ROMANIA

WASTE MINIMIZATION IMPACT PROGRAM

EVALUATION OF THE WASTE MINIMIZATION PROGRAM

AT

SIDERMET S.A.

JUNE 16 - 18, 1997

USAID/WEC COOPERATIVE AGREEMENT
NO. ANE-0004-A-00-0048-00

World Environment Center
419 Park Avenue South
New York, New York 10016

OCTOBER 1997

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Project Description:	N/A
Project Type:	Waste Minimization Impact Program Assessment
Country:	Romania
Industrial Sector:	Cast Iron
Dates:	June 16 - 18, 1997
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Participants:	Sidermet Staff and WEC/PPC Team
Project:	N/A
Business Development:	N/A

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I. INTRODUCTION

A joint WEC/PPC team including Louis Gilde, Project Consultant, Robert Locke, Project Consultant, Vladimir Gheorghievici, Pollution Prevention Director, and Frank Szymborski, WEC Project Manager, visited Sidermet which had participated in the WEC Waste Minimization Seminar.

The plant visit was to:

- Provide guidance and assistance in establishing an effective waste minimization program; and

- Ascertain the progress in the identification and implementation of the WMIP project.

During the discussions with the plant's technical staff, it became evident that Sidermet is interested in developing a formal waste minimization program. However, due to a lack of funds, the plant proposed to concentrate their efforts on those projects that could contribute to reducing their production costs and/or improving product quality. In this regard, the plant requested WEC to provide additional expertise to improve manufacturing/process procedures.

WEC acknowledges the contribution made by the volunteer project consultants, Messrs. Louis Gilde and Robert Locke, who gave freely of their time and energy in assisting WEC in its Waste Minimization Impact Program in Romania.

II. EXECUTIVE SUMMARY

The WEC team visited Sidermet S.A. on June 16, 17 & 18, 1997. The following report identifies potential projects for improvements in the production of coke and pig iron. Problems are listed with suggested solutions and benefits. Efforts to undertake solutions should reduce: operating costs, energy costs, employee exposure to toxic gases, air pollution, river pollution and ground water pollution.

Sidermet management has expressed an interest in an improved waste management program as evidenced by requesting WEC to develop this plant visit. Sidermet already sells blast furnace slag for highway construction. Water from the cooling tower is used for slag quenching purposes and other industrial water applications . Further water conservation measures are potentially available by investigations and a follow-up visit.

Although the major environmental impact is from water pollution, this should be resolved when the new air coke quenching system is activated. Air pollution matters concern worker exposure in addition to community effects.

The internal environmental management team must be reinforced with direction from top management and strong leadership from the individual responsible for that position. It is expected that WEC's 10 step waste minimization program, following receipt of this report, will provide benefits. A follow-up visit to encourage and assist in furthering the plant's accomplishment should be considered if results are to be optimized.

III. FINDINGS

Introduction

We were impressed with the professionalism of the employees and management at Sidermet S.A., Calan. It was obvious that the company's lack of financial resources limited what could be accomplished. Many of the suggestions in this report were known to the staff of Sidermet, but frequently the limitations of finances handicapped improvements in operations.

In addition to the suggestions below, the institution of WEC's 10 step program of waste minimization involving every worker in the factory will result in savings and strengthen the economics of Sidermet. The 10 step program only works if everyone from top management to the lowest employee is totally dedicated to the effort in action and deeds.

This concept should not only be employed on existing operations, but should be incorporated in the design and construction of the new continuous casting cast iron pipe project which is expected to produce a major contribution to the income of the Sidermet factory.

The staff had given the visiting WEC team a general listing of some of their objectives to improve factory efficiency and cost reductions. These are listed in the Addendum of this report.

Potential Projects

COKE OVENS

Problems:

1. Plant personnel are fully aware of the coke oven problem, but due to lack of money, the condition has not been corrected. The coke oven doors do not provide a tight closure causing excess fumes to escape into the atmosphere. This causes a ground level health and safety problems.

2. Water quenching of coke is used to prepare the coke for blast furnace. The water is generally discharged to the River Strei and has the potential of exceeding water quality standards of the local equivalent EPA.

Solutions:

1. Currently, one coke oven battery is in the process of reconstruction. The plan is to hold this completed unit in reserve pending failure of either of the currently used batteries. It is recommended that the unit be placed into service and each used battery, in turn, be reconstructed using the latest technology. The lifespan of a reconstructed battery with good maintenance should be approximately ten years.

2. Proceed with the completion of the current coke dry quenching project as quickly as possible. Improvements in coke quality are recognized by factory personnel and the elimination of a potential water pollution problem will be realized.

Benefits:

1. The appropriate rebuilding of the units with better gas connections will increase levels of chemical concentrations thus improving the efficiency of coke oven batteries. This will have the added benefit of reducing the volume of gas to be handled in the chemical plant and, at the same time, increase the recovery of chemicals more efficiently.

The environmental benefit of these improvements will be a reduction in air emissions of particulates and chemicals. There will also be the corollary benefit of reducing worker exposure to these materials. By reducing ground level ambient air contaminants, the need for regular monitoring of the atmosphere can thereby be reduced to occasional auditing of conditions.

The improved collection of coke oven gases reduces the volume of exhaust gas to be collected and treated for chemical recovery. By increasing the chemical plant efficiency, less energy will be needed to produce the same or greater amounts of chemicals.

2. Higher quality coke produced by dry quenching will reduce coke usage at the blast furnace thus providing savings and eliminate water pollution and potential monetary penalties.

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BLAST FURNACE

Problems:

1. Sludge resulting from air emissions wet scrubbing is not beneficially reused. This material is essentially 27% iron and the balance is of minerals from the smelting process discharged into the blast furnace flue gas. These particulates are collected in a dry cyclone and wet scrubber air emissions control train. The wet scrubber sludge is collected in a clarifier/settling basin. The sludge as removed is at 20% moisture. These solids are stored on-site causing loss of land and potential groundwater problems.

2. The dry cyclone rotary discharge valve discharges directly to an open railroad car. This causes ground level air pollution problems in addition to loss of iron solids which could be reused.

3. Management has expressed concern about the weighing system used to prepare feed stock for the blast furnace. Apparently, the lack of high quality iron ore adds to this difficulty and requires an excess of coke to produce the pig iron product.

Solutions:

1. With approximately a 27% iron content, reclamation of this material from the wet scrubber as a raw material feed stock for the blast furnace is recommended. To prepare the sludge for recycle, either a screw type centrifuge or belt press could be used to remove the residual moisture. If a low cost binder, such as a starch, were to be added before the dewatering process, it is possible that the solids could be agglomerated to avoid losses from the blast furnace in the flue gas.

The on ground storage of blast furnace "sludge" is estimated to be 165,000+ tons. At the time of this visit, the solids pile was dry. This suggests that recycle to the blast furnace could be possible. There is a potential recovery of $3 million USD, based on the cost of raw iron ore. Recycle of this feed stock to the blast furnace is recommended.

2. Provide a sleeve from the rotary valve to the railroad car and use a temporary cover over the open tailraces used for the recovery of dry cyclone discharge. This cover will contain the fines as the valve discharges into the rail car.

3. Purchase of higher quality iron ore will have a multiplying affect. Besides reducing coke requirements, there may be a reduction in the quantity of solids in the flue gas.

Benefit:

1. Recovery of the blast furnace sludge as feed stock could supplant some iron ore requirements and improve cost efficiency of the factory. The estimated cost for iron ore is $18 USD/ton. By reusing these solids as a feed stock, there is a projected savings of one million USD/year.

Unless higher quality iron ore is obtained on a continuing basis, improvements in the handling of the sludge with a centrifuge for dewatering purposes will increase productivity of the factory. Less equipment use and labor will be spent in handling the sludge at the clarifiers.

2. The dry cyclone discharge into the rail cars will reduce the loss of fines and eliminate a ground level air pollution condition.

3. Weighing improvements can be achieved by using higher quality raw materials. This includes iron ore and coke feed stock. If better raw materials are not obtained, then capital expenditure to provide for a new weighing system will be required.

General:

Management has taken the position of making area supervisors economically responsible for any events causing discharges to the River Strei, in excess of standard limitations. To be fair to area supervisors, management should provide adequate production facilities that operate with minimal pollution and proper end of pipe pollution treatment. Area supervisors are responsible for proper training of all employees. Management is encouraged to provide better equipment so that unfair penalties are not assessed for no fault of the area supervisors.

Conservation of natural resources is expected to accrue from employing the above solutions. By collecting the blast furnace sludge through a dewatering system, the recovered water can be recycled or used as industrial water elsewhere in the factory. This reduces the makeup requirements from the river and the pretreatment needs to make the water acceptable for use.

Actions Required:

SIDERMET

1. Incorporate the attached "Boosting equipment reliability" guidelines, as an ongoing management program of employee involvement in reducing operating costs. Minimizing lost production, improving profits and resulting waste minimization are expected to result.

2. Use the known technology currently available in Germany to recover the lost iron ore and supplementary chemicals from the blast furnace flue gas as a raw material stock. The beginning phase is to recover a potential $3 million USD now in the sludge stockpile. This material is virtually dry and should not result in any difficulty in handling.

3. Place the rebuilt coke oven batter. on line at completion of the reconstruction and begin rehabilitation of either of the two units currently in use. The upgrading of the coke ovens will improve coke production, improve worker health and safety and increase chemical recovery.

4. Complete as quickly as possible the coke oven air quenching system. The drawback of water quenching of coke is the unreliability of avoiding contamination of the River Strei and consequent monetary penalties.

5. If water quenching of coke is not eliminated, then management must seriously consider the rehabilitation of the on site waste water pretreatment system.

WORLD ENVIRONMENT CENTER

1. Provide to management the latest technology of coke oven battery design and operating practices.

2. Provide the latest technology for raw material charging of blast furnaces.

Remarks:

Basically, management has not addressed the concept of waste minimization on the precepts of the Pollution Prevention Center/WEC Program. The opportunities of waste minimization are far out-weighed by concerns of maintaining market share and discovery of ways to improve the income of the company. We believe that pollution prevention is a more significant factor and we believe that the problems and solutions outlined above delineates these concerns. The concern of management is reflected in the many hours of interview afforded us.

By employing best management practices throughout the factory, adverse environmental problems can be lessened. By focusing on improvements in operations, higher job performance can be expected. With concentration on production improvements, efficiency and product quality, the company should realize higher profits.

Addendum

The management team representing the company expressed concerns about the performance of the company and the need to correct certain deficiencies. These are listed below. Our report touches on some of the issues with possible low cost solutions. Others may require some capital expenditure beyond the scope of the WE team to be able to address at this time.

Blast Furnace

1. Due to raw material characteristics, the weighing equipment for charging is inappropriate for this application.

2. Particulate in the flue gas are captured in a wet scrubber. Disposal of this sludge is becoming a problem due to the quantities being amassed.

Coke Ovens

1. High leakage of the battery doors is effecting personnel with toxic gases.

2. Excess phone/ammonia in the coke quenching discharge water has resulted in monetary penalties due to contamination of the River Stray.

APPENDIX I

(POLLUTION PROBLEMS HIGHLIGHTED BY PLANT)

Foundation
Pollution Prevention Center

Tel / fax: 40.1.2212050; 2211948; 2211899
Email address: cpp@org.pcnet.ro ;
Web site: www. cpp.ro

August 28, 1997

Pollution Problems at the Company Sidermet S.A. Calan

1.1 Pollution Problems at the Sintering Plant

Following handling, crushing, screening, at the sintering plants results dust from the raw materials introduced into the batch and from the sintered iron.

Also, the intake air from the exhaust fans is carrying dust particles and combustion gases.

The pollutants are collected and introduced in cleaning facilities with bag filters and electrostatic precipitators, but their construction and the high expenses necessary for their operation and maintenance make that the exhaust air from these facilities to contain dust and chemical pollutants : CO, CO_2 , SO_2, NO_X.

Although, yearly, the quantity of dust retained in the dedusting facilities reaches 495 tons/year, at the batching belt conveyors the dust concentration is 190-400mg/m^3. The content of CO in the ambient atmosphere of the sintering plant is 126 mg/m^3.

1.2 Pollution Problems at the Iron Making

The waters resulted from the liquid iron cooling at the belt casting machines at the blast furnaces no. 1 and no. 2 have to be settled in one of the 2 containment's of the of the settling tanks belonging to the liquid iron casting machines. The waste water are discharged unsettled into the river due to the fact that the erection and commissioning of the settling and recirculation facility for the sprinkling water used at the liquid iron casting belt machine no. 1 is not finished.

in the slag dump which capacity is already completely used. During the granulation process of the slag there are acid vapors emissions due to the sulfur content of the molten slag. The sludge resulted from the wet scrubbing of the blast furnace gas in the radial settling tanks is evacuated in adhoc dumps which do not have anymore storage capacity. Although the sludge has an iron content (Fe) of 20-30%, there are not clients for it and its storage becomes impossible. At the time the monthly output of sludge is 500-600 tons and within the company's yard are stored more than 150,000-180,000 tons.

1.3 Pollution Problems at Coke Making Plant

At the coke plant (including the chemical facilities) the main pollutants are coal dust, gases and by-products.

The pollutants discharges are :

- permanent : waste gas stakes and aeration basins from the biological treatment
- periodical : charging of the coal in the coking ovens, coke discharging and quenching, the stack belonging to the adjusting station for the coke gas outlet into the atmosphere, charging and discharging of the, utilized liquid chemical products and reactives (ingredients).
- incidental : pipe ducts purging, hydraulic closing devices, accidental discharging from tanks, accidents at the equipment and facilities

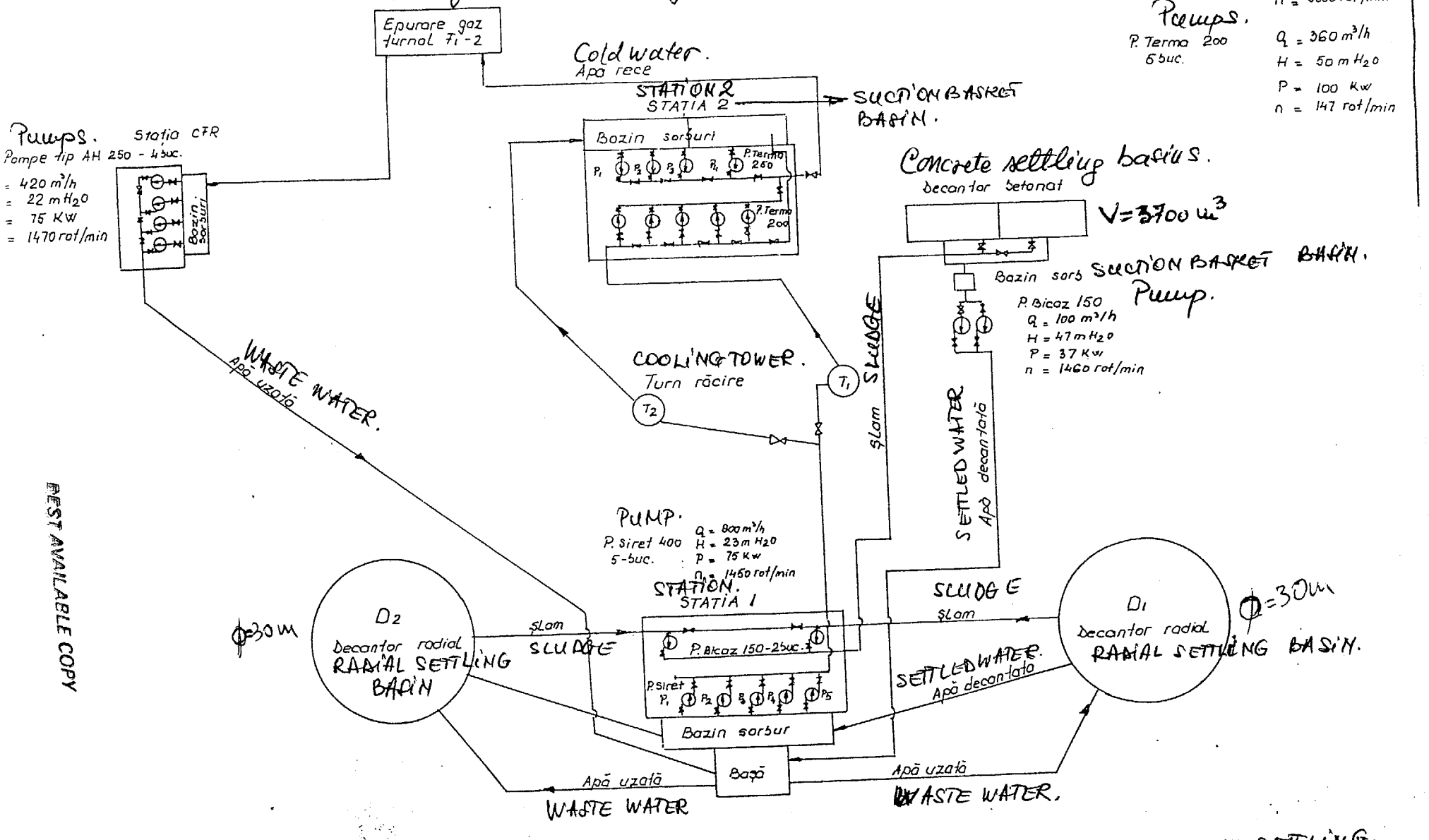
In order to reduce the air pollution from the coke plant, strongly affected by the SO_2 and H_2S emissions, is necessary to redesign and realize the coke gas desulfurization and ammonia striping facilities

As these waters are corrosive, and the collecting and transport system for the waste waters in that area is clogging, there is the danger to affect the ground water. It is necessary to remake the collection and transport system as for the storm, sanitary and phenolic waters as for the coke gas condensate collecting system.

The erection works for the biological treatment facility have been stopped in 1990 due to the lack of financial resources. From the same financial reasons, the designing, erection, commissioning of the other works mentioned above are developed, creating a potential risk for the surrounding environment.

"SIDERMET" CĂLAN

Blast furnaces no. 1-2 gas cleaning.



Pumps
P. Termo 250
4 buc.
Q = 720 m³/h
H = 80 m H2O
P = 250 KW
n = 3000 rot/min

Pumps.
P. Termo 200
6 buc.
Q = 360 m³/h
H = 50 m H2O
P = 100 KW
n = 147 rot/min

ONE LINE DIAGRAM OF THE SETTLING FACILITIES FOR THE BLAST FURNACE GAS CLEANING

Schemă tehnologică sector decantoare epurare gaz furnal

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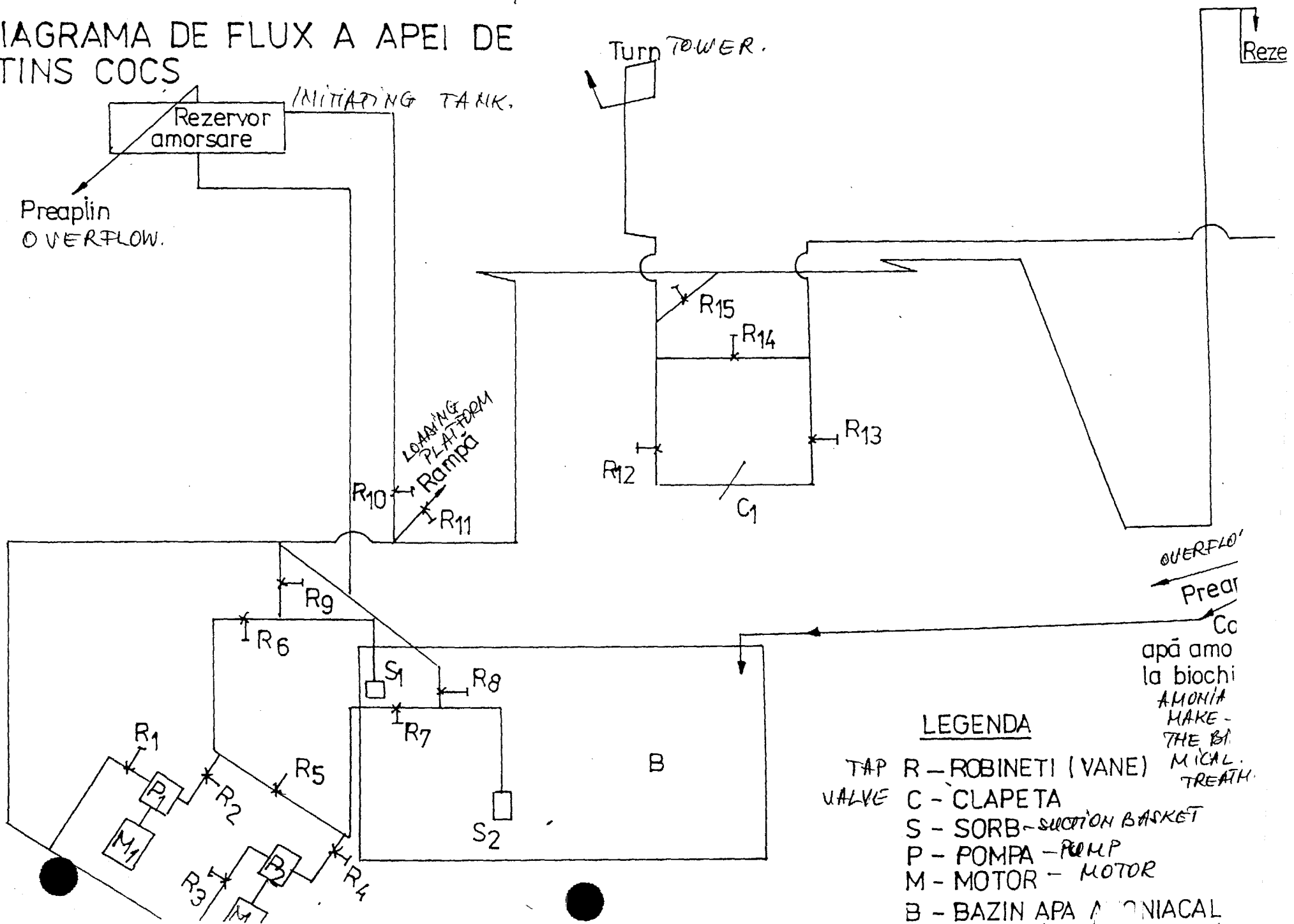
ONE LINE FLOW DIAGRAM OF THE COKE QUENCHING WATER.

DIAGRAMA DE FLUX A APEI DE STINS COCS



LEGENDA

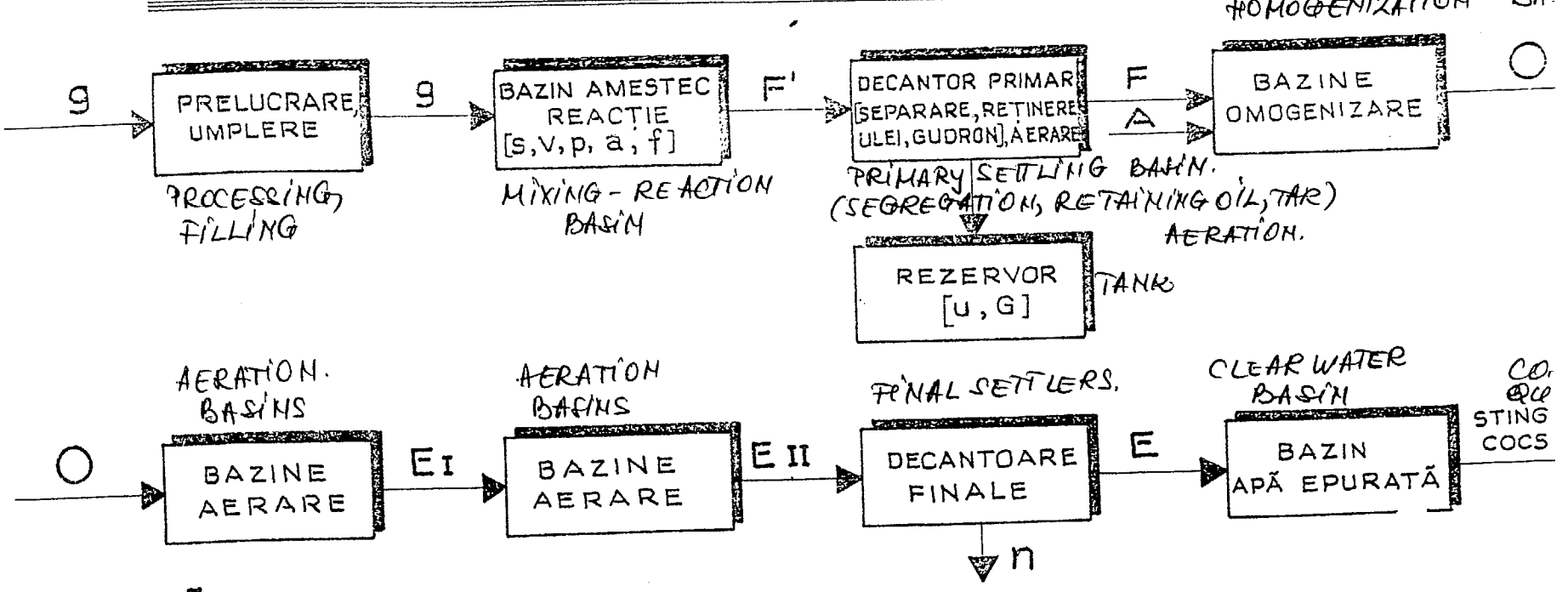
TAP R – ROBINETI (VANE)
VALVE C – CLAPETA
S – SORB – SUCTION BASKET
P – POMPA – PUMP
M – MOTOR – MOTOR
B – BAZIN APA AMONIACAL
AMMONIA W[illegible] BASIN.

S.C. "SIDERMET" S.A. CĂLAN

MECHANICAL-CHEMICAL - BIOLOGICAL TREATMENT.

EPURARE MECANO-CHIMICĂ ȘI BIOLOGICĂ

4;5



LEGENDĂ:

F'	—	Apă fenolică preepurată mecano-chimic Phenolic water pretreated (mechanicaly-chemically)
F	—	Apă fenolică epurată mecano-chimic Phenolic water treated (mechanicaly-chemically).
O	—	Apă fenolică omogenizată Homogenized phenolic water
EI	—	Apă epurată tr. I Treated water - phase I
EII	—	Apă epurată tr. II — " — phase II
E	—	Apă epurată - Treated water.
n	—	Nămol activ Active sludge
s	—	Sulfat feros Ferrosulphate
v	—	var Lime
p	—	polielectrolit Polyelectrolite
a	—	acid sulfuric Sulphuric acid.
f	—	acid ortofosforic Orthophosphoric acid.
U	—	ulei și gudron ușor tar and light tar, suspended particles. → oil and light tar
G	—	gudron și suspensii
A	—	Apă industrială Industrial water.
g	—	Apă impurificată cu uleiuri și gudroane Impurified water with oils and tars.

g

Q prolect, m³/h	=	95
Q 1997, m³/h	=	10
pH Suspended particles		7,5
Suspensii, Filtering residuals	=	158
Rezid. filtr. 105° C	=	2000
Sulfați, mg SO_4 Sulphates	=	80
Cloruri, mg Cl/l Chlorates	=	860
Fier, mg/l Iron	=	4
CCO, mg/l	=	1950
CBO_5, mg/l	=	370
Fenoli, mg/l Phenols.	=	270
Amoniu, mg/l Ammonia	=	155
Cianuri, mg CN^-/l Cianides		1
Sulfocianuri, mg SCN^-/l Sulphocian		1
Sulfuri + H_2S, mg/l H_2S Sulphides	=	3
Substanțe extractibile, mg/l Extractables. matte	=	10

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APPENDIX II

(PROCESS DETAILS FROM PLANT)

RMET S.A. CĂLAN
.T.C. LABORATOARE

Data 16.06 1997

BULETIN ANALIZA Nr. 66

ta	Ora	Nr. Lab.	Denumirea probei	ANALIZĂ TEHNICĂ									Observații
				% Wt % SiO_2	% Aa % CaO	% Va % MgO	% Sa % Al_2O_3	% I.U. Fet	% I.R. FeO	% Mn	% S	% P.C.	% H_2O	% C
			PROBĂ ȘLAM NR. 1	15,37	12,27	3,00	6,63	25,34	16,11	0,60	0,184	21,90	33	–
			PROBĂ ȘLAM NR. 2	10,32	11,16	4,20	9,18	29,43	12,17	0,99	0,160	19,56	34	–
			PROBĂ ȘLAM NR. 3	11,87	9,76	2,80	10,20	26,08	18,25	0,72	0,496	23,72	41	–
			ȘLAM THEISENE F1	11,20	12,27	3,80	10,71	27,62	17,90	0,54	0,416	24,44	39,6	99,1

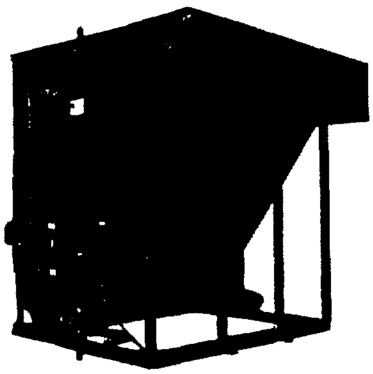
Șef laborator,

Întocmit.

APPENDIX III

(EQUIPMENT RECOMMENDED BY CONSULTANT)

Improved Inclined Plate Clarifier
Models from 55 to 3300 Square Feet Settling Area



- Compact 6´ or 8´ height fits into new or existing structure
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- Settled sludge mechanically thickened –single discharge port
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Fax 630-543-1169 • greatlakes@waterlink.com

GREAT LAKES ENVIRONMENTAL INC.
A WATERLINK COMPANY
• Waste Water Treatment • Vacuum Filter • Inclined Plate Clarifiers • Oil/Water Separators

Frank — This is t[he] equipment that Eng. Morosanu Virgil, Consilier at Sidernet was asking about.

of 7500. Features include anti-temper control covers and rechargeable battery pack for 10 hours of power. Sensidyne.

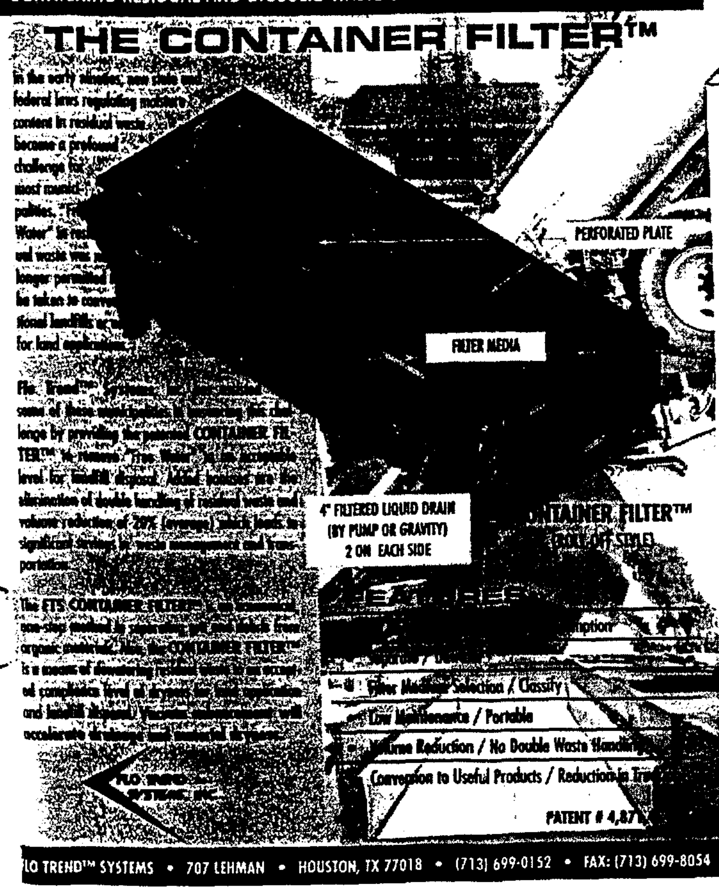
Circle 192 on card.

bodies from potential damage while maintaining a clean area or venting a hazardous one. HEMCO.

Circle 193 on card.

DEWATERING RESIDUAL AND BIOSOLID WASTE CAN BE A SIMPLE ONE-STEP PROCESS:

THE CONTAINER FILTER™



This type of equipment would also be applicable at Sidernet, in lieu of the recommended screw type centrifuge.

FLO TREND™ SYSTEMS • 707 LEHMAN • HOUSTON, TX 77018 • (713) 699-0152 • FAX: (713) 699-8054

Circle 129 on card.

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APPENDIX IV

(BUSINESS CARDS OF CONTACTS)

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APPENDIX V

(LIST OF MATERIAL FORWARDED TO SIDERMET)

BROCHURES AND OTHER PERTINENT INFORMATION PREVIOUSLY FORWARDED TO SIDERMET

1. Bethlehem Steel - Waste Management
2. Coke Oven Door Liner
3. The Life of Coke Ovens and New Coking Processes Under Development
4. Coke Oven Exhaust System
5. Coke Plant Wastewater Biological Treatment Facility
6. Steelmaking Flow Lines