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ENVIRONMENTAL ASSESSMENT

SIDERCA S.A. - STEEL COMPANY
CALARASI, ROMANIA
April 3 - 7, 1995

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EXECUTIVE SUMMARY
Trip Report
to
SIDERCA S.A.
CALARASI, ROMANIA

The author visited the SIDERCA S.A. site during the first week of April 1995 as a volunteer specialist to the World Environment Center. Purpose of the visit was to make an environmental assessment and recommendations.

This large complex consists of a minimill which has been operational since 1980, and an integrated steelmaking complex (1985-89) which is approximately 95% complete, but not operational.

The minimill has two 100-ton electric arc furnaces. Air emissions from these furnaces are totally uncontrolled, and represent the Number 1 environmental problem at this plant. The plant has been cited by the Environmental Protection Ministry, and was fined for not having air pollution control facilities in operation. This report contains suggestions for controlling and abating these air emissions.

Other minor air pollution sources were noted, and are addressed in this report. Water pollution does not appear to be a major problem for SIDERCA S.A.

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Introduction

The steel company SIDERCA S.A. is located in the City of CALARASI, Romania, approximately 120 kilometers south east of Bucharest.

This city, with an approximate population of 70,000, has become an industrial center. It produces steel, paper, textile garments and vegetable oil.

This section of Romania is a very flat plain near the Danube River, and was formerly an agricultural region. Being a flat plain, the area has good natural ventilation.

Objective

Purpose of the author's visit was to make an environmental assessment of the situation today, and to prepare a report to the World Environment Center, with appropriate recommendations based on the author's experience and judgment.

The author serves as a volunteer specialist to the World Environment Center. He is not employed by any equipment supplier, nor does he have any investment interest in any present or potential equipment supplier.

DESCRIPTION OF SIDERCA S.A.

SIDERCA S.A. is a state-owned steel company, which presently employs approximately 3,500 men and women.

This very large steelmaking complex is located on a plant site of 750 hectares (1,850 acres). The plant site has a man-made harbor, connected by a 6 kilometer man-made canal to the Danube River, which in turn connects with the Black Sea. Water transportation is therefore available for incoming raw materials and outgoing steel products; highway and rail transportation also is available.

This steelmaking complex consists of two major facilities.

1. The first unit, which is now in operation is an electric-arc furnace minimill with a projected annual capacity of 400,000 metric tons.

This minimill, which began operation in 1980, consists of :

-2 100-ton Electric Arc Furnaces
-2 Billet Casting Machines
-1 Hot Rolling Mill

2. The second major component of this facility is a fully integrated steelmaking complex with a projected capacity of 1,800,000 metric tons annually. This plant was designed in such a manner that it could be eventually expanded to a capacity of 3,600,000 tons per year.

This integrated steel plan consists of the following major components:

- A new harbor with unloading facilities for raw materials
- Raw material storage and blending facilities
- A lime calcining plant with 3 Rotary Kilns
- A Sintering Machine
- Coke Ovens
- A Blast Furnace with a volume of 2,700M3 capacity
- A Basic Oxygen Shop with 2 Vessels with a volume of 160 tons each
- A Medium Section Hot Rolling Mill
-A Heavy Section and Rail Hot Rolling Mill

Auxiliary components include:

- A plant to produce Oxygen
- A thermal power plant which utilizes coke oven gas and natural gas
- Maintenance Shops
- An internal Plan Railroad system
- An intake and Water Treatment System

This integrated facility has not been completed due to lack of funding. Various components are estimated to be 90-95% complete.

One battery of Coke Ovens has been completed and is operational. Only the foundations are in place for the second battery.

It is estimated that the investment to date in this new facility is US$2.0 billion; to finish the plant might require investment of an additional US$250.0 million.

More details of the capacities of individual units are given in Appendix Table I and Appendix Drg. I.

FINDINGS

Electric Furnace Shop

The electric furnace shop is equipped with two furnaces, each 6.4 meters in diameter. Each furnace is equipped with a 50-kilowatt (kW) transformer. Nominal furnace capacity is 100 metric tons per heat.

The design capacity of the melt shop was projected at 400,000 metric tons annually. In 1994, actual production was 140,088 tons.

Tap-to-tap time varies from 4.5 to 6 hours, and the average number of scrap charges is 3.7 charges per heat. There have been as many as 6-7 charges per heat. As a result, the average melting rate (productivity) is 20 metric tons per hour per furnace.

There appear to be two major reasons for this low melt rate:

- the scrap charge is very lightweight, with little or no heavy scrap or bundles, and
- the transformers are relatively small for the capacity of the furnaces.

This very light scrap adds to air emission problems, because the excessive number of scrap charges permits more emissions from the furnaces.

Environmental Discussion

Originally, each furnace was equipped with a Direct Evacuation system (DEC) which used a "fourth hole." Hot furnace gases first were conducted to a scrap pre-heat station, then to a heat exchanger, and finally to a 180,000 m3/hour baghouse, equipped with silicone-treated polyester filter bags. There was a separate baghouse for each furnace. There were no canopy hoods for secondary fume control.

This system worked for only a few months. It was reported that the scrap compacted, thus impacting the flow of the gases through the scrap pre-heat station. It also was stated that the polyester filter bags failed after a very few months. The reason for the bag failure was said to be mechanical rather than thermal.

As a consequence, none of the gas cleaning system is in operation today. The duct to the "fourth hole" has been disconnected, and the bag filters are shut down. The air emissions from the two furnaces are totally uncontrolled, with fumes emitted directly from the furnaces into the melt shop building, then exiting through the roof monitors.

During the author's observation of melting operations on Tuesday, April 4, 1995, the emissions became so heavy at times that they could not escape via the roof monitors, and began to settle down into the melt shop. Such a condition not only creates serious visibility problems for the crane operator, but may have a potential for serious health problems among workers in the melt shop.

The emissions exiting from the roof monitors are highly visible. While being driven to the plant about 9:00 A.M. on two mornings, the emissions were plainly visible from a distance of 1-2 kilometers.

It is the opinion of this author that these uncontrolled melt shop emissions are the No. 1 air pollution problem at SIDERCA S.A. CALARASI.

Plans for Improvement

This author was advised that the following actions are being considered to improve the production performance of the electric furnace melt shop:

- Install an 85 metric ton EBT (Electric Bottom Tap) furnace to replace the existing No. 2 furnace.

- Install an 80 kW transformer with the new EBT furnace.

- Install a ladle refining (LR) system.

- Install a vacuum-degassing (VDG) system.

- Install a scrap preparation/cutting/baling system.

These proposed improvements have two primary objectives:

-To increase productivity of the melt shop by increasing tons per hour.

-To improve steel quality via the LR and VDG systems so that the billets can be used by the rail mill to produce a higher dollar value product than the present billet, which is a commodity product.

It is contemplated that product quality improvement also may require use of sponge iron as part of the charge material into the electric furnace to reduce "tramp" elements in the steel.

This author was advised the funding for the ladle refining and vacuum degassing systems has been approved, and that construction work is under way. Funding for the 85-ton EBT furnace and the 80kW transformer has been requested, but is not approved as of this report. The new electric furnace funding request reportedly proposes additional money for air pollution control, but no technical details were given about what is proposed.

The author was unable to ascertain status of funding for the scrap preparation system.

Commentary

The proposed productivity and quality improvements will not resolve the emission problems by themselves, but if the improvements in scrap preparation also are approved, the use of heavier scrap will reduce the number of scrap charges per heat, thereby reducing the opportunity for emissions.

Other proposed improvements -- to automate the continuous caster and improve quality of the rail mill -- will be discuss later.

Air Emission Control Requirements for Melt Shop

Several alternatives should be evaluated to control the major air emissions from the existing melt shop. Step 1 should include:

- rehabilitate and re-bag the two existing baghouses.

- rehabilitate and re-connect the Direct Evacuation (DEC) system

- close the roof monitors over the two existing furnaces, then fabricate and install canopy hoods in the roof structure above the crane.

- purchase and install a new baghouse of approximately 1,000,000 M3/hour to capture fugitive emissions during charging and tapping.

- equip the ducts from the new canopy hoods with appropriate dampers and controls so that the fumes from charging and tapping can be directed to this new baghouse, depending on which furnace is in a tapping-charging operating phase.

Step 2 assumes approval of the new EBT furnace:

- design the furnace for both DEC (direct evacuation) and canopy hoods above the furnace to capture charging and tapping emissions. Design and construct a new, 1,000,000 M3/hour baghouse with appropriate control dampers in the ducts so that the new baghouse can be used for both primary control (DEC) and secondary control of fugitive emissions from charging and tapping.

The ideal time to accomplish this from an engineering and capital cost viewpoint is during the installation of the EBT.

An alternative is to enclose the existing (or new) furnaces in a four-sided enclosure with suitable access doors for scrap charging. This house will contain the emissions, and would be properly ducted to a new baghouse. This concept, which has been used in Denmark, Sweden and Germany, is the most positive from the standpoint of controlling air pollution, but presents some operating problems.

Billet Casting & Hot Rolling Machines

Billet Casting Machines

This plant originally was equipped with two four-strand billet casting machines with a projected capacity of 350,000 metric tons annually. Actual production in 1994 was 133,000 metric tons.

During the author's visit to the casting machine, only three strands of a single casting machine were in use, casting billets 240 mm x 215 mm in cross-section. After casting and cutting, the billets go to a re-heating furnace.

There were minor air pollution emissions from the tundish of the casting machine, which is not equipped with hoods for fume capture. Compared with the melt shop problem, however, this is not significant.

Hot Rolling

After re-heating, the billet goes to a two-high reversing mill. The primary stand has seven passes, which convert the billets to bars. The hot bars then go to the final finishing stand to achieve final dimensions, to a hot saw for cutting to length, and finally, to a cooling table.

Products from the No. 1 Hot Mill include the following: Squares of 60, 80 and 100 mm; Rounds with diameters of 80, 90 and 100 mm; and Tube Blanks with diameters of 110, 120, 130 and 150 mm. This mill also can produce about 10-15,000 metric tons annually of a unique product called a "railroad slipper" for use as rail ties in South America and other locales where termites make use of wooden ties impractical.

The No. 1 Mill does not produce shapes such as angles, U-shapes or I-beams. Bars are shipped to other mills who roll these profile shapes, but are sold under the CALARASI name.

Hot Rolling Mill Water System

This system consists of flumes under the rolling mill which take the water to a scale pit for primary sedimentation. Scale is removed from the pit by an overhead crane, and the scale is sold to outside users. The water is pumped to a cooling tower, then recirculated to the mill cooling system. A side stream takes some of the water to sand filters for further cleaning.

The author was advised that there was no blow-down from this water system, and that only make-up water is used for hardness control.

Coke Plant

The original design concept for SIDERCA S.A. was for two coke oven batteries of 65 ovens each, with a projected capacity of 850,000 tons each. Actual production in 1994, 192,529 tons. The ovens are of Russian design, but major components were fabricated in Romania.

The No. 1 Battery was started up in June 1986. Only the foundations are completed for No. 2 Battery as of April 1995.

The No. 1 Battery consists of 65 ovens. Each oven is 16 meters long, 7 meters high and 450 millimeters wide. The coal charge per oven is 31.5 metric tons.

The projected coking time when the batteries were designed was 17-19 hours; however, during the visit of April 6, 1995, actual coking time was 28 hours. When a question was raised about the extended coking time, the explanation was that it is an economic decision because of the high cost of imported coal.

Environmental Observations

Pushing

The author observed the pushing of one coke oven during his visit. Air emissions were very light. It was explained that with 28 hours coking time, the percentage of volatile materials is quite low. There are no facilities to control emissions during pushing.

Charging

Although the oven battery has two collector mains, the technique of staged charging is not utilized.

The author observed two charges from the top of the battery. Charging time was approximately two (2) minutes each. Air emissions during the charge were extremely heavy, and at times the larry car disappeared from view.

It was explained that the steam pressure for the ejectors in the standpipes was quite low, but that this situation would be remedied by Monday, April 10. The problem was an inadequate supply of coal.

Commentary

With two collector mains and some minor modifications to the larry car, staged charging could be utilized. The coke plant engineer mentioned that some consideration was being given to using high pressure ammonia liquor for the injection in place of steam.

Standpipes

During the visit, many standpipes had visible emissions. It was again explained that this was a result of low steam pressure.

Lids

With a few exceptions, the lids looked good; however, the author did not walk the entire top of the battery, due to time constraints.

Doors

Approximately 35% of the coke oven doors showed visible emissions, with slightly more on the pushing machine side showing emissions.

A special point of emphasis should be made here: these ovens are seven (7) meters high, but virtually all of the visible emission from doors were from the top -- from the chuck doors -- for the leveling bar.

Only 2 of a total of 130 doors showed significant visible emissions from the bottom of the doors. This indicates a very good door maintenance program.

The author was advised that the maintenance crew consists of five (5) people on day shift, plus two (2) additional per shift on the ovens.

Combustion Stack

The coke oven combustion stack, which is 153 meters high, was observed several times. The plume from the stack looked very clear at all times, indicating very few flue leaks.

Quenching

The coke plant was originally designed for dry quenching, but the system never worked. Today, the wet quenching procedure makes use of coke plant waste water.

By-Products Area

The by-products recovery system was originally designed to recover tar, oil, benzene and ammonia liquor.
To increase the fuel content of the coke oven gas, the benzene is not recovered today. Only tar, oil and some ammonia liquor is presently recovered; the market for ammonia liquor is reported to be very soft.

Waste Water

The original plant design called for biological treatment of the coke plant waste water; however, the design did not work well because of several factors. These factors included insufficient oxygen supply, temperatures were too low in the cold months, and an insufficient supply of phosphorus to maintain a viable biological community.

As a consequence, waste water is used today for wet quenching.

Miscellaneous Commentary.

A new door design known as Flexi-Door is being evaluated. This originally was a German design, but has been adapted by the Romanian Technical Institute, and is currently being tested at Galati Steel Works.

Recommendations

The use of contaminated coke plant waste water for wet quenching contributed to the overall air pollution problems, and somewhat reduces coke quality.

It is the recommendation of this author that a study should be made to determine what is required to rehabilitate the biological treatment plant, and to convert wet quenching to clean, fresh water.

The author was advised that sanitary wastes from the steel plant are collected separately and sent to the City of CALARASI for treatment with the sanitary wastes from the city.

As an alternative to rehabilitating the coke plant biological plant, it may be possible to install sufficient holding tanks and pump stations to deliver the coke plant waste waters to the city unit for biological treatment. It is suggested that this alternative be investigated.

Rail Mill

Improvement Plans

In conjunction with the proposed improvement plans for the Electric Furnace Shop, there also are plans to upgrade and improve the rail mill to produce products with a higher monetary value.

These plans include improved automation of the billet cast plus automated quality improvement measuring devices for the rail mill. Such devices would include eddy current testing, ultrasonic testing and laser dimensional controls for the rails.

If the plans are approved and implemented, the rail mill could produce quality rails of 60, 90 and 100-meter lengths.

While these plans do not have a direct impact on environmental quality improvements, they would increase overall plant profitability, which might make funds available for environmental improvements.

WATER SYSTEM

The plant water system was designed and built to satisfy the needs of the large, integrated steel plant. With only the electric furnace operation, the average intake for 1994 was 6.2 million gallons per day, or 700,000 m3/month.

The water intake is located on the industrial canal, which connects to the Danube River. Intake water has a pH rating of 7-8, and contains 100-250 mg/liter of suspended solids, depending upon the season of the year. The water is treated with lime and ferrous sulfate, settled in large concrete clarifiers, and then distributed via pumps to the steel plant network.

The treated water was observed from the top of one of the large clarifiers, and the quality (clarity) looked very good.

Solids which settle in the clarifier go to two mud ponds (settling basins), then to a decanting pond for sedimentation settling before discharge to a branch of the Danube River.

Industrial waste waters from the plant are collected in three separate main systems, each of which has its own separate sampling stations. These three systems then flow into a common open channel to a retention basin for settling. From the retention basin, the waste waters are pumped to the decanting pond mentioned above, then discharged to a branch of the Danube River (see Drg. II).

Observations of this common collection channel showed no traces of oil stains, nor of an oil sheen. The waste water looks quite clear, and ducks were observed in the open channel. The author was informed that fish also exist in the open channel.

The three separate sampling stations sample waste water from:

1. the thermal power plant
2. the electric furnace-hot rolling area
3. the coke plant

Analytical data supplied by plant personnel to the author show that virtually all parameters are in compliance with environmental regulations, with two exceptions:

- the chloride level in the water from the thermal power plant was above the level set by regulations, and,

- so was the sulfate level.

The author did not visit the power plant, but theorizes that these excess values may be the result of a zeolite softening plant for boiler feed water.

Critical parameters such as cyanide, phenol, chromium and iron all were below the levels permitted by regulations.

Analytical data of the river water above and below the plant discharge fails to show any major differences in water quality despite the face that the downstream sampling point would contain discharges from other sources in addition to steel plant discharges.

Dissolved oxygen level downstream is slightly lower than upstream, but is satisfactory. The phenol, iron, chloride, and suspended solids levels downstream are slightly higher, but not enough to be of major concern.

In summary, it does not appear that water pollution from SIDERCA S.A. represents a serious problem.

Ground Water

Well water is not used at the steel plant. All potable water comes from the Danube River.

There nevertheless are three fairly shallow wells on the plant property, for which there exists some analytical data. For a reason that those contacted by the author could not explain, the well in the vicinity of the electric furnace shop is very high in chlorides (324 mg/liter). All three wells were high in sulfates.

The author was advised that this data has remained constant over time. The reason for these high levels of chlorides and sulfates continues to be a mystery to this author, but since the well water is not used, their existence is of minor consequence.

INTEGRATED STEEL FACILITIES

The individual components of this fully integrated steel plant, with a projected annual capacity of 1,800,000 metric tons, are reported to be 90-95% complete. This plant is said to be the newest in Romania, and represents technological improvements of the mid-1980's i.e. approximately 1985.

This plant already represents an investment estimated at US$2.0 billion. Cost of completion is estimated at US$250 million.

Environmental control equipment associated with each of the individual production units also represents circa 1985 technology. Since these production units are not operating, the author spent only a limited amount of time touring the units.

Sinter Plant

The sinter plant is equipped with two separate gas cleaning systems.

The primary system, which serves the wind-boxes (combustion zone) of the sinter machine is rated at 2,000,000M^3/hr., and consists of electrostatic precipitators rated at 5 MW each.

The secondary system, which is an internal collection system to pick up dust at raw material transfer points, is for worker protection within the sinter machine building. This system is rated at 800,000M^3/hr, and also uses electrostatic precipitators.

Waste gases from the circular sinter cooler are recirculated back to the wind-boxes as pre-heated combustion air. The projected cleaning performance of these electrostatic precipitators is to clean the gases down to 0.1gm/M^3.

This plant is designed to produce a self-fluxing sinter (i.e. high calcium content). Experience in the USA has been that waste gases from self-fluxing sinter are difficult to clean with electrostatic precipitators because of the low conductivity of the dust.

Blast Furnace

The blast furnace, with a working volume of 2700M^3, is equipped with the Paul Wurth Top for charging.

The cast house is equipped with a baghouse of 2,000,000 M^3/hr. capacity for capture of cast house emissions.

Emissions from charging are treated first in electrostatic precipitators for dust removal. The captured dust is recycled to the sinter plant. The gases then go to a two-stage Venturi scrubber for further cleaning. Cleaned gases are reused for heating the stoves, and the excess is used at the thermal power plant.

Basic Oxygen Furnace Shop

This is a three-vessel shop, with each vessel having a melting capacity of 160 metric tons. Only two vessels are proposed to be operational at any one time, with the third being re-lined.

Each vessel is equipped with a high-energy Venturi scrubber for cleaning the primary fumes emitted from the vessel. These scrubbers are designed for 1500mm-H_2O pressure drop (59 inches of water), and should do a good job of gas cleaning.

There are no hoods for capture of secondary fumes from charging and tapping.

Medium Section and Heavy Section Rolling Mills

Time did not permit a visit to these facilities. The author was advised that each is equipped with scale pits, sand filters and cooling towers to create what is essentially a closed-loop recycling system.

SOLID WASTE DISPOSAL

A quick, drive-by tour was made of the solid waste disposal area, which is located in a low-lying area next to the man-made harbor.

The author observed slag disposal and the usual plant rubble such as waste and broken refractories. No oil drums or suspected hazardous materials were observed.

Since the air pollution control equipment is not operating, there was no electric furnace baghouse dust (which is a hazardous waste) at the disposal site.

Because the disposal area in a low-lying area, the potential for leaching of hazardous materials into the ground water could be a serious problem.

The plant received one citation from the Environmental Protection Agency, and paid a fine of 1,000,000 lei for improper disposal of electric furnace slag.

The author inquired about storage tanks for petroleum products and their potential for spills, but was advised that fuel oil is not used in the plant. Therefore, the potential for spills does not exist. There may be minor quantities of fuels stored in the maintenance shops, but these were not visited.

REGULATORY CONSIDERATIONS

Romania has promulgated a comprehensive list of air and water pollution control requirements. The allowed air emissions are applicable for the entire country; however, the allowable pollutant concentrations in discharge water are specific for each plant site.

Ambient air standards for Romania are comparable to those of the United States and Western Europe, although allowable emissions for an electric arc furnace are more lenient than those of the USA

The ambient air in the vicinity of SIDERCA S.A. was well within the allowable standards for SO_2 during the year 1994.

The one significant violation of the standard was in the dust fall measurements. The regulation calls for a maximum of 17g/m2/month. During 1994, 16 pieces of data were collected; of these, 10 exceeded the standard, mostly during the summer and fall. The highest value of 80.83g/m2/month was in June.

The author is of the opinion that this violations reflect a problem with wind-blown fugitive dust which is not related primarily to emissions from the electric furnace shop. Observations of the roads within the steel plant, as well as streets within the city of CALARASI, revealed a heavy dust loading, and vehicular traffic caused much of that dust to become air-borne.

Based on research performed at Armco Steel Corporation (the former employer of the author), it was determined that very significant improvements in air quality could be achieved by vigorously cleaning roads and streets with motorized vacuum cleaners.

It is the recommendation of this author that the management of SIDERCA S.A. and the authorities of CALARASI should explore a joint effort to clean all roads and streets. An effort only by the steel company will not achieve the needed improvements. The joint effort should be cost-effective if the two parties share the cost of purchasing and operating the mechanized vacuum cleaners.

SIDERCA management has already implemented a program of tree planting to help control fugitive dust. The author encourages continuation and expansion of this effort as a low-cost means of improving ambient air quality.

POST PLANT VISIT DISCUSSIONS

At the conclusion of the plant visits, the author met with Mr. Gheorghe Scirlea, Director of the Development Division of SIDERCA S.A., and later that evening with Mr. Alexandru Georgescu of the Ministry of Industry as well as representatives of the World Environment Center.

The ideal environmental solution for SIDERCA would be to finish construction of the integrated steelmaking facilities, put them into operation, and shut down the electric furnace complex.

In the short term, this is not likely to happen because of existing strains on the Romanian economy. The Romanian steel industry has an annual production capacity of 17 million metric tons of steel; in 1994, it produced 6 million metric tons, or 35% of capacity.

To finish the integrated facilities will require an additional investment estimated at US$250 million. The opinion was expressed that the government of Romania cannot make that investment at this time, and that it is highly unlikely that funds would be forthcoming from the European Economic Community (EEC) because of fears about further competition.

SIDERCA has stated its interest in a joint venture relationship with a non-Romanian partner. It also was stated that the government will provide warranties for such a joint venture investment.

Mr. Georgescu said he believes there will be a substantial market for heavy structural members and railroad rail to rebuild the infrastructure of Eastern Europe as well as in certain Middle East locations (e.g. Lebanon).

SIDEX S.A. at Galati, Romania, has excess blast furnace and pig ironmaking capacity. The author suggested consideration of having SIDEX produce pig iron for shipment to SIDERCA via the Danube River, which would partially resolve the poor scrap quality situation which now exists at SIDERCA. Of course, this idea would have to meet cost-benefit standards.

These closing discussions persuaded the author that all parties are sincerely interested in addressing environmental problems at SIDERCA, but action is constrained by the existing economic situation.

ACKNOWLEDGMENTS

The author wishes to personally thank all the men and women who helped make his visit to Romania so enjoyable, interesting and educational.

Hospitality was warm and genuine, and the spirit of cooperation and helpfulness was more than any visitor could reasonably expect.

The author made many requests for data, which were quickly and thoroughly provided by Mrs. Chiru Mioara of the Environmental Protection Office. This data, which was of course in the Romanian language, was verbally translated for the author, and by the next morning, the author received typed copies of these requests in English.

The author also expresses a very warm thank you to Mrs. Aldea Gabriela of the Development Department, who accompanied him on visits to all plant departments, served as an extremely competent translator, and did all in an enjoyable manner. She walked many miles, climbed many stairs and never complained, even though she was in the seventh month of pregnancy.

THE AUTHOR

John E. Barker, P.E.
Consultant

John E. Barker is now President of his own private consulting firm, Energy and Environmental Management.

He retired in December 1989 as Assistant Vice President of the diversified steelmaker, Armco Inc., after 40 years in environmental and energy management.

During his Armco career, he was very active in the American Iron and Steel Institute (AISI), and chaired both its Energy Committee and Environmental Affairs Committee. He also served three years as the American steel industry's representative to the Committee on Environmental Affairs of the International Iron and Steel Institute (IISI).

During his Armco career, Mr. Barker also directed Armco Environmental Engineering, a wholly owned subsidiary of Armco Inc. This engineering company provided environmental consulting services and project engineering management both to domestic (American) companies and overseas projects in Italy, Spain, Sweden and Yugoslavia.

Since his retirement, he has worked on two very diversified projects for the Trade and Development Program of the Agency for International Development (AID). These projects were in Karabuk, Turkey, and Bohumin, Czechoslovakia.

Mr. Barker continues to offer consulting serves as a private consultant to various organizations.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

As previously noted, SIDERCA S.A. is a very large steelmaking complex located in Southeast Romania on the Danube River in the city of CALARASI. The complex consists of two steelmaking units:

- A minimill with two 100-ton Electric Arc Furnaces built about 1980, and
- An integrated steel plant begun in 1985 which is 95% complete.

The Number 1 environmental problem is the totally uncontrolled air emissions from the two electric furnaces.

Other air pollution problems, in decreasing order of importance, are:

* Coke Plant charging emissions
* Use of contaminated waste water in wet quenching at Coke Ovens
* Fugitive, wind-blown emissions

Water pollution does not appear to be a major problem, with the possible exception of chlorides from the vicinity of the termal power plant.

Recommendations

The author recommends the following actions, beginning with least-cost items and working up to the most capital-intensive:

1. Continue and expand the tree planting program (Rings of Green).
2. Explore with the officials of CALARASI the purchaseof motorized vacuum cleaners to clean plant roads and city streets.
3. Implemented "staged charging" technique when charging the coke ovens.
4. Rehabilitate the coke plant's biological treament plant, or alternatively, investigate joint treatment via CALARASI's sewage treatment plant; also, convert wet quenching to clean, fresh water.
5. Install a large new baghouse, canopy hoods and DEC system concurrently with the installation of the new EBT furnace.
6. Complete construction and activate the integrated steel plant, shut down present operations of the Electric Furnace shop.

APPENDIX

1. List of people met
2. Drawing I: Plant Map
3. Table I (2 pages): List of Facilities
4. Drawing II: Plant Water System
5. List of Photographs

People Met During Visit

Ministry of Industry

dr.ing. Alexandru Georgescu
Steel Industry Expert

SIDERCA S.A.

Cristian Nicolae Parvan
President

Gheorghe Scirlea
Director-Development Division

Margine Nicolae
Chief - Electric Furnace Shop

Cioc Alexandra
Chief-Technical Office

Stan Nelu
Metallurgical Engineer - Technical Office

Toader Ion
Engineer - Electric Furnace Shop

Mrs. Chiru Mioara
Engineer - Environmental Protection Office

Cimseanu Valeriu
Engineer - Water Treatment Plant

Oancea Genia
Engineer-Water Network

Mrs. Aldea Gabriela (translator)
Engineer-Development Department

Mr. Tenea
Engineer and Chief - Coke Plant Laboratory

WORLD ENVIRONMENT CENTER

Liviu Ionescu
Coordinator for Romania

Francis J. Szymborski
Project Manager

Vladimir Gheorghievici
M. Sci., Expert Engineer

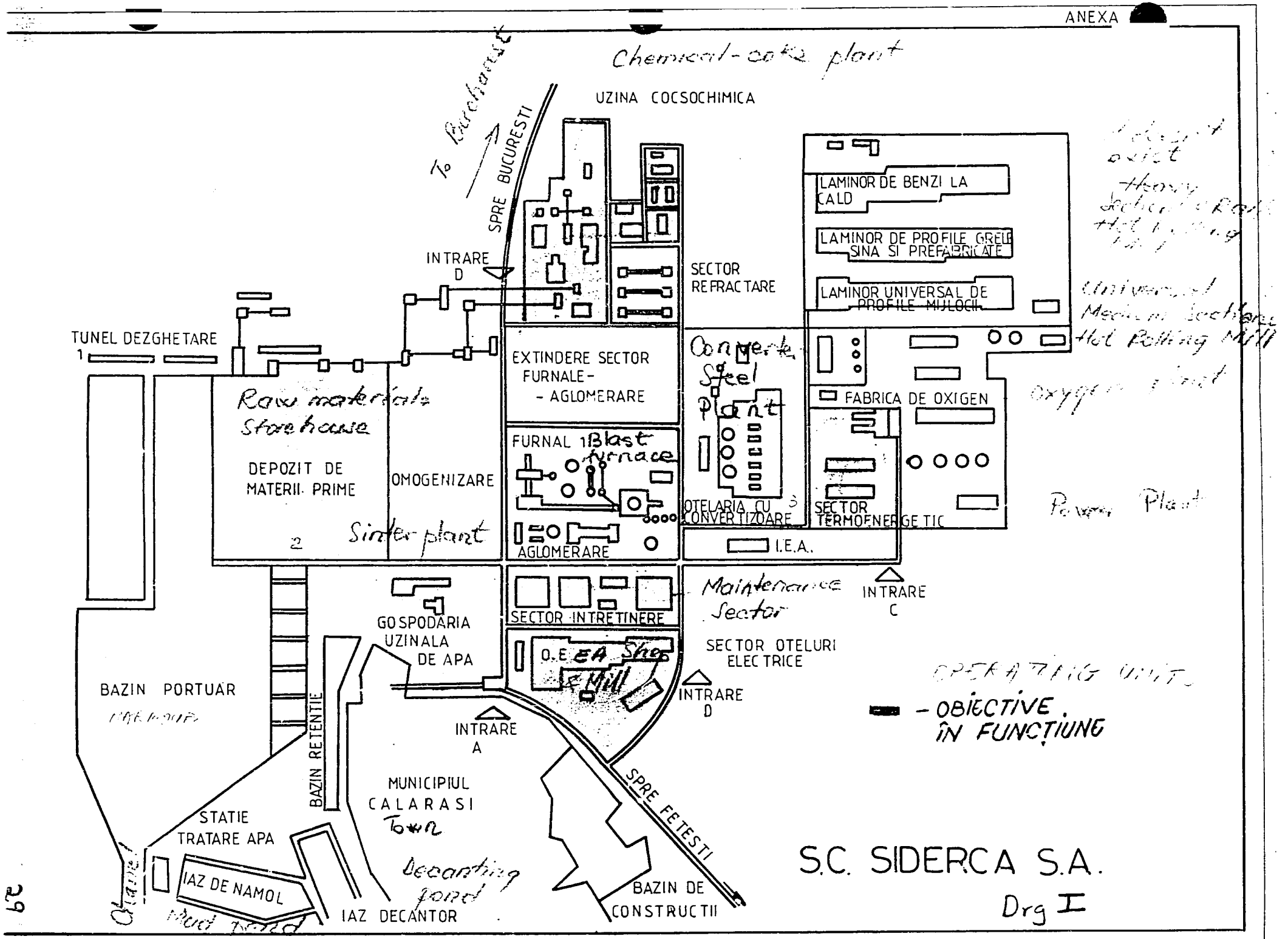

Chemical-coke plant
UZINA COCSOCHIMICA
To Bucharest
SPRE BUCURESTI
INTRARE D
SECTOR REFRACTARE
LAMINOR DE BENZI LA CALD
LAMINOR DE PROFILE GRELE SINA SI PREFABRICATE
LAMINOR UNIVERSAL DE PROFILE MIJLOCIE
TUNEL DEZGHETARE 1
EXTINDERE SECTOR FURNALE - - AGLOMERARE
Converter Steel Plant
FABRICA DE OXIGEN
Raw materials Storehouse
DEPOZIT DE MATERII PRIME
OMOGENIZARE
2
Sinter plant
FURNAL 1 Blast furnace
AGLOMERARE
OTELARIA CU CONVERTIZOARE 3
SECTOR TERMOENERGETIC
I.E.A.
Power Plant
INTRARE C
Maintenance Sector
SECTOR INTRETINERE
GOSPODARIA UZINALA DE APA
O.E.E.A. Shop
Mill
SECTOR OTELURI ELECTRICE
INTRARE D
OPERATING UNIT
- OBIECTIVE ÎN FUNCTIUNE
BAZIN PORTUAR
BAZIN RETENTIE
INTRARE A
MUNICIPIUL CALARASI
Town
SPRE FETESTI
STATIE TRATARE APA
Channel
IAZ DE NAMOL
Mud pond
IAZ DECANTOR
Decanting pond
BAZIN DE CONSTRUCTII
S.C. SIDERCA S.A.
Drg I

Table I

MAJOR EQUIPMENT AT THE „SIDERCA" S.A. – SHARE COMPANY

(1) MAJOR EQUIPMENT (AS OF JULY 1991)

DIVISION	EQUIPMENT		NUMBER OF UNITS	ANNUAL PRODUCTION CAPACITY (1,000 TONS)	AUXILIARY EQUIPMENT	REMARKS
IRONMAKING	COKE OVEN BATTERIES	No. 1 No. 2	55 OVENS 65 OVENS	850 850	• 1 COKE DRY QUENCHING UNIT Not operating	• START – UP – JUNE 1986 • DURING ERECTION
	SINTER PLANT		1	4 000		• PLANT WITH ACCEPTANCE TESTS PERFORMED
	BLAST FURNACE		1	1,850	• CONVEYOR LOADING • HEARTH LOADING „PAUL WURTH" DEVICE • OXYGEN BLOWING, FUEL INJECTION • COAL INJECTION	• PLANT ERECTED IN A MEDIUM RATE OF 90 % • INNER VOLUME 2,700 m^3 • INVESTMENT PROJECT
STEELMAKING	ELECTRIC ARC FURNACES	100 t / heat	2	400	• SECONDARY METALLURGY • LADLE TREATMENT	• START – UP – MAY 1980 • INQUERY
	CONTINOUS CASTING MACHINES	No. 1 No. 2	2	350		• START – UP – MAY 1980 • 4 STRANDS BLOOM CASTING MACHINES • CASTING RADIUS 10 m • INQUERY FOR CONTINOUS CASTING MACHINE ROUND SECTIONS
	BASIC OXYGEN FURNACES	150 t / heat	2	1,800	• HOT METAL PRETREATMENT (DESULPHURIZING) • 1 VACUUM DEGASSING UNIT (R H TYPE) • LADLE TREATMENT	• PLANT ERECTION MEDIUM RATE 90 % • L D WITH BOTTOM STIRRING TYPE CONVERTORS • ORDERS FOR SECONDARY METALLURGY UNITS
	CONTINOUS CASTING MACHINES	No. 3 No. 4 No. 5 No. 6	4	1,140		• PLANT ERECTION MEDIUM RATE 90 % • 3 x 6 STRANDS BLOOM CASTING MACHINES • 6 STRANDS CONTINOUS CASTING MACHINE FOR TUBE BLANKS • CASTING RADIUS – 12 m
HOT ROLLING	MEDIUM SECTION / BAR MILLS	No. 1	1	350	• 2 BLOOM REHEATING FURNACES	• START – UP – JUNE 1991 • 2 HIGH REVERSIBLE STANDS • PRODUCTS: – BARS 75 – 150 mm ROUND 60 – 120 mm SQUARE – PLATE PRODUCTS – I AND U SHAPE
		No. 2	1	530	• 2 BLOOM REHEATING FURNACES	• PLANT ERECTION MEDIUM RATE 75 % • 15 UNIVERSAL, INTERMEDIATE AND FINISHING STANDS • PRODUCTS: – I AND U SHAPE – ECONOMICAL I AND U SHAPE – ANGLE SHAPE – RIM 8"–10"
	HEAVY SECTION / BAR AND RAIL MILL	No. 3	1	1,520	• 2 BLOOM REHEATING FURNACES • 1 RAIL QUENCHING AND HARDENING UNIT	• PLANT ERECTION MEDIUM RATE 95 % • 2 HIGH REVERSIBLE STANDS • PRODUCTS: – HEAVY RAIL – CRANE RAIL – I AND U SHAPE – ANGLE SHAPE
OTHERS	REFRACTORY PLANT		1	210	• 3 ROTARY KILNS	• PLANT ERECTION MEDIUM RATE 95 % • SINTERED DOLOMITE • DOLOMITE BRICKS
	MECHANICAL PLANT		1	50		• START – UP 1975 – 1983 • METALLIC STRUCTURES • SPARE PARTS • IRON, STEEL CASTINGS, FORGINGS

Table I

(2) POWER & WATER SUPPLY

		EQUIPMENT		CAPACITY	REMARKS
ELECTRIC POWER GENERATORS	PRODUCTION	MAIN PLANT ELECTRIC POWER GENERATORS	No 1 No 2	31,000 KW	• START – UP 1981 – 1985
		SECOND PLANT ELECTRIC POWER GENERATORS	No 3 No 4	58,000 KW	• PLANT ERECTION MEDIUM RATE 75 %

		DAILY CONSUMPTION		REMARKS
WATER SUPPLY	INDUSTRIAL WATER FROM DANUBE RIVER	ACTUAL	16,900 m^3	• 145,400 m^3 RECYCLING WATERS
		FINAL	96,400 m^3	• 752,900 m^3 RECYCLING WATERS
GAS	COKE OVEN GAS	ACTUAL	$1,145 \times 10^3$ Nm^3	
		FINAL	$2,290 \times 10^3$ Nm^3	
	NATURAL GAS	ACTUAL	130×10^3 Nm^3	
		FINAL	588×10^3 Nm^3	
	BLAST FURNACE GAS	ACTUAL	——	
		FINAL	$8,280 \times 10^3$ Nm^3	
LOW PRESSURE STEAM		ACTUAL	1,928 TONS	
		FINAL	5,800 TONS	

(3) CONNECTIONS

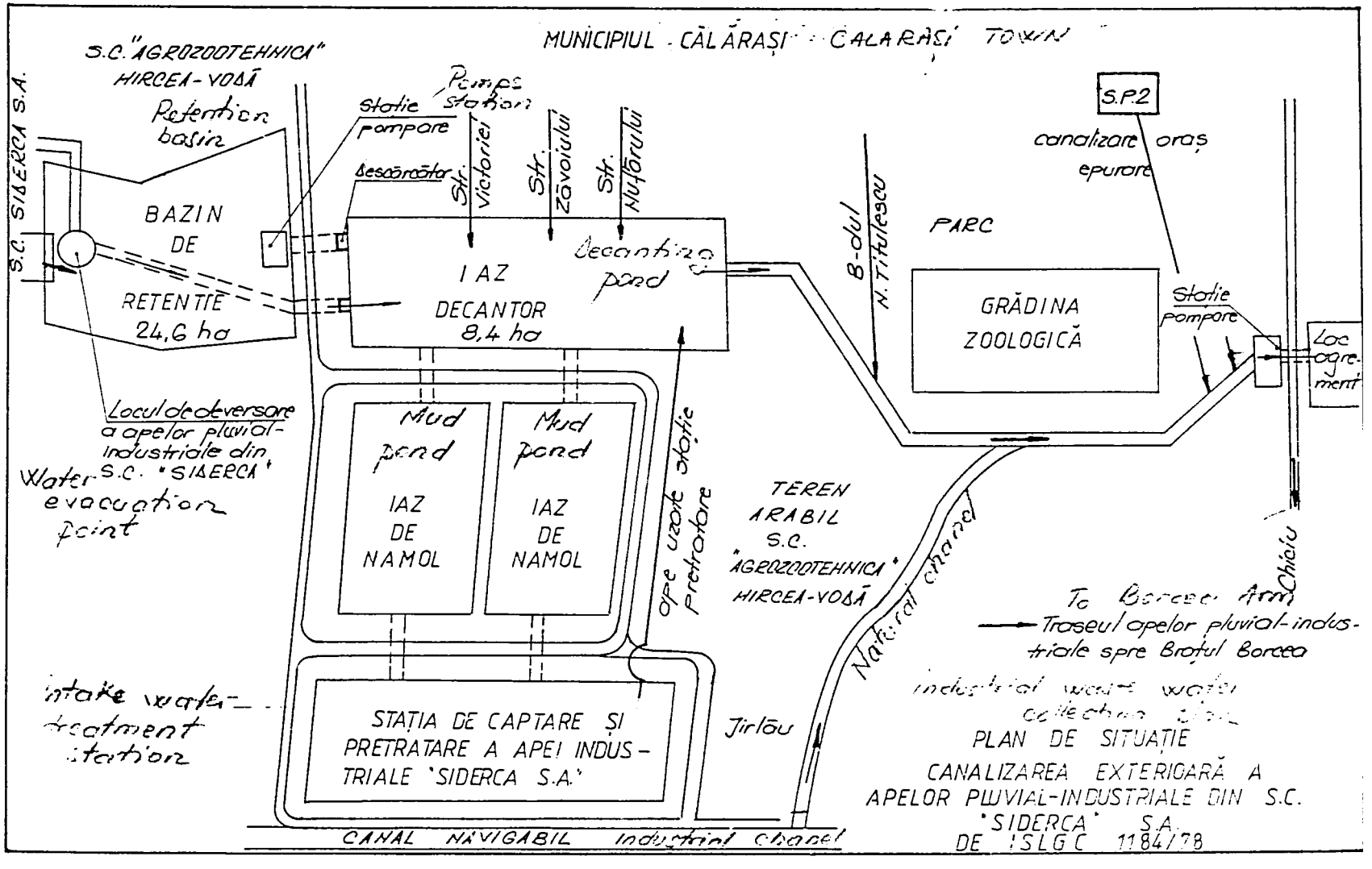
			ANNUAL INLET CAPACITY (1,000t)	ANNUAL OUTLET CAPACITY (1,000t)	REMARKS
WATER	CALARASI HARBOUR * * PORTOFRANCO AREA (PROJECT)	ACTUAL	1,050	350	• BARGES 1,500 TONS
		FINAL	11,275	2,725	• ERECTION MEDIUM RATE 90 % • BARGES 3,000 TONS
	ROUTES	CALARASI HARBOUR — BORCEA CHANNEL 6Km — DANUBE RIVER 72Km — DANUBE-BLACK SEA CHANNEL 64Km — CONSTANTZA HARBOUR			
	CONSTANTZA HARBOUR * * PORTOFRANCO AREA (PROJECT)	MAXIMUM 150,000 TONS SHIPMENT TRANSSHIPMENT INTO / OUT OF BARGES			
RAILWAY	CONNECTION POINT TO THE NATIONAL RAILWAY NETWORK	CALARASI NORD STATION	MARSHALLING CAPACITY (DAILY) 1,500 WAGONS		
	ROUTES	CALARASI NORD STATION — 19 Km — MARSHALLING YARD CIULNITZA — 109 Km BUCAREST; 116 Km CONSTANTZA			
	INNER RAILWAY NETWORK	TOTAL LENGTH		DAILY MARSHALLING CAPACITY	
		ACTUAL	65 Km	IN	750 WAGONS
		FINAL	105 Km	OUT	750 WAGONS
HIGHWAY	ROUTES	CALARASI — 120 Km — BUCUPESTI			
		CALARASI — 125 Km — CONSTANTZA			
	INNER LAND NETWORK	TOTAL LENGTH			
		ACTUAL	35 Km		
		FINAL	53 Km		

(4) OTHERS

		AREA (1,000 m^2)
COMPANY AREA	PLANT AREA	5,650
	GREEN AREA	1,850
	TOTAL	7,500

NUMBER OF WORKERS	ACTUAL EMPLOYEES	5,800

Drawing II: Plant Water System



LIST OF PHOTOGRAPHS

1. Fumes from No. 1 Electric Furnace during scrap melting procedures.

2. Inside Melt Shop looking toward roof monitor.

3. View from CALARASI looking toward Melt Shop (on a Wednesday morning)

4. Waste Water Collector Channel (note ducks)

5. Waste Water Pump Station (left to right)

   Mrs. Chiru Mioara, Engineer-Environmental Protection Office
   Mrs. Aldea Gabriela, Engineer-Development Office (translator)
   Mr. Cimpeanu Valeriu, Engineer-Water Treatment Station

6. Instake at Water Treatment Plant (large clarifiers in background)

7. Industrial Canal to Danube (instake water source)

8. Inoperable Baghouse, Electric Furnace Shop

9. Coke Ovens pushing emissions

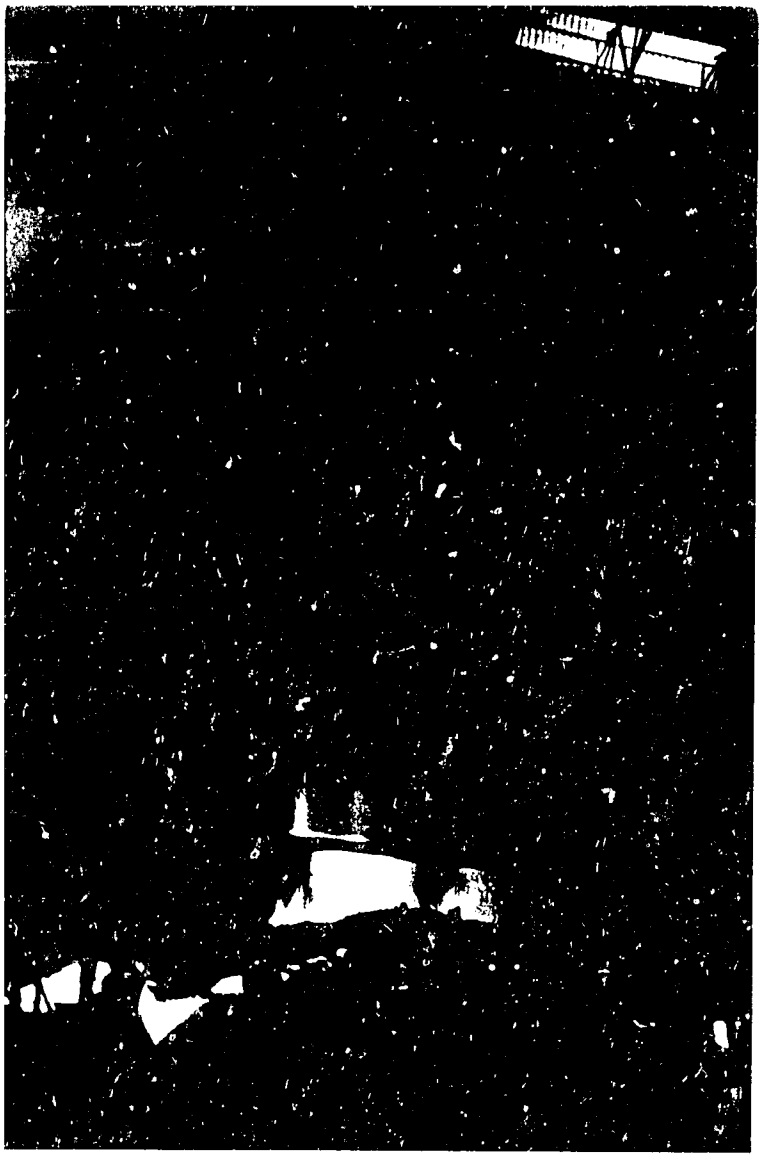
10. Coke Ovens charing emissions

11. Coke Ovens door leaks

12. New Blast Furnace (unfinished)

13. New Basic Oxygen Furnace Shop (3 Venturi scrubbers)

14. Calarasi: downtown apartment buildings



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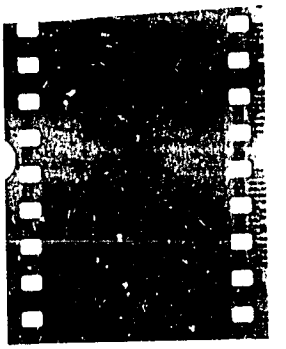

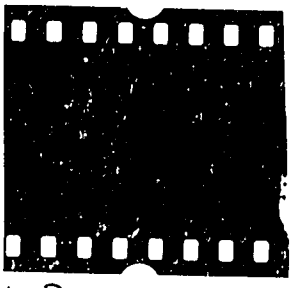

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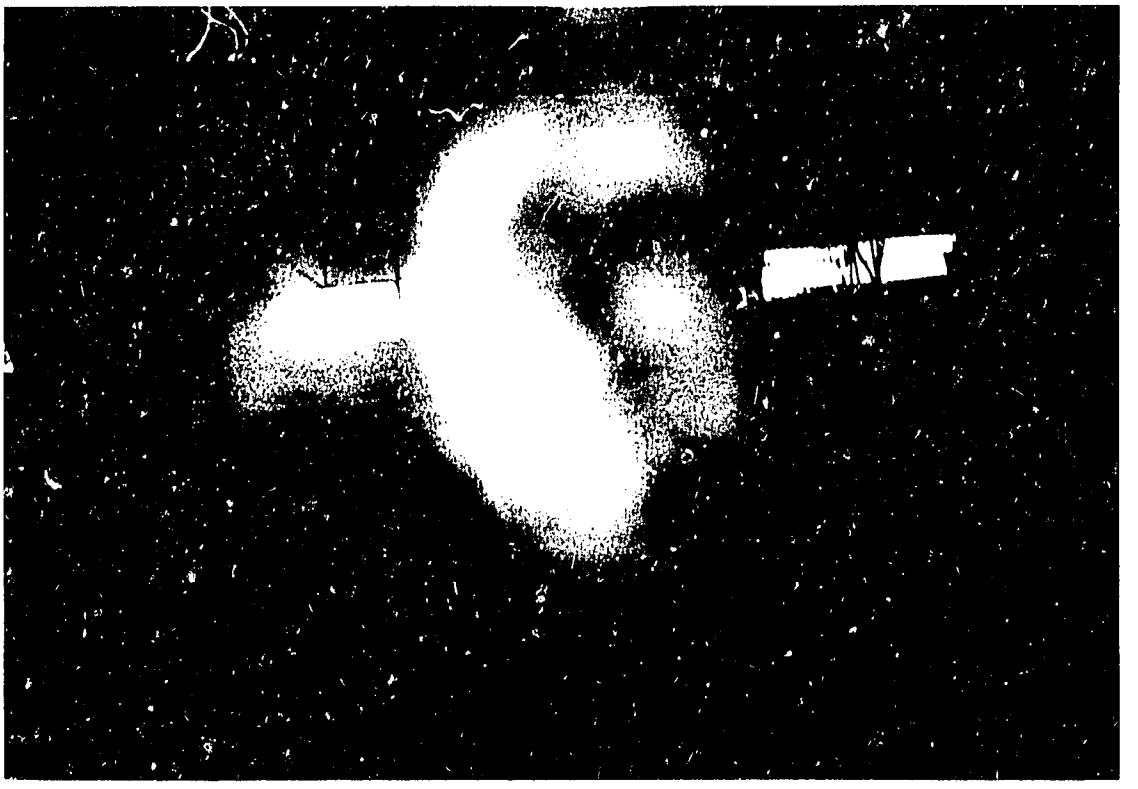

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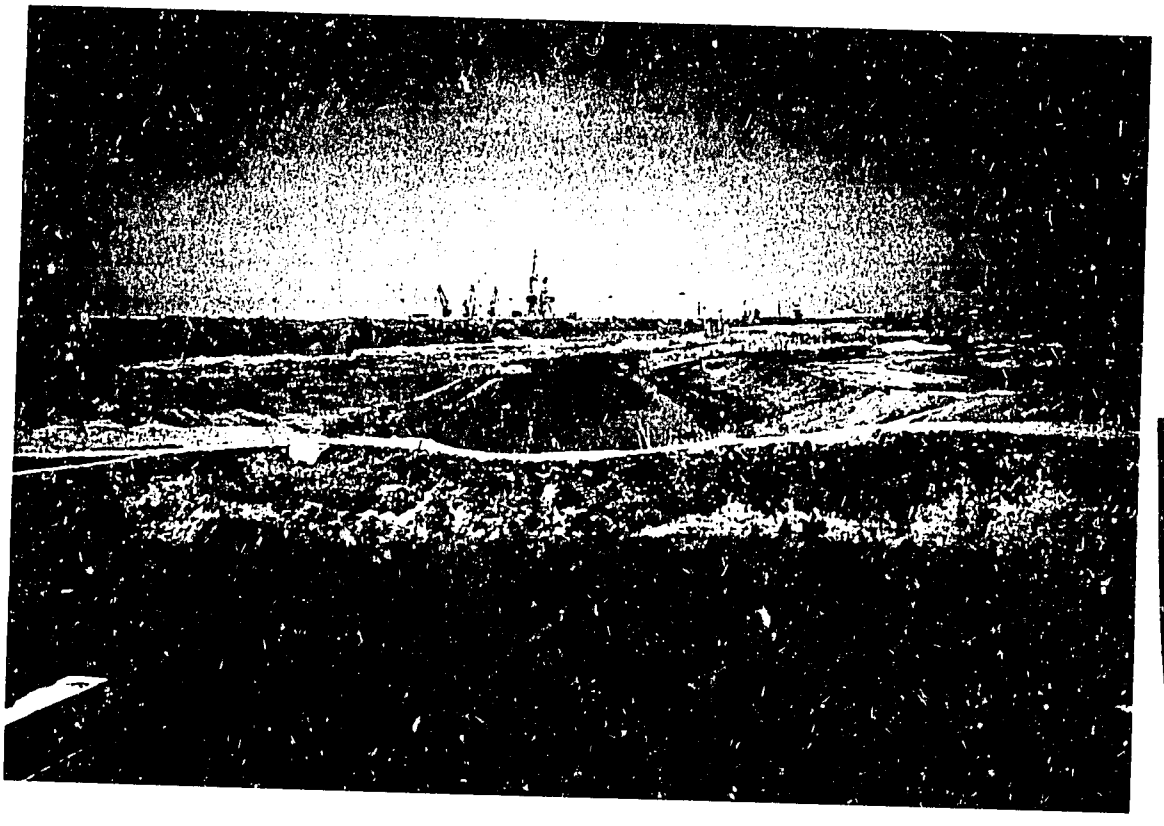

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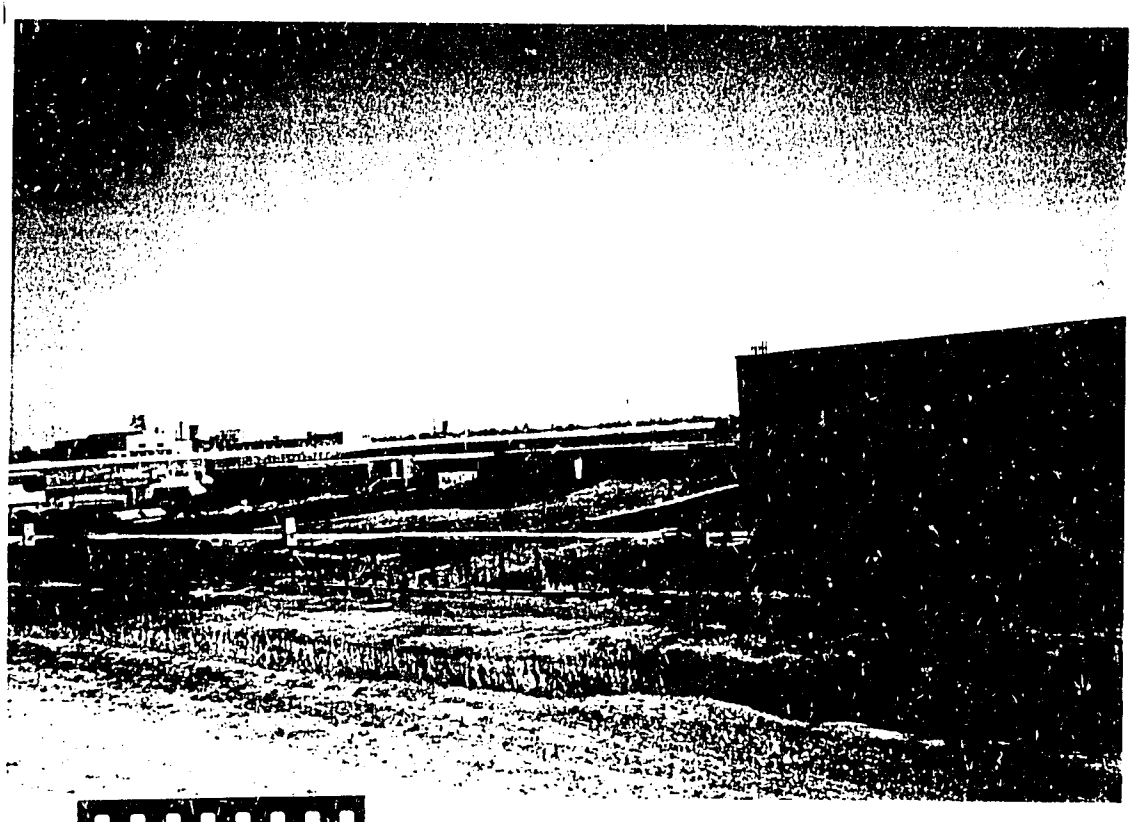

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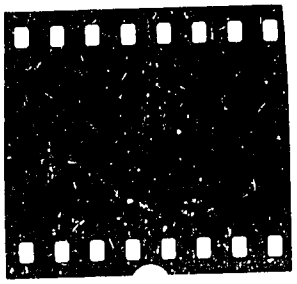

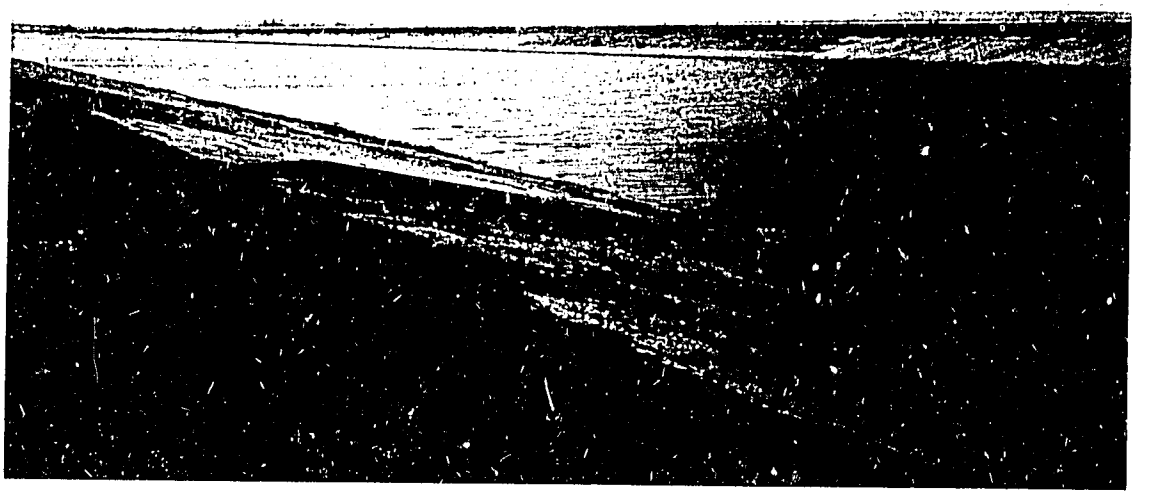

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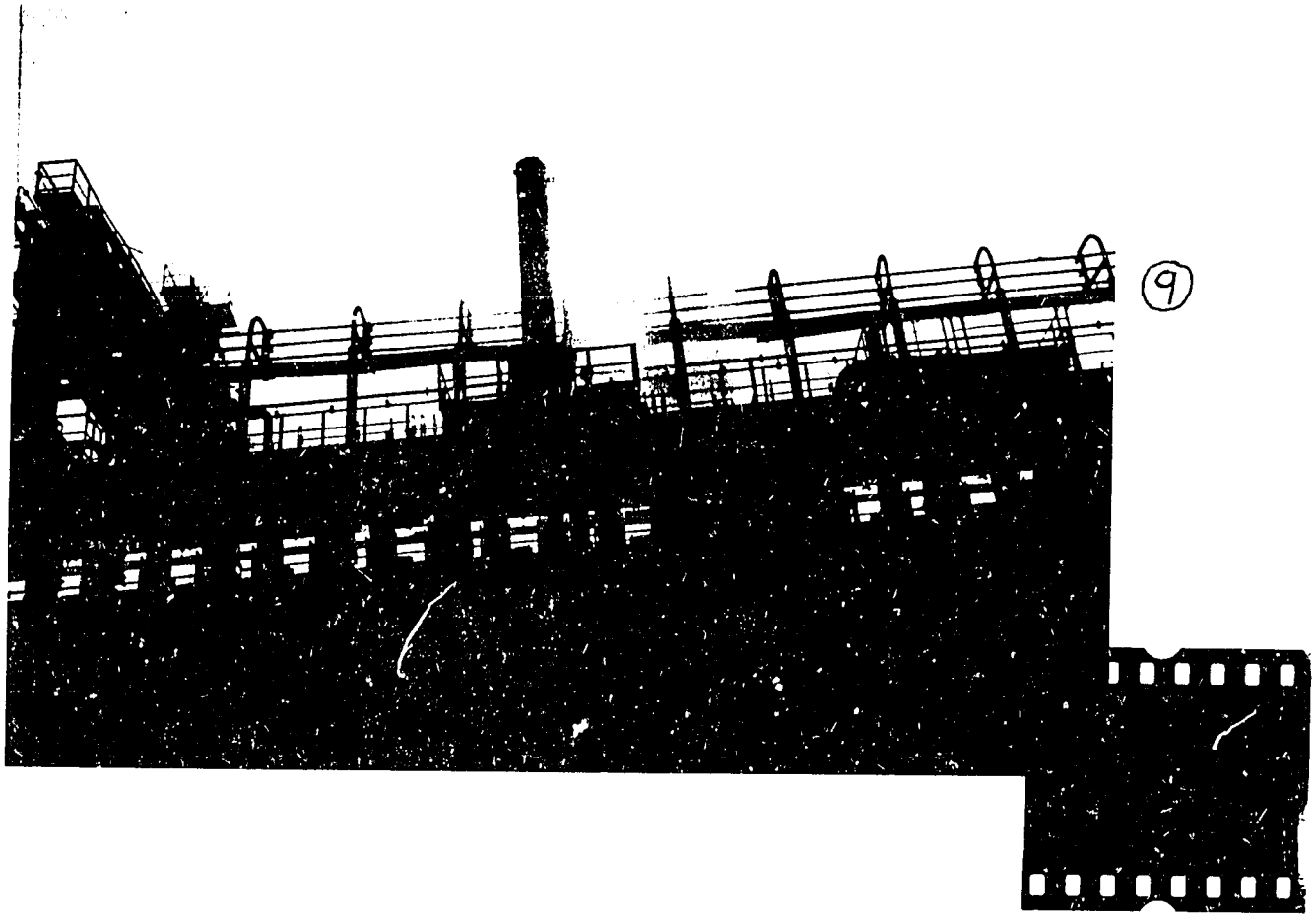

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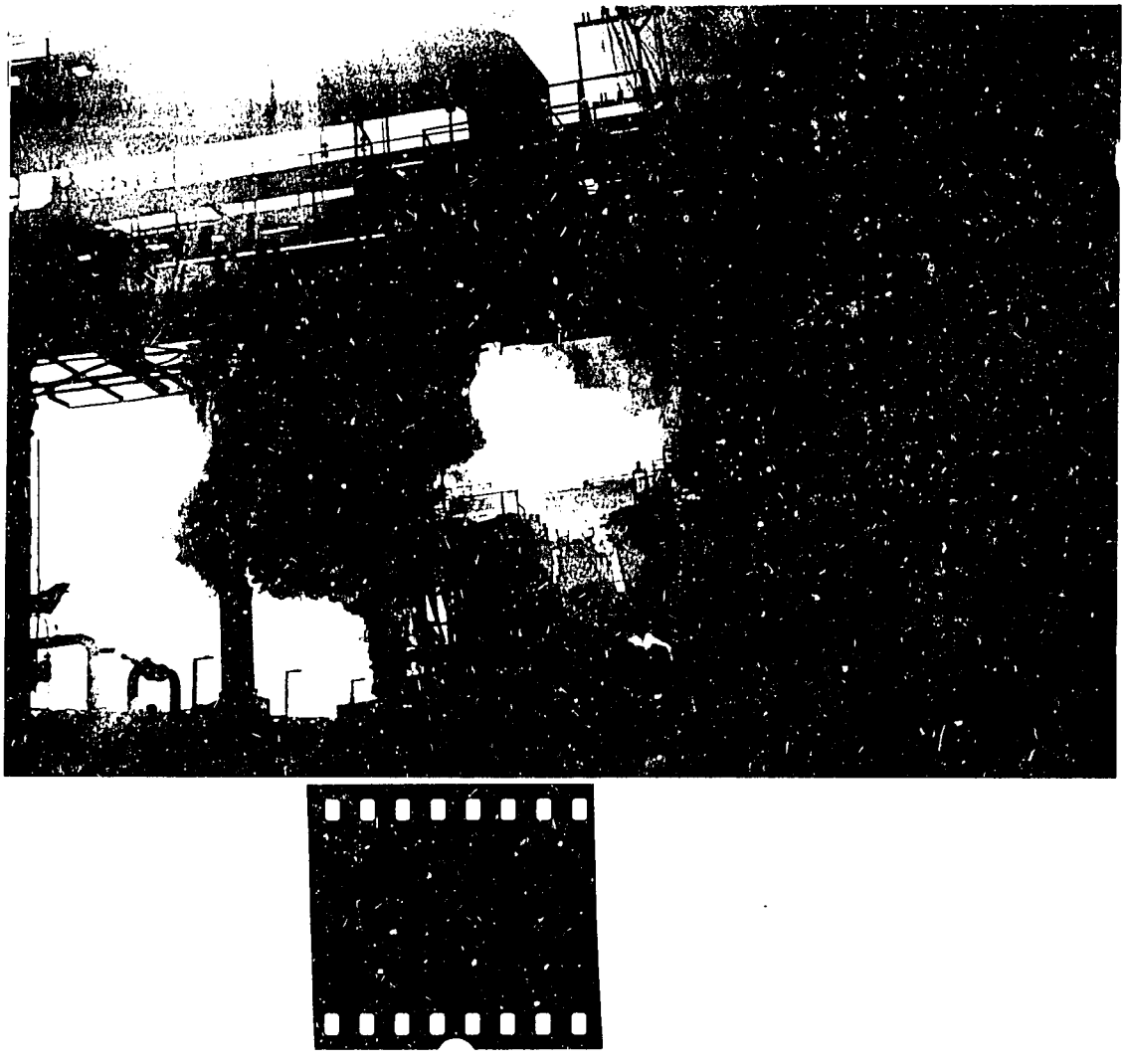

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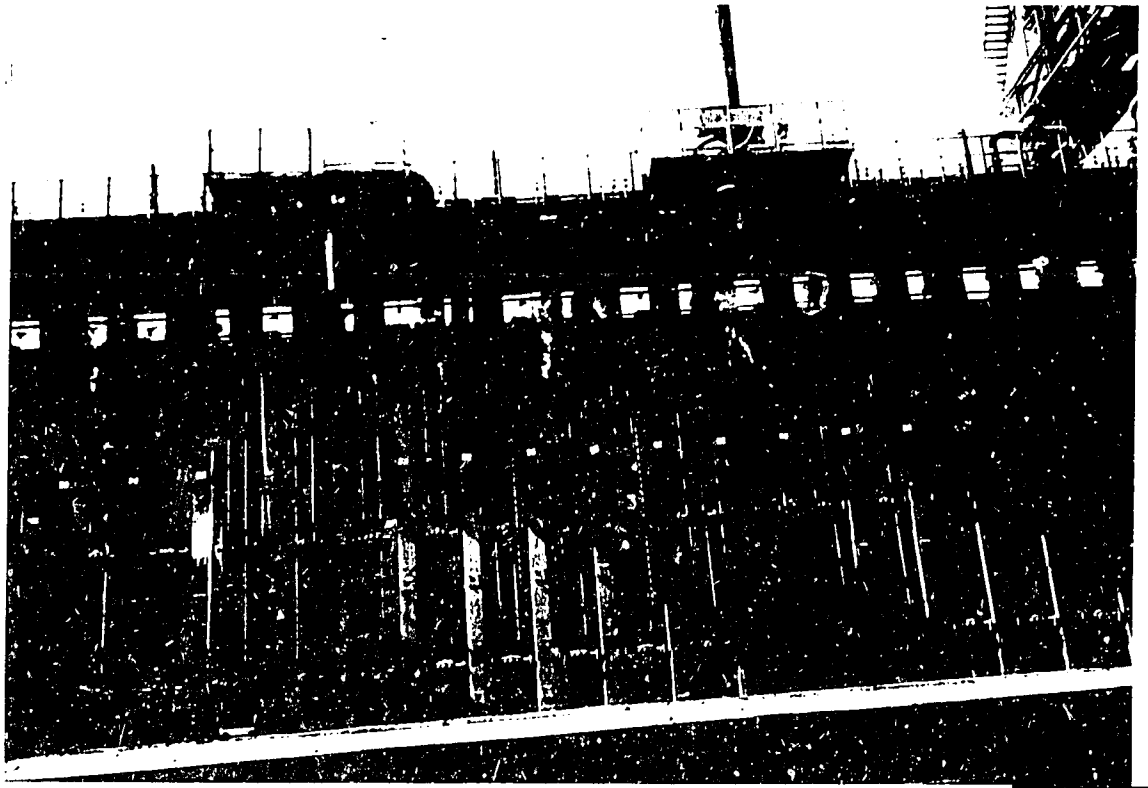

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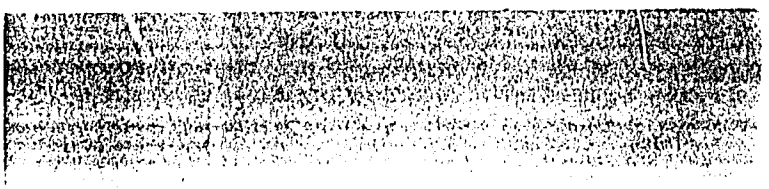

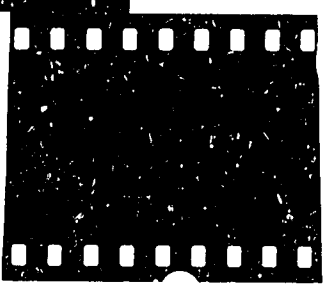

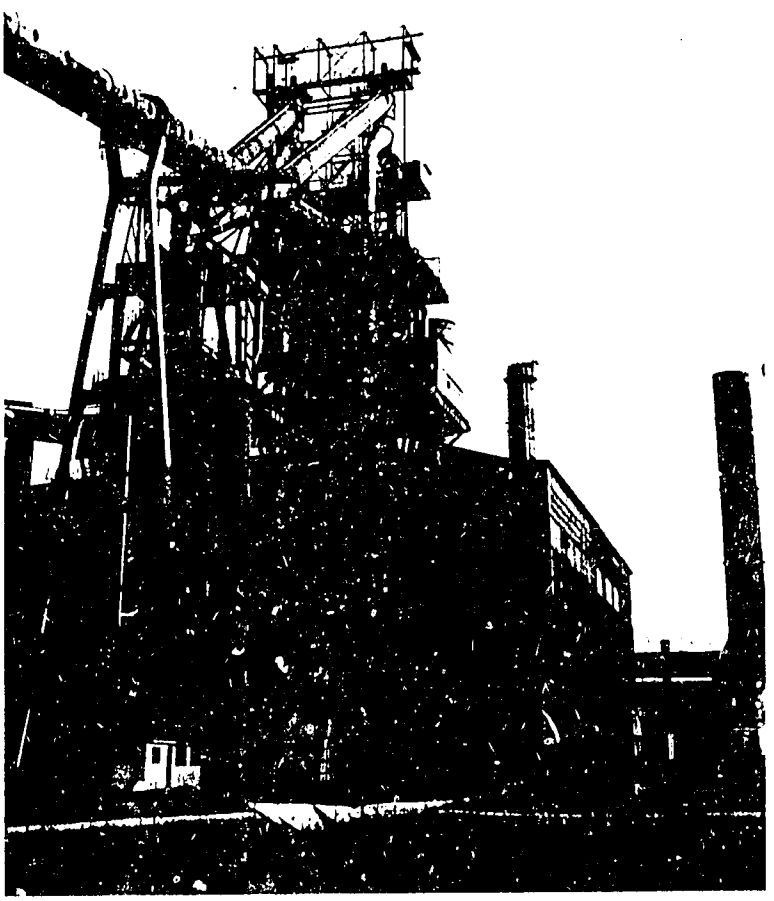

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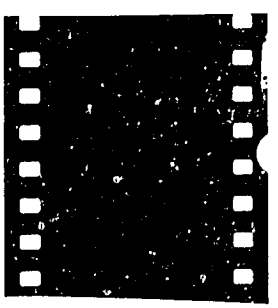

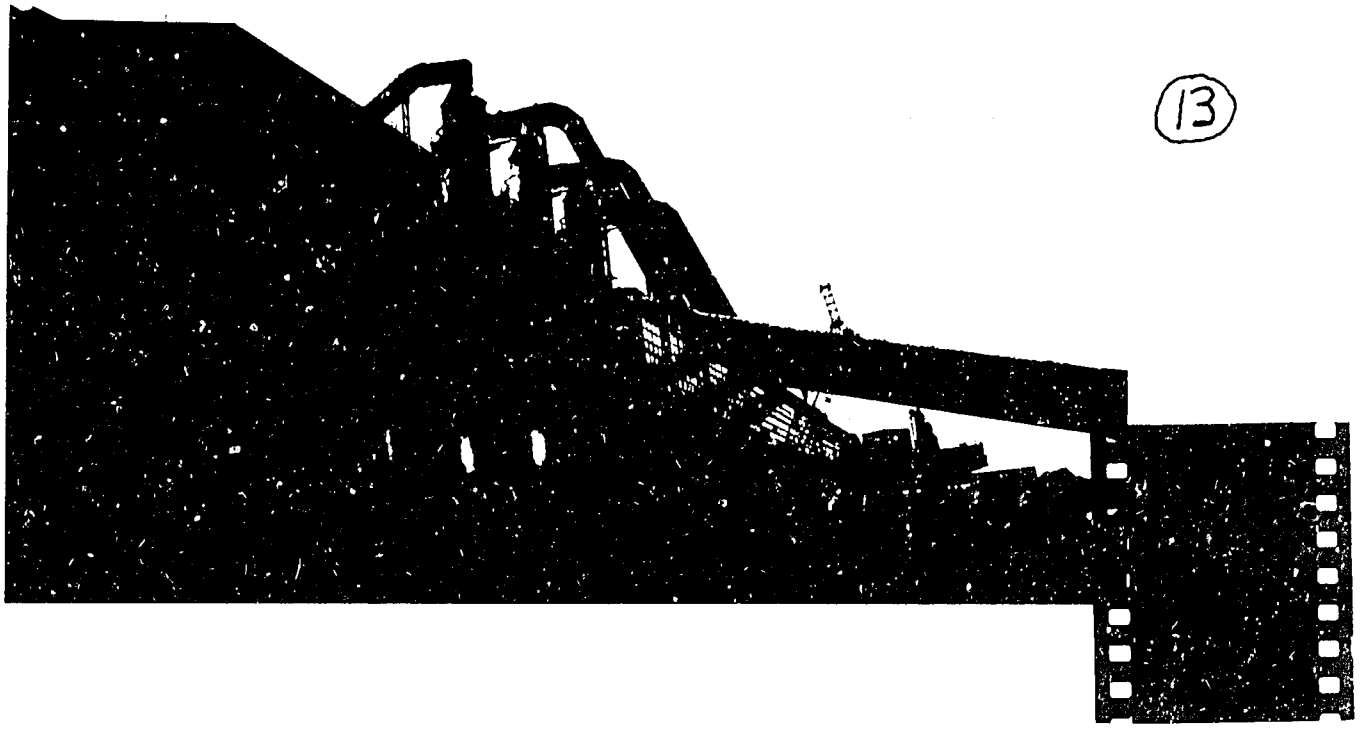

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