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COPSA MICA METALLURGICAL PLANT

Visit 19. 5. - 24. 5. 1991

Consultant: Dr. Reinhard Fischer
28. 5. 1991

Report about the visit of the Copsa Mica Metallurgical Plant

from 19. 5. - 24. 5. 1991

by Dr. Reinhard Fischer

I have met

in Bukarest	Alexandru Tarana, Genêral Direktor Ministry of Industry, Ecological Division
	Calin Popescu, Managing Director Cornel Florea, Deputy Director Ministry of Industry, Public Relations Division
at the plant	Ladislau A. Frumosu, State Subsecretary Ministry of Industry, Department of Metallurgical Industry
	Gheorghe Stefanescu, Director adjunct Ministry of Industry, Department of Metallurgical Industry Division of Ecology of Non Ferrous Metals
	Nicolae Bodea, Director general Sometra, SA
	Volker Hammrich, Director tehnic Sometra, SA
	Octavian Pop, Head of Training Department Sometra, SA
	Vasile Mucundorfean Engineer for safety, health and environmental protection Sometra, SA

Most informations were given by Mr. Hammrich, Mr. Pop acting as interpreter.

1. Plant and process.

1939-1966	A zinc smelter was in operation using at least 12 horizintal retort furnaces, capacity each 5 t/d zinc. Average production 5 000 t/a zinc.
1958	Erection of 1. New Jersey zinc refining column.

1962	Project to install the I.S.P. technology for production of zinc, lead and sulfuric acid.
1966	Commissioning of the plant No. I, built by British companies. Reasons for building the plant here: Nearly same distance to several mines. Natural gas, water, working force.
1974	Erection of lead electrolysis, Italian made, 38 000 t/a lead.
1975	Treatment plant for slurry of electrolysis.
1978	Furnace for antimony production.
1984	Erection of I.S.P. plant No. II, Rumanian made.
1985	Erection of 250 m stack and connecting pipes.

I.I. Process.

The Imperial Smelting Process has been developed in England and is in use since the 60 th in several countries in the world.

The process is able to treat bulk zinc-lead-concentrates to recover simultaneously zinc and lead metal, also copper and precious metals.

The concentrates are roasted and agglomerated on a sinter machine. The sulfur contained is burnt to SO_2 which is treated after dedusting in a contact plant to produce sulfuric acid.

The sinter is smelted with coke in a blast furnace, the zinc volatized is condensed to liquid metal, the liquid lead and the slag is tapped from the bottom of the furnace.
The lead contains the copper and the precious metals.

Zinc is refined to 99,99 % in New Jersey distillation columns. Lead is refined to 99,99 % by electrolysis.

Anode slurry from the electrolysis is smelted in short rotary furnaces to produce Doré metal (containing silver and gold), antimony and bismuth slags.
Doré metal is further enriched by cupellation.
Antimony- and Bismuth-slags are treated by reduction to produce metal.

The Wälz kiln is used to treat zinc containing residues evaporating zinc and producing zincoxyde.

By chemical methodes, using solutions, zinc- and cadmiumsulfat are produced.

Pyrite is roasted in a fluosolid roaster to produce sulfuric acid and to help to increase the SO_2 level of the off-gases of the sinterplant.
For pyrite cinder is no use, it is dumped.

1.2. Equipment.

The metallurgical plant comprises:

Covered storages for concentrates and coke

2 I.S.P. plants consisting of

Sinter plant
Sulfuric acid plant
Blast furnace
Decopperizing plant

4 New Jersey zinc refining systems

2 lead electrolysisses

2 Wälz kilns, 1 wrecked

Fluosolid roaster for pyrite

4 short rotary furnaces, 3 in operation for anode slurry treatment

1 cupellation furnace for Doré metal

1 furnace for antimony production

Plants for production of zinc- and cadmiumsulfat

Plant for production of zinc dust

2 effluent water treatment plants

Laboratory

Repair shops

Social buildings (change house etc.)

2. Present situation.

2.1. General

The plant is in a very bad condition, not only concerning unrepaired, partly wrecked equipment but also cleanness and order is missing.

The plant management mentioned the following reasons:
In the past:
Priority of metal production, no care for environmental problems.
Lack of spare parts, especially those which are not produced in Rumania.
Isolation from the development of zinc and lead metallurgy and the means for environmental protection outside Rumania.
Since 1978 interruption of the exchange of experience with the other ISP users in the world.

At present:
Lack of spare parts.
Shortness in electricity.
Shortness in skilled labor.After the revolution 30 % of the workers retired at the age of 50. Many good workers left for western countries.
Unplanned break downs of parts of the plant because of the bad conditions of the equipment.

Mr. Hammrich and Mr. Pop have visited recently the ISP plant in Britain, Germany and Poland.

2.2. Present situation of operation.
By order of the Ministry of Industry the production of the plant was reduced to 50 % of the capacity of one ISP line because of heavy pollution of the environment.
The No. I ISP line were working but is due to be stopped at the end of May for a 90 days repair. Then the No. I shall start again, because the overall working conditions are said to be better than the No. II.
The No. II was repaired and prepared for starting, which I could see during the visit.

In operation were also

1 Wälz kiln
1 lead electrolysis with 132 cells, producing ca. 60 t/d lead
Slurry treatment plant with 3 short rotary furnaces.
Zinc- and cadmiumsulfat- and zincdust-plant, zinc distillation No. 3 + 4, which I have not visited.

The production and consumption figures for 1984, 1986, 1989 and 1990 are given in table 1 to 4.

3. Health regulations.

Every 6 month medical examination for each worker by doctor of the plant.

Urine analysis : Coproporhyrine, ALA

If necessary lead in urine, lead in blood.

The following table shows the scheme of the treshold values

	normal	acceptable	excessiv	dangerous
Lead in blood	- 40	40-80	80-120	+ 120
Lead in urine	- 80	80-150	150-250	+ 250
Coproporphyrine	- 150	150-500	500-1500	+ 1500
ALA	- 6	6-20	20-40	+ 40

Cases of industrial diseases in 1990

Cases of professional saturnism	102
Cases of saturnistic colics (pains)	27

Monthly instruction about accidents and health.

Most workers have dust masks, but there exists a shortage in masks. But no central cleaning of masks.

No smoking regulations in the plant, but not regarded after revolution.

Rules for employment of minors exists, but no prohibition for women employment.

Working clothes are furnished and washed by the plant

Concentration of lead in the air of the working places is measured monthly. Table 5 shows average figure of 1990. Column 3 shows the treshold values. Column 4 shows the yearly average.These figures are possibly mathematical averages which say nothing about peak values and their duration.
It is remarkable that also in those parts of the plant where normally low concentrations occur, as zincsulfat-, sulfuric acid- plant etc., the treshold values are surpassed. Diffuse emissions inside the plant could be the cause.

4. Conditions of workers.

Working 6 h/d, 5 days a week.

Lunch and 1 ltr. of milk daily free.

Payment:

Fixed, depending on the working place. Ministry fund of about 1-2 % of wages for special bonus for workers, now superintended by the trade union.
No incentive payment for example for reduction of break downs or good performance of work.
The main subject of bonus was the fulfilment of the plan of production.

The number of plant staff is given in table 6.

5. Responsibility and decisions.

In the past the Ministry of Industry owned the plant, set the standards for health and environment, made the plan for the production, fixed the prices for raw material and products and determined the amount of money to be spent for wages, spare parts, repairs.

In 1978 the standards were:

Environment	mg/m^3 /24 h (?)
SO_2	0,250
H_2SO_4	0,100
Lead	0,001
Dust	0,35

Working place	mg/m^3		mg/m^3
Pb	0,2	ZnO	10,0
CdO	0,2	SO_2	15,0
H_3As	0,3	Sb	0,5
Bi	10	Cu	0,15
HF	2	CO	50
H_2SO_4	1,5	Dust	15

A standard for the contents of the effluent gases should have been existing, as Mr. Hammrich told me, but I could not get the figure.

All these standards will be revised now.

Now the Ministry of Environment set the standards.

The Sibiu-Institut which measured around the plant belongs to the Ministry of Environment.

The Ecological Department of the Ministry of Industry has to supervise the realisation of the standards by the plant management and also to furnish the money to build the necessary equipment.

Plant manager have very few rights to decide.

6. Remarks about the working conditions of the plant.

Most equipment needs extensive repairs.

- 7 -

In a comparatively better state are

ISP blast furnaces
one lead electrolysis
decopperizing plants
treatment plant for anode slurry
antimony and bismuth plant
cupellation furnace
Wälz kiln

Extensive repairs are necessary for

sinterplants
sinterplant off-gas cleaning
sulfuric acid plants
zinc refining plant
dedusting systems off different plants

The question is which equipment can be repaired or must be replaced. Parts of the sulfuric acids plants f.e. are wrecked.

6. Yards and roads.

Yards and roads are covered up to 10 cm with metal bearing, fine material. Loads of scrap laying everywhere.
During my visit most of this material were slurry because of the weather. But in summertime it becomes dry.

The dump for slags and pyrite cinder is also covered with scrap.

7. Pollution

There are two sources of pollution:

From point sources of emission.
From diffuse sources of emission.

7.1. Point sources of emission.

They are numbered at the map, enclosure 1.

No. 1 + 2
Off gases of the blast furnaces.They are washed in a Theissen washer and burnt to preheat coke and blast air.
They normally and also here contain very few dust.

No. 3 + 4

Off-Gas of sintermachines. It contains 3-5 % SO_2 and up to 10 g/m^3 dust, containing zinc, lead and cadmium.

Normally these gases are dedusted and the SO_2 content is converted to SO_3 with about 98 % conversion efficiency, the SO_3 is absorbed by sulfuric acid with an absorption efficiency of 99 %. The dedusting has to be done very efficiently to avoid contamination of the contact mass of the converter.

In the past and at present very often unplanned break downs in the gas cleaning system and in the sulfuric acid plant occured. Not to stop sinter- and blast furnace-production gases were let off trough short stacks before dedusting or after dedusting, so that dust and SO_2 were emitted.

Also conversion and absorption efficiency did drop down, because contaminated catalysts were not replaced and absorption tower not maintained.

From these sources most of the pollution has been and is still originated.

In a normal ISP plant the factor of sulfuric acid produced to intake of sulfur into the plant is ca. 2.8. Looking at table 1-4 to production of sulfuric acid and sulfur intake the calculation shows factors between 0,79 and 1,34. That means, that

1984	42 000	t/a
1986	45 000	t/a
1989	79 000	t/a
1990	12 000	t/a

of SO_2 have been emitted to the air.

No. 5 is the Wälz kiln

No. 6 is the anode slurry treatment plant

No. 7 + 8 are the zinc distillation plants

No. 9 + 10 are the decopperizing plants.

Number 5 to 10 contribute to pollution mainly dust in a minor quantity compared with the sinter plants.

The laboratory of the plant is not equipped for determination of emitted gas quantities and dust contents. It only has an electric pump and washing bottles, by which gas contents, f.e. SO_2, can be determined. This equipment is not suitable to determine the dust content.

7.2. Diffuse sources of emission

The roads and yards, the open air concentrate and byproduct storage and the dump are producing severe pollution by zinc, lead and cadmium containing dust in the dry season. This pollution will mostly occur in the vicinity of the plant. But with higher velocity of wind this dust can be carried several kilometers.

My estimation is that during dry periodes the quantity of this dust pollution is in the same range as the quantity of dust coming from the point sources of pollution.

7.3. Effluent water.

Water of the plant goes into the Tirnava Mare river only trough one outlet. Most of the water was treated in the water treatment plant of ISP plant No. I. only by adding lime. The chlorination for destroying CN-compounds in the washing water of the Theissen washer was not in operation.

8. Recommendations

8.1.

During repair of ISP line No. I in the next 90 days a connection should be made of sinter gas outlet before dedusting plant, behind dedusting plant (venturi) and behind absorber to the 1 600 mm Ø flue leading to the 250 m stack. The stack is lined with acid resistant bricks. The steel pipe of the flue is only covered with an acid resistant thin layer. Therefor the pipe should be lined inside with a better acid resistant material to avoid quick corrosion. If not available in Rumania buying from abroad.
The ventilator before the stack should have an acid resistant rotor which is not sensitive for sticking of dust onto the blades which would cause unbalance. If no experience in Rumania with that type of rotor buying abroad.

This measure would allow to run the sinter plant also in case of break down of the gas cleaning or sulfuric acid plant.
The 250 m stack will dilute the SO_2 and dust concentration to such an extent that the treshold values for SO_2 and dust in air and for dust deposit not will be surpassed.

8.2.

Repair of dedusting equipment of point sources of emission No. 5 to 10 and repair of hoods and exhaust piping.
This can be done by fitters of the plant, some spare parts, f.e. filter bags, should be bought from abroad.

8.3.

Immediate cleaning of the plant site from metal bearing material by carrying it onto big heaps. Depending on the metal contents controlled by analysis it is advisable to make differnt heaps. Later on can be made the decision about the use of that material.
These heaps and also the open air stocks of concentrates and the dump should be sprayed with lime milk (solution of Ca $(OH)_2$ in water) which forms a thin solid layer on the surface of the material avoiding erosion by wind.

Mr. Hammrich has already started a team to clean the dump of scrap on a basis that the profit from selling the scrap should be split between the team and Sometra. The same system should be applicable to clean the plant.

When these undertakings are finished I recommend to run one ISP line on full capacity of the sulfuric acid plant.
The present half capacity means either smaller gas quantity or smaller SO_2 content in gas or more interruptions.
All this is not good for a sulfuric acid plant which should be operated at high gas quantity and SO_2 content.

Theses recommended measures diminish pollution and give time for a comprehensive study about the future of the plant. This study should be made by foreign experts together with Rumanian Institutes.

8.4.

The study should comprise:

1.

Is a zinc-leadsmelter advisable in Rumania because of availability of concentrates from the country and because of consumption of zinc and lead in the country?

2.

Is Copsa Mica the right place concerning transpotation, natural gas, water, working force and hazards to the environment?

If both questions are answered positivly further studies should comprise:

3.

An obligatory offer from international companies for the repair of the existent equipment.

4.

An obligatory offer from international companies for the replacement of worn out equipment and repair of the remaining.
For the replacement more modern equipment should be considered.
For example sulfuric acid plant with double catalysis and replacement of the two condensers at the blast furnace by one.

5.

An obligatory offer from international companies for a more modern plant using other technologies than ISP.

Possible companies for offers 3 and 4 is Lurgi in Germany, for offer 5 KHD Humboldt Wedag in Germany.

I would estimate the necessary time for

study 1 + 2	6 month
offer 3, 4 + 5	12 month

That means that the Rumanian Government can make the decision about the future of the Copsa Mica plant at the end of 1992.
The rehabilitation of the plant will then take about 3 years.

8.5.

Concerning general regulations to minimize emissions I propose to employ the German schemes for protection of the environment and of the workers.
The German regulations provide an engineer who belongs to plant staff having direct access to the general management and taking care of emission problems (Immissionsschutz-Beauftragter)

A governmental inspector being permanently in the plant would take over the responsibility for running the plant. This responsibilty should better remain with the management.
Only in cases of very severe danger to the public by emissions of a plant the German authorities have the right to stop the plant.

8.6.

Concerning the problems of the use of vegetables etc. by the population around the plant I attach a copy of recommendations which were given by German authorities in a similar case.

Aachen, 28.5.91

Table I. production and consumption 1984

1984	Fizic to	Zn to	Pb to	Cu to	Au kg	Ag kg	S to
zinc metalurgic	38.170,0						
Plumb electrolitic	29.430,0						
acid sulfuric	59.700						
<u>Consum</u>							
conc. zincos	49.976	26.078	813	574	85	5152	17.189
conc. plumbos	23.975	2.952	12.143	885	114	22.297	8.151
conc. colectiv	50.340	17.354	9.573	1.731	484	18.728	17.411
prod. oxidice	1720	163	1.079	10	12	1.317	8.152
Total	126.011	46.547	23.608	3.200	695	47.494	50.903
%		37,0	19,0	2,6	0,56	3,8	407,2
Pb Baia-Mare	13.673		13.179		1024	41.853	

1986	Fizic to	Zn to	Pb to	Cu to	M4 kg	M5 kg	S to
zinc metalurgic	46.418,0						
plumb electrolitic	34.400,0						
acid sulfuric	63.090,0						
Consum							
conc. zincos	10.395	4270	186	70	13	904	3534
conc. plumbos	9.961	1.041	5185	121	20	8517	2.191
conc. colectiv	149.572	50.488	26.635	2302	670	44.347	40.154
prod. oxidice	2.700	189	2.211	43	71	27.793	1.093
Total	152.272	55.988	34.217	2.536	774	81.561	46.973
%		32,0	22,6	1,4	4,4g/to	465g/to	26,8
Pb Baia-Mare	11.430		10.927		564	36.848	

Table 2. Production and consumption 1986

1989	Fizic	Zn	Pb	Cu	M4	M5	S
	to	to	to	to	kg	kg	to
zinc metalurgic	11.463.48	29 849					
Pb electrolitic	12548,600	24 908					
acid sulfuric	17443,0	43 490					

Consum

	Fizic	Zn	Pb	Cu	M4	M5	S
conc. zincos	2797	1345	59	37	-	199	868
conc plumbos	5002	183	3.718	154	-	590	697
conc. colectiv	156.003	53.150	29.186	2.600	1176	55.760	45.388
prod. oxidice	23.828	9.027	9.388	115	177	66.507	8078
Total	187.630	63.705	42.351	2.906	1353	123.056	55031
%		33,9	22,5	1,5	0,7	655,8	29,3
Pb Baia-Mare	10549		10.075		656	34.774	

Table 3. production and consumption 1989

Table 4. production and consumption 1990

1990	U/M	Fizic	Zn	Pb	Cu	Mn	Mg	S
Zinc metalurgic	to	11463,533						
Plumb electrolitic	to	12548,600						
Acid sulfuric	to	17443,0						
Consum								
Conc zincos Zink Konzentrat		2124	974	56	25	0,5	153	722
Conc. plumbos Blei Konzentrat		164	21	103	5	1,5	54	55
Conc. colectiv Misch. Konzentrat		30746	10748	10776	8569	83	12346	11072
Produse oxidice		10652	2237	6991	138	177	10163	2130
Total		43686	13980	17926	8737	262	22716	13979
%			32	41				
Pb. Baia Mare		5924		5718		219	13610	

SITUATIA

determinărilor de noxe pe anul 1990-valori medii -

normally: average of 3 measurements done at places where high concentrations are expected

Nr. crt.	Secţia	Noxa	CMA mg/mc	Concentraţia medie mg/mc
0	1	2	3	4
1.	Furnal I	Pb	0,2	1,11
	Schachtofen I	ZnO	10,0	10,93
		CdO	0,2	0,06
	Blast furnace I	SO_2	15,0	7,3
2.	Furnal II	Pb	0,2	1,38
		ZnO	10,0	4,9
	Blast furnace II	CdO	0,2	0,0
		SO_2	15,0	1,5
3.	Aglomerare II ISP	Pb	0,2	2,18
	Sinterplant II	ZnO	10,0	7,84
	Sinteranlage II	CdO	0,2	0,0
		SO_2	15,0	14,96
4.	Rafinare Zn	Pb	0,2	0,48
	New-Jersey	ZnO	10,0	9,4
		CdO	0,2	0,47
	Zinc distillation	SO_2	15,0	1,58
5.	Sulfat Zn	Pb	0,2	1,14
	Zinksulfat	ZnO	10,0	11,4
		CdO	0,2	0,16
		SO_2	15,0	4,3
6.	Electroliză Pb	Pb	0,2	1,06
	Blei Elektrolyse	ZnO	10,0	4,07
		CdO	0,2	0,07
		SO_2	15,0	2,36
		Cu^2	1,5	0,07
	Lead electrolysis	Sb	0,5	0,0
		Bi	10,0	0,24
		HF	2,0	1,13
7.	F.A.S. I	Pb	0,2	1,16
	Sulfuric acid plant I	ZnO	10,0	1,68
	Schwefelsäurefabrik	CdO	0,2	0,1
		SO_2	15,0	16,8

Average over ...

0	1	2	3	4
8.	Aglomerare I ISP Sinterplant I Sinteranlage I	Pb ZnO CdO SO_2	o,2 lo,o o,2 15,o	1,11 9,76 o,18 17,85
9.	Perimetrul uzinal Environment Umfang	Pb ZnO CdO SO_2	o,2 lo,o o,2 15,o	o,81 4,23 o,04 6,72

(6 Punkte (bei Windschiff)
(outside)

DIRECTOR,
Ing. Bodea Nicolae

B. A. P. I. *Situatia efectivului de personal existent la data de 17.05.1994* Md. 1

Table 6. working force

Nr. crt.	Sectia	worker Muncitori Arbeiter	foreman Maiștri Muster	office TESA Büro Angestellte	total TOTAL Gesamt	
1	Topire I	667	39	17	723	ISP line No. I
2	Topire II	317	15	15	347	ISP line No. II
3	Chimie	229	12	4	245	Pyrite roaster + zincsulfat
4	Rafinare	178	11	3	192	New Jersey distillation
5	Wälz	62	1	1	64	Wälz kiln
6	Electroliză	260	10	6	276	Lead electrolysis
7	At. mecanic	350	10	7	367	Mechanical workshop
8	At. energ	299	11	11	321	Electrical workshop
9	Tr. auto	226	1	3	230	Truck transport
10	Tr. feroviar	55	1	–	56	Railway transport
11	Vagoane	75	–	–	75	Wagon loading
12	CTC+Lab	148	–	10	158	Laboratory
13	Depozite	70	–	–	70	Concentrate and material storage
14	Neindustr	202	–	–	202	Canteen and industrial water
15	Of. calcul	9	–	–	9	Calculation office
16	Ventilatie	17	–	1	18	Ventilators
17	TESA	–	1	145	146	Office
		3164	112	223	3499	

Coop. Record Abad cd. 4708-1983

250 m stack in operation

To the right emission of sinterplant

Short stack of absorption tower sulfuric acid plant

Tirnava Mare valley
view to Copsa Mica

SOMETRA
Metallurgical plant

CARBOSIN
Carbon black plant

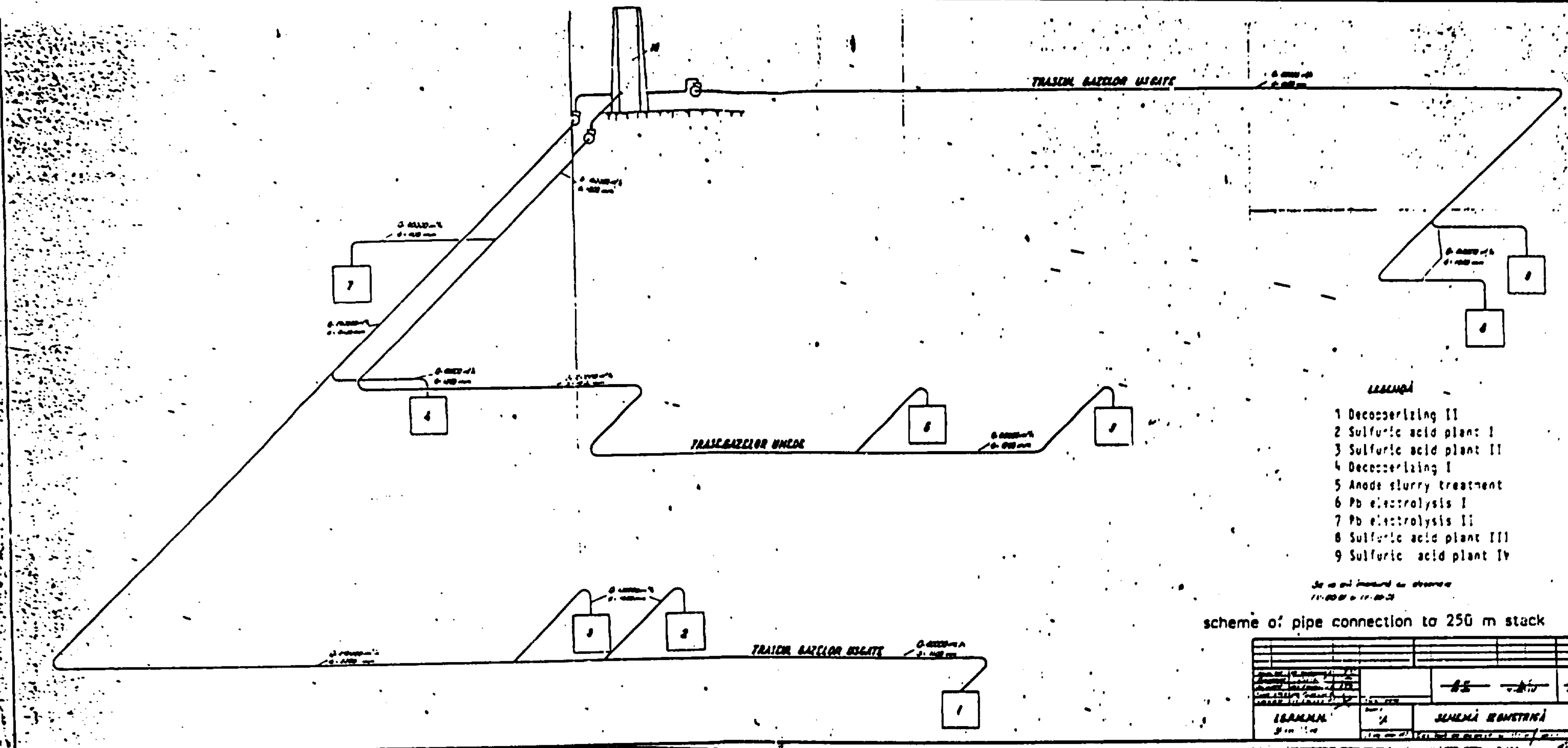
Anode slurry treatment plant

Decopperizing

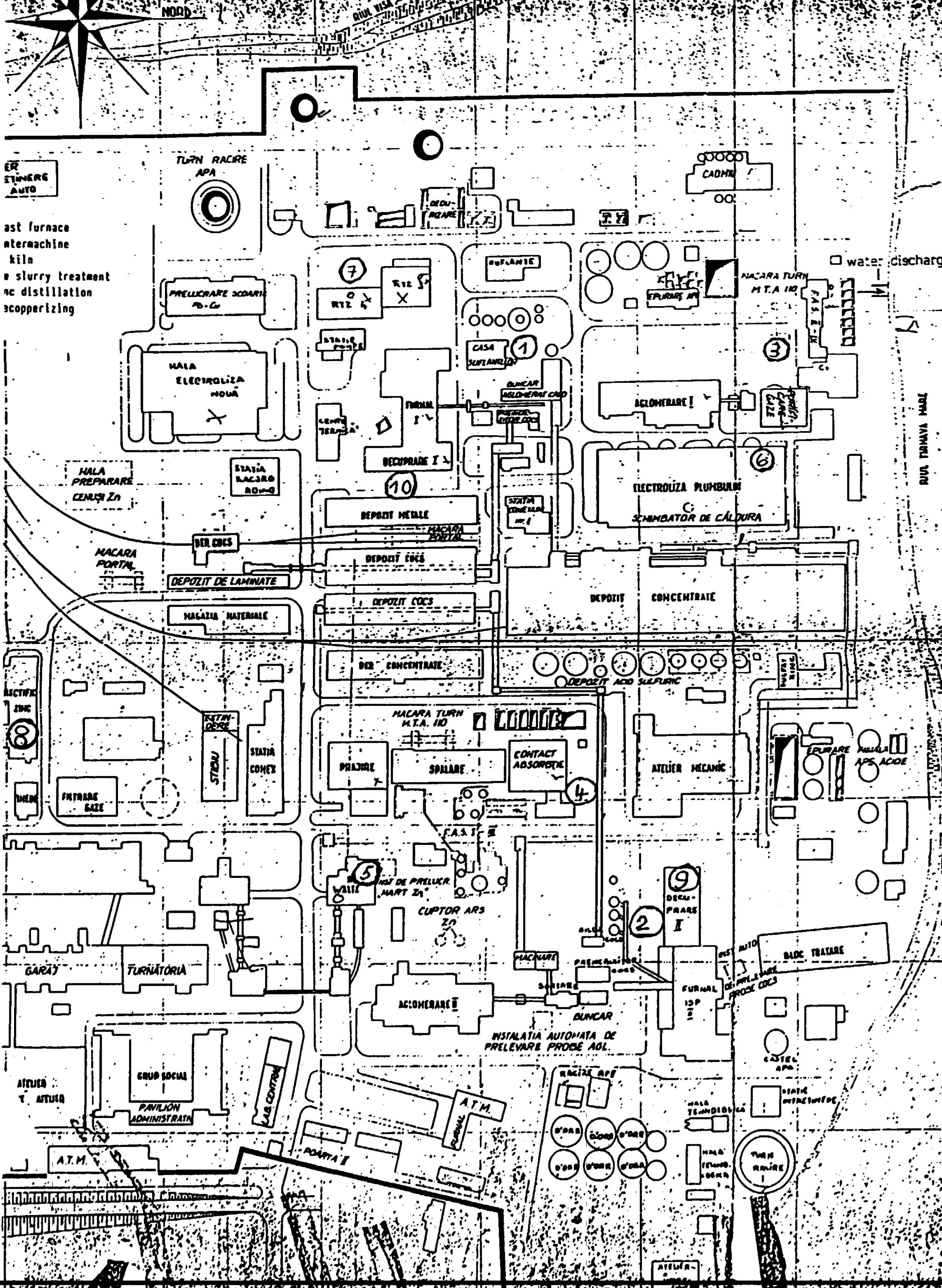
Hoods at blast furnace tap hole

Plant water discharge

Upstream river pollution



scheme of pipe connection to 250 m stack



NORD
TURN RACIRE APA
ast furnace
ntermachine
kiln
e slurry treatment
nc distillation
ecopperizing
CADMIU
SUFLANTE
water discharge
MACARA TURN M.T.A 110
EPURARE APE
PRELUCRARE SCOARIE Pb-Cu
HALA ELECTROLIZA NOUĂ
CASA SUFLANTELOR
AGLOMERARE I
FURNAL I
DECUPRARE I
ELECTROLIZA PLUMBULUI
SCHIMBATOR DE CĂLDURA
HALA PREPARARE CENUŞI Zn
DEPOZIT METALE
DEP. COCS
MACARA PORTAL
DEPOZIT COCS
DEPOZIT DE LAMINATE
DEPOZIT CONCENTRATE
MAGAZIA MATERIALE
DEP. CONCENTRATE
DEPOZIT ACID SULFURIC
RIUL TIRNAVA MARE
STAŢIA COMEX
FILTRARE GAZE
MACARA TURN M.T.A. 110
PRAJIRE
SPALARE
CONTACT ABSORBŢIE
ATELIER MECANIC
EPURARE APE ACIDE
F.A.S.
CUPTOR ARS Zn
DECUPRARE II
BLOC TRATARE
GARAJ
TURNĂTORIA
AGLOMERARE II
BUNCAR
FURNAL ISP
INSTALAŢIA AUTOMATA DE PRELEVARE PROBE AGL.
GRUP SOCIAL
PAVILION ADMINISTRATIV
LAB. CENTRAL
A.T.M.
POARTA II
TURN RĂCIRE
1
2
3
4
5
6
7
8
9
10