TRIP REPORT TO STOMANA AND KAMET STEEL MILLS

IN PERNIK, BULGARIA

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DISCLAIMER

The opinions expressed herein are the professional opinions of the author and do not represent the official position of the Government of the United States or the World Environment Center.

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I. EXECUTIVE SUMMARY

An environmental review was made of the steel plant operations of Firma Stomana and Kamet J.S. Co., both located in Pernik, Bulgaria. Pernik is an industrial community about 25 kilometers from Sofia, separated from Sofia by a mountain range. There is significant air pollution in Pernik, primarily from the large heating and power plant which burns local high ash, high sulfur coal with minimal control.

The Stomana facility is reasonably good environmentally. Some improvements are required in air pollution control and solid waste handling. Integrated steel production facilities - blast furnaces and siemens (open hearth) steel furnaces which were formerly major air pollution sources have been shut down permanently. Current steel production is in electric arc furnaces (EAFs). These furnaces are equipped with well-designed systems to capture all particulate emissions, but the air cleaning systems are inadequate to minimize emissions. Improved systems have been proposed and will make this system satisfactory.

Lime and dolomite kilns are equipped with electrostatic precipitators which do a reasonably good job but do not achieve recently higher standards. Some upgrading of the equipment is needed.

A minor but very visible source of particulate pollution is the burning operation in the scrap preparation area. Some control is recommended.

The water systems at Stomana are good. Quality of the discharges is excellent and the water quality of the Struma River shows no pollution. One recommendation is made for protection against possible spills.

Solid waste practices are generally satisfactory, although some provision should be made to minimize wind entrainment of EAF dust at the disposal site.

The Kamet installation must be considered in three parts. The principal plant is a reasonably modern facility for the production of high quality steels. It has good facilities for air and water pollution control and reasonable practice for its solid wastes. The principal plant appears to be acceptable environmentally.

Across a main highway from the principal plant is an obsolete melting shop and rolling mill for production of standard steel products such as reinforcing bar. The three 10T EAFs have at present no air pollution controls and are environmentally unacceptable. Even though this plant will be shut down shortly, a dust collecting system is now being installed which will reduce emissions but not improve working conditions. Although there is no water pollution control facility, water discharge presents no problem. Solid waste facilities are adequate but unsightly.

All components of a new facility to replace the old melt shop and rolling facility have been received and sit in crates on plant property. This facility, when installed, will provide the latest and best technology for air and water quality control, replacing the obsolete facilities described above. Its installation has been delayed. The best ecological action for Kamet is the installation of this new facility.

II. FINDINGS

A. INTRODUCTION

The purpose of this visit was to conduct an environmental review of the Stomana and Kamet steel works, both located in Pernik, Bulgaria.

Pernik is a small industrial town about 25 kilometers from Sofia. It sits in a valley between mountain ranges and is separated from Sofia by mountains. The most visible and conspicuous feature of the town is the tall stack of a major heating and power plant. This plant is located near the steel plants of Stomana and Kamet. It burns local coal high in ash and sulfur and continuously emits a large, extremely visible plume high in particulate matter. It is reported that the air cleaning system is not operating adequately--particulate emissions have been estimated to be over 100 tons per day. It is very clear to the observer that the power plant is the major source of air pollution in Pernik.

Limited data on community air quality show that there is a major problem with particulate matter in the Pernik area. These data, gathered by Stomana personnel, are shown in Table I. It is very clear to an observer that the power plant stack is the major source of this particulate matter.

The local authorities have formed an Environmental Council which takes an active concern in the operation and facilities of the industrial operations. The Council exercises some control over both air and water discharges from these industrial operations, but has apparently accepted as a fact of life the far greater emissions from the heating and power plant.

B. STOMANA

The Stomana plant produces mild steel bar and section products in EAFs. It had been an integrated plant producing iron in blast furnaces and steel in Siemans (open hearth) furnaces, but these facilities have been shut down and will not operate again.

1. Air Pollution Sources

Since the blast furnaces and open hearth furnaces have been shut down, the potential sources of air pollution at the Stomana plant are the EAFs, the reheating furnaces, kilns for production of lime and dolomite, scrap preparation and fugitive dust.

a. The plant has three 100-ton EAFs in a single shop. The shop is well designed for control of air pollution. Each furnace is equipped with a "fourth hole" extraction system plus extensive canopy hooding which amounts in essence to entire building evacuation. There is no escape of fumes from the building even when all three furnaces are operating at capacity. This system for the collection of fumes appears to be completely satisfactory.

Capture of the collected fumes, however, is less than satisfactory. Furnaces 1 and 2 are connected to electrostatic precipitators which are rated to achieve a discharge of 60 mg/m^3 of particulate but are not attaining that performance. Discharge from these furnaces is estimated to be about 335 tons per year. Furnace 3 is connected to a baghouse rated to achieve 30 mg/m^3 of particulate. Performance has deteriorated from about 20 mg/m^3 to about 40 mg/m^3 with total emissions estimated to be about 100 T/yr.

Newly adopted Bulgarian regulations limit particulate discharges from electric furnace steelmaking to 30 mg/m^3. The baghouse on Furnace 3 is capable of achieving this standard. The present bags in this unit have been in service for almost six years and should be replaced. Stomana has scheduled this bag replacement for later this year. At that time, the unit will also be divided into separate compartments to permit better maintenance while the system is in operation. With this work, performance should be acceptable under the new standard.

The precipitators on Furnaces 1 and 2, however, are old and somewhat obsolete. It is doubtful whether, even with complete rebuilds, they could attain the new standards. Stomana has developed plans and received proposals to replace these precipitators with a new baghouse rated at 15-20 mg/m^3 of particulate. Installation of this new baghouse will bring the entire EAF operation into fully acceptable environmental operation.

It is recommended that continuous stack monitors be installed to measure particulate emissions in the stacks from the two baghouses to assure that continued operation within standards is achieved.

b. The reheating furnaces in all of the finishing operations are fired with natural gas utilizing reasonably modern combustion controls. These furnaces present no pollution problems and are fully acceptable environmentally.

c. Located at the far end of the plant are two rotary kilns for the production of burnt lime and dolomite. These kilns are equipped with electrostatic precipitators designed to achieve about 300 mg/m^3 particulate concentrations in the stacks. Performance has deteriorated to the point that emissions are currently in the range of 600-700 $mg/^3$. Although this performance was satisfactory under the previous standard of 1 g/m^3, new Bulgarian regulations will limit emissions to 200 mg/m^3 (dropping to 130 mg/m^3 in 1995).

Even with major rehabilitation, it is doubtful that these precipitators could achieve the present standards, much less the 1995 standard. One possibility for achieving compliance would be to abandon the dolomite kiln, carry out both operations in one kiln, and to install the second precipitator in service with the existing precipitator on that one kiln.

d. The only other process source of particulate emissions at Stomana is the burning required for the preparation of scrap for charging into the furnaces. This is an intermittent operation, dependent on the quality of available scrap. It is not a significant source of large quantities of particulate, but it is extremely visible from outside the plant when it occurs and could be a source of community complaint. It would seem judicious to take some steps to limit this obvious source of particulates either by enclosing the operations or by development of portable capture units to be used at locations where scrap is cut.

e. There are fugitive emissions from the handling of EAF dust. These are discussed below under Solid Wastes.

2. Water Pollution Sources

Process water used at the Stomana plans is received from an industrial water system serving the Pernik area and is utilized in three recycle systems.

The recycle system for the EAF shop included primary scale pits, three 30-meter clarifiers (two in use, one spare), cooling towers and sand filters. Blowdown from the cooling towers is discharged to the Struma River. Scale and slimes are presently stored on land within the plant area.

The section and sheet mill recycle systems include primary scale pits followed by multi-section horizontal clarifiers for oil and solids separation with cooling towers for recycle. Discharge from the secondary clarifiers is discharged to the Struma River.

Other discharges from the plant to the Struma River drain plant areas no longer in use or simply rainfall from open plant areas.

Table II shows the water quality as received from the industrial water supply, in the Struma River above and below the plant, and average examples from the various outfalls. These data are based on extensive sampling and analyses done by Stomana personnel. It is clear from these data that the water system at Stomana is environmentally satisfactory and is causing no pollution problems. All discharge parameters are well below the standards set by Bulgaria for industrial discharges with the exception of oils. Presence of oil contents higher than the discharges in the intake water and in the river above the plant shows that the plant is not causing any oil pollution or degradation of water quality.

One possible inadequacy of the Stomana water system is the potential for discharge into the river of any oil spilled within the plant area. No provision is currently made for capture of spills in or near channels leading to the discharge points. This potential could be greatly decreased by installing a small catch-basin with submerged discharge at each outfall to the river. It is recommended that consideration be given to installation of these catch-basins.

3. Solid Wastes

Principal solid wastes from the Stomana plant are slag from steelmaking, dusts from the furnace air cleaning systems, and scale and slimes from the water treatment facilities.

Slag is disposed in a large landfill area which has been used for slag disposal for many years. The landfill appears to be well managed. Any drainage is into a valley leading to a settling pond. Landfills from local coal mines and for fly ash from the heating power plant drain to this same area. No problems are apparent in this area.

Dust from the EAF air cleaning system is disposed in the same landfill area as the slag. The dust is put in a separate area of the landfill so that it may be recovered in the future should it be possible to recycle and reuse this material. Reuse seems

unlikely, since the dust contains only about 5% zinc and feasible recovery systems are based on the 20% zinc content found in some dusts. The one problem observed in this area is in dust raised and reentrained in the air in the dumping and compacting of the dust. It is recommended that either (a) a pelletizing process be installed for consolidation of the dust or (b) water sprays be installed in the disposal area and utilized to prevent dust discharges.

Some of the coarse scale is recycled to the steelmaking furnaces. Most of the scale and slimes from the water treatment systems are simply stored on land within the plant area. While there are no immediate problems with this practice, it is obvious that it cannot continue indefinitely. It is recommended that a program of land disposal in the landfill site used for slag be developed.

C. KAMET

1. General

A discussion of the environmental considerations of theKamet facility in Pernik, Bulgaria, must consider the plant in three sections:

a. The principal Kamet plant is a reasonably modern facility for the production of high quality steels. This plant has modern electroslag melting facilities, a forging shop and extrusion presses for the production of high-grade steel products.

b. Across the main highway from this shop is an obsolete melting shop and rolling mill for the production of standard steel products such as reinforcing bars. These facilities were acquired some years ago from Stomana and can only be classified as totally outdated and worn out.

c. A brand new facility from Danieli (Italian) for EAF production and rolling of a variety of bar products from various grades of steel. This facility was acquired as an expansion and upgrading of capacity, planned to replace the old facility described in (2) above. Installation has been delayed and the equipment sits in crates on plant property awaiting approval and financing for its completion.

2. Environmental Status

a. The principal plant melts steel in Russian-designed electroslag melting furnaces equipped with a complete German-designed dust control system that seems to be completely adequate. The system treats about 18,000 m^3/hr of air, with tests showing inlet dust loadings of over 500 mg/m^3 and outlet loadings from 3 to 4 mg/m^3. The system meets national standards for emissions of CO, SO_2, NO_x and F as well as dust and is considered completely satisfactory to local authorities.

The reheating furnaces in the forge shop are fired with natural gas and are equipped with modern combustion controls so that they present no emission problems.

There are no other significant combustion processes in this plant area; therefore it appears completely satisfactory relative to air pollution.

The water system in this plant gets its fresh water from the industrial water system feeding industry in the Pernik area. This water is fed into a 6000 m^3 reservoir which supplies cooling water to the electroslag melting furnaces, the forging shop and the extrusion shop. Cooling water is returned to a single basin and cooled in cooling towers before recycling to the main reservoir. Excess water from the system is discharged to an industrial sewer leading to a control treatment system which recycles water to the industrial water system for Pernik. Analysis indicate the discharge meets all criteria for industrial discharges to the river with the exception of oil which is handled in the central treatment facility. Erratic oil content in the discharge samples (at times as high as 500 mg/l) are taken as an indication of plant problems and are followed up by investigation and corrective action. Thus, this area has no water pollution problems.

Solid wastes from the plant are slag from steelmaking scale from the forge shop, and dust from the air pollution control system. Slag is disposed along with slag from the EAFs in the other part of the plant in a common slag area discussed below. The scale from the forging shop is recycled and melted in the furnaces. Dust from the air pollution control system is treated as a hazardous waste and disposed as such by the local authorities.

This entire section of the plant can be considered environmentally acceptable and well controlled.

b. The steelmaking shop in the old plant consists of three 10T EAFs in a large extremely dilapidated building. These furnaces were installed in 1951 and are, at best, obsolete. The rolling mill in this plant is even older than the EAFs; it was not new when installed in 1933. The atmosphere and working conditions in these old facilities are unsatisfactory and unsafe. This portion of the plant is scheduled to be shut down as soon as replacement facilities are available.

At present there are no air pollution controls on the EAFs. Fumes during all phases of the operation are discharged into the building and emitted to the atmosphere through numerous monitors and holes in the walls and roof. This system is consistent with the age and condition of the plant but is environmentally unacceptable. Although the melt shop will be shut down within a few years, the local authorities have ordered the installation of a dust control system. Now under construction is a system of canopy hoods over the crane ways connected to a baghouse rated at 105,000 m^3/hr. Observation of fume generation and emission rates indicate that this system should satisfactorily control emissions to the atmosphere from this source although it will not improve the poor working environment.

The only other potential source of air pollution in this plant area is the reheating furnaces in the rolling mill. The only significant emission in SO_2 from the burning of heavy oil with 2.5% sulfur content. Ambient air data in the Pernik area do not indicate there is SO_2 concentration in excess of standards, and the local authorities are satisfied with these furnace emissions.

The only significant use of industrial water in this area is once-through use for roll cooling and scale removal in the rolling mill. Water from the mill is discharged through primary and secondary scale pits directly to the Struma River. While this system is primitive, analysis of the discharge indicates low suspended solids content. The discharge is satisfactory to local authorities. Therefore, analyzing the age and condition of the mill, it appears satisfactory.

Slag from the EAF shop is and has been for years disposed in a valley on plant property. This valley is, at best, unsightly but does not appear to present any significant

environmental problem. Groundwater contamination is possible, but there are no nearby users of groundwater. The local authority has suggested ground cover and planting. This seems a reasonable step to prevent future problems and will be done when the overall facility is replaced.

c. The Danieli facility is the solution to air and water problems at the Kamet plant. The high power 40T EAF will be enclosed in a "doghouse" as well as equipped with a "fourth hole" extracting system and all auxiliary operations, including the ladle furnace adequately hooded and controlled by a 100,000 m^3 baghouse designed for 15 mg/m^3 cleaning. Reheating furnaces will be gas fired. A tight recycle system will be included for all waters used in cooling and rolling operations. The latest environmental technology is an integral part of this system.

3. The Real Problem

Replacement of the old melting and rolling facility with the Danieli facility would provide significant benefits both ecologically and economically. Ecologically it would provide the latest and best technology for both air and water quality control, providing reduced emissions even though capacity is increased, and vastly improving working conditions. Economically it will increase production capacity, product mix and product quality while reducing costs. Installation in the main plant area will result in consolidation of facilities with great cost savings.

Yet the local authorities have denied permission for that installation on environmental grounds, citing an obscure regulation dealing with distance of a steel plant from residential areas. They have increased environmental pressure against the installation by approving high-density residential construction immediately adjacent to the proposed melt shop site.

To circumvent the cited regulation, Kamet has evaluated the installation of the Danieli EAF facility at the site of the old plant. This would considerably increase capital investment since that location across the major highway would require construction of an underpass to permit material transfer as well as extensive site clearance. It would result in continuing inefficiencies and cost disadvantages because of the material transfers. The local authorities question the ecological desirability of even this revised installation.

Scheduling of the Danieli installation is now uncertain for several reasons. Should the alternate furnace location be required, the costs of the installation would be greatly in excess of the original plan and Kamet has no assurance of capital availability. Secondly, the installation cannot proceed without approval from local authorities and they still express environmental concerns.

Environmental assessments by the Institute of Ecology of the Bulgarian Academy of Sciences and by an independent expert commissioned by UNIDO confirm that the Danieli installation would help rather than harm the ecology of Pernik. Approval and financing of this installation would appear to be the best approach to the environmental problems of Kamet.

III. RECOMMENDATIONS AND CONCLUSIONS

A. STOMANA

The Stomana plant is a reasonably good production facility with a reasonable environmental control program. To make it fully acceptable environmentally the following steps are recommended:

1. Rehabilitate and replace the bags in the baghouse serving #3 EAF;

2. Replace the precipitators with a new baghouse on #1 and #2 EAF;

3. Upgrade air cleaners on limestone and dolomite kilns;

4. Install catch-basins at water outfalls;

5. Reduce dust reentrainment from EAF dust disposal;

6. Reduce emissions from scrap burning;

B. KAMET

Replacement of the old electric arc furnace (EAF) and rolling mill facility provided by Danieli would provide significant benefits both ecologically and economically. Ecologically, it would provide the latest and best technology for both air and water quality. Economically, it would increase productivity capacity and product quality while reducing costs.

The original proposal was that the Danieli facility be installed in the main Kamet plant area. My analysis shows that this installation would have no undesirable ecological impact on Pernik. An alternative proposal would relocate the Danieli EAF across the highway. Although this alternative would increase the distance between the EAF and residential areas, it would not result in ecological improvement. Dust and fumes generated by traffic required in transportation of materials would outweigh any minor benefits from the increased distance. In addition, the relocation would result in increased capital expenditures and continuing increased operating costs.

Therefore, I conclude that the best ecological action for Kamet is the installation of the Danieli facility within the Kamet plant area.

C. GENERAL COMMENT

At both Stomana and Kamet, management has demonstrated clear recognition that consideration of the environment has become an important part of steel plant management. Each plant has set up a department of ecology and each has appointed a competent individual to spearhead this effort. Each is attempting to set up programs to assure environmental compliance.

Each, however, is somewhat hindered in its efforts by some isolation from the mainstream of world efforts in environmental control and by a lack of training in modern environmental technology. For example, they are not familiar with up-to-date monitoring equipment or with air modeling techniques for estimating impact of emissions and controls. They recognize these problems and are seeking assistance.

World Environment Center could assist them by arranging contacts with such organizations as:

1. The Industry Office of the United Nations Environment Program, which has developed technical documents on the iron and steel industry;

2. The International Iron and Steel Institute, which has done extensive work in steel industry environmental control;

3. The International Environmental Bureau, a division of the International Chamber of Commerce, which is set up to disseminate environmental know-how;

4. U.S. Environmental Protection Agency, which has perhaps the strongest technical background in areas such as monitoring and modeling.

Contacts are now being made to establish liaison between these organizations and Stomana and Kamet.

TABLE I

PERNIK AIR QUALITY DATA

		Particulate Matter Mg/m^3	SO_2
Bulgarian Standard		150	50
Previously Reported Data		50-1200	10-230
February 1992 Location	A	730	0
	B	212	0
	C	322	0
March 1992 Location	A	1040	14
	B	250	13

Location A - Pernik Industrial Zone
B - Village Toward Sofia
C - Toward Pernik Residential Area

TABLE II

STOMANA
WATER QUALITY DATA

		pH	Total Solids	Dissolved Solids	Suspend. Solids	Dissolved O_2	Total Fe	Oils
						All in Mg/l		
Intake Water-Industrial Water Supply		8.4	458	423	35	10.2	0.0	8.0
Struma River - Upstream from Stomana		8.2	344	294	50	9.7	.50	3.2
Struma River - Downstream from Stomana		8.2	375	320	55	9.4	.33	2.8
Discharges from Stomana								
EAF Area	A	8.3	356	310	46	9.3	.77	5.8
	B	8.3	327	233	94	10.2	.68	6.9
Section Mill Area	A	8.4	334	304	30	9.8	.52	1.7
" " "	B	8.3	360	312	48	10.5	.66	6.9
Sheet Mill Area	A	8.1	344	308	36	10.1	.54	3.8
General Mill Drainage	A	8.2	334	302	32	10.1	.50	9.0
" " "	B	8.1	440	401	39	10.1	.41	2.4
" " "	C	8.2	381	345	36	10.5	.45	3.2
Bulgarian		6-8.5		<1000	<50	>4	<1.5	<0.3

PERSONS VISITED

FIRMA STOMANA

- Stoyan Iliev, Executive Director
- Ivan Banov, Director, Engineering Division
- Ivan Dimitrov, Chief, Department of Ecology
- Dimiter Stoyanov, Chief, Water Division
- Valentina Antova, Translator

- Lily Pavlova, Member, Pernik Environment Council

KAMET J.S. CO.

- Todor Kovachev, President
- Zdravko Filipov, Manager, Development and Investigations
- Rumana Mitkova, Chief, Ecology Department
- Iva Tsvetkova, Correspondent, Translator

AUTHOR

Earle F. Young, Jr., now retired, spent 25 years working full time on the environmental control aspects of the steel industry.

After receiving a B.S. in Chemical Engineering from Carnegie Institute of Technology in 1949, Mr. Young was employed by Jones & Laughlin Steel Corporation in 1956. After several years in research, primarily in raw materials processing, he was placed in charge of the corporation's environmental program in 1965. He guided that program until 1976, organizing the environmental department of the corporation, guiding the selection and design of facilities for air and water pollution control and solid waste management and negotiating permits with regulatory authorities. In that work he became fully familiar with the pollution problems and solutions for three integrated steel plants, a stainless melt shop, numerous finishing mills, coal mines and iron ore mines.

In 1976, he left J&L to join the American Iron and Steel Institute (AISI) as its chief environmental officer. He was responsible for liaison between the member steel companies and the U.S. Environmental Protection Agency, for dissemination of pollution control information among member companies and for management of the research in environmental control sponsored by AISI.

Mr. Young has served with the World Health Organization and the United Nation's Environmental Program in the development of background information and technical guidance relative to environmental control in the steel industry.