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PRIDE Project in Development and the Environment

OPPORTUNITIES FOR USAID/EAP PROJECTS IN BULGARIA

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The objective of the Project in Development and the Environment (PRIDE) is to help the U.S. Agency for International Development (AID) design and implement programs that foster the agency's environmental and natural resources strategy for sustainable economic growth in the Near East and Eastern Europe.

PRIDE provides AID and participating countries with advisory assistance, training, and information services in four program areas: (1) strategic planning, (2) environmental policy analysis, (3) private sector initiatives, and (4) environmental information, education, communication, and institutional strengthening.

The project is being implemented by a consortium selected through open competition in 1991. Chemonics International is the prime contractor; subcontractors include RCG/Hagler, Bailly, Inc.; Science Applications International Corporation; Capital Systems Group, Inc.; Environomics, Inc.; Industrial Economics, Inc.; Lincoln University; and Resource Management International, Inc. In addition, AID has entered into a cooperative agreement with the World Environment Center to support implementation of PRIDE.

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OPPORTUNITIES FOR USAID/EAP PROJECTS IN BULGARIA

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March 31, 1995

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ACRONYMS AND ABBREVIATIONS

ABB	Asea Brown Boveri
BTU	British Thermal Unit
CMEA	Council for Mutual Economic Cooperation
EBRD	European Bank for Reconstruction and Development
EAP	Environmental Action Program for Central and Eastern Europe
EPA	U.S. Environmental Protection Agency
EXIM	U.S. Export Import Bank
FBC	Fluidized bed combustor
FGD	Flue gas desulfurization
FSU	Former Soviet Union
GCal(GC)	Gigacalorie
GDP	Gross Domestic Product
GOB	Government of Bulgaria
GTCC	Gas Turbine Combined Cycle Cogenerator
IBRD	International Bank for Reconstruction and Development
IFI's	International Financing Institutions (World Bank Group, EBRD)
k	thousand
MM	millions
MWe	Megawatt of heat
MWth	Megawatt of thermal energy
MOE	Bulgarian Ministry of Environment
MPa	Megapascal (unit of pressure)
NO_x	Oxides of Nitrogen
OPIC	U.S. Overseas Private Investment Corp.
PHARE	Central and Eastern Europe Economic Restructuring Assistance Program
PPC	Project Preparation Committee of the EAP
REI	MO Regional Environmental Inspectorate
RI	Regional Inspectors
SAIC	Science Applications International Corporation
SO_2	Sulfur dioxide
t/h	Tons per hours (for boiler capacity)
USAID	U.S. Agency for International Development
USEPA	U.S. Environmental Protection Agency
VHC	Vratza heating company
WEC	World Environmental Center

SECTION I
OVERVIEW AND RECOMMENDATIONS

A. Overview

This project verification and identification mission to Bulgaria in support of the Environmental Action Program (EAP) for Europe was carried out between January 8 and 18, 1995. Like previous missions to Poland, Slovakia, Czech Republic, and Lithuania, the parameters of the mission were those of the Project Preparation component of the EAP.

However, there were several significant differences between this mission and previous EAP missions. Unlike previous missions, this mission was a follow-up mission to two previous EAP World Bank evaluations in Bulgaria. Therefore, the USAID team was charged with evaluating a refined list of candidate investment sites previously identified by the World Bank, rather than calling on the host government to develop a list. A second important distinction is that this team evaluated investment candidates for total, or at least partial, grant financing rather than debt financing. USAID is prepared to make available up to $1 million for an EAP project investment in Bulgaria. Finally, it is USAID's goal to select an investment site (or sites) where its grant funds may be leveraged with loan financing by the World Bank. Thus, the investment candidates were chosen from a World Bank priority list. Moreover, USAID plans to concentrate its other environmental programs geographically around the EAP investment candidate site in order to increase the positive impact of assistance and realize natural synergies of the various environmental assistance programs. In fact, an official from the U.S. Environmental Protection Agency (EPA) accompanied the team during the mission in order to evaluate regions for potential technical assistance programs.

During the mission, the team visited four municipalities and preliminarily evaluated eleven candidate investment sites. These were:

- District Heating Gasification, Plovdiv
- Residential Heating Gasification and Conversion, Stara Zagora
- Flue Gas Desulfurization at Agrobiochim Fertilizer and Chemical Plant, Stara Zagora
- Technological Upgrades and Refurbishment of Maritza East Thermal Power and Heating Units, Radetki and Galobovo
- Residential Heating Gasification, Dimitrovgrad
- Emission Control of Kiln at Vulkan Cement Plant, Dimitrovgrad
- Neochim Fertilizer and Chemical Plant, Dimitrovgrad
- Manganese Removal in Residential Drinking Water, Dimitrovgrad
- Residential District Heating Extension, Vratza
- District Heating Plant Improvement, Vratza
- Flue Gas Desulfurization Plant at CHIMKO Fertilizer and Chemical Plant, Vratza

As stated before, this list was substantially developed from World Bank officials who made visits to Bulgaria in November and December 1994. However, several sites were added to the list of candidate projects based on information collected at the Ministry of Environment and Regional Environmental Inspectorates.

B. Findings and Recommendations

Hot spot areas of environmental health risk continue to exist in Bulgaria. The most immediate health risks appear to be posed by air pollution. Each of the sites visited were significant point sources for air pollution in hot spot areas identified by the MOE and the World Bank. While many sources contribute to this problem, the concentration of industries around population centers and the use of poor quality indigenous coal and high sulphur oil for fuel are large components. Alteration of specific industrial processes, conversion of fuel sources to less polluting sources, and implementation of emission control devices could, in many cases, substantially reduce health risks to populations living in hot spot areas.

This mission identified many EAP potential investment candidates from the sites visited that represented reasonable and viable projects. However, USAID is limited by the total dollar commitment that it can make to this program. Therefore, the team recommends that USAID actively promote projects not selected for this grant investment project to other donors through the PPC process.

Of the eleven potential investment candidates, several meet the PPC criteria for financing under the EAP. In some cases potential candidates would require significant work in order to bring the project to fruition, while others would require little preparation for implementation. Those requiring groundwork prior to implementation are no less attractive in the long-run, but will be excluded from the final options for immediate grant investment. The team recommends that USAID actively promote these projects with other donors. The summary of the team's findings are presented in short project summaries. More in-depth evaluations of these projects may be found in Section III.

B1. District Heating Gasification, Plovdiv

The town of Plovdiv is a major industrial town with problems with emissions from its two district heating systems. The two heating companies have developed aggressive programs to extend service to areas now heated only with local boilers and furnaces which operate on poor quality fuels with no emissions controls. The cost of this extension is between $500,000 and $1.1 million, depending on the design of the system. The program has been developed to the point of a detailed design, and will be ready for implementation by the end of the month.

Beyond this first step, both heating companies have plans for replacement of boilers with gas turbine combined cycle cogeneration systems. These will likely be phased in over time at a cost in excess of $40 million.

B2. Residential Heating Fuel Conversion, Stara Zagora

Residential heating is a serious problem in Stara Zagora where there is neither a central heating company nor gas service. The poor quality fuel and short stacks throughout the residential areas substantially contributes to the air pollution. In order to address this, the municipality would like to convert residential, commercial, and public buildings to natural gas. The municipality is the minority stockholder in a company formed with Overgas—a private gas engineering and distribution company—to provide gas to the city. Overgas, as a for-profit company, will only serve areas where they can operate profitably. Accordingly, their first priority is the industrial zone of Stara Zagora. The barrier to movement into the residential and commercial areas is lack of committed customers due to the costs of converting the individual buildings and boilers to gas use. These costs must be borne by the building owner. Overgas has suggested the creation of a fund which would loan money

at favorable rates to potential residential and commercial customers to build momentum for the gasification of the town. The fund would require about $2.4 million in capital. This amount could be financed by a combination of grants and loans.

B3. Agrobiochim Fertilizer and Chemical Plant, Stara Zagora

The large fertilizer company outside of Stara Zagora operates a large coal-fired heating plant which lacks controls for sulfur dioxide. The plant is seeking assistance in implementing a large-scale flue gas desulfurization unit. The cost is beyond the scale of the USAID/EAP program, and the health impact is less than the least costly heating project located in the town.

B4. Maritza East Thermal Power and Heating Units, Radetki and Galobovo

The Maritza East power plants are large central power plants, using coal of the lowest quality for fuel, with a complete lack of SO_2 controls. Two plants were examined by the team. Maritza 1 is aging, and will have been completely replaced by 2000, at a cost of more than $700 million. On the contrary, Maritza 3 is a much more modern plant, needing flue gas desulfurization (FGD). Given the plant's size, the cost of an FGD is about $200 million.

B5. Residential Heating Gasification, Dimitrovgrad

Dimitrovgrad, like Stara Zagora and Plovdiv, is plagued with emissions from residential buildings in the center of town burning wood, coal, and mazut (heavy fuel oil). The solution developed for the municipality is the conversion of these units to gas. From a technical and health perspective this project is equivalent to that of Stara Zagora, but more fully developed for presentation.

B6. Vulkan Cement Plant, Dimitrovgrad

The national government has decided to close Vulkan in 1997 based on its adverse impact on the environment and population in Dimitrovgrad unless it can reduce its emissions to meet national ambient air concentration standards. Specifically, the plant will be allowed to operate if it installs proper emission control equipment and finances this investment through joint ventures, privatization, or other means. Until that time, it will only be allowed to operate at significantly reduced capacity.

Vulkan plant management has increased sales and is concentrating its specialty cement production toward export markets. These are convinced that the company can operate successfully once the pollution issues are resolved. To address this issue, Vulkan management contracted a German engineering firm to design a reconfiguration of the baghouse using existing facilities and implementing a new filtration system. This proposal would reduce dust emissions to acceptable levels and allow the plant to continue to operate two kilns at full capacity. The proposal is estimated to cost approximately $1 million (70 to 80 million Leva). Since the plant has no access to capital, outside financing is essential for this project.

B7. Neochim Fertilizer and Chemical Plant, Dimitrovgrad

Emissions from Neochim Fertilizer and Chemical Plant currently meet emissions standards. This is due in part to the catalytic controls on its ammonia production units and also, in part, to reduced production. Neither the plant manager nor local environmental officials identified any

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environmental projects at Neochim that they felt required, or were appropriate for, USAID assistance.

B8. Manganese Removal in Residential Drinking Supply, Dimitrovgrad

The town of Dimitrovgrad has identified high levels of manganese in its water. They recently installed a treatment system that is working effectively to reduce manganese concentrations. The pipes of the system, however, are still scaled with manganese. Technical guidance on methods that can be used to remove the manganese were requested. This material can be provided pro bono by the USAID technical contractor.

B9. District Heating Extension, Vratza

In Vratza, like many other towns in Bulgaria, buildings in the center of town are burning poor quality fuel without emission controls and the exhaust is emitted into the atmosphere through short stacks. The proposed solution in Vratza is to extend the district heating system so that residents have an alternative heating source. The cost is between $400,000 and $500,000. The project, however, is intended be done in conjunction with improvements to the central heating boilers.

B10. District Heating Plant Improvement, Vratza

The district heating system in Vratza is operated by a single company. The boilers and distribution system are in good condition, but of low quality. The company would like to convert the fuel system of the boilers so that they could burn natural gas ($600,000) and construct steam cogenerators ($4.1 million). The project has been developed through the conceptual design stage and a budget for final design and implementation has been prepared. The company has developed a plan that relies on loans, and has a payment schedule which can be maintained if the company is allowed to set heating prices to an economically acceptable level.

B11. CHIMKO Fertilizer and Chemical Plant Desulfurization, Vratza

A single stack at the CHIMKO fertilizer is responsible for half of the sulfurous emissions in the municipality of Vratza, and contributes substantially to the town's poor air quality given that it is located 800 m south of the city boundary. The plant has solicited proposals from three Western companies for a unit which will catalytically convert all sulfur compounds in the exhaust to H_2S which can be recycled to the Claus unit. Total emissions of sulfur compounds can be reduced by 99 percent, effectively halving the towns emissions and cutting ambient concentrations in half except during the peak of the heating system. The plant has evaluated the options, and then prepared its own design at much lower cost. The engineers responsible for the design are very capable, having worked the in the plant's research institute which design most of the plant's process equipment. The plant also routinely fabricates units of comparable complexity. The total cost of the project is $1.2 million, but the plant, which is profitable, can provide partial financing.

1. District Heating Gasification, Plovdiv
2. Residential Heating Fuel Conversion, Stara Zagora
3. Agrobiochim Fertilizer and Chemical Plant, Stara Zagora
4. Maritza East Thermal Power and Heating Units, Galabovo and Mednikarovo
5. Residential Heating Gasification, Dimitrovgrad
6. Vulkan Cement Plant, Dimitrovgrad
7. Neochim Fertilizer and Chemical Plant, Dimitrovgrad
8. Manganese Removal in Residential Drinking Supply, Dimitrovgrad
9. District Heating Extension, Vratza
10. District Heating Plant Improvement, Vratza
11. CHIMKO Fertilizer and Chemical Plant Desulfurization, Vratza

SECTION II
MISSION OBJECTIVES AND PROJECT SELECTION CRITERIA

A. Mission Objectives and Terms of Reference

The present mission, composed of a USAID team manager, a consultant from PRIDE, and a WEC specialist had two principal objectives: (1) identifying, selecting, and evaluating economically viable environmental investment demonstration projects that would be implementable with grant funds from USAID; (2) complementing work of existing USAID environmental project and non-environmental projects; and (3) meeting USAID's requirements of sustainability and replicability. The team was to obtain the commitment of TA recipient entities and government agencies to complement future USAID assistance with local expertise and other resources.

Our terms of reference also included the following:

- Explaining the concept of the EAP and proposed USAID technical and financial assistance.
- Obtaining a clear understanding of current environmental and economic conditions, the institutional setting governing the environmental sector, and public investments in that area.
- Recommending, as appropriate, procedures for enhancing coordination among various government agencies (at the central and local levels), industry federations, and other non-governmental organizations (NGOs) in the areas of data collection and analysis of ambient environmental quality conditions, environmental health risks, and project identification, prioritization, and selection.

B. Site Selection Criteria

Pursuant to the terms of the Lucerne Agreement, we accorded the highest priority to projects that:

- Offered the greatest potential for reducing environmental health risk.
- Had a significant impact on local conditions and could serve as demonstration projects replicable at the national and regional levels.
- Could be implemented in a relatively short period of time at a relatively low cost.

The Environmental Action Program

The EAP for Central and Eastern Europe (CEE) was formulated at the meeting of ministers of the environment from Western countries and former Soviet Bloc nations in Lucerne, Switzerland in April 1993. The EAP recognized that, despite extensive efforts in the CEE and the New Independent States (NIS) of the former Soviet Union, severe environmental problems remain unresolved. In view of the limitation of grant financing for environmental investments, it was decided that Western aid and resources should be focused and leveraged with those of the recipient governments to maximize their impact. The EAP specifically cites the following pollutants as critical:

- Airborne dust
- Lead and heavy metal in air and soil
- Sulfur dioxide (SO_2), nitrogen oxides (No_x), carbon monoxides (CO), and other gases, especially in combination with dust

However, the Lucerne Agreement also recognizes that specific regions and localities may have equally serious environmental health threats in addition to these region-wide hazards.

EAP Structure. Two task forces were established to support EAP efforts. The first group includes the signatory countries, international financial institutions (IFIs), and environmental NGOs and was to be responsible for assisting CEE and NIS countries in the formulation and development of national environmental action programs. The second group, known as the Project Preparation Committee (PPC), was to coordinate donors efforts in identifying, selecting, and preparing projects for possible funding through IFIs. Four environmental investment advisors were provided by individual PPC members to the World Bank and the European Bank for Reconstruction and Development.

PPC Criteria. The funding of EAP projects is expected to be obtained from domestic and international markets, including IFI loan facilities. Therefore, the projects selected by the host countries and the PPC must be economically viable and credit-worthy to access the debt markets. To support the PPC process, the U.S. government pledged $10 million over a three-year period. Most of this assistance was to be channeled through USAID, although EPA is also an active participant in the two task forces.

USAID Missions. To stimulate host country efforts in setting up domestic processes in the development of national EAPs and PPC activities, USAID fields periodic missions to the region to (1) explain PPC criteria and provide technical assistance in project preparation, (2) identify and evaluate projects that fit the PPC criteria *in terms of environmental health improvement and economic viability,* and (3) determine the commitment of the local sponsoring entity and ascertain how future technical assistance can be best used.

In addition to the criteria noted above, our team considered potential benefits of other USAID programs and their complementary impact on the proposed EAP project. Other USAID non-environmental projects include public administration and democratic institutions.

Finally, the team considered the dual goals of replicability and sustainability in selecting and evaluating EAP projects.

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SECTION III
GENERAL ENVIRONMENTAL AND ECONOMIC CONDITIONS

A. Economic Conditions

The economic climate in Bulgaria provides a relevant background to the current state of the environment. Since 1991, Bulgaria has faced considerable economic difficulties. Total industrial output dropped 25 percent from 1990 to 1992; for 1993 it should decrease to about 10 percent, with a turnaround expected in 1995. Value added by the industrial sector fell approximately 40 percent, while the declines in the agricultural and service sectors declined by 7 and 20 percent, respectively. Annual inflation was expected to reach 120 percent by the end of 1994. The population has suffered significantly during the difficult and long transition period from central planning to a market-based economy. It is estimated that nearly 70 percent of the population live on the verge of poverty, as the prices of many goods have risen, while real wages have fallen. In addition, unemployment, a previously unknown phenomenon, rose from less than 1 percent to over 15 percent from 1990 to 1993.

Bulgaria's transition to a market-based economy has been slower than in other countries in Central Europe. Several reasons account for this, but Bulgaria's significant reliance on intra-Council for Mutual Economic Cooperation (CMEA) trade was a key factor in the lack of speed with which the transition has been made. In 1990, up to 70 percent of its trade was with the former Soviet Union and the CMEA, significantly limiting Bulgaria's access to Western markets. Beginning in 1993, with limited exposure to export earnings, the Bulgarian economy was caught in terms of a trade crisis, as it was forced to pay market prices for fuel. Because Bulgaria has limited quality fuel resources, and many of its industries are energy-intensive, reliance on the former Soviet Union for oil and natural gas is ensured and will further pressure the national budget. The trade deficit has been exacerbated by UN trade sanctions against neighboring Serbia. Ultimately, the rate of Leva depreciation has been accelerated by these factors.

The government has made significant progress in market liberalization and macroeconomic stabilization. In 1991, most prices were liberalized simultaneously with the introduction of a floating foreign exchange regime for the Leva. It appeared that the budget deficit was brought under control during 1991, falling from 8.5 percent of GDP to 4 percent, due to substantial cuts in government expenditures. However, budget pressures caused from decreasing revenue and increasing expenses (mainly for fuel) have caused the deficit to exceed its former level. Bulgaria has financed its budget shortfalls in the past with foreign debt; the foreign debt load is $12 billion and foreign commercial debt is $10 billion. However, servicing this debt has become a problem given falling revenues. In fact, the country renegotiated the terms of its commercial debt after it suspended debt service in 1992; 50 percent of this debt was written off as a result of the negotiations.

The sharp drop in economic activity from 1989 to 1993 was accompanied by major shifts in the composition of industrial output. The largest declines in output have occurred in the iron and steel, machinery, electrical products, transport equipment, and rubber industries. With the exception of power and heat generation, the overall composition of production has shifted from industries that are major air pollution sources to those that produce lower emissions per unit of output. While this trend is positive for the environment, it is expected to reverse as heavy industries begin exploiting export markets.

The decline in national income and industrial production has been accompanied by a large drop in aggregate energy consumption. From 1989 to 1993, it is estimated that consumption of primary

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energy fell by 44 percent; consumption of petroleum products fell by nearly 75 percent and coal consumption by 68 percent. However, expenditures for energy have increased as a percentage of GNP. Overall there has been a substantial shift towards greater reliance upon nuclear power and domestic brown coal. Consumption of energy from nuclear and indigenous brown coal, which are the main fuels for heat and power generation, have fallen by only one-half. Consumption of electricity and heat has fallen less than other uses of energy due to continued state subsidization. While prices of imported petroleum and coal have been market-determined since 1991, prices of natural gas and domestic brown coal remain controlled. Prices of domestic brown coal, in particular, have been kept artificially low in order to provide cheap fuel for the thermal power sector. Despite increases in nominal electricity prices, neither the level nor the structure of tariffs encourages efficient consumption.

The recent change in the bulgarian government is expected to have a substantial impact on the economy. The Bulgarian Socialist Party, bolstered by a new majority in recent parliamentary elections, has pledged its support for market reforms, mass privatization, and fiscal discipline.

B. Environmental Overview

Environmental quality has improved in general since 1990. Overall pollution levels have decreased in hot spots identified by the GOB and the World Bank. Nevertheless, true environmental reform has been delayed by the slow pace of economic reforms. Consequently, progress on complex environmental policy formulation has been slower than anticipated, while environmental improvements have mainly resulted from the economic and industrial slow-down. Overall, official data suggest that air pollution has been reduced considerably more than water pollution. Air quality in the main hot spots has improved since 1990 and generally correspond to the estimated fall in emissions from reduced industrial activity.

Despite substantial improvement in its air quality, concentrations of pollutants remain dangerously high in several of the priority hot spot areas, including Asenovgrad-Plovdiv, Dimitrovgrad-Galabovo, Kurdzhali, Pernik, and Pirdop. Additionally, Vratza, Stara Zagora, Burgas, Pleven, and Sofia also represent areas of significant environmental health risk associated with high levels of air pollution. For Galabovo and Dimitrovgrad, worsening air quality is associated in large part to the large thermal power stations located nearby, which burn local low quality high sulphur coal. These stations are significant sources for SO_2 and particulate emissions. Increased industrial activity, which has been largely flat during the emission observation period, will likely increase as export markets are explored. Thus, emission levels of all primary air pollutants will likely increase with increased industrial output.

Water quality improved significantly in most river basins from 1990 to 1993. Reduced discharge from agriculture, as well as industry is reflected in the improvement in water quality for the Jantra, Maritza, and Tunja rivers. Serious concerns remain over heavy metal levels in the Arda and Upper Maritza river basins; irrigation using water from these sources has exacerbated the problem. With the restructuring of the economy, the primary sources of water pollution will likely be small and medium sources, rather than large industrial plants.

Erosion continues to be one of the major sources of land degradation. Approximately 29 percent of the arable land is affected by water and wind erosion. Overuse of mineral fertilizers and incorrect irrigation have resulted in acidification and salinization of soil. An inventory of polluted lands in 1993 identified 19,358 hectares polluted with heavy metals, 1,913 hectares with radionuclides, 25 hectares with oil products, and 403 with acidification. Additionally, heavy metal pollution from smelter aerosol emissions are a significant problem in Kurdzhali, Pirdop, Plovdiv, Elisseina, and Pernik.

The current priorities recommended by the World Bank to the GOB are as follows:

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- Reduce emissions of lead and heavy metals from metallurgy plants.
- Reduce exposure to air-borne lead from the use of leaded gasoline.
- Reduce exposure to high levels of particulates and SO_2 in Asenovgrad-Plovdiv, Dimitrovgrad-Galabovo, Kurdzhali, Pernik, and Pirdop.
- Reduce exposure to high levels of specific air pollutants in Burgas, Pleven, Sofia, Vratza, Stara Zagora and Varna.
- Minimize heavy metal contamination of drinking water and food supplies.

Environmental policies identified to achieve these goals are:

- Strong incentives to encourage the use of unleaded gasoline.
- Substituting natural gas or other fuels for low quality coal and lignite used by households, local district heating boilers, and power stations. This could be achieved by creating smokeless zones, or through tax incentives.
- Promote low-cost "housekeeping measures" at metallurgical and chemical facilities to reduce pollution and waste.
- Increase and maintain the real level of pollution fees and fines, especially for key pollutants.

C. Poor Coal Quality

Bulgaria's air pollution problems are rooted in the quality of the domestic coal, which is among the very worst in the world. A typical assay is as follows:

Higher heating value:	6110 BTU/lb
Moisture:	30-35 percent
Ash:	23 percent
Sulfur:	up to 6 percent

Some very bad coals, such as that used at the Maritza East power plants, have moisture contents as high as 55 percent, and in the specific case of Maritza, high clay content. Under the best of conditions, the use of this fuel results in much higher levels of dust and SO2 emissions. In the worst cases, the uniquely bad characteristics of Bulgarian coal required special accommodations. Since boiler design must be adjusted to accommodate the coals, it is not clear that standard scrubber designs will work as well with the very high SO2 concentrations. In the case of Maritza East Number 1, the coal must be dried before use in a process which produces emissions on a par with the plant itself.

Production costs at Maritza are reported be about $5.00 per ton, which seems, at first, to be exceptionally low. The cost at Maritza, however, is probably the lowest in the country given the thick seams, the very large scale of the operation, and very favorable mining conditions. Even here, the cost, when adjusted for the low heat and high moisture content is not substantially lower than low sulfur coals from similarly favorable deposits in the U.S., such as the Powder River Basin of Wyoming.

The coal in Bulgaria, which is the main energy resource, is very poor in quality and not inexpensive. The historically low price of electricity, which was set below production costs, would, at

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first seem illogical. It may, however, have been driven by the ecological imperative to discourage coal use in residential areas.

D. Availability of Natural Gas

Bulgaria has no domestic supply of natural gas. Most, or all, of the gas is purchased from Russia at a high price relative to the West. Retail sales to large industrial customers were reported to cost between $2.20 and $2.80 per million BTU. Beyond this, the supply was not universally available through the year. Various explanations for this were given during the mission. For instance, in Dimitrovgrad, the chemical plant was shut down due to the lack of gas supplies. Supplies, according to this director, were low because residential demand was high.

On the contrary, in Vratza, the heating plant manager was pursuing development of the gas turbine combined cycle cogeneration unit, with confidence that the gas supply was reliable. Chimko, the chemical plant in Vratza has also received gas reliably.

Also Overgas, a retail gas distribution company, expressed confidence in its ability to buy gas on the wholesale market, both from Bulgargas and directly from producers (GAZPROM) with Bulgargas as the carrier. They noted, however, that the country lacked regulations on carriage of gas.

While all developers of central boiler gas projects were also confident of gas supplies, all noted that they were maintaining the ability to burn mazut as a hedge against higher gas prices or interruptions in supply.

All of these diverse statements make it difficult to assess the reliability of the gas supply. One bright spot, however, is the planned construction of a pipeline from Iran to Greece through Bulgaria. This will provide another wholesale source of gas, breaking the Russian monopoly. This project is several years away, but not certain given fluid conditions in the region.

SECTION IV
PROJECT REVIEWS AND EVALUATIONS

A. District Heating in Plovdiv

The objective of the projects in Plovdiv, Bulgaria are to reduce emissions from the large combined heating and power plants or the buildings heated with individual boilers by replacement of their crude oil boilers with gas turbine combined cycle units.

A1. Current Situation

The city of Plovdiv is Bulgaria's second largest city with a population of about 400,000, located in the center of the country at the northeast end of the large Thracian valley. It is an important city culturally, historically, and industrially. Buildings in the city are predominantly heated by two central heating systems, which operate as separate companies. Each system is centered around a single relatively large plant. The northern system is larger and serves about two-thirds of the area of the city including the center of town and the large concentration of the industry along the city's northern border. The remainder of the city is served by the southern system with the exception of about 260 buildings in the center of the city. In total, these buildings include about 30,000 flats. These are heated by a variety of fuels, as follows:

35.7%	coal (including briquettes)
13.4%	wood
15.3%	liquid fuel
1.4%	LPG
34.2%	electricity

The high use of electricity is due to the historically low electricity prices. The low prices, however, do not reflect the actual cost of generation and may not be sustained in the long run.

A1a. The Northern System

The northern system provides process steam and heat to about 40 industries. It uses both high sulfur lignite and crude oil (with 3.5 percent sulfur content) as fuel. There are no NO_x or SO_2 controls, and particulate control is limited to cyclones. Emissions are high as one would expect. The local inspectorate has current emissions data but did not provide this during the meetings. Environmental impact assessments have been prepared for the northern plant and for the individual heating units in the areas served.

The system operates four steam boilers and two heat only boilers. The capacity of the heat only boilers is about 200 GC/hour. Electrical generation comes from two 30 MW steam turbines and one 25 MW steam turbine. The distribution system has about 65 km of concrete pipe. The condition is described as poor with substantial losses measured in October 1994. The system is currently being upgraded with new pipe from Asea Brown Boveri (ABB). Electricity is provided to the grid at rates which the plant manager could not provide in the meeting but which he described as less than cost.

A1b. The Southern System

The southern system provides steam and hot water to about 35,000 flats using three 100 GC/hr heat only boilers and four steam boilers with a capacity of 12 t/hr. The system does not generate electricity. A second plant with six similar steam boilers provides process steam to industries in the southern part of town. The southern system has recently completed a conversion to dual fuel (gas/oil) boilers and burned mostly gas during 1994. Oil was used on 15 days. The distribution system is reported to be in very good condition.

Both heating systems are state owned. Rates are currently set by the government for electricity, heat, and steam. The manager of the northern system reported that they loose money on electrical production, break even on heat, and make money on steam. Since these three functions are integrated, however, allocation of costs to one function or another is not unambiguous, and can affect the apparent profitability of each component of the system's operation. Though there are no immediate plans for privatization of the basic heating system, partial privatization is a component of the improvement project, as will be explained in the next section.

Air quality in Plovdiv is generally regarded as problematic, but data provided by the regional inspectorate seem to indicate general compliance with Bulgarian ambient standards. In addition to the heating plants and the smelters, major point sources include a paper mill, foundries, and a fertilizer plant. At most sites, the 8-hour standard for NOx, dust, and SO_2 is not exceeded more than once during 1994. In the center of town, NOx is the principal problem. This undoubtedly related more to vehicles than to the heating/power plants. At one site, dust levels were very high, but SO_2 levels were not comparably elevated. The documentation provided does not indicate whether this site was associated with a particular source.

The town and the heating companies have prepared a master plan for improving the air and, more specifically, for reducing emissions from the power plants. The final plans will be available in English with specific proposals by the end of the month.

A2. Proposed Project

The details of the proposed environmental improvements to the Plovdiv heating system will be forthcoming at the end of January. Specific AID/EAP proposals can not be prepared until these final plans are available. In general terms, a USAID project in Plovdiv will focus on the continued development of the Plovdiv systems. The elements of this development are as follows:

Step 1. Improvement of the distribution network of the northern system status: ongoing with ABB.

Step 2. Conversion of newer crude oil boilers in the northern system to a dual fuel capability. status: ongoing or complete.

Step 3. Extension of the natural gas pipeline network to serve 4,100 flats in the center of town. Status: initial engineering complete, proposals developed. cost is $590 K to $1064 K depending on pipeline specifications.

Step 4. Construction of a 25 MWe /59 MWth GTCC unit to supply buildings not now connected to either heating system. Status: proposal from ABB for $20+ million which is beyond the USAID budget. Further analysis by southern heating company indicates acceptable payback at circa $12 million.

Step 5. Replacement of older boilers in the northern system with GTCC units with electrical capacity of 39 MWe, and thermal capacity of 170 GC/hr in two stages of two units each. Status: proposal development. Cost about $22 million per stage.

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The USAID has sufficient resources under the EAP program to pay for the extension of the gas pipeline system to the residences (Step 3) either in whole or in part. This would substantially improve air quality in the center part of the town. Detailed design is scheduled for completion by the end of the month, so construction can begin in short order. The key design issue to be resolved is the revising of Bulgarian standards for natural gas pipelines. Uncertainty over standards accounts for the variation in the estimated cost of the project.

A3. Recommendation

The gas pipeline is a low risk project which will certainly improve environmental health at a reasonable cost. The implementing agency is in place, and is highly experienced. The project is developed to the point of detailed design and can be completed quickly. It has much to recommend it, and is in the first tier of the projects examined.

The gas turbine projects are beyond the scale which USAID can consider, and the cost of the projects, as estimated by ABB does not provide for a reasonable payback.

All information on possible projects in Plovdiv was collected in a single meeting, with no written documentation. Substantial documentation, however, will be available at the end of January 1995. These proposals promise to provide substantially more complete and detailed information than is typically available for AID/EAP project development. Beyond the selection stage, EAP project development should be put on hold until additional documentation is received.

B. Residential Conversion to Gas in Stara Zagora

B1. Current Situation

Stara Zagora is located in the foothills on the norther edge of the Thracian valley. It is a moderately large city by Bulgarian standards (population 150,000 to 200,000) and an important industrial center. Forty-five industries are located in and around Stara Zagora. It is also important culturally: Thracian archeological remains date to 3,000 BC. The air in Stara Zagora is heavily polluted, with SO_2 and NO_X concentrations more than double Bulgarian standards. The regional inspectorate reports that most of the industries are not serious sources of pollution as they use a single central heating plant. The principal sources of pollution are the chemical factory, scattered small boilers and furnaces, and transportation.

The small boilers and furnaces are located in residences and public and commercial buildings throughout the town. These are a significant source of exposure to SO_2 because they burn poor quality fuel, have no emissions controls, emit pollutants through short stacks, and are located in dense population zones. There are 80 public buildings, including hospitals, schools, administrative offices, shops, and other diverse buildings. Approximately 110 small boilers serve some of the public buildings and large apartment buildings. In some cases, the boilers serve a single building, in others a group of nearby buildings. Other residences are heated by individual stoves using coal, briquettes or mazut. There is no central heating company.

The fuels used vary, running the gamut from electricity to lignite, wood, and high sulfur mazut. The city is not currently served by gas.

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B2. The Proposed Project

The town's strategy to reduce low level emissions is to extend gas lines into the city to convert building heating to gas. This is being done in cooperation with the Overgas company of Sofia, a private, closely held company which develops gas distributions systems (through their engineering division) and sells gas to end users.

Overgas has designed a complete natural gas distribution system for the town which would be capable of serving every building. Their intent is to implement this in stages. The first customers to be served will be the large industrial customers to the south of town. This is logical from Overgas's perspective for several reasons. First, the current gas lines run into the town from the south. Second, the industrial customers are high volume consumers who can be connected with much less investment relative to the expected sales. These factors offset the relatively low markup on the gas—17 percent over cost for industrial customer versus 80 percent for residential customers because the cost of service is lower and payment is more consistent. Overgas began connecting industries during January of this year, and will complete the extension of the system by the end of the year.

Overgas and the Stara Zagora municipality hope to continue gas heating conversion by moving northward from the industrial area into the residential and commercial areas. The barrier to this is the cost of converting individual buildings. Overgas pays all costs for conversion up to the buildings's meter; the building owner is responsible for the costs of conversion within the building. In cases where there is a boiler in the building and a central hot water heating system, conversion typically involves installation of new burners for the boilers. This is a matter of several hundred to one thousand dollars, plus any costs which are necessary for refurbishing the boiler. The payback for this investment is very short.

In cases where stoves or furnaces are used, and there is no hot water heating system, the conversion cost is $2,000 to $3,000 per unit, and the payback from conversion is three or more years—unacceptably long for residential customers under current economic conditions in Bulgaria. Overgas is prepared to engineer and implement the conversion, but it is the responsibility of the building or boiler owner to pay for the conversion.

In communities in the U.S. converting from coal to gas, the standard practice is for the gas retailer to finance the conversion and to recover costs over several years through a surcharge on the gas bill. Overgas, however, does not have the capital to finance conversion at costs which are acceptable to residential customers. They are rushing to extend their systems and the available capital is fully committed to this purpose.

The case of residential and commercial gas conversion in Stara Zagora is a classic "chicken and egg" problem. Overgas will not extend their system into the residential areas until they are assured of adequate demand. The customers, however, will be slow to sign up at first. Market penetration typically begins slowly, with a few customers who are more accepting of risk or whose circumstances are particularly favorable to the new technology. Most individuals do not move to a new technology until they have seen several applications. The first few percent of penetration are much slower than the growth in penetration when market share exceeds 25 percent.

The objective of the proposed project is to subsidize the initial residential and commercial conversions to enable Overgas to begin the extension of the system. The proposed approach is to provide a combination of grants and loans to a newly created gas service company—jointly owned by Overgas and the municipality—to provide gas to the town. (Overgas owns 60 percent; Stara Zagora 40 percent .) The funds would be used to create a fund which would make loans to residential and

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commercial customers for gas heating conversion. Loans would be paid over a two- or three-year period as part of the residential gas bill. This would allow Overgas to pursue the model which was used successfully in the U.S. In actuality, the money would be paid directly to Overgas for the conversions by the jointly owned gas supply company. The building owner would assume an unsecured debt equal to the cost of conversion.

For its own buildings, the municipality would either borrow from the fund, or a fraction of the fund's capitalization would be diverted directly to the municipality. Overgas has estimated that the initial capitalization of the fund would have to be about $2.4 million. This would pay for the initial conversion of 60 boilers in public buildings, 1,000 apartments currently heated by boilers, 500 apartments without boilers, and 250 residences without boilers. On repayment, additional units could be converted. The fund could certainly be established with less capitalization, but the investment must be sufficient to convert enough buildings to justify Overgas's investment in the pipeline network in the residential area.

Work on the project can begin in June if the fund is in place. Work can not begin sooner as Overgas is committed until then to the industrial conversions. About 100 units could be converted by the fall. The remaining conversion would span a period of two years. The limiting factor is Overgas's capital to build the lines. Overgas will have to invest about $2 million to complete the distribution system.

B3. Recommendations

This project would have a very positive effect on air quality in Stara Zagora by directly addressing the most important sources of emissions. In addition, it is a model project that could be replicated in other municipalities. It is not simple, however, or without risk. The ancillary benefits are substantial. The fund would provide a mechanism which could facilitate conversions far beyond the number which USAID could pay for directly. The inducement to Overgas to invest its own funds has a definite multiplicative effect. Managed correctly, the fund could conceivably be intact when there is no longer a demand for new conversions in Stara Zagora, at some time in the distant future. If the fund is properly structured it could then be taken to another town and the entire process repeated.

Finally, this project would be profitable for Overgas. While Overgas is a for-profit company, its business area is beneficial to the country, so its success will ultimately improve environmental quality in Bulgaria.

The downside of this project is the difficulty for USAID to establish the gas conversion fund. There are substantial legal, administrative, and accounting issues to be resolved. These may be routine to the Bulgarians who will ultimately be responsible for forming the fund, but the USAID must be sure that the fund functions as intended and the assets not be commingled with the general funds of the joint gas distribution company.

There are several risks. First, USAID will be banking on the success of Overgas. No detailed financial data were available for the company, so there can be no definitive assessment of risk. The company has, however, successfully built distribution companies in four other Bulgarian towns and sells 1.1 billion cubic meters of gas annually as the second largest supplier in Bulgaria after Bulgargas.

An equally important risk is that USAID would be relying on voluntary conversion to gas, which is subject to vagaries of consumer preference and is influenced by changing conditions in the local and national economy and in fuel markets. Overgas hired the Gallup organization to conduct a market study

of the potential for conversion and is fully committed the business. Overgas has offered to make its financial report, its business plan, and the Gallup survey available for review on a confidential basis.

Finally, the supply of gas has been intermittent to Bulgaria from Russia. Users may be reluctant to convert to gas for heat if supplies are in question.

All of these risks warrant further investigation by USAID before this project is undertaken.

C. Flue Gas Desulfurization at Agrobiochim

C1. Current Situation

Agrobiochim is located in Stara Zagora in the foothills of the mountains of the Thracian valley. It is a moderately large city by Bulgarian standards (population 150,000 to 200,000) as well as an important industrial center. Forty-five industries are located in and around Stara Zagora. It is also important culturally: archeological Thracian remains date to 3,000 BC. The air in Agrobiochim is heavily polluted with SO_2 and NO_X concentrations, more than double Bulgarian standards. The regional inspectorate reports that most of the industries are not serious sources of pollution as they use a single central heating plant. The principal sources of pollution are the chemical factory (Agrobiochim) which includes a large thermal plant, scattered small boilers and furnaces and transportation. There are also higher levels of dust, ammonia, ammonium nitrate, and hydrocarbons associated with the chemical plant.

Agrobiochim has been operating since 1963, and includes a mix of new and old technologies. The principal product is fertilizer, so the most critical emissions are associated with the production of ammonium nitrate. Other products include silicon dioxide, caprolactam, liquid carbon dioxide, ammonium phosphate, sodium benzoate, dicalcium phosphate-dihydrate, nitric acid, methylmetacrylate, trisodium phosphate, cyclohexanone, nitrogen, and polymethyl methacrylate pellets.

Since the plant's construction, it has been modernized several times. Originally quality Bulgarian coal was used, but was first upgraded to use mazut (heavy fuel oil) and then natural gas. In 1990, catalytic emissions controls were added. The regional inspectorate confirms that the new controls effectively eliminate the nitrogenous emissions when operating. NO_x emissions are only observed during startup and shutdown. Neither the inspectorate nor the company identified additional process emissions controls as a priority.

The more important source of emissions from the town's perspective is Agrobiochim's thermal power plant. The plant contains five 70 ton coal boilers and two gas boilers. The boilers are reported to be structurally sound, and have been the subject of "internal reconstruction" (presumably retubing) every five years. At present, the only emissions controls are cyclones for dust control. Annual SO_2 emissions from the boilers are about 8,500 tons. The coal boilers burn very poor coal.

The only technically feasible approaches to reducing emissions are to use natural gas or to apply flue gas desulfurization (FGD). The local price of gas is reported to be about $2.20 to $2.80 per million BTU versus $0.85/MM BTU for coal, so the plant feels that gas is not an option. FGD from Western sources is also regarded as too costly. Instead, the plant has identified an FGD unit from Moldava that it believes will work with its very high concentration of SO_2 emissions and at much less cost.

The Agrobiochim plant is also a source of water pollution. The principal waste stream is fly ash from the power station. Storm water runoff and episodic releases of nitrates are also a problem. No

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studies have been done for waste water treatment or storm water control. Plant management states that about three months would be required to prepare a control program,

At present, Agrobichim is 100 percent state owned. Production last year was severely depressed, with capacity utilization from some product lines operating at only 30 percent of capacity. A substantial recovery is expected in 1995, with capacity utilization across the plant exceeding 70 percent. Sales are expected to increase from 3.5 billion Leva to 5.5 billion Leva (94 Leva), so plant management is moderately optimistic. About 70 percent of sales are for export, principally to Greece, Turkey, Syria, and England.

The plant's immediate problem is the extreme lack of working capital. Before the change in government, the plant was allowed $15 million for this purpose. After restructuring, they were left without working capital. At present, they have only about $6 million. Cash flow is a very serious problem. Plant management cited 15 to 30 day delays in payment. With sales next year expected to be about $80 million, the entire working capital barely covers 30 days' receivables. Effectively, the plant is operating at the very margin despite its relatively good condition and growing markets.

C2. Proposed Project

Emissions from Agrobiochim can be grouped into three categories—water, airborne from the process units, and airborne from the heating plant. Of these, the airborne emissions have a greater health impact. There is no indication that discharge from the settling ponds or storm water runoff is contaminating drinking water, though there is certainly an ecological impact. Process emissions are of lesser importance. The principal source of air pollution has been effectively controlled with the catalytic reduction unit. Lesser sources of process emissions are important, but less so than emissions from the power plant.

There are no technical mysteries in reducing SO_2 in power plant emissions. Scrubbing is the standard, proven solution. SO_2 levels in Agrobiochim, however, are higher than normal in Western power plants. This raises questions about the effectiveness of the FGD technology.

Agrobiochim has selected an FGD technology from Moldava, largely on the basis of cost. Total cost is expected to be about $1.5 million for five stacks, which is well below the cost of Western technologies. Plant engineers predict 60 percent removal of sulfur and 90 percent for dust during actual operation, but have observed only 30 to 40 percent removal in actual operation of similar FGD units.

C3. Recommendations

The proposed project has merit, but is not clearly the best choice for a USAID grant investment project. The project will reduce SO_2 emissions by about 5,100 tons annually. If it can be implemented at the expected cost, and the Moldavan FGD performs as expected, the capital cost per ton of SO_2 capacity is about $295. There will be substantial costs for power, maintenance, and disposal of the sludge. This cost is not particularly good, even by U.S. standards, and is substantially higher than other projects in Bulgaria, such as those in Vratza. The average cost per ton of SO_2 removal in the U.S. using FGD, is about $450, including all operating costs, for units which remove 90 percent of emissions. A higher performance FGD, with 85 to 95 percent removal might be more cost-effective when measured in terms of cost per ton removed, but the plant engineers have concluded that the Moldavan unit is the best they can afford.

Data provided by the regional inspectorate indicate that the predominant wind direction carries Agrobiochim's emissions away from the city toward an area of relatively sparse population. Given the higher cost of this project per ton of emissions eliminated and the lesser impact on the population than projects in the center or town, the Agrobiochim project should not be the first or second priority. It is, nonetheless, a legitimate project that should be addressed at some point. When it is necessary to proceed, the choice of technology should be examined one more time. Because the plant has very little money for capital investment, they are drawn to the lowest cost option, despite its lower performance. Taking this option will effectively forestall the option of a better, albeit more costly FGD unit at a later date, when, presumably, the plant can afford it. Though the emissions are a pressing issue, delay may be the best strategy given the pressing financial problems and the realistic possibility for improvement over the next several years.

D. Maritza East Power Plants

D1. Current Situation

The three Maritza East power plants constitute a major power generation complex in central Bulgaria. They are minemouth plants located to take advantage of the large coal deposits in the region. Maritza 1 is the oldest plant, and supplies heat to a nearby town and generates electricity for the national grid. Its electrical capacity is 500 MWe. It also includes a facility for making briquettes, which are used for heating in rural areas. Maritza 2 and 3 are generating plants only, with capacities of 840 MWe and 1,460 MWe respectively.

The root of the plants' environmental problems is the coal which, while in abundant supply, is of exceedingly poor quality, though its sulfur content is better than average for Bulgaria. A run-of-mine assay is as follows:

Ash Content	14.96 percent
Moisture Content	56.00 percent
Carbon	18.62 percent
Hydrogen	1.54 percent
Oxygen	5.56 percent
Nitrogen	0.33 percent
Sulfur Content	1.63 percent
Lower calorific value	1,300-1,600 kcal/kg
Volatiles content	60 percent

While it has been maintained well, Maritza 1 is an obsolete plant which is reaching the end of its lifetime. The major components have logged more than 300,000 operating hours. The design of the boiler requires a large coal drying operation which is a major source of dust and sulfurous emissions. The emissions controls on the drying operation are cyclones which remove only about 70 percent of the dust. Exhaust conditions prohibit the use of an electrostatic precipitator. The regional environmental inspectorate identified the drying operations as the principal problem at the plant. The exhaust streams have dust concentrations of 1,700 to 1,800 mg/m^3. The main steam generating boilers have ESPs, but no SO_2 control. The ESPs are reported to be highly effective.

To date, the plant has been fined about 70,000 Leva per month for excess emissions—just over $1,000. The plant is unconcerned about the amount. Fines are scheduled to escalate to 650,000 Leva per month this year. At this point, the fines become problematic, but the plant has no option to reduce

emissions. The plant has been audited by several Bulgarian organizations, who recommended against improvement in favor of replacement in the next several years. Bechtel Corporation inspected the plant in 1994 and determined that it must be retired by 2000.

Total fines between January 1995 and January 2000 will amount to about $720,000, conservatively assuming that they are indexed for inflation. This is far less than the cost of the required flue gas desulfurization, and vastly less than the cost of boiler modifications to use the coal without the extensive drying. The only option open to the plant is retirement and replacement at a cost on the order of $700 million, about $1,500 /kW. Until then, the fines are effectively a tax. A conceptual design for the new plant has been developed. It is centered around two 500 ton fluidized bed combustors. Preliminary discussions have been held with ABB and Fluor, as well as German and French companies.

The larger and newer Maritza East 3 is in much better condition overall, and will continue to operate beyond 2015. It has four stage ESPs, and meets Bulgarian emissions standards for all pollutants except sulfur dioxide. The required FGD will cost about $200 million. Due to the way electricity is sold in Bulgaria—artificially low government-controlled prices that do not reflect generating costs—neither the plant nor the electric company can provide the required capital from internal sources, nor can they demonstrate the financial performance that would be required by commercial lenders. Effectively, financing for the FGD must come from the national government or from international lending institutions with a government guarantee. Bulgaria intends eventually to raise electricity prices to cover costs. When and if this happens, internal financing and commercial borrowing can be considered if the project is not already underway.

D2. Proposed Project

Neither the replacement of Maritza 1 nor the FGD at Maritza 2 is at a scale that is feasible for USAID support under the EAP program. USAID could, conceivably, assist Maritza 3 in pursuing financing. The fundamental difficulty with financing, however, is demonstrating the parent company's sustained ability to service the debt. This is difficult to do with governmentally determined rates which are lower than the operating costs. Financing is really more of a central government issue than a company issue, thus making this project beyond USAID's scope for environmental projects.

E. Residential Conversion to Gas in Dimitrovgrad

E1. Current Situation

Dimitrovgrad, a town on the southern edge of the Thracian valley, suffers from heavy air pollution. Studies conducted in the 1980s indicated significant incidence of respiratory diseases in adults and children related to the emissions from the town's several industries and local heating. These studies were secret at the time. The results of a more recent study which confirmed the earlier results, but were made public and widely discussed at meetings. As a result, the citizenry recognize the problem and strongly support environmental improvements despite the town's poor economic condition.

Dimitrovgrad is an industrial town with a large cement plant and a fertilizer plant. In addition to the emissions from these major sources, there is pollution from the central heating plant, and from several hundred buildings near the center of town that are not connected to the central heating system. These individual buildings are heated with a mix of high sulfur mazut (heavy fuel oil), very poor quality coal, and wood. Mr. Olan Dickov, the deputy mayor, cited these three sources as the town's principal contributors to air pollution.

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The extent of the town's problem and the priority given the environment by the citizenry and the town government is demonstrated by the exceptional measures that have been taken to reduce emissions. Operations have been sharply curtailed at both the chemical and cement plants specifically to reduce emissions. This has had a deleterious effect on the employment and the general economy. The town would like to find ways to increase production consistent with environmental imperatives.

The chemical plant and cement plant are discussed in other sections. Improvement of the central heating station and gasification of the individually heated buildings would provide some leeway for the industries.

E2. Proposed Project

Dimtrovgrad would like to pursue a two-stage approach to reducing emissions from the heating system. The town reports that natural gas is readily available in the region, but the strategy for the heating system is replacement of the boilers with a fluidized bed combustor (FBC) which can burn the local coal within emissions limits. The FBC will be made in Bulgaria. This option was chosen partly on the basis of cost and partly in recognition of the 5,000 coal miners employed in the area.

The individual buildings, however, will be converted to gas rather than connected to the district heating system. This decision is consistent with the preference expressed throughout the country for heating in buildings versus district heating, except in cases where there is a viable district heating system with excess capacity or cogeneration using gas turbines.

The heating plan in Dimitrovgrad intends to pursue the FBC replacement at the district heating plant. No requests were made for assistance with this project. The mayor asserted that they would welcome assistance with the conversion of individual buildings to gas. The city's energy manager felt that supplies of natural gas were reliable, that gas would be cost-effective, and that the customers would convert to gas if available, bearing the cost of conversion. Assistance could be used in extending the distribution network.

At this point, the project is in the conceptual stage. While this project was raised in the Dimitrovgrad meetings, it was not on the original schedule. Accordingly, the town was not prepared to present any details on the project and time was not available.

E3. Recommendations

The project for gasification of individual buildings in Dimitrovgrad has merit. In terms of cost and impact it is on a par with several similar projects, like the one in Stara Zagora. It would effectively eliminate the sulfurous and particulate emissions associated with local heating. The lack of detailed information and the relatively early stage of development, however, argue for one of the other similar projects.

F. Vulkan Cement Plant

F1. Current Situation

Vulkan Cement began operations in 1947 producing portland cement products using wet cement processing. Of the six cement producing companies in Bulgaria, Vulkan is the fourth largest. Currently, Vulkan produces seven basic cement products and three asbestos-cement products. The cement products range from basic dry portland cement concentrate to special low-heat and water resistant products. The asbestos-cement products are prefabricated water pipe, roof tiles and paste-board. At

least one of these products, the heat-resistant paste-board, uses a type of asbestos proven to be hazardous to health (chrysolite asbestos), making the asbestos-cement products likely pose a health risk related to the type of asbestos used in the process. However, it is unclear at what level the production of this product line is continuing. Due to reductions in production, current capacity is approximately 280,000 mt of total products. This represents approximately 11 percent of the total current capacity for Bulgaria.

Nearly all of Vulkan's production is consumed in domestic markets, with only six percent being exported in 1994. The plant director would like to increase exports due to higher prices received on Western markets, and will attempt to export up to 25 percent of production in 1995. He believes that this is attainable, given the high quality and specialty cement products that the plant produces. Vulkan's sales have been increasing steadily from 290 million Leva in 1993 to 400 million Leva in 1994 (adjusted for inflation). The company currently has 700 employees, but expects this to drop to approximately 550, thus reducing a portion of operating expenses.

Vulkan's air pollution is the most serious concern for the plant's ongoing operations. The main environmental impact from the plant is dust emissions from kilns, resulting from clinker (early stage of cement) manufacture. This significantly affects the population since the plant is virtually within the city limits. In fact, the national government has decided to close Vulkan in 1997 based on its adverse impact on the environment and population in Dimitrovgrad unless it can reduce its emissions to meet concentration standards. Specifically, the plant will be allowed to operate if it installs proper emission control equipment, either through joint venture, privatization, or other means. Originally, the plant was to be closed at the end of 1995, but concerns about employment and the possibility of eventual privatization resulted in an extension to 1997. Up until 1997, the plant may operate only at a reduced capacity until emission control devices are installed.

Vulkan uses a wet system for grinding and blending raw materials (limestone, clay, and other materials depending on the product). The raw materials are fed to long rotary kilns, which dry, preheat, and calcine raw materials as the mixture progresses down the kiln length. The heat is supplied by burning natural gas at the discharge end of the kiln. The clinker at the burner end is cooled, mixed with gypsum, and ground into a fine powder called cement.

Vulkan is currently operating only two of its eight kilns on a regular basis, and uses another occasionally. Bag house filtration is currently operating on the duct of the stack, but is inadequate due to the condition of the equipment and the design of the filtration system. Originally the baghouse was designed to capture 99 percent of dust emissions (down to 1,500 mg/m^3), but the current system is working far less efficiently than planned. Plant officials estimate that stack emission concentrations are approximately 15,000 mg/m^3.

The plant is designed so that the four kilns in the operational half of the town are ducted to a single stack, with the bag houses on the ducts. The plant is addressing the poor performance of the bag houses by operating only two of the four kilns at a time, and ducting the emissions through both the kiln's own filter and the filter for the idle unit.

Temperature and other conditions in the kiln are continuously monitored, but manually controlled. Automation of control in the burner and calcination zones might also reduce the load on the filtration system through better mixture of raw materials. Specifically, better control of temperature in these zones would likely result in better clinker formation and reduce the loss of dust to the filters.

The plant director stated that the plant infrastructure is in adequate condition, however this was not confirmed. The kilns are not in need of reconditioning, but new burners should be installed.

Although the plant switched to natural gas fuel, the cost of the natural gas is more expensive than solid fuel. This is especially the case with the wet cement process, which requires significantly more energy to form clinker than dry processes used in the West. Currently, Vulkan uses approximately 3,000 m^3 of gas per hour per kiln; per mt of clinker, it requires approximately 1,700 to 1,800 KCal of energy. Therefore, Vulkan plans to switch its fuel to coal and is negotiating with an Indonesian company to provide high quality coal to the plant. A switch to coal as a fuel source would require burner retrofitting.

Vulkan owns their limestone quarries which are located near the plant and have adequate reserves for 60 years of production at current levels. This will guarantee raw material product for the company and allows it to better control costs of a portion of their raw material prices.

F2. Proposed Project

The German firm Lurgi has designed modifications to the baghouses which retain the existing structure. This upgrade would reduce dust emissions to acceptable levels and allow the plant to continue to operate two kilns at full capacity. The proposal is estimated to cost 70 to 80 million Leva.

Given the low cost of the refurbishment and the projected impact on the population of Dimitrovgrad, this project meets the criteria of the PPC as an ideal EAP project. However, this project will have a high likelihood of being funded through an international financing institution or through the proposed pollution abatement fund being sponsored by the World Bank. Therefore, the proposed grant funding project would have less of an impact than for other investment candidates. USAID should use all of its relationships with other donors in the PPC to promote this project. If sufficient support is not garnered for this project, USAID may consider sponsoring an evaluation of the project and promote investment with domestic funding sources, such as the U.S. Export Import Bank (EXIM) or the U.S. Overseas Private Investment Corporation (OPIC).

G. Neochim Chemical Plant

G1. Current Situation

The Neochim plant is a large fertilizer plant located on the edge of Dimitrovgrad which also produces a number of lower volume chemical products. Operations at the plant were originally reduced at government direction to address the town's poor air quality (See writeup in subsection E). Operations were limited in 1993 and 1994 due to poor market conditions and curtailed gas supplies. Total operation in 1993 was at 30 percent of capacity for half of the year. Production in 1994 was 70 percent higher, though this still translates to a very low capacity utilization. The manager stated that 1995 would be "even better," though the plant was shut down at the time of the EAP visit due to a lack of gas supplies. The price for nitrate fertilizers is up sharply over the last quarter giving the plant some justification for cautious optimism. The company exports 50 percent of its product, principally to Greece, Turkey, Great Britain, and France.

The reason for the shutoff of the gas was not clear. The plant has not paid for gas for several months, but the plant manager felt that their supply was shutoff because Bulgargas could not simultaneously meet the demand from residences and industry. He speculated that Bulgargas was not paying their suppliers due to the large debt owed Bulgargas by the many companies which are not current in their payments. Neochim's manager believed that the gas would be turned on in March, but noted that the best season for producing fertilizer was winter to meet the spring demand.

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The principal potential source of emission in the plant is the ammonia production area, but this has a relatively new catalytic control that works well. The plant meets or exceeds all emissions standards. The local environmental official agreed that there are no problems with the plant's airborne emissions. The plant's manager stated that the plant did not require assistance to deal with its environmental problems. He noted that there were several minor problems, but they were dealing with them internally.

G2. Proposed Project

There is no AID/EPA project at NeoChim. The plant manager was referred to the World Environmental Center (WEC) for assistance in waste minimization.

H. Manganese Removal in Dimitrovgrad Drinking Water

H1. Current Situation

The drinking water supply in Dimitrovgrad has historically been contaminated with manganese, posing a health problem. A treatment facility to remove manganese was installed several years ago and is operating well. There is, however, a buildup of manganese in the pipes from the years before the cleanup. The town has solicited assistance to develop a strategy to remove this efficiently.

H2. Proposed Project

This project is not sufficiently developed to be considered formally by the AID/EAP program, but the assistance required is modest. The town's needs should be communicated to firms with experience in drinking water systems design. These firms could contact the town directly and provide the requested information on a pro bono basis.

I. Extension of the District Heating System in Vratza

I1. Current Situation

Vratza, in Northwest Bulgaria, is a "hotspot" of air pollution and measures to control pollution in and around the town have been given a high priority by the Bulgarian government. During the heating season (November to April) a considerable amount of air pollution is produced by the town's many heating boilers. Although local boilers heat only 40 percent of the town they produce over twice as much sulphur dioxide as the Vratza Heating Company (VHC) heating plants (Table IV-1).

Most of the public buildings in the center of town, including government buildings, hotels and schools, are heated by small, independent boilers. Typically these boilers burn highly polluting lignite or heavy fuel oil (mazut) and discharge pollutants only 20 to 30 meters above the ground. The effluent gases contain levels of dust, sulphur dioxide, and lead oxides which greatly exceed legal levels and pose serious health risks.

This project will eliminate the need for independent boilers by extending the present district heating system. District heating is supplied by VHC which at present supplies heat to about 60 percent of Vratza Municipality. VHC uses a small number of large heating plants located outside the town center. These plants operate more efficiently than local boilers and produce considerably less pollution. This can be clearly seen in the case of sulphur dioxide, a major air pollutant.

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At present the VHC heating plants have spare capacity which could be used to provide new consumers, but the current supply network is not adequate to distribute this heat.

I2. The Proposed Project

One way of addressing the air pollution problems in Vratza is to convert all the local stoves and boilers to natural gas. The town and VHC analyzed and rejected this option because of high cost, lack of enabling legislation (there are no laws regulating domestic gas supply in Bulgaria), and existing alternative opportunities (given that there is unused capacity in the heating plant). In Vratza, the costs of gasification are four times higher than those of extending the heat supply system (Table IV-2) and, thus, considered prohibitive under the present Bulgarian financial climate.

Imported steel pipes with foam polyurethane insulation will be needed to implement the project. The U.S. can not provide the required pipes with European specifications at a competitive price. To meet European standards, the pipes must be provided by member companies of the European Association of Insulated Pipe Producers,

The various project phases are shown in Table IV-3. The project will take 70 days to carry out. This includes five days to finalize the design. Rapid construction is necessary to minimize the disruption caused by laying pipelines in the central town area (the main area not connected to the VHC distribution network). The project will only take place after an Environmental Impact Assessment, as required by Bulgarian Law, has been completed.

I2a. Environmental Benefits

This project will improve the environmental situation in Vratza in two ways:

- The elimination of the air pollution produced by local stoves and boilers in the town center. Not only do VHC central boilers produce less pollution, they are situated outside the town so that pollution that is emitted has less impact on the population of the town. The reduction in air pollution that will result from this project is shown in Table IV-4.

- Reduction in the use of potable water in local boiler systems. This will make a major contribution toward water conservation in Vratza, a town where there are severe restrictions on water supply. At present, houses are supplied with water for two to three hours every two days.

I2b. Project Costs

The total cost of this project will be $436,978, broken down as follows:

Imported Equipment	$203,200
Transport	$20,320
Assembly work	$18,288
Customs duty	$32,512
Construction work	$54,000
Heat Conducting Detours	$42,000
Total Expenses	$370,320
Value Added Tax (18%)	$66,658
Total Cost	$436,978

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The financial basis of the project is outlined below. A loan of $236,000 is being sought:

Project Loan	$236,000
VHC & Municipality	$66,000
Consumers	$135,000
Total Cost	$437,000

The loan repayment schedule is shown in Table IV-6. It assumes a 10-year loan (which includes a 2-year period with interest repayments only) at an annual interest rate of 3.2 percent .

Table IV-1
Sources of SO_2 Pollution in Vratza during the Winter

Sources	SO2 pollution	
	(tons/6 months)	(percent)
CHIMKO	1,240	30
VHC	960	23
Households (liquid fuels)	740	18
Households (solid fuels)	1,240	29

Table IV-2. Comparison of the Costs of Extending Heat Supply System with Supplying Natural Gas to Local Consumers

Activity	Heat supply (000 USD)	Gas supply (000 USD)	Investor
Equipment (for networks)		200	Foreign
Carrier networks construction			
- Pipes	210	270	Foreign
- Work	56	80	Bulgarian
Detours	52	386	50 % by consumers
Control stations (20)	111	-	Consumers
Gasification of boilers	-	350	Foreign
Gas boilers construction	-	450	Foreign
Other	10	20	Consumers
Total	439	1,756	

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Table IV-3. Duration and Costs of Construction Work

Activity	Duration	Cost
Insulated pipes delivery	20 days after money becomes available	10,160 (x 10^3 BG Leva) 210 (x 10^3 USD)
Excavation works*	40 work days after receipt of permit	1,057 (x 10^3 BG Leva)
Pipes assembly and tests	60 work days after start of construction	1,150 (x 10^3 BG Leva)
Communications restoration	10 work days	493 (x 10^3 BG Leva)

* To lay 877 meters of pipes

Table IV-4 . Projected Impact on Air Quality

Pollutant	Emissions in the heating season (tons)				Pollution (percent) reduction		Current Ambient Concentration (mg/m^3)		Expected Concen. (mg/m^3)	Cost of pollution control (USD/kg)
	CHIMKO	VHC	Other liquid fuel	Other solid fuel	over VHC	over town	obs.	legal limit		
SO_2	1,240	960	740	1,240	100	19	0.9	0.5	0.7290	0.29
NOx	-	29	29	39	90	31	0.18	0.085	0.1242	7.80
CO	-	2.5	2.5	4	30	6	8.0	6.0	7.5200	437.00
Dust	-	200	963	1,887	100	21	0.75	0.15	0.5925	3.70
Soot	-	300	301	539	100	16	0.3	0.15	0.2520	1.30
VaOx	-	10	10	12	100	25	0.004	0.0015	0.0030	29.50
CrOx	-	2	0.83	0.7	100	29	0.003	0.0015	0.0021	232.50

Table IV-5. Expected Improvement in Air Pollution in Vratza

Pollutant	Pollution Reduction		Standard admissible concentration (mg/m^3)	Expected concentration (mg/m^3)	Cost pollution control (USD/kg)
	Tons	Percent			
SO_2	1,764.00	60	0.5	0.3600	0.29
NOx	80.51	83	0.085	0.0310	54.60
CO	3.06	34	6.0	5.2800	1,793.50
Dust	2,898.00	95	0.15	0.0378	1.30
Soot	958.00	84	0.15	0.0480	2.90
VaOx	22.72	71	0.0015	0.0012	188.30
CrOx	3.15	90	0.0015	0.0003	1,313.80

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Table IV-6 Load Repayment Plan (all figures in $000)

Year	Total loan	Annual interest rate[1] (3.2 %)	Loan repayment	Total repayment with interest	Source of repayment: Industrial companies	City of Vratza	VHC support for production
1	236.0	7.6	-	7.6	1.52	3.572	2.376
2	236.0	7.6	-	7.6	1.52	3.572	2.376
3	236.0	7.6	29.5	37.1	7.30	17.600	12.200
4	206.5	6.6	29.5	36.1	7.22	16.976	11.913
5	177.0	5.7	29.5	35.2	7.04	16.544	11.616
6	147.5	4.7	29.5	34.2	6.84	16.338	11.286
7	118.0	3.8	29.5	33.3	6.66	15.651	10.989
8	88.0	2.8	29.5	32.3	6.46	15.181	10.659
9	59.0	1.9	29.5	31.4	6.28	14.758	10.362
10	29.5	0.9	29.5	30.4	6.08	14.288	10.032
Total	236.0	49.2	236.0	285.2	56.92	134.471	93.809

I3. Recommendations

This project is well conceived and offers substantial reductions in SO_2 emissions at a reasonable cost per ton. The organization is in place to begin to execute the project immediately. The project enjoys the strong support of the environment ministry, the regional inspectorate, the city of Vratza, and district heating company. The objectives are consistent with EAP priorities, and the scale is within the ability of the USAID program for Bulgaria. The difficulty from a grant perspective is the technical requirement that the pipe be purchased form a European supplier.

J. District Heating Plant Improvement in Vratza

J1. Current Situation

Bulgaria has very limited indigenous energy resources. The main resource of the country is coal, of which 85 percent is lignite. The calorific value of the lignite used in power stations and heating plants is one of the lowest in the world, with a very high moisture (above 55 percent), high sulfur content (4.5 to 6.0 percent), and ash content (above 20 percent) as described in previous subsections, (see C and D). The air pollution problem in Vratza results from using low quality fuel in district heating and individual heating units.

Government policy has kept fuel prices very low and given industry little incentive to save energy which has resulted in extremely high energy consumption per unit GDP. Electricity consumption, in particular, is high (at 5.4 TWh per annum Bulgaria has one of the highest per capita electricity consumptions in Central and Eastern Europe).

Some 75 percent of lignite production in Bulgaria goes to electricity generation and there is growing environmental concern not only about atmospheric pollution from lignite combustion but also about the damage caused by open-cast mining. Bulgaria has a high proportion of electricity-intensive

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industries, an estimated 17 percent of electricity produced is either wasted or used by the energy industries themselves.

Because of the artificially low price, electricity is widely used for space heating with appalling inefficiency and high emissions. There is an urgent need to replace electricity for heating in the residential and commercial sectors by providing efficient, district heating, based on the combustion of cleaner fuels. In this context the World Bank has noted the importance of switching to natural gas.

Bulgaria uses high levels of district heating from central heating stations. Centralized heating for the domestic sector has progressively penetrated the energy market, covering 27 percent of the total heat demand in these sectors. Almost 16 percent of the total population is supplied by district heating networks. Centralized heat supply systems have been installed in 30 of the biggest cities and towns in Bulgaria. The renovation and development of district heating, coupled with cogeneration of heat and power will likely be the future development of the Bulgarian energy system.

Vratza, like many Bulgarian industrial towns, has a highly centralized heat supply which provides heat to households and industries. The principal heat supplier is the Vratza Heating Company (VHC) which operates heat plants throughout the Vratza municipality area. Several of these plants use boilers burning either lignite or heavy fuel oil (mazut), both poor quality fuels with high sulphur content. This project is concerned specifically with three of the mazut-burning heat plants; Gradska, Kaloian, and Vesletz which contribute significantly to the air pollution problems of the town (Table IV-7).

At present the VHC meets 60 percent of the town's heating requirements due to limitations in the distribution system (see subsection I). A large number of small local and district boilers supply both domestic and industrial consumers comprising the supply of the remaining 40 percent of Vratza's heating requirements. Most of these installations work at very low efficiencies and also burn poor fuels. The net result is compounding pollution problems throughout the area.

J2. The Proposed Project

The objectives of the project are:

- To convert the Gradska plant from mazut to natural gas.
- To construct a "steam-gas" cycle for the cogeneration heat and electricity.
- To construct an automatic-gas distribution station (AGDS).

If fully implemented, these changes will result in:

- A dramatic decrease in all the air pollutants presently emitted by Gradska, with the total elimination of sulphur dioxide.

- The shut down of two older and highly polluting heating plants (Kaloian and Vestetz) both of which burn mazut, have low stacks, and are highly polluting.

- An increase in the VHC capacity to provide heat to Vratza, from the present 60 percent to an estimated 90 percent of consumers, and to be self sufficient in electricity.

This project has been developed in association with the Bulgarian Committee of Energy and has the full support of the Ministry of Environment. It will help Bulgaria meet its international obligations to reduce sulphur dioxide emissions and will be part of the national strategy to reduce atmospheric pollution levels (in particular those due to dust, soot, heavy metals, carbon dioxide, carbon monoxide,

and sulphur dioxide) in "hotspot" regions. It also will meet national priorities of providing clean district heating and will serve as a pilot project for demonstrating fuel switching. In addition, the project would provide local needs for cheaper heat and power.

Under the project, two new 3.9 MW gas-turbine units will be installed at the Gradska heat plant, allowing the existing plant to be converted to natural gas. The combined effect of these proposals will be to increase the overall efficiency of energy conversion from the present 30 to 40 percent to 80 to 82 percent and, in addition will generate electricity as well as heat.

The VHC has considered various alternatives to the proposed project, including the possibility of flue gas desulphurization (FGD). The FGD option has not been pursued for the following reasons: (1) the construction costs for retro-fitting are high (estimated at three times the cost of the present proposal); (2) there are technical difficulties in fitting FGD to small heat sources; (3) the FGD option will not allow the development of new power generating capacity: and (4) FGD would reduce, rather than increase, the efficiency of the heating plant.

These considerations led to the decision to construct a gas fired combined heat-power generation, and to gasify the existing plant. In all, the company considered six different designs using steam-gas units ranging from 3.0 to 10.3 MW. The chosen design was chosen because: (1) it had the highest possibility for rapid construction and quick start-up; (2) the project would require a relatively short pay-back period; and (3) it would result in the lowest heat and power production costs.

Equipment specifications are as follows:

- AGDS with capacity of 30,000 m^3, (P_{in}= 4.0 MPa, P_{out}= 0.6 Mpa).
- High pressure gas line (4.0 Mpa).
- Low pressure gas line (0.6 Mpa).
- 6 gas reduction installations (0.6 to 0.02 Mpa) for gasification of existing boilers
- 2 gas-turbines (P_{el}= 3.9 MW).
- Electric system to link with existing electric network (6/20 kV).

The project designs, site construction for building premises, roads, additional platforms and land restoration will be carried out either by VHC or by Bulgarian companies contracted by VHC. Project consultants, equipment suppliers and construction companies will be appointed by normal competitive tendering procedures. The project phases and their duration are outlined in Tables IV-8 and IV-9.

J2a. Environmental Benefits

The environmental benefits of this project are significant. Currently, the VHC mazut burning plants are a major source of air pollution in the town of Vratza. These plants exceed the legal limits for dust, soot, aerosol lead and SO_2. Realization of this project will result in a 41 percent reduction in SO_2 emissions, 52 percent in No_x, and 74 percent in dust (Table IV-10) from the three important heating plants.

Natural gas fired boilers produce nitrogen oxides (NO_x) which are carefully monitored. Current levels of NO_x emissions are low and well within acceptable levels (approximately 10 percent of the standard admissible concentrations, Table IV-10). The new equipment to be installed as a result of this project will enable further reductions in the production of No_x.

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J2b. Project Costs

The prices of heating and electrical energy in Bulgaria are fixed. Although the cost of energy has recently been increased, the State still subsidizes the difference between the real energy production costs and the prices paid by consumers. This policy does not allow companies like VHC to accumulate sufficient funds to reconstruct and modernize its heat production process. In the past such activities were funded by the Committee of Energy, but such funds are no longer available. Hence, VHC has proposed this project, only after detailed considerations of the possible ways in which this project will generate sufficient funds to pay back a loan.

The total cost of this project will be $5.113 million, which the VHC has broken down into a two-stage loan.

Stage 1 Loan

This first stage of the project involves establishing the gas supply to the "Gradska" plant and establishing branch network connections for other gas consumers. This first stage involves: (a) reconstruction of the existing boilers, (b) introduction of automatic adjustment of combustion, and (c) automatic monitoring of the outgoing smoke. Total cost is $520,000. VHC will pay the cost of the necessary gas pipe line at $41,000 (7.9 percent total cost).

VHC's proposed repayment schedule is shown in Table IV-11. This calculation assumes a six-year loan (one year of which is used for interest only payments); at an annual rate of interest of 3.2 percent. This is within the company's ability to repay, but the terms are, obviously, more favorable than commercially available. The loan could be paid back from contributions of industry, the municipality, and VHC's own resources.

Stage 2 Loan

The second stage will involve the reconstruction and building of new installations for the new gas turbines. The total cost is $4,593,000. VHC will pay the costs of the connection to electricity grid; construction work, overhead crane, and boiler connection at $327,840 (7.1 percent total cost).

The repayment schedule for the Stage 2 loan is shown in Table IV-12. This stage of the project has been prepared in cooperation with the Committee of Energy. Repayments assumes a 12-year loan (which includes a three-year period where only interest is paid) at an annual eight percent rate of interest.

Payback of the load can come from VHC anticipated profits on selling heat and electricity (15 to 17 percent profit margin has been forecast); from the Municipality of Vratza privatization funds, and from the fees that new consumers will pay in order to get connected to the heat and electricity supply system.

This project has substantial financial benefits:

- VHC has negotiated agreements with various companies in Vratza to supply both heat and electricity. These companies have agreed to contribute toward the loan repayment in return for fixed heat prices (Table IV-11).

- VHC has negotiated an agreement with the municipality of Vratza to supply heat to the university and student residential quarters of the town. The municipality will directly use some 25 percent of the extra supply capacity being developed in this project.

- Heat is cheaper to produce using natural gas than using mazut, even allowing for the fact that VHC might have to reduce heating costs to encourage new users. At present, prices for heat are fixed, thus the company strategy is to connect more users to their distribution network whilst cutting production costs.

- Savings on environmental fines, although to date the MOE has not fined the company. It is likely that this will change in the near future. Therefore VHC will have to budget for pollution fines in its future operating costs.

The overall improvement in air pollution is quantified in Table IV-13.

Table IV-7. Impact of Project Implementation on Air Pollution in Vratza

Emissions (tons)					Percent Reduction in Emissions		Ambient Concentration			Cost of Control ($/kg)
	CHIMKO	VHC	other liquid fuel	other solid fuel	over VHC	over town	current	legal limit	after	
SO_2	1,240	960	740	1,240	100	41	1.5	0.5	0.8850	0.3
NOx	-	29	29	39	90	52	0.18	0.085	0.0864	101.3
CO	-	2.5	2.5	4	30	18	8.0	6.0	6.5600	3,150.0
Dust	-	200	963	1,887	100	74	0.75	0.15		2.3
Soot	-	300	301	539	100	68	0.3	0.15	0.2040	4.5
VaOx	-	10	10	12	100	46	0.004	0.0015	0.0022	347.0
CrOx	-	2	0.83	0.7	100	61	0.003	0.0015	0.0012	2,395.0

Table IV-8 . Project Phases

Project phases	Activities
1st Phase	Technical/Economic Report (including choice of investment alternative)
2nd Phase	Environmental Impact Assessment
3rd Phase	Preparation of Technical Design (to take delivery of equipment)
4th Phase	Securing Gas Supply and Reconstruction of Existing Equipment
5th Phase	Construction Works
6th Phase	Assembly Works
7th Phase	Adjustments, Tests, Commissioning

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Table IV-9. Duration of Project Phases

Project phases	Activity	Duration (days)
1st Phase	Choice of Alternative	10
2nd - 3rd Phases	Preparation of Designs and Assessments	210
4th - 7th Phases	Actual Project Work	576
1st - 7th Phases	Whole Project	796 (Total)

Table IV-10. Comparison of the Measured Emissions of Selected Air Pollutants from Heat Plants Using Heavy Fuel Oil (mazut) with Natural Gas in Vratza. (Data from Vratza Heating Company)

Pollutant	Upper legal limit	Mazut	Gas
NO_x	200	10	90
Soot	100	135	0
SO_x	1,000	2,350	0
CO	100	10	10

Table IV-11. Repayment of Stage 1 Loan (all figures in $000)

Year	Total loan	Annual interest rate (7 percent)	Loan payment	Total repayment with interest	Source of Repayment		
					Industrial companies	Vratza	VHC
1	520	16.64		16.64	4.160	7.155	5.325
2	520	16.64	104	120.64	30.160	51.875	38.605
3	416	13.28	104	117.28	29.320	50.430	37.530
4	312	9.98	104	113.98	28.495	49.011	36.474
5	208	6.66	104	110.66	27.665	47.584	35.411
6	104	3.33	104	107.33	26.832	46.152	34.346
TOTAL		66.53	520	586.53	146.632	252.207	187.691

Table IV-12. Repayment of Stage 2 Loan (all figures in $000)

Year	Total loan	Annual interest rate (8%)	Loan repay-ment	Total payment with interest	Annual production costs	Total costs	Sources of repayment		Annual balance
1	4,593	367.4	-	367.4	-	367.4	Electricity	Heat	-367.4
2	4,593	367.4	-	367.4	-	367.4	-	-	-367.4
3	4,593	367.4	-	367.4	2,617.2	2,984.6	1,618.5	1,752.0	+385.9
4	4,593	367.4	510	877.4	2,617.2	3,494.6	1,618.5	1,752.0	-124.1
5	4,083	326.6	510	836.6	2,617.2	3,453.8	1,618.5	1,752.0	-83.3
6	3,573	285.8	510	795.8	2,617.2	3,413.0	1,618.5	1,752.0	-42.5
7	3,063	245.0	510	755.0	2,617.2	3,372.2	1,618.5	1,752.0	- 1.7
8	2,553	204.2	510	714.2	2,617.2	3,331.4	1,618.5	1,752.0	+39.1
9	2,043	163.5	510	673.5	2,617.2	3,290.7	1,618.5	1,752.0	+79.8
10	1,533	122.6	511	633.6	2,617.2	3,250.8	1,618.5	1,752.0	+119.7
11	1,022	81.8	511	592.8	2,617.2	3,210.0	1,618.5	1,752.0	+160.5
12	511	40.9	511	551.9	2,617.2	3,169.1	1,618.5	1,752.0	+201.4
	Total	29400	593	7,533	2,617	33,705	16,185	17,520	0.0

Table IV-13. Results of Project Implementation on Air Pollution in Vratza

Pollutant	Emissions Reduction		Standard admissible concentration (mg/m3)	Expected Concentration	Cost pollution control (USD/kg)
	tons	percent			
SO_2	1,764.0	60	0.5	0.3600	0.29
NOx	80.51	83	0.085	0.0310	54.60
CO	3.06	34	6.0	5.2800	1,793.50
Dust	2,898.0	95	0.15	0.0378	1.30
Soot	958.00	84	0.15	0.0480	2.90
VaOx	22.72	71	0.0015	0.0012	188.30
CrOx	3.15	90	0.0015	0.0003	1,313.80

J3. Recommendations

This is a well thought out/designed project. The GTCC's are beyond USAID's resources but the first phase is feasible.

K. Flue Gas Desulfurization at CHIMKO

K1. Current Situation

CHIMKO is a large and relatively modern chemical plant located just to the south of Vratza, about 800 m from the town. The CHIMKO company's main products are carbon sulphide, CS_2, (used in the manufacture of synthetic fabrics) and urea (a nitrogenous fertilizer). Virtually all the urea and most of the carbon sulphide produced are sold abroad. For example, CHIMKO claims to provide

approximately four to five percent of world urea production. It is an important Bulgarian exporter and the main employer in the town of Vratza, with a work force of 2,200 people.

Data presented by the World Bank demonstrate a clear link between the incidence of severe pulmonary diseases and the levels of airborne pollutants in the town. This has recently been emphasized in Environmental Action Plan for Central and Eastern Europe (EAP) which lists Bulgarian towns that have documented associations between either acute or chronic respiratory diseases and air pollution. Vratza is included on both lists, due primarily to severe air pollution problems. It has been designated as a "hotspot" area and was one of the 14 most polluted air basins listed in the national report on Environment and Development submitted to the United Nations Conference on Environmental Development (UNCED) Rio Conference.

The proposed project will substantially reduce levels of sulphur dioxide (SO_2), currently the town's main pollutant. Average annual SO_2 concentrations (0.9 mg/m^3) are almost twice the legal limit (0.5 mg/m3) and rise to much higher levels in the winter (winter average = 1.5 mg/m^3). Over 60 percent of Vratza's SO_2 is produced by CHIMKO, which is the largest single SO_2 polluter.

The problems are compounded by the geographical location of the CHIMKO plant in relation to the town. Both the town and the CHIMKO carbon sulphide installation are built in a valley, surrounded by hills 3 to 6 times higher than the main source of pollution. Rapid dispersal of pollutants is inhibited by the predominance of low air inversions and the high percentage of calm weather. The fact that the CHIMKO plant is located only 800 m from the town magnify the impact of its emissions on the town. The proposed project, by targeting SO_2 control measures at CHIMKO, will substantially reduce pollution levels in Vratza and thereby reduce health risks to its inhabitants.

K2. The Project

Carbon sulphide is produced by vaporizing sulphur (S) in a methane atmosphere, one of CHIMKO's operational problems is the treatment of the waste gases from the process. The main component (92 percent) of these gases is the highly toxic hydrogen sulphide (H_2S) which must be treated before it can be released into the atmosphere. Waste gas treatment is done by the "Claus" process by which the H_2S is burnt in air (in an oxygen deficiency, such that the ratio of H_2S to oxygen is 2:1) to produce elemental sulphur which is recycled to the carbon sulphide plant. At present, 94 percent of S is recovered in this way which means that the gases leaving the Claus unit contain an estimated 0.8 to 1.0 percent H_2S; 0.4 to 0.5 percent SO_2; and 0.2 to 0.5 percent S (in aerosol or vapor form). Given the toxicity of H_2S these gases are further treated by burning in a furnace which transforms most S and S-containing compounds into SO_2 which is then released into the atmosphere. In all it is estimated that the CHIMKO plant discharges an average of 2,480 tons of SO_2 into Vratza's atmosphere each year.

The proposed project will desulphurize the vent gases from the Claus unit by a process which catalytically converts all S-compounds to H_2S, which after cooling is selectively absorbed by an amine solution. H_2S can then be released in a regenerator and recycled to the Claus unit.

Desulphurization by this method is a well proven technology, first introduced commercially to the chemical industry in 1973 and subsequently applied in over 150 installations worldwide. Typically such processes are low in energy consumption and can achieve a 99 percent S-recovery from waste gases.

K2a. Environmental Benefit

By law, Claus vent gases must have at least 98 percent of S-compounds removed before they can be released into the atmosphere, whereas the current rate varies between 93.5 and 94 percent . Thus,

the CHIMKO plant is operating illegally. Implementation of this project will result in over 99 percent of the S-compounds being recuperated. The forecast decrease in SO_2 emissions to the atmosphere is dramatic, from the present 310.0 to 3.4 kg/hr SO_2. The reduction in the SO_2 emissions and the overall environmental effect of the project are further elaborated in Table IV-14.

K2b. Financial Benefits

The project will result in considerable financial savings on environmental fines and costs of raw materials. In addition it will allow CHIMKO to take advantage of new export markets that it is now developing in Greece and Turkey.

The company expects savings annual savings of roughly $90,000 from two sources:

- Raw materials: an estimated 1,280 tons of sulphur will be returned to the CS2 production process, with a resulting savings of between $76,800 and $89,600 per annum (depending on world sulphur prices).

- Environmental fines: average of $700 per month over an 11-month production year yielding a total saving of $7,700.

K2c. Project Costs

Various S-recuperation technologies have been proposed by a number of Western companies, three of which have made offers to supply and install such equipment. In addition CHIMKO has carried out its own feasibility study and developed its own implementation plan; the costs of the competing technological designs are compared in Table IV-15. Clearly the least cost method is the CHIMKO project design which has been selected by the company. One of the reasons for lower costs is that the CHIMKO design requires relatively few imported materials, with most of the equipment needed will be produced in Bulgaria (Table IV-16). The intention is to construct the modifications envisaged by this project in one stage over a one year period after the loan funds become available. The various project phases are shown in Table IV-17.

The total expenses for the design, equipment supply, assembly and construction are estimated at $1.5 million. The capital investment is detailed in Table IV-16. CHIMKO can contribute $290,000 toward the project from its own financial resources, and is seeking a $1.2 million loan to complete funding.

K2d. Company Details

The CHIMKO is a major national and international chemical producer. Although the demand for carbon sulphide was much reduced in 1992-93 the company has recently negotiated new orders with customers in Greece and Turkey. These contracts represent a new market and offer the company new opportunities for expansion in the future. As a result full-scale production of carbon sulphide began in September 1994.

The desulphurization of the carbon sulphide process is part of the CHIMKO's strategy to reduce operating costs, as well as meet national environmental standards and to save on the costs of pollution fines. The loan required to implement the proposed pollution control project is relatively small in comparison to the profitability of the carbon sulphide process and expected savings on environmental fines and raw material costs.

K3. Recommendations

The project at CHIMKO is technically sound, simple, and direct. It can cut SO_2 levels in the town in half at a moderate cost. CHIMKO is ready to proceed very quickly, and has the in-house engineering capability to make the project successful.

Table IV-14. Reduction of Sulphur Dioxide (SO2) Emissions in Vratza

Emissions (tons/year)			(% Reduction)		Ambient Concentration (mg/m3)			Cost SO_2 control ($/kg)
CHIMKO	liquid fuel	solid fuel	over CHIMKO	over town	measured	legal limit	expected	
2,840	1,310	340	99	59	0.90	0.50	0.46	0.61

Table IV-15. Comparison of Alternative S-recuperation Technologies

Company	Production cost CS_2/ton (USD)	Installation costs (million USD)
CHIMKO (BG)	223.31	1.21
Lurgi (D)	230.74	4.67
Comprimo (NL)	230.63	10.00
Jacobs (USA)	238.27	13.1

Table IV-16. Breakdown of Capital Investments and Costs

Activities	Investment Costs (x 10^3 USD)
EIA*	
Working design	25
Construction /assembly	215
Equipment	
- Bulgarian	695
- Imported	515
Other expenses	50
Total Capital Investment	1500?

*Environmental Impact Assessment as required by Bulgarian Regulation N1 of 28 December 1992 on the EIA.

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Table IV-17. Stages of Project Development

	Months after money becomes available
Operating design	4
Construction works	6
Manufacture of devices and equipment	9
Equipment supply	10
Equipment assembly	11
Commissioning and a 72-hour test	12

Table IV-18.
CHIMKO Co. Business Plan Projections of Annual Profit

Year	Net profit (x 10^6 USD)
1995	5.5
1996	6.1
1997	6.2

Table IV-19. Strategy for Repaying Loan
(all figures in $000)

Year	Total loan	Annual interest rate (7 %)	Loan Payment	Total payment with interest	Source of Repayment			Support to production	Annual Balance
					Avoided Fines	Savings on Sulfur	Company Payment		
1995	1,210	84.70	-	84.70	-	-	84.70	84.70	-
1996	1,210	90.63	605	696.63	6.20	79.70	610.43	696.33	+0.70
1997	605	96.97	605	701.97	6.20	79.70	616.77	702.67	+0.70

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ANNEX A
COMMENTS FROM EPA

To:	John Tennant, USAID	Sofia, Bulgaria
	Lori Freer, USAID	Washington, DC
	Lee Pasarew, USEPA	Washington, DC
	Bill Muszynski, USEPA	New York

From: Michael Gilbert, USEPA

Subject: Draft Trip report conclusions on the joint USEPA/USAID mission to Bulgaria regarding potential EAP investment and capacity building projects (January 6-14, 1995).

Date: January 15, 1995

During this mission, I accompanied Brandon Prater of USAID, and Craig Miller, an expert consultant, who were investigating potential EAP investment projects that could be made feasible with U.S. Government assistance. A prerequisite for consideration of any investment project is that it result in an improvement of human and/or environmental health. Prior to embarking on this mission, EPA, USAID, and the World Bank had identified air pollution as the most serious threat to human and environmental health in Bulgaria. Thus, the mission only considered investments that would address sources of air pollution.

During the last Project Preparation Committee (PPC) meeting held in Kirkenes, Norway, the World Bank representative (Krystalina Georgova) indicated that Bulgaria currently lacked, and would soon require, the capacity to institute comprehensive air management strategies for various sections of the country. Subsequential discussions with USAID indicated that helping to develop this capacity in Bulgaria would be consistent with EPA's capacity building role within the EAP framework.

Over the last several years, EPA has been working to increase both the technical and environmental management capacity of the Bulgarian Ministry of Environment (MOE). The MOE had also indicated that they would like assistance in developing comprehensive air management strategies for several areas of poor air quality around the country. In addition, they have recently received modern equipment from the Central and Eastern Europe Economic Restructuring Assistance Program (PHARE) for conducting ambient air monitoring (both mobile and stationary labs), emission (stack) monitoring, and laboratory analysis, as well as computer support to manage the data collected.

While Brandon Prater and Craig Miller examined the engineering and investment aspects of potential projects, my goal was to ascertain what complimentary role EPA could play at the particular investment locations being investigated by USAID. Since the investments were limited to addressing air pollution, I was most interested in learning the capacities of the local Regional Inspectorates (RI) to manage the air media. I envision that both the air department of the MOE and the RIs would be EPA's major partners in any such project addressing air pollution. In addition, I was interested in ascertaining the impact on human health and the environment that particular investment projects

could have. For instance, if a source emits a large pollution load but falls on an uninhabited area, the resulting effect on human health may be less than that of a smaller source whose pollution falls on a more densely inhabited area.

In the interest of time, I will confine my review of the sites visited to the capability of the appropriate RI to address environmental problems through a capacity building project, and the relative environmental benefits of the projects being considered. Detailed financial and engineering information is contained in the reports being prepared by Messrs. Prater and Miller. In addition, due to serious time constraints on our mission, I split from Messrs. Prater and Miller at certain instances in order to meet with RIs and the USAID representative.

1/5/95 My first meeting was with the MOE. It included Mr. Phillipov (Foreign Relations), Mr. Kandev (Air), and Ms. Oreola Ivanova (Sofia Conference Preparation). In brief, I discussed the reason for my follow-up visit (I had met with the air department in November), and explained that wherever possible, the U.S. government desired to co-locate EPA's technical and management capacity building projects (with the MOE) at a location where other U.S. government programs are targeted. As during my last trip, I reiterated that no project had yet been proposed and that we were seeking to ascertain the MOE's perception of their priorities.

Mr. Kandev informed me that a Mr. Smith of the U.K. Know-How Fund was completing a report on the country's four major smelters, and that non of them appeared to be a "win/win" project. This included the smelters at Kirejeli and Pirdop.

Ms. Ivanova then provided me with a list of 15 projects that have been prepared for presentation at the PPC meeting in Sofia January 17-19, 1995. The District heating plant in Vratza was the only one that our team would be visiting on this trip.

I asked their opinion as to the highest priority projects that the U.S. team would be visiting. They indicated that Vratza, Plovdiv and Stara Zagora are their highest priorities. Note that Mr. Kandev (and Natov) appear very anxious for assistance in Plovdiv. A Geographic Information System display clearly indicates that Plovdiv has the highest pollution load per capita in the country. It is Bulgaria's second largest city at 500,000 people. They are also very interested in receiving air management assistance in Stara Zagora, which has the highest pollution load per unit area of the country. Kirdjeli and Pirdop had only one major source and relatively small impacted populations, and would not be their priority areas for U.S. assistance. It is important to note that the MOE informed me that Bulgarian law is strong enough for the RIs to take strong enforcement actions against polluters.

1/5/95 Along with Mr. Kandev and Ms. Ivanova, I met with Ms. Toyunatova of the Pirdop RI. The smelter is the one major source of air pollution in the area. They also have a significant problem from fugitive emissions from materials storage. In general, pollution from Pirdop is isolated from Sofia (80 km), and the impacted population is between 10,000 to 20,000. The RI has their own monitoring equipment, but has not received the continuous automated equipment from PHARE and has limited computer capabilities at this time.

Production is currently at 50 percent capacity and she estimates that between $50 to 60 million is required to address the SO_2 and NO_x pollution emanating from the smelter. The smelter has a major capacity problem with their landfill, into which they discharge arsenic

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in solution. Although the RI claims that their is no groundwater problem, leachate from the landfill is discharged to the Kuselodeva and then to the Zlatiska rivers. She estimates that constructing a new landfill of suitable capacity would cost $500 million (I double checked this number with her, since it seemed extremely high. She reconfirmed this value). Note that additional information will be available when the Know-How Fund's report is completed this month.

Opinion: I do not believe that Pirdop would be a suitable location for an EPA capacity building project. Although the RI staff is highly educated and professional, they lack the PHARE equipment that would make continuous and real-time monitoring possible, as well as stack testing equipment and computer data management. However, the biggest detraction from Pirdop is the straightforwardness of the problem (addressing the air media). With only one significant pollution source, it is virtually impossible to demonstrate "air management" or environmental decision making. Finally, the impacted population is the lowest of all the potential investment locations visited.

1/9/94 Meeting with Bulgarian Industrial Association: Mr. Bojdar Danev, Chairman. This NGO has 13,000 members, with 10,000 private companies, 2,000 coops, and 1,000 state industries.

Opinion: I believe that this association may be an appropriate NGO partner for any project which would eventually seek to regulate pollution (and thus regulate industry). They appear to represent one of the key groups that has an interest in how air management strategies are both developed and implemented. Mr. Danev indicated that he was extremely interested in helping in any way possible, and that the regulated industries are key elements of the public.

1/10/94 Meeting with Mr. Minkov of RI and Messrs. Kishkuov and Ugrinov of the Plovdiv Thermal power stations. I had visited the RI during my November mission.

Opinion: I believe that Plovdiv would be an appropriate location for an EPA capacity building project. There are approximately 12 large pollution point sources, as well as mobile and non-point sources or air pollution. This would provide a sufficiently complex background on which to develop a comprehensive air management strategy (and any type of environmental decision making project). The RI has received the PHARE equipment and the staff is currently being trained in its operation. There are good relations and a sharing of information between the RI and Health Inspectorate. The population is the second largest in Bulgaria. The RI has already taken several enforcement actions addressing air pollution, and seem eager to develop and implement a comprehensive air management strategy. Since we did not meet with any NGOs in Plovdiv, the public outreach of any project in Plovdiv will need further development. Both potential projects considered in Plovdiv would reduce the exposure of large population to significant sources of air pollution (SO_2).

1/10/95 Meeting with Ms. Barakova of the Stara Zagora Regional Inspectorate and Katya Dyankova of the NGO "Ecoglasnost."

Opinion: I believe that Stara Zagora would be an appropriate location for an EPA capacity building project. Three of the country's largest polluters are located near the city, although air modeling would be required to determine their effect upon the city's highly inhabited areas. In addition, there are several large pollution sources within the city itself, and mobile

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and non-point sources or air pollution. This would provide a sufficiently complex background on which to develop a comprehensive air management strategy (and any type of environmental decision making project). The RI has received the PHARE equipment and the staff is currently being trained in its operation. There are good relations and a sharing of information between the RI and Health Inspectorate. The population of 200,000 is significant. Although the RI did not seem to completely grasp the concept of air permitting, she seemed well versed in available enforcement tools at her disposal and eager to develop and implement a comprehensive air management strategy for the area. The NGO community seemed active and anxious to participate in any potential project and the mayor was open and receptive to our cooperation with his community. Potential investment projects considered in Stara Zagora would reduce the exposure of a large population to significant sources of air pollution (SO_2, NH_3, NO_x).

1/12/95 Meeting with Dimitrovgrad Mayor and Environmental Expert and Haskov RI (for Dimitrovgrad).

Opinion: I believe that Dimitrovgrad would be an appropriate location for an EPA capacity building project (with the Haskovo RI). The Mayor is extremely interested in obtaining assistance in improving the city's air quality, but has very real concerns regarding the viability of the largest employers (and polluters) in his town, which would also be an excellent location for an environmental decision making project. There are approximately six large pollution point sources, and mobile and non-point sources or air pollution. I believe that this would still present a sufficiently complex background on which to develop a comprehensive air management strategy (and any type of environmental decision making project). The RI has received the PHARE equipment and the staff is trained in its operation. There are good relations and a sharing of information between the RI and Health Inspectorate. The RI has already taken several enforcement actions addressing air pollution, and seem eager to develop and implement a comprehensive air management strategy. (Due to RI enforcement actions, the local cement plant is currently operating below 50 percent capacity). Potential projects considered in Vratza would reduce the exposure of the population to significant sources of air pollution (SO_2, and particulates).

1/13/95 Meeting with Mr. George Tsenov of the Vratza RI.

Opinion: I believe that Vratza would be an appropriate location for an EPA capacity building project. Due to my meeting with the AIDREP, I was unable to attend the visit to the CHIMCO facility or with the Vratza Mayor (see Prater's report). There are approximately 20 significant point sources in the area, ranging from 10 to 104 meters in height. As always, there are also mobile and non-point sources or air pollution. The city is surrounded by industries and mountains and most air pollution falls upon the town of approximately 100,000. Vratza is often subjected to pollution inversions. Health studies indicated that H_2S and NH_3 are the significant air pollutants of concern. SO_2 is a significant problem during winter months. There are a wide variety of industries in the town, including textile, electronic, chemical, and metallurgical.

I believe that the situation in Vratza would present a sufficiently complex background on which to develop a comprehensive air management strategy (and any type of environmental decision making project). The RI has received the PHARE equipment and the staff is currently being trained in its operation. There are good relations and a sharing of

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information between the RI and Health Inspectorate. The impacted population is significant. The RI has already taken enforcement actions addressing air pollution, and seem eager to develop and implement a comprehensive air management strategy. Since we did not meet with any NGOs, the public outreach of any project in Vratza will need further development. Both potential projects considered would reduce the exposure of a large population to significant sources of air pollution (H_2S, NH_3 and/or SO_2).

Summary

I believe that the EPA could play a productive and complementary role to any of the investment projects being considered in Plovdiv, Stara Zagora, Dimitrovgrad and Vratza. All locations have extremely well qualified and supplied RI's. Based upon this preliminary investigation and related conversations with appropriate Bulgarian counterparts, all projects being considered by Messrs. Prater and Miller at these locations would reduce the exposure of significant populations to pollutants having a detrimental effect on these populations. Again, note that the MOE has expressed its preference for a project location.

Since any work that would be carried out under our EAP support activities would be performed by EPA regional staff (most likely from our Region II-New York Office), no commitment can be made at this time for the performance of a project. However, EPA Region II has indicated a strong willingness to develop and implement an appropriate EAP project, and would supply expert staff for such an effort.

At this time, I believe with confidence that for the locations mentioned above, EPA could provide an extremely useful and important capacity building project, perhaps in the form of developing a comprehensive air management program for one of these areas. All work would be conducted with our partners at the Bulgarian MOE, the appropriate RI, and local contractors. An objective of any project would be to leave the capacity to replicate the project within Bulgaria itself. In this way, the MOE could apply this methodology to any part of the country where they believe it necessary.

EPA awaits USAID's decision regarding the location of the EAP investment project, and looks forward to initiating a complimentary capacity building project in Bulgaria as soon as possible. I look forward to hearing from you in Washington to finalize this matter at your earliest convenience.

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ANNEX B
OPPORTUNITIES FOR USAID/EPA PROJECTS IN BULGARIA

GOOD CANDIDATES
Flue Gas Desulfurization at Chimko - $1.2 million Large single stack source of SO2, which accounts for 50% of towns emissions 99% control is possible Completion within 6 month Strong support from Ministry
Residential Conversion to Gas in Stara Zagora - $1.0 to $2.4 million Creation of fund to accelerate the conversion of individual buildings to gas use Impacted building are in the center of town Working with municipality and private gas distribution company Substantial development work required
District Heating in Plovdiv - $600 K to $1061 K Gasification of commercial and residential buildings in the center of town Detailed design complete by the end of the month Working with established local district heating companies
Vulkan Cement Plant - $930 K to $1250 K Large cement plant with huge dust emissions is located near town Plant is scheduled for shutdown in the absence of better emissions control Current baghouses can be rehabilitated German company is completing engineering
Residential Connection to District Heating in Vratza - $250 K Project to connect individually heated systems to district heat company Engineering essentially complete Established company which can repay expenses Project requires European pipe
District Heating Plant Improvement in Vratza - $520 K + $4,593 K Follow-on to connecting remaining buildings in town Straightforward conversion of mazut boiler, with follow-on gas turbine project Well established company Engineering is well developed

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NOT APPROPRIATE AT THIS TIME
Flue Gas Desulfurization at Agrobiochim - $1.5 million Plant is located downwind of city Emissions problems are associated with power and heat production Plant prefers low performance Moldavan FGD Delay to purchase better technology may be appropriate
Maritza East Power Plants - $200 million to $1000 million Power sector project of extreme large scale FBC at Maritza 1 and FGD ar Maritza 3 are preferred technologies Bechtel has examined site
Residential Conversion to Gas in Dimitrovgrad - price not determined Gas conversion project like Stara Zagora or Plovdiv Project not developed in sufficient detail to pursue at this time
Neochim Chemical Plant - none Plant meets environmental standards due to cutback in production Plant is old, and has severe financial problems Plant does not want assistance
Manganese Removal in Dimitrovgrad Drinking Water - $0 Town has contaminated drinking water system Has requested reference materials on cleanup methods (if any) This can be provided pro bono.

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