 2.660 = 13.280 \quad kg/y$$

Operation time will be 16 hours a day within 240 day per year.

This means an operation time of

$$t = 240 \times 16 = 3840 \ h/y$$

and by this a solvent emission potential of

$$m_s = 13.280 / 3.840 = 3,46 \ kg/h$$

can be calculated.

Together with the total aspiration volume, the average concentration of solvents is

$$c_s = 3.460.000 / 85.000 = 40,7 \ mg/m^3$$

This is a very low level which results from the high total aspiration volume.

In the exhaust air volume of the several steps, specially from ovens and painting cabin much higher concentrations, reaching a level up to ten times higher, will occure .

D. Future wheel painting:

The solvent emissions of this workshop can be calculated theoretically by the following parameters:

Capacity:	200.000	wheels/y
Coating demand:	100	g/wheel
Solvent content:	60	%

The total coating demand per year is

M_c = 200.000 x 0,1 = 20.000 kg/y

From this amount a solvent emission potential of

M_s = 20.000 x 0,6 = 12.000 kg/y

results.

Using the technology of powder coating, this quantity could be reduced to a level of **approx. 1.200 kg/y**. The application of this technology normally requires the use of an after burning unit with heat recovery installations.

Vi. LOCAL CONDITIONS:

Beside the general overview in the report of the first mission detailed investigations about the neighbourly factories were performed.

The following counting shows the present factories in the direction from west to east.

		distance km	remarks
	* oil refinery plant	15	hc
	* concrete panal workshop		d
	* cement workshop	8	d
	* lift trucks manufacture		p
	* glass workshop		d
	* plastics workshop		hc
	* shool articel manufacture		ep, p, dg
	* sausage factory		c
	* cannery	3	c
	* boot factory		s
	* tobbaco factory		
W	* winery and distillery		c
	* poultry factory		c
:	* mechanical workshop		ep, p, dg
:	* power station		ce
:	* textile factory		col, app
:	* furniture factory		p
:	* ceramic workshop		d
:	* rubber and latex factory		s
	* institute for casting		
E	* casting and furniture school		
	* institute for casting machines		
	* iron casting workshop		d
	* mechanical workshop VABZAROW		d
	* mechanical workshop LINDEN		d, dg, p
	* ALUMINIUM CASTING PLANT PLEVEN	0	
	* iron and steel casting workshop		d
	* tractor repair shop		p
	* factory for prefabricated components	1	d

Legend of remarks:

ep	electroplating	p	painting
dg	degreasing	c	cooling (FREON)
s	solvents	col	coloring
app	finishing liquid	ce	combustion emissions
hc	hydrocarbons	d	dust

As it can be seen, the "Aluminium Casting Plant" is located in an area of high concentrated industrial facilities with high pollution potential.

VII. CONCLUSION:

The analyses of the aluminium cast plant at Pleven and the investigations on the surrounding industrial facilities show that from the general view of environmental status this plant is not a main producer of dangerous pollutants in the area.

By the results of the contractors work, pollutants are emitted into the environment by two "defined" sources but mainly "diffuse" through windows and doors.

Health diseases occure in a high range and must be lowered in an easily feasible first step by improving the working conditions in several departments of the production.

Beside the technical recommendations for the three priorities of the plant modification, which are based on the fact, that the production will not change in future , several considerations about the use of alternative substances (e.g. core sand) should be carried out.

VIII. LIST OF PEOPLE MET:

Backstopping Officer, UNIDO VIENNA

Mr. Theodor Tivonov, President, Metal Technology, Pleven, Bulgaria

Mr. George Popovski, Deputy Plant Manager, Alu Cast Plant, Pleven, Bulgaria

Mrs. Evangelitza Wankowa, Chief Laboratory

Mrs. Tanja Shoumkova, Staff member, Metal Technology, Sofia Bulgaria

Mr. Popov, Plant Manager, Wheel Casting Section, Alu Cast Plant, Pleven, Bulgaria

Mr. Stambolsky, Trade Union Leader, Alu Cast Plant, Pleven, Bulgaria

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Annex 4

SOME CONCLUSIONS AND RECOMMENDATIONS

SEMINAR IN SOFIA

by

Ivan Stankovich, P.E. Consultant
Piedmont, California, USA

CONTENT

Some Conclusions and Recommendations

The conclusions and recommendations are based on the following factors:

- Visits to the Pleven aluminium casting plant, survey of production facilities, meetings and discussions with the management, engineers, workers, medical personnel, trade-union leaders and others.

- Immission and Emission measurements performed by the UNIDO Contractor and local authorities.

- Assumptions, that existing plant equipment and processes can be used and even improved.

- Projected new economic relations in the near and more distant future as seen by the present plant management and members of the UNIDO experts.

A. Conclusions

(a) In view of new forthcoming economic conditions, environmental, occupational and health requirements, a reorganization and partial reconstruction of the existing plant will be required.

(b) The changes will include reorientation of the plant production on new marketable products, improvements in efficiency, working conditions, housekeeping, environmental control and automation, as well as changes in plant organization and management structure.

B. Recommendations

(a) Perform a preliminary economic and engineering study of plant modernization.

(b) The study will be performed jointly by Bulgarian engineering organization(s) and UNIDO consultant(s).

The UNIDO consultants, if possible, will be consultants with experience in marketing and management of aluminium production, environmental engineering and automation.

1.1 Preliminary Economic and Engineering Study

The study will include, but will not be limited to:

(a) Determine the most marketable products which the plant can produce in near and distant future.

(b) Determine processes and equipment which will be utilized after plant modernization.

(c) Try to find potential buyer for non-utilized equipment.

(d) Propose new general arrangement and layout for Plant.

(e) Recommend technical improvements in existing processes and equipment, and, if required, new equipment.

(f) Prepare an environmental impact study for new conditions.

(g) Project possible sales and profit for both: export and domestic products.

(h) Propose rational and economic automation for both production and industrial ventilation.

(i) Estimate the cost of plant modernization, both in hard and domestic currency.

(j) Recommend most efficient plant organization and management structure.

1.2 Cost Estimate for the Economic and Engineering Study

(order of magnitude, based on UNIDO practice)

No.	Category	Base US$	Expenses US$
1.	Economic Analyses and Marketing Assistance - UNIDO (3) man months)	18,000	18,000
2.	Engineering, Occupational Health Environmental Control Assistance, Cost Estimates (4) man months - UNIDO	24,000	24,000
3.	Automation - Preliminary Design, including software development - UNIDO (3) man months	18,000	18,000
4.	Organization and Management Consultations - UNIDO (1) man month	6,000	6,000
5.	Bulgarian engineering organization - Travel	-	18,000
	Total:	66,000	84,000

overall $150,000

Seminar at "TECHMET", Sofia

On 5th and 6th of November, as planned and arranged by UNIDO, Ivan Stankovich, Consulting Engineer of Piedmont, California, USA, has conducted a seminar at the "TECHMET" headquarter on Industrial Ventilation and Air Pollution Control for the engineering personnel in charge of design and improvements of conditions at the Aluminium Casting Plant in Pleven.

At the beginning of the seminar an introductory discussion took place in the office of Dipl. Ing. Georgy Voikov, Vice Director of "TECHMET" and in the presence of department managers Dip. Ing. Markova and Asew Angelov and Mrs. Tanya Shoumkova.

The audience of the seminar consisted of 10 - 12 engineers including two from the Pleven Plant. The seminar content is attached to the report (Appendix). The objective of the seminar was to:

(a) Familiarize the responsible engineering personnel with the practice in Environmental Centre Engineering in the USA and West Europe in general.

(b) Familiarize the audience with detail engineering practice in industrial ventilation, with existing sources of information, such as performed projects, handbooks, etc.

(c) Demonstrate the merits of using existing computer programmes ("Exhaust')in resolving air pollution and industrial ventilation projects.

(d) Familiarize with existing computer programmes for bulk materials handling systems (sand, dust, etc.) such as "DENSE", "DILUTE", and "Air lift".

(e) Demonstrate the use of a computer programme to balance the temperature in the shop ("Dilucool").

(f) Show how to modernize the existing core making machines in order to minimize the formaldehyde, phenol and dust immissions into the building.

SEMINAR ON METAL TECHNOLOGY

Monday 5 November 1990

Environmental Control - Metal Industry

1. Introduction (10 - 12:00)

- Reconstruction of Aluminium Plants
- Chemical Industry
- Joint ventures
- UNIDO
- Economical Questions

2. Air Pollution Control and Ventilation Systems (14-16:00)

- Supply and Exhaust Systems
- General and Local Exhaust System
- Local System Components
- Principle of Fluid Mechancis and Simplification
- System Calculations
- Air Cleaning Devices
- Dry Scrubbers

3. Air Pollution Control 6/11/90 (10 - 12:00)

- Exhaust Fans
- Programmable Logic Controlers (PLC)
- Software - "Exhaust Programme"

4. Bulk Material Handling

- Air Slides
- "Dilute" Pneumatic Conveying
- "Dense" Pneumatic Conv.
- Air Lifts
- Software

5. Questions and Answers

Annex 5

THOUGHTS ON MARKET STRATEGY FOR THE ALUMINIUM CASTING PLANT IN PLEVEN BULGARIA

by

Professor A.B. Jernelov

SUMMARY

A solution of the environmental problems at the aluminium casting plant has as a prerequisite that and is dependent on the formes for a solution of the eocnomic and organizational problems of the company (many of which are common for all import based and export dependent Bulgarian enterprises).

Aluminium for the casting plant must be imported and paid for in convertible currencies. To obtain the convertible currency of blue products must be sold on the export market.

The present organization for sale, the contact network and knowledge of west-european languages within the company are totally insufficient to generate the required volume of sales. The company in its present form is of little interest for any established OECD - company in the trade - that is one with access to aluminium and with access to a market for finished or intermediate products.

To allow for efficient management and a rational production, the structure of the company should be simplified and its line of products concentrated.

The idea of a solution contains the following elements:

A. The creation of a west-european sales organization with the following facilities:

1. A group specialized in sale of aluminium wheel - rims and hub-caps to european car manufacturers. As customers are few and the number of products low, a limited sales-force based e.g. in Brussels ought to achieve a good volume of sales provided quality requirements can be met.

Goal: 3 qualified salesmen with support should reach a volume of orders of 1,500 tons aluminium with a product value of twice the price for aluminium within one year.

Present value of expected sale	$6,000,000
Yearly cost for sale-organization	$ 500,000

2. Mail order sale of "pirate" wheel-rims and hub-caps in aluminium in Scandinavia and England for sportversions of leading cars.

Goal With a sales-organization gradually developed as volume increase, a total volume of 1000 ton at a total price of three times the metal value should be achievable within 3 years.

Present value of expected sale	$6,000,000
Yearly cost for sale-organization $5000,000 + 25% of sale that is at goal volume	$2,000,000

The activity could be coordinated with sale of muffler and exhaust systems in aluminium.

3. For the reconstruction and renovation building market in eastern Germany a sales organization for heat-radiators, butterfly-valves and other types of equipment for energy-saving and environment is created.

The customers are the construction companies and the arguments for sale are low weight and energy savings.

Relatively few customers.
A non-conventional product.
Location e.g.: Berlin.

Goal: 5 Salesmen with support should within two years reach a volume of 1000 ton at a value of 175% of the price of aluminium.

Present value of expected sale	$3,500,000
Yearly cost for sale-organization	1,000,000

The activity could be coordinated with the sale of construction elements in aluminium.

B. Collaboration is established with a company in a NIC-country with production of rolled aluminium products but with no or limited casting capacity, which is looking for markets in Europe for finished aluminium products.

   The company should have the ambition to build a national aluminium casting capacity and be interested in second hand as sell as new casting machines and Bulgarian know-how.

Goal: To sell within a year existing casting machines not presently in use to a value of $1,000,000 corresponding to 500 ton aluminium.

To yearly during five years sell new equipment and know-how to a value of $2,000,000 corresponding to 1000 ton of aluminium.

A concept for organization and ownership

The aluminium casting plant and the machine construction plant in Pleven are converted to an independent company and reduced to 50% in staff size. The new company should be without debts and other historic liabilities. Ownership is transferred to management and remaining employees.

West-european groups undertake to create the sales-organizations outlined under A and enter into contractual arrangements with the Pleven Aluminium Casting Company.

An aluminium producer from a NIC-country enters into contractual arrangements outlined under B and other long-term agreements of mutual benefit (e.g development and sale of aluminium products consisting of both rolled and casted components).

The NIC Aluminium company enters into agreements on sale of e.g. exhaust systems for cars and construction material in aluminium with the sales organisations mentioned under A.

The Bulgarian, west-european and NIC partners take as groups equal size parts of the shares in Pleven Aluminium Casting Company.

Some economic estimates	$ million
Sale in west (A)	15.5
Cost of sales in west	3.5
Net sales in west	12
Corresponding value of Al-metal 3,500 ton at $2,000	.....7...
Net income	5

Sale to NIC-country			2
Corresponding to 1000 ton of aluminium			

One thousand tons of aluminium products are sold locally at a price not below twice the aluminium price.

Exchange rate for calculation		10 leva/$
Domestic sales		40 mln leva
Estimated costs in local currency		(mln leva)
salaries 500 x 6,000	3	
energy	1	
others	1	
repair, maintenance, rennovation	20	
	25	
Calculated annual profit	15 mln leva	
	5 mln $	

Some general comments

The strategies for the Pleven Aluminium Casting Plant should be seen in three steps. The first is survival for 1991. Here the hope is that established contacts in the Soviet union (light tractors) and France (car wheels) can provide the required markets and sources of aluminium.

The strategies outlined above in this paper should be seen in the 1 - 3 year perspective and may be valid for the next decade.

In the long time-perspective the most interesting market in aluminium casting industry is probably the core casting one, as many producers move out of it dependent on the severe and costly occupational and environmental health problems associated with this line of production. Provided technical solutions can be found and implemented to solve or and least control these problems a profitable market segment may be within reach.

Annex 6

INDUSTRIAL SAFETY AND OCCUPATIONAL TOXICOLOGY

by

Dr. Helmut Friza

CONTENTS

UNIDO

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT FOR THE PEOPLE'S REPUBLIC
OF BULGARIA

JOB DESCRIPTION

SI/BUL/90/801/11-54/J12101

Title:
CONSULTANT IN INDUSTRIAL SAFETY AND OCCUPATIONAL TOXICOLOGY

Duration: Two weeks

Duty station: Pleven (Bulgaria) - 1 week
Vienna -1 week

Purpose of the Project: To provide an environmental impact assessment and to elaborate an optimal implementation scenario for decision-makers in order to reduce occupational and environmental hazards at Pleven plant for aluminum casts.

DUTIES:

1.To elaborate, on the basis of the observations of previous experts and own studies, as well as on the basis of the measurements done by the contractor's team, the list of the most hazardous imissions affecting the Plant personnel.

2.To perform the correlation of these data with the recorded rate of diseases of the Plant staff and to advise on the economic and amenity losses to be caused by these factors.

3.To advise upon the technique and methodologies to reduce the negative influence of the occupational factors onto the personnel exposed to them.

4.To suggest on the plan of measures to be incorporated into the general rehabilitation scenario and bearing the actions needed to significantly improve the occupational standards at the Plant site.

5.To participate, with the materials ready to be discussed at the cost-benefit level, at the expert's group meeting in UNIDO, together with the group of other experts.

QUALIFICATIONS: A degree or substantial working ex[illegible] in industrial toxicology and alleviation of toxic [illegible] in industrial enterprises.

LANGUAGE: English

..../..

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

Project Personnel Recruitment Branch, Department of Industrial Operations
UNIDO, Vienna International Centre, P.O. Box 300, A-1400, Vienna, Austria

2. Report

2.1 The most hazardous immissions affecting the plant personnel

2.1.1 Kind of immissions

The immissions in the Plant were measured by (a): the Hygienic and Epidemic Inspection (HEI) of Pleven (Jan./Feb. 1990) and (b): by AlpenConsult (27.08. - 31.08.1990).

The twelve main immissions relevant for occupational health described in the respective reports were (alphabetical order):

1- Aceton (a)
2- Aluminium aerosols (a)
3- Butanol (a)
4- Carbon Oxide (a)
5- Dust (b)
6- Formaldehyde (a)(b)
7- Gasoline (a)
8- Hydrocarbons (a)(b)
9- Lead aerosols (a)
10- Noise (b)
11- Phenol (a)(b)
12- Toluol (a)

2.1.2 Treshold levels for working places for the measured immissions:

1- Aceton (a)
Bulgaria: PDK 250 mg/m3
Germany: MAK 2400 mg/m3
2- Aluminium aerosols (a)
Bulgaria: PDK 2 mg/m3
Germany: MAK 6 mg/m3
3- Butanol (a)
Bulgaria: PDK 100 mg/m3
Germany: MAK 300 mg/m3
4- Carbon Oxide (a)
Bulgaria: PDK 20 mg/m3

Germany: MAK 33 mg/m3

5- Dust (b) containing quartz

Bulgaria: PDK n.a.

Germany: MAK 4.0 mg/m3

6- Formaldehyde (a)(b)

Bulgaria: PDK 1 mg/m3

Germany: MAK 0,6 mg/m3

7- Gasoline (a)

Bulgaria: PDK 300 mg/m3

Germany: MAK n.a.

8- Hydrocarbons (a)(b)

Bulgaria: PDK 300 mg/m3

Germany: MAK due to cancerogenity not existant

9- Lead aerosols (a)

Bulgaria: PDK 0,01 mg/m3

Germany: MAK 0,1 mg/m3

10- Noise (b)

Bulgaria: n.a.

Germany: 85 dB(a)

11- Phenol (a)(b)

Bulgaria: PDK 5 mg/m3

Germany: MAK 19 mg/m3

12- Toluol (a)

Bulgaria: PDK 50 mg/m3

Germany: MAK 380 mg/m3

2.1.3 Immissions overpassing the threshold levels and their localizations in the plant:

1- Aceton (a)

Base Painting: Average concentration (a): 700 mg/m3

This concentration is more than 200% of the PDK and way under the MAK

2- Aluminium aerosols (a)

Battery charging shop: Average conc. (a): 2 mg/m3

Argon welding: Average conc. (a): 2,2 mg/m3

Induction melting: Average concentration (a): 2,2 mg/m3
Casting machines: Average concentrations 2,1 to 2,3 mg/m3

These values are 10 to 30% over the PDK and way under the MAK

3- Butanol (a)
Base painting: Average conc. (a): 300 mg/m3

This concentration is 300% of the PDK and 100% of MAK

4- Carbon Oxide (a)
Casting machine VP-1000 with core and graphite oiling: Average conc. (a): 23,3 mg/m3

This concentration is ca. 115% of the PDK and about 60% of MAK

5- Dust (b) containing quartz
Sand blasting machines: Average conc.(b): 4 - 4,5 mg/m3

This concentration is up to ca. 110% of MAK

6- Formaldehyde (a)(b)
Casting machine: Av. conc. (a): 3,5 mg/m3
Casting machine VP-1000: Av. conc. (a): 3,5 mg/m3
Core machines: Av. conc. (b): 2,25 mg/m3

These concentrations are 225 to 350% of PDK and ca. 330 to 530% of MAK

7- Gasoline (Benzin)(a)
Washing with gasoline: Av.conc. (a): 700 mg/m3

This concentration is ca. 330% of PDK; due to the fact, that benzine may have different constituents, there is no MAK - level available.

8- Hydrocarbons (a)(b)
Casting machines: Av. conc. (a): 216 mg/m3

Core machines: Peak conc. (b): +10 to +15 mg C/m3

Av. conc. (b): +5 mg C/m3 (ca. 100 mg/m3?)

Casting machines VP 100/3: Peak conc. (b): +15 mgC/m3

Av. conc. (b): +3-4 mg/m3 (ca. 80 mg/m3?)

Core dryer section: Peak conc. (b): +10 mg C/m3

Thermic treatment section (b): +9 mg C/m3

Av. conc. (b): +6 mg C/m3 (ca. 120 mg/m3?)

Diesel high lift truck (b): +9 mg C/m3

These concentrations are maximal 105% of the PDK; due to the fact, that they are carcinogenic, there is no MAK

9- Lead aerosols (a)

Base painting: Av. conc. (a): 0,012 mg/m3

This concentration is 120% of PDK and way under MAK

10- Noise (b)

The average noise values (b) are over 85 dB in following places:
Casting machines, saw machines, product finishing,
Peak values over 100 dB (b) were found in following places:
melting furnance section, casting machines, saw machines, product finishing
Peak values over 90 dB were found in following places:
mixer, casting mach., sawing mach.

Therefore hearing loss may occur in the Casting section, in the sawing section, in the product finishing section, and in the melting furnace section (in front of).

11- Phenol (a)(b)

Casting machines: Av. conc.(a): 15 mg/m3

This concentration is 300% of PDK and under MAK

12- Toluol (a)

Base painting: Av. conc. (a): 150 mg/m3

This concentration is 300% of PDK and under the MAK values

2.1.4 Ranking of working places according to their health risks sum:

Core machine: ++++++ (noise, hydrocarbons, formaldehyd, carbonoxid, phenol and quartz dust)
Casting machines: +++++ (noise, hydrocarbons, formaldehyd, carbonoxid, phenol)
Sand blasting: + (quartz dust)
Core dryer: + (hydrocarb.)
Thermic treatmt.: + (hydrocarb.)
High lift truck: + (hydrocarb.)
Base painting: + (butanol)
Gasoline-washing: + (gasoline)
Saw machine: + (noise)
Product finish.: + (noise)

Additional health risks observed:
- No heating and local heat radiation
- Danger of accidents with high lift truck
- Sawing machine dangers
- Ultraviolet and infrarared light in melting section
- Handling of radioactive material and x-rays
- Asbestos materials

2.2 Influence of hazardous immissions

Aluminium: Aluminium lung (Aluminosis), Pneumoconiosis
Asbestos: Pleural plaques, Mesothelioma
Carbonoxid: Headache, dizziness, drowsiness, weakness, vomiting, nervous disorders
Cold: Neuralgias, respiratory infections
Formaldehyde: Dermatitis, irritation and sensitization of moucous membranes, chronical respiratory diseases, irritation of intestinal tract (ingestion), headache, neurological effects, sterility in women, cancer of the nose and sinuses.
Hydrocarbons: Respiratory and dermal carcinogenicity.
Noise: Deafness

Phenol: Skin diseases, weight loss, marasmus, genetic effects, irritation of moucous membranes, irritation of respiratory tract, central nervous depression, headache, liver and kidney toxicity, myocardial effects
Quartz dust: Bronchitis, Pneumoconiosis, Silicosis, Silico-Tuberculosis

2.2.1 Influence on observed disease rates - Distribution of diseases in the plant

For the year 1989 the Hygienic Institute in Pleven prepared a health report.

All 133 workers and employees of the plant section observed were examined by different specialists.

53 persons (ca. 40%) were described to have disease symptoms. 9 new cases (ca. 7% of all persons examined and 17% of persons with symptoms) were freshly detected. 10 persons (ca. 7,5% of all 19% of persons with symptoms) were defined to have professional diseases.

The distribution of conditions between specialities was:

	N Pers.	% dis. (53)	% ex. (133)	% symp. (79)
1. Neurological disorders	26 Pers.	49%	20%	33%
2. Internal diseases	19 Pers.	36%	14%	24%
3. ENT - disorders	17 Pers.	32%	13%	22%
4. Eye disorders	17 Pers.	32%	13%	22%
Sum	79 Pers.	149%	60%	101%

Due to the fact, that 49% of persons had more than one disorder, one might estimate, that about 35% (of diseased) had two disorders and 14% (of diseased) had three disorders.

The Neurological disorders were distributed as follows:
26 Persons (49% of diseased persons, 20% of all examined and 33% of all symptoms)

	N Pers	% dis. (53)	% ex. (133)	% neur. symp. (26)
1. Neurasthenie	15 Pers.	28%	11%	58%
2. Back Sympt.	7 Pers.	13%	5%	27%
3. Klimacterium	4 Pers.	8%	3%	15%
Sum	26 Pers.	49%	20%	100%

Neurasthenie (which have 11% of all examined persons) might be caused by following exposures in the factory:
Carbonoxide, Cold, Formaldehyde, Phenol.
Also the back symptoms may be influenced by nerve irritating substances like above.
These exposures are found mainly in the core production and casting machines section.

The internal diseases were distributed as follows:

	N Pers	% dis. (53)	% ex. (133)	% int. symp. (19)
1. Gastroint.dis.	11	21%	8%	58%
2. Respirat.dis.	3	6%	2%	16%
3. Heart+Circ.dis.	3	6%	2%	16%
4. Rheuma	1	2%	<1%	5%
5. Diabetes	1	2%	<1%	5%
Sum	19	36%	14%	100%

Gastrointestinal diseases (which have 8% of all examined persons) might be caused by following occupational exposures in the plant:
Formaldehyde
This substance mainly occurs in the core production section and in the casting section of the plant.

The respiratory diseases might be promoted by dust, formaldehyde, aluminium, cold and hydrocarbons.

Age distribution of internal diseases:

16-45 years	3 dis.Pers. of 82 examined	(<4%)
45-55 years	14 dis.Pers. of 39 examined	(36%)
55+ years	2 dis.Pers. of 12 examined	(17%)

This result indicates the possible exposure of chronic occupational risk factors, in this case possibly formaldehyde.
The lower figure in the age group over 55 years indicates a drop-out proces.

Lenght of stay in plant of internal diseased persons:
1-15 years 3 dis.Pers. of 97 examined (3%)
15+ years 16 dis.Pers. of 36 examined (44%)

This highly significant difference also indicates the importance of the occupational factors on the disease frequency.

As high internal-diseases-risk-group we can therefore define people, who worked more than 15 years in the plant and is in the age-group between 45 and 55 years of age. More than 40% of persons with these characteristics are internally diseased. If one adds the chronical neurological diseases to this group, the percentage of diseased persons in this category exceeds for shure 50% of the population of about 20 persons. Probably this figure is grossly identical with the above described occupational diseases group of 10 persons.

For them, exposure has to be stopped and preventive measures have to be taken, not to expose further persons to the risk factors in the risk places.

The eye disorders in the plant population was fond to have following distribution:

	N Pers	% dis. (53)	% ex. (133)	% eye symp. (17)
1. Chr.Conjunct.	6	11%	5%	35%
2. Optical dis.	6	11%	5%	35%

3. Catarracta	1	2%	<1%	6%
4. Others	4	8%	3%	23%
Sum	17	32%	13%	99%

The main symptom in eye disorders was chronic conjunctivitis which may be related to following exposures:
Formaldehyde and phenol; these exposures occur mainly in the core production and casting section of the plant.
The catarracta may be related to ultrared radiation.

The main ENT-disorders according to the examination of the 133 persons were:

	N Pers	% dis. (53)	% ex. (133)	% ENT symp. (17)
1. Pharyngitis	7	13%	5%	41%
2. Opht.neuralgia	6	11%	4,5%	35%
3. Otitis	1	2%	<1%	6%
4. Others	3	6%	2%	18%
Sum	17	32%	13%	100%

The main symptom of pharyngitis may be connectet with following exposure: formaldehyde, quartz sand, phenol, cold, aluminium dust and hydrocarbons; the symptom of ophtalmicus nerve neuralgia may be related to: Carbonoxide, formaldehyde, phenol.

Most of these substances and exposures are found in the core production and casting sections as well as in the sand blasting of the plant.

The results of above statistics are also strengthened by the results of urine laboratory examinations performed in Pleven plant:

Results of urine check-ups:
(over allowed limits)
1. Casters: phenol ....30% pos., formaldehyde....30.6% pos.

2. Melters: phenol.....50% pos., formaldehyde....25% pos.
3. Sandcorers: phenol.....25% pos., formaldehyde....42% pos.
4. Mechanics : phenol..... 0% formaldehyde....71% pos.

2.2.2 Influence on economic and amenity losses

There is no question that avoidable disease spells account for avoidable direct and indirect costs and losses of socioeconomic benefits.

The average duration of sick leave in the Aluminium factory was:

1986	7,5 days
1987	8,3 days
1988	8,5 days
1989	9,4 days

The Incidence of sick leave spells per 100 workers was:

1986	170,4	new cases per 100 workers
1987	123,5	- " -
1988	151,2	- " -
1989	94,6	- " -

The Prevalence of the number of days in sick leave per hundert workers in a year was:

1986	1271,1	days sick leave per 100 workers
1987	1021,7	- " -
1988	1291.7	- " -
1989	888,9	- " -

(Prevalence = Incidence*Duration, if the situation is rather stable.

That means, from 100 workers in Pleven plant, there were in the years 1986 to 1989 in theory 3 - 5 persons permanently in sick leave, or better 3 to 5% of the plant staff. These 3 to 5% do not account for the persons, who went out of job due to health reasons (see above under point 2.2.1). Due to not available statistics, the number cannot be estimated.

The machine Factory "Vapzarow" shows a duration of sick leave of 100 workers (we do not know, if the age groups are comparable!) of about 1100 days per year, which means about 4% or four workers out of 100 being sick all the year long.

The Machine Factory "Ilinden" shows a duration of sick leave of 100 workers of maximal 957 days per year, which means that 3 workers out of 100 are theoretically sick for a whole year long, or in other words, 3% of the personnel.

Due to the fact, that we do not have the age distributions to compare, we can assume, that in the pleven aluminium plant 1 person of 100 personnel is lost yearly due to diseases originating in the plant due to different working conditions to the two other plants. Due to the differences in lenght of sick spells, one can assume that in the aluminium plant, there are less chronic diseases than in the machine factory "Ilinden" and the same amount as in the factory "Vapzarow", but that there are more acute spells in the aluminium castig plant than in the factory "Ilinden". This may be also caused by the influence of a higher proportion of drop-outs in higher age because of chronic diseases, which cannot be veryfied due to a lack of statistics.

For shure, one person per year out of 100 workers is lost to productivity due to plant-inherent reasons, possibly the occupational characteristic of the plant.

The uselessly paid salary of these people would have been better used for financing protection measures. Due to the chronicity of the diseases in question a half-time of the health effects of the protection measure will be about 10 years. Within these ten years, the drop-out rate due to health reasons will decrease.

If one accounts only for one drop-out ten years before pension,

the loss is doubled (due to the fact, that people drop out in average 5 years before pension, this is a substantial underestimation). If one accounts for the medical treatment during these 10 years, the loss is at least tripled. If the person in question lives longer than these ten years, this loss due to - not at all intensive treatment - is about fourfold a years salary per 100 persons working per year.

We have therefore a minimal estimate of one salary per 100 workers loss per year, a moderate estimate of four salaries loss per 100 workers per year; I do not dear to estimate a maximal loss due to the conditions in Pleven Plant due to health reasons, but it must be in the range of 10 salaries per year per 100 personnel only accounting for the loss of working time and rather minimal treatment costs.

That means, that 1% to 10% of the salaries costs are lost due to the lack of proper working places protection in Pleven Aluminium Plant, with a half-time of reduction in case of proper protection measures of about 10 years time.

I do not dear to estimate the other costs, as for the family, production loss due to personnel change, etc., or to account for the estimated costs of an earlyer death (does it cost or does it economize money, if people die short after their pension? - there are different oeconomic opinions on this point!).

It would not be fair, to compare with the allover Incidence of Pleven district (100,1 vs. about 120-150 in Pleven plant), to compare with the allover duration of diseases in Pleven district (9,3 vs. 8,5) or with the allover Prevalence in Pleven district (955,2 vs. 1000 to 1300), due to the fact of other age- and sex-distributions in the general population and in the population of the plant.

But, if one compares the general Bulgarian Statistics with the data available for Pleven (see statistics in the appendix), Pleven district shows up as to be a district of Bulgaria with rather low health standard (and within this District Pleven aluminium Plant accounts for lowering the average values of its district). Within Pleven District, Pleven town (with its factories) accounts for the highest average of diseases (duration, incidence, prevalence), so that Pleven Town may be, from the health point of view, defined as a high risk area within Pleven District, and Pleven District within Bulgaria, which fact is probably caused by its factories.

The general loss of working power and the general treatment costs of chronic diseases, not accounting for other socio-oeconomic losses (e.g.: migration of skilled personnel and young away from Pleven), as demonstrated or better: estimated for the Aluminium Plant applies for the whole town of Pleven. Urgent action is needed to keep the damage within borders.

2.3 Techniques and methodologies for immission and risk reduction

There are in occupational environment protection three points of attack for reduction of risk:

- Emission reduction
- Transmission reduction
- Immission reduction

There are in occupational medicine three points of preventive attack:

- Working place control
- Health control of workers
- Management advice and action monitoring

2.3.1 Emission reduction:

Possible measures:

- Use of better non-emitting Materials (e.g. no asbestos, better sand quality, less alu scrap due to more precise production),
- Capsulation (Core producing machine, sand)
- Closing of non productive section of factory (core production?)
- Use of other technology (diesel high lift cars)

2.3.2 Transmission reduction:

- Ventilation (core production, casting, melting)

- Walls (Noise)

2.3.3 Immission reduction

- Glasses (Radiation)
- Mouth protection with masks (dust, phenol)
- Clothing change (phenol, formaldehyde)
- Ear props (noise)
- Washing with special products (phenol)

2.3.4 Working place control

- Doctor's description of each working place and its risks
- Advice for management of necessary changes
- Monthly control of working places

2.3.5 Health control of workers (special investigations according to working place and exposure)

- Start of employment
- Each year
- On request of the worker or of the management

2.3.6 Management acvice and action monitoring

- Doctor and Security engeneer in the management board!
- Teaching of occupational health and risks of the concerned workers in selected groups
- Workshops for occupational health action and registry with the workers of the plant

3. Summary:

Pleven Aluminium Casting Plant is one of the Pleven Factories which account for the low health status of Pleven Population, comparing with Pleven District ant Bulgaria.

The main diseases caused by occupational exposure in Pleven Plant are:

- Neurasthenia
- Gastroenteritis
- Back disorders
- Pharyngitis
- Conjunctivitis
- Ophtalmicus Neuralgia
- Chronic respiratory and cardial diseases

All these symptoms and diseases may be brought in connection with occupational exposure, for instance with the emissions of the core production and the casting section of the plant but also with other working places within the plant.

The main occupational hazards of these working places are formaldehyde, phenol, hydrocarbons, carbonoxide, quartz sand, noise, cold and heat, and others like UV, Gamma-, Infraredradiation or asbestos.

The plant specific occupational risk is causing at least the loss of one person's salary per year per 100 personnel, but one has to account for 4 to 10% loss of the entire salary costs in the next ten years after appropriate measures in order to reduce the risk, due to the chronicity of the conditions, if one accounts only for working time loss and for (very low) treatment costs.

A set of recommendations for immission reduction and for occupational medical action is given.

UNIDO EXPERT GROUP MEETING

INTEGRATED QUALITY CONCEPT:
case study on integrated monitoring
(environmental/occupational/technological aspects)
PLANT FOR ALUMINUM CASTS, in Pleven Bulgaria

AGENDA AND TIMETABLE

Monday, 12 November 1990

10:00-10:15	Opening address: UNIDO
10:15-10:30	Integrated Quality Concept M.Boutoussov
10:45-11:30	Demonstration of the Videofilm about Pleven Plant
11:30-12:15	General Description of the Main Findings and Suggestions on the Agenda. A.Jarnelov
14:00-14:30	Results of the on-site investigation and measurements by ALPENCONSULT H.Meisterhofer
14:30-15:15 15:30-16:00	Brief Statements of the Expert Group on their Findings W.Gaubinger, I.Stankovich, H.Friza, H.Meisterhofer, A.Jarnelov
16:00-16:45	Essentials of Environmetal Economics R.Luken

Tuseday, 13 November 1990

9:00-10:30	Informal Discussion
10:45-12:00	Detailed Report and Suggestions of a Consultant in Aluminum Casting Technologies- I.Stankovich
14:00-15:00	Detailed Report and Suggestions of a Consultant in Environmental Engineering -W.Gaubinger
15:00-15:45	Detailed Report of a Consultant in Occupational Health and Toxicology -H.Friza
16:00-16:45	Detailed Report of Group Leader- -A.Jarnelov
16:45-17:00	Discussion and Comments

Wednesday, 14 November 1990

9:00-10:00	Comments of Representatives from Pleven Plant- E.Vankova, N.Ekov, T.Shoumkova.
10:00-10:45	Comments from UNIDO -R.Luken, S.Maltezou, V.Iliev, R.Williams
11:00-12:00	Working Discussion on the Assessment of the Status with Integrated Quality at the Pleven Plant
14:00-15:15	Working Discussion (Continuation)
15:30-15:45	Draft Statement on Discussed Matters- -A.Jarnelov
15:45-16:15	Comments from Participants
16:15-16:45	Finalization of Economical Issues of the Proposed Plan of Environmental and Technological Rehabilitation- Consultants

Thursday, 15 November 1990

9:00-10:00	Comments on Availability af Funds Mobilization for Implementation of the Proposals of Group Meeting- H. Meisterhofer, I.Stankovich, A. Jarnelov, opinions of EMGI Section and Infrastructure Branch (UNIDO)
10:00-10:30	Working Discussion
10:45-12:00	Finalization of Discussion and Nomination of the Editorial Group for Final Document
14:00-16:00	Editorial Group, Consultations with UNIDO and Bulgarian Authorities- A.Jarnelov

LIST OF PARTICIPANTS

UNIDO EXPERT GROUP MEETING

Integrated Quality Concept : case study in Integrated Monitoring (Environmental/Occupational/Technology Aspects)
PLANT FOR ALUMINUM CASTS, Pleven, Bulgaria
12-15 November 1990

1. A.Jarnelov, Group Leader, UNIDO consultant, SI/BUL/90/801
2. W.Gaubinger, UNIDO consultant, SI/BUL/90/801
3. H.Friza, UNIDO consultant, SI/BUL/90/801
4. I.Stankovich, UNIDO consultant, SI/BUL/90/801
5. H.Meisterhofer, UNIDO contractor, SI/BUL/90/801
6. E.Vankova, Pleven Plant, Bulgaria
7. N.Ekov, Pleven Plant, Bulgaria
8. T.Shoumkova, Association Metal Technology, Bulgaria
9. M.H.A.Hamdy, Director.IIS, UNIDO
10. S.Maltezou, IPCT, UNIDO
11. W.Kamel, Chief, ECU/PPD, UNIDO
12. R.Luken, ECU/PPD,UNIDO
13. M.Lesjak, ECU/PPD/UNIDO
14. B.Karlsson, Head, PLAN/IIS, UNIDO
15. G.Roces, AREA/PPD, UNIDO

15.C.Winkelmann, PRAS/OS, UNIDO

16.C.Walker-Brosio, CONTR/GS, UNIDO

17. V.Iliev, MCT/IO, UNIDO

18. G. Donocik, AREA/PPD, UNIDO

19. N. Falcon Castro, EPL/INF, UNIDO

20. M. Boutoussov, IIS/INFR, UNIDO