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Sarajevo Rehabilitation Program: Assessment of the Energy Supply Situation and of the Proposed Rehabilitation Plans

Final Report
SARAJEVO

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Preface

The work described in this report has been carried out by Resource Management Associates of Madison, Inc. (RMA), under the direction of the United States Agency for International Development (USAID).

This working document, prepared by RMA, presents the results of an assessment of the International Rescue Committee plans to rehabilitate the Sarajevo energy supply systems during the current emergency situation.

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1.0 EXECUTIVE SUMMARY

The city of Sarajevo is in a wartime condition. The city has suffered severe physical damage, and the population is experiencing extreme hardship due to the war which started over two years ago. Even the reduction in fighting, monitored by the United Nations, has failed to reduce tensions. A blockade of the city also continues to disrupt all activities. The limited access to Sarajevo has prevented adequate supplies from entering the city. Currently, there are shortages of all major resources including natural gas, electricity, wood, coal, and vehicle fuel.

From August 11 through August 21, 1994, Dr. William Dries visited Sarajevo to help conduct surveys, assessments, and analyses for evaluating and, if necessary, modifying and/or supplementing the International Rescue Committee (IRC) plans for the emergency rehabilitation of the Sarajevo energy supply systems. Dr. Dries, representing Resource Management Associates (RMA) of Madison, worked closely with the IRC, the UN Special Coordinator for Sarajevo, the host country, and USAID representatives during his stay. Activities included on-site inspections and observations of the gas-fired heating systems which supply heat to the housing units, of the gas connections to end-users, and of the inoperative butane-propane storage and distribution facilities.

The IRC proposal plans to repair and rehabilitate the heating and gas systems serving approximately 120,000 people (an estimated 33% of Sarajevo's wartime population) before and during the 1994-95 winter season. The repairs and rehabilitation will provide a minimum level of heat with each flat having one or more heated rooms, depending on the availability of the gas and its pressure. Additional benefits from the proposed activities include a reduction in the total gas required for heating since it will be used more efficiently, reduced gas waste, and safer operation of the gas system and equipment. There are three major activities proposed by the IRC:

1) ***District Heating System.**** The IRC plans to repair and put into operation twenty-six central boiler houses and distribution piping serving buildings which house a total of approximately 120,000 people. The estimated cost is $1,000,000. A more exact cost will be determined once a survey and estimate of the required work , currently in progress, is completed. The cost will probably be less than $1,000,000. *However, this work will not include repairs or starting up the heating systems inside the building. Repairs to the heating systems in the buildings must be done to insure that heat will be available inside the buildings.*

   Recommendations for Additional Work:

   Repair heating systems inside the buildings at a additional cost of $1,950,000. The repair is feasible for 26,000 of the 32,000 flats, the remaining 6,000 are too badly damaged and unoccupied.

2) ***Replacement of 5,000 Makeshift Gas Connections.**** The reparation and replacement of 5,000 makeshift gas connections to end-users (approximately 20,000 people) have an estimated cost of $2,900,000. Replacement gas connections will not be made in the buildings mentioned above in No. 1. The intent is to cut off the makeshift gas connections when heat is restored. This project is a continuation of a project implemented by the IRC which connected 2,500 users. The success of this initial project shows that the IRC is capable of doing the proposed 5,000 gas connections.

Recommendations for Additional Work:

Sarajevo Gas, the city utility, has a plan to provide 10,000 gas meters and regulators on connections to existing and new users. The total cost is $1,700,000. The new regulators will improve safety and reduce waste. The meters are not necessary to provide gas for use this winter, and by deleting the meters, the cost will be $1,200,000.

3) ***Butane-Propane Distribution and Storage Facility***. The IRC plans to repair and put into operation a facility owned by DD "PLIN" Sarajevo. This facility will supply bottle gas, as it did before the war, allowing residents whose buildings are heated by the central boiler houses to cook food. Makeshift and illegal gas connections currently supplying natural gas should be eliminated when the central heating and building heating systems are operational. The estimated cost for this project is $1,200,000.

Recommendations for Additional Work:

Provide three additional tank trucks and drivers to deliver 33 ton/day of gas from Metkovic. This additional capacity will be needed for three months to assure an adequate supply of bottle gas to end-users. The cost for the tankers, fuel, and drivers is estimated to be $180,000.*

Provide a 100kW butane/propane gas-fired portable engine generator set to provide stand-by electric power for the facility. The estimated cost is $25,000.

If the recommendations are implemented, the total cost for this project would be $1,405,000.

* See Section 2.0 for modifications based on the latest IRC proposal dated August 28, 1994.

Overall, the IRC preliminary proposal with recommended changes will provide a well-defined plan. The time schedule will depend on the availability of all resources. The influence of the war creates uncertainties as to the availability of the resources, and delays in the time schedule are likely. The preliminary cost estimates appear to be acceptable. Additional work by the IRC is required to refine the cost estimates. See *Table 1* for a summary of the costs of the proposed projects.

There are several options which exist for funding reduction or deferral:

- Deleting $1,200,000 for 10,000 connections as explained in item 2 above.
- Reducing district heating by up to 50%. This will amount to a reduction in cost by $1,500,000.

Table 1. Cost Estimates

	Requested by IRC	Additional Recommended	Total
District Heating	$1,000,000	$1,990,000	$2,990,000
5,000 Gas Connections	2,900,000	---	2,900,000
10,000 Connections including regulator cabinet w/ provision for future meters	---	1,200,000	1,200,000
Propane-Butane Bottle Gas Facilities	1,200,000	205,000	1,405,000
SUBTOTAL	$5,100,000	$3,395,000	8,495,000
Contingency			1,200,000
TOTAL			$9,695,000

Feasibility of the IRC Activities

The political realities of the conflict must be considered. The control of the land in and around Sarajevo is divided between the Serbs and the Bosnians. The 1991 pre-war census of Sarajevo showed a population composed of 35% Serbs, 8% Croatians, and 57% Muslims (Bosnians). The areas within Sarajevo controlled by the Bosnians have a population which is composed of Serbs and Bosnians. The projects in this proposal are in the Bosnian controlled areas. Areas controlled by the Serbs are being served by past and current IRC projects. Under these projects, natural gas is being extended to Grbavica, Kasindo for a hospital and for future gas connections elsewhere in the community as well as to a bakery in Rajolvac. Past and present aid provided by the UNHCR has been divided between the Bosnian-Serb areas and the Bosnian areas. The reconstruction activities must recognize the concerns of both parties since their cooperation will be needed to complete them. (See pages 1, 2 and 3 of the report by Clayton W. Vickland in Appendix E for further discussion.)

The IRC should have the flexibility to balance the benefits between Bosnian-Serb areas and Bosnian areas of Sarajevo. This will increase chances that the Serbs will not cut off the main gas pipeline to Sarajevo.

The International Rescue Committee (IRC) is the organization which will receive USAID funding and will manage the activities. The IRC's success in completing a previous project, funded by other sources, which provided 2,500 gas connections demonstrates the organization's capabilities. The IRC has gired the 3-E Company of Sarajevo as a consultant. This company employs Bosnian and Serb engineers who live in both Bosnian-Serb and Bosnian areas. (See page 2, Appendix E)

While the IRC has the capability to manage the proposed activity effectively, there are some areas of concern. Local people who are experienced in the management of projects similar to the boiler house and heating system rehabilitation should be added to the IRC staff. The availability of skilled and semi-skilled people to do the repairs may be limited and thus may delay the time schedule. Acetylene and oxygen, used for cutting and welding, are in very short supply and may also cause delays.

The IRC management believes it can overcome these difficulties. In the event of shortages, the completion will be delayed. It should noted that even partial completion, i.e. one boiler house and heating systems for the buildings served by that boiler house, will provide heat for the occupants. Success can be measured by:

- The time schedule of the work
- The cost of the work
- The number of people with heat and LP gas cooking in their flats this winter.

Predicting the future accurately, including the time schedule and cost of the work involved, is difficult because the conditions in Sarajevo are influenced by the war. Successful completion will depend on the availability of materials, equipment, supplies and people.

The procurement for the majority of materials, supplies, and equipment will be from outside of Bosnia. Procurement of equipment, components, and materials from the USA is not feasible as the original equipment suppliers are based in Europe and the former Eastern Bloc countries. The original suppliers will be used as they are the only source of replacement equipment and components that will match the existing equipment. A source origin waiver for materials, equipment and supplies will help to expedite activities and insure completion during the coming winter. Transportation to Sarajevo will be through areas controlled by Serbs as well as Bosnians. The surface vehicles and air routes are subject to closure due to the politics of the situation.

The present preliminary IRC proposal is not complete and has several areas where more detailed plans and backup data are necessary. These will be described in more detail in the remainder of the report.

Finally, it is recognized from the outset that this will be a high risk endeavor subject to wartime conditions beyond the control of IRC or USAID.

2.0 COMMENTS ON THE IRC PROPOSAL OF AUGUST 28, 1994

The latest proposal by the IRC dated August 28, 1994 (received on September 7, 1994) has been modified from the previous preliminary proposal. Based on review of the most recent proposal and discussions with Mr. Fred Bieganski of USAID, the following comments are pertinent:

1) ***Replacement of 5,000 Makeshift Gas Connections***. The latest IRC proposal on page 3 "B. Project Location" and page 9 "d. Beneficiaries" defines the areas in which 5,000 makeshift gas connections will be made. "B. Project Location" implies that there was pre-war natural gas piping to and inside of the buildings in the central and old sections of the city. This is not accurate as the high rise buildings and many buildings in the old section were not equipped with internal gas piping.

2) ***District Heating System***. Page 17 (paragraph two from the bottom of the page) of the new IRC proposal shows direct costs of an additional $1,000,000 to repair the distribution piping from the boiler houses to the buildings. This was not in the previous proposals, and the cost estimate should be given in more detail.

3) ***Butane-Propane Distribution and Storage Facility***. On page 18 "3. Propane-Butane Project", the cost of $835,000 is based on two trucks. The recommendation to increase the number of trucks to five is no longer valid because the initial requirements for LP gas supply can be provided with the two trucks.

4) ***Suggested Budget for the IRC Proposal (August 28, 1994)***. The total budget at this time is approximately $6,000,000 as determined by USAID.

   - Page 15 "A. General Costs" should be reduced from $1,411,600 to $800,000.
   - Page 17 "1. Project to Repair Central Heating System" should be reduced from $4,000,000 to $2,000,000. The IRC proposal should provide additional detail of the cost breakdown for the recommended repairs.
   - Page 18 "2. Replacement of Makeshift Gas Connections" should be left at the proposed cost of $2,389,980.
   - Page 18 "3. Propane-Butane Project" should be left at the proposed cost of $835,000.

   Future costs to complete the above items are expected to be about $2,600,000. This funding will be provided when a major portion of the $6,000,000 has been used.

3.0 DISTRICT HEATING SYSTEM (TASKS 1 & 2)

The boiler houses were inspected in order to verify the information in the preliminary proposal of the IRC. (See *Table 2* for a list of boiler house that were visited.) Mr. Kemal Niksic of the IRC, personnel from Toplane (the city organization responsible for the heating system and boiler houses), and engineering personnel from Engineering Gas Technology (EGT) accompanied Dr. Dries.

***Table 2. Information on Boiler Houses Visited* (3)**

Address *	Boilers & Capacity	Flats	Flats today (usable)
Alipasnio Polje 13	four 12MW	8359	8359
Branke Blazek 17	three 6MW	1676	1676
Hrasno 20	five 6MW	4587	2300
Cenjic Vila II 14	three 8MW	2772	2772
Dobrnja III-1 1	three 6MW	3691	3691 (1)
Zetra 35	four 9MW	5500	5500
Povoznjak 15	four 3MW	1500	1500 (2)
Zivko Josilo 18	three 6MW	1137	1137
		TOTAL FLATS**	26,935

* Number given on map of Sarajevo (See Appendix A.)

** Total population (4/flat average) 110,240

(1) Boiler house Dobrinja III-2 was destroyed and flats are now served by Dobrinja III-1by interconnection of piping.

(2) Six to eight people to a flat, many are refugees

(3) Boiler houses and flats are located in Bosnian controlled areas and are occupied by Serbs and Bosnians.

Boiler houses serving another 5,801 flats were not visited due to lack of time. They are part of the EGT survey. The boiler houses visited represent 83% of the flats served by the boiler houses in the EGT survey. EGT is surveying 26 boiler houses and has completed 17. The final reports will be available to the IRC in four weeks. The EGT information will be used

by the IRC to define the scope of work, and it should included the necessary materials and supplies to complete the work.

A detailed list of damage at the Dobrinja III-1 was compared with EGT's list (see Appendix A). This boiler house was selected at random to check the accuracy of the EGT survey. EGT is doing a good job of preparing a list of work required. The list includes only the items necessary to put the boilers into operation. Additional repairs for automatic controls were not on the EGT lists; the boiler will be operated manually.

Boiler houses K-1, K-3, K-4, K-7 Dobrinja were not visited for security reasons. A total of 1,210 flats (pre-war count) are served by these boiler houses.

Some additional information should be included in the IRC proposal. For example, a list of hand tools, small power tools, and the amount of critical supplies, such as acetylene gas for welding, and how they will be obtained should be a part of the IRC proposal. The extent of repairs required on the pipe lines, distributing heat from the boiler houses to substations and from substations to the houses, should be detailed in the IRC proposal. The amount of work required may not be completely defined by the EGT survey, and the IRC should work with Toplane, the city group responsible for the boiler houses and distribution piping, to define this work.

Based on the meetings, boiler visits, and review of the work done by EGT, it is evident that EGT is doing an excellent job of determining the extent of the rehabilitation. Also, the scope of the IRC proposal should be increased to include work needed inside the buildings and flats to repair damage to the heating system caused by freezing and war actions. Toplane has some information and should be hired, along with EGT, to complete the survey and estimates of cost for this work. See *Table 3* for a summary of the recommended changes to Tasks 1 and 2 of the IRC proposal.

The EGT survey of the boiler house when completed will include costs. At this time, it is not possible to comment on the cost estimates. A rough guess on costs to repair the heating system and provide heat in at least one room of each flat is $75 per flat. Work in 26,000 flats would require about $1,950,000. This amount will have to be verified by the above-mentioned survey. The work would not include replacing glass. Many flats have no glass due to war damage, and the windows are covered with plastic film.

The IRC has discussed the possibility of a fund of about $10,000 to $20,000 to be used to fund work which would define the scope of the IRC proposal in more detail. This would be used to pay Toplane to survey the repairs needed to the heating systems in the buildings. It would also be used to define a financial plan to establish a wage structure for the employees of the local organizations hired by IRC to do the work.

Table 3. Summary of Recommendations - Tasks 1 & 2

Recommendations for Additional Work

1. Include the repair of the heating systems inside the buildings and flats. The work consists of repairing or replacing heating pipes and radiators damaged by war action, freezing, and vandalism. Parts of the piping system were used for makeshift gas piping. Almost all of the materials are available at the buildings. The cost estimate is 67% labor with the remainder being supplies and material. These costs need to be verified by a survey of the work required.	$1,950,000
2. Provide funds to IRC for planning purposes and for surveying distribution piping and repairs needed inside the buildings.	$20,000
3. Provide eight portable combustion analyzers to allow the boiler plants to operate at higher efficiencies. This will reduce gas consumption by 3 to 5 percent.	$40,000

Recommendations for Changes to the IRC Proposal

1. Include hand tools and supplies.
2. Provide additional detail on the management plan for the project. Experienced project managers with knowledge of the local situation should be hired. A local manager with experience managing large international projects is the best choice. The IRC should contact Mr. Drino for suggestions.
3. Provide a priority list of systems to be repaired based on the largest number of occupants and least cost to do the work.
4. Provide an explanation that supports the necessity to purchase replacement parts and equipment from non-USA manufacturers to match the original equipment.

4.0 REPLACEMENT OF 5,000 MAKESHIFT GAS CONNECTIONS

4.1 Task 3

The program to replace 5,000 makeshift gas connections is well-planned, and the IRC has successfully completed a prior project for 2,500 connections. The costs and time schedule are acceptable. Review of the IRC proposal has resulted in the following comments:

- Steel gas piping should be welded to reduce leaks from thread connections. If thread connections are used, the fittings should be malleable iron to reduce breakage due to loads imposed on the system by changing conditions. Welding may not be feasible because acetylene gas is in short supply. An alternative is to provide bottle gas or liquid fuel, portable engine-driven electric arc welders and welding rods, supplies and equipment.

- Copper piping using soft copper tube with compression fittings reduces the need for welding and acetylene.

- Transport costs should be based on air freight to insure prompt delivery.

- Labor costs are estimated to be an average of $4.00US per hour including all fringe benefits, overhead, and profit. The labor estimates of the IRC proposal are about 15% of the material costs. The US$4.00 per hour labor costs are based on discussions with local and national government representatives and people in help organizations. The actual labor costs may be much less as the current economic conditions have resulted in the inability to compensate workers or in wages of less than one dollar per month. The hourly labor costs for local labor, as determined by IRC, should be included.

- IRC cost estimates for materials appear to be 50% lower than the estimates made by Dr. Dries based on a check of one of the estimates in the preliminary IRC proposal. The estimates by Dries use USA prices. (See Appendix B).

- The use of local people trained by the British ODA gas project should be included in the possible sources of labor to install the gas connections. That project is managed by Tony James (formerly by Rob Rowe).

- The IRC should be aware that funds from USAID require procurement of materials and equipment from USA manufactures. A request for permission to procure from non-USA sources needs to be made.

4.2 Task 4 - Potential Dangers of the Natural Gas System

The present gas systems within the boiler houses, if repaired and operated properly, will be safe. The gas distribution system outside the buildings where makeshift connections and lines have been installed is a potential danger and can be reduced by removing these unsafe connections when the heating has been restored to the buildings.

Makeshift gas connections to provide heat inside can be cut off and cooking needs provided by bottle gas (i.e. Propane/Butane). A supply of bottle gas will be available when the bottle gas distribution plant is put into operation. (See Task 5.) This plant must be repaired concurrently and put into operation with the heating systems.

Removal and/or replacement of makeshift gas lines and connections on the distribution system is currently being made by the British under the ODA. This plan may need additional funding. The local labor costs paid by the British should be checked by the IRC.

4.3 Gas Meter Proposal

Sarajevo Gas, headed by Mr. Selmanovic, would like USAID to fund the purchase of 10,000 gas meters and regulators in weather proof and tamper proof housings. The regulators are needed immediately to provide proper connections, but the installation of meters is not necessary to achieve the goal of providing heat for housing this winter.

The cost of this project is approximately $1,700,000, and the meters would be purchased from a USA company, American Meter. Deleting the meters from the plan would save $500,000. The decision to do this is up to the USAID representative.

Details of implementing this project are vague and a detailed description of how it will be implemented by Sarajevo is needed. This should include the time schedule and costs of implementation. It appears that funds for this project would flow from USAID to Sarajevo Gas. The IRC should control the funds and monitor Sarajevo Gas' work.

5.0 BUTANE-PROPANE DISTRIBUTION AND STORAGE FACILITIES (TASK 5)

The office and plant of DD "PLIN" Sarajevo were visited on the 13th of August by Dries and Zobrist. They met Mr. Asim Zorlak, General Director, and four of the technical people from PLIN. Kemal Niksic, the interpreter, facilitated the discussions. The talks dealt with the type of organization and ownership, and the potential for operation as a private company. The potential is good. Fred Zobrist will comment on this in his report.

The technical discussion centered on the plan to restart the bottle gas distribution and storage system. The plan as detailed in the IRC proposal includes costs estimated by PLIN. The costs are based on estimates by PLIN experts, and they seem reliable.

The plant which is located in a Bosnian controlled area was surveyed, and damage to the three 150 cubic meter storage tanks are as follows: one tank has very little damage requiring minor welding repairs; a second tank requires the replacement of several meter-high sections (damage from artillery fire); and the third tank has larger holes in several meter-high sections and will need extensive repairs. Possible use of some of the good sections from this tank to repair the other tanks was discussed and appears feasible. The third tank may be usable if the total height is reduced by about one half. In addition, the transfer pump house to unload tank trucks needs repairs to its piping and new pumps. The house for filling and testing bottles needs minor repairs and is part of the proposed work. Materials, equipment and supplies for the work are available according to PLIN.

Plant operations consume about 50 kW of electrical power. The city utility provides electricity on a priority basis. A new stand-by portable butane-propane gas-fired electric generator of 100 kW capacity would provide power when the city utility fails.

The proposed plan provides transportation with two trucks to bring gas from Metkovic. Each truck has a 10T capacity. Based on the maximum capacity of the bottle filling house (3,000 bottles/day), all 50,000 bottles estimated to be in the city can be filled in about 17 days. This requires 33T/day, and truck delivery is estimated to be 7T/day. At the 7T/day rate, it will take 80 days to fill 50,000 bottles. One bottle lasts about 75 days when used for cooking. At a filling rate of 500 bottles a day, it will take 100 days to fill the bottles in the city. This will cause a shortage that will create a black market. The black market should be prevented by increasing the supply from Metkovic to 33T/day. Five trucks will be able to supply the plant with a maximum of 33T/day.

Table 4. Summary of Recommendations - Task 5

1. Provide three additional 10T trucks (purchased or rented) to move gas from Metkovic to Sarajevo. (An LP tanker truck and trailer, 10T capacity, was seen on a trip near the town of Liseljak parked next to a house. This tanker may be available.)
2. Provide one 100kW gas-fired engine generator set to provide stand by power to operate the plant. Unit to be complete with manual transfer switch. Voltages and frequency to be determined by PLIN.
3. *Additional details for the costs and origin of the tank trucks, repair materials, equipment for tank repair, and the costs listed in tables 1.1 and 1.2 of the IRC proposal should be included in the final proposal.**
4. *A detailed plan to distribute the gas bottles, including the responsible organization and means to insure that the correct end-users receive the gas and the costs, should be added to the proposal.**

* Based on information from F. Zobrist.

Overall, the project appears to be well-planned, *the schedule appears optimistic*, cost estimates are reliable and the rehabilitation of the facilities will accomplish the technical goals of the project.

This project must be funded along with the rehabilitation of the boiler houses, heating distribution system, and heating systems inside buildings.

Bottle gas must be available to the occupants of the flats as soon as heat is restored by the central boiler house because the temporary natural gas supply to the buildings will be cut off. The bottle gas will be used by Serbs and Bosnians in Sarajevo. The plant is located in the Bosnian area.

6.0 CONFIRMATION OF IRC ASSESSMENT OF ENERGY SUPPLY SITUATION (TASK 6)

The IRC proposal accurately describes the energy supply situation, and in the coming winter the situation will not improve. Coal mining is severely reduced, and the limited supply is used at the electric power plants. The transportation of wood, coal and liquid fuels by rail and motor vehicles is limited because of the conflict, as is the supply of vehicles, and fuels for those vehicles. Apparently, kerosene and kerosene heaters for residential heating were not considered for similar reasons of limited availability of fuel and equipment. Electric and gas supplies are very limited as described by the IRC.

7.0 BUILDING INSULATION AND WEATHERIZATION MATERIALS (TASK 8)

Insulation and weatherization materials may be useful and practical to improve schools and hospitals which are currently being repaired. The work is being managed by the United Nations Office of the Special Coordinator for Sarajevo. Due to the conflict, a very large supply of insulation and weatherization materials is being stored by the UN on the Dalmatian coast and is not available for use in Sarajevo. The UN AP projects 123 and 126, Repairs to Schools, and AP project 112, Medical Facilities Repairs, managed by John Fawcett, may have weatherization and insulation repairs which need funds as well as materials and supplies.

John Fawcett should be contacted by the IRC or a local USAID representative to determine the needs.

8.0 FEASIBILITY OF THE IRC PROPOSAL OF AUGUST 28, 1994

Past and current IRC activities in Sarajevo have been achieved by working with the Bosnian-Serbs and Bosnians at all levels of government. The complete failure of the economic, social, and physical infrastructure creates very difficult working conditions.

Unpredictable future actions could quickly destroy, delay, or stop progress. Such potential obstacles as identified by the IRC include:

- The lifting of the UN arms embargo to Bosnia-Herzegovina this fall
- The withdrawal of UNPROFOR (United Nations Protection Force) from Bosnia-Herzegovina
- The entering of NATO forces into Bosnia-Heryegovina
- The suspension of the natural gas supply to Sarajevo
- The restriction of all supplies to Sarajevo by the blockade
- The destruction of repaired facilities by military action.

It is essential to secure the cooperation and support of the Bosnian-Serbs and Bosnians. This cooperation and support will occur if both parties benefit from the activities. The success of future work depends the ability of the IRC to satisfy the needs of all parties. The IRC has demonstrated with their past projects that they can do this.

APPENDIX A

District Heating

Appendix A Contents:

1. List of Boiler Houses

2. Revised List of Boiler Houses

3. Maps Showing Boiler House Locations\

4. Sample EGT Survey Boiler House Dobrinja KD III-1

List of Boiler Houses

35 ZETRA 4 37000 17,000 5500

	Boiler house name	Num. of boilers	Installed heat capacity	Minimal heat cap. required	Num. of flats
			kW	kW	
5	1 Dobrinja III-1	3	21000	7000	1846
	~~2 Dobrinja III-2~~	~~3~~	~~21000~~	~~7000~~	~~1845~~
KD-1	~~3~~ K-3 Dobrinja I	2	2560	1300	320
KD-3	~~4~~ K-4 Dobrinja I	2	2560	1300	318
KD-4	~~5 K-5 Dobrinja I~~	~~2~~	~~2560~~	~~1300~~	~~198~~
KD-7	~~6 K-6 Dobrinja I~~	~~2~~	~~2560~~	~~1300~~	~~214~~
	7 K-7 Dobrinja I	2	2515	1300	237
	~~8 K-8 Dobrinja I~~	~~2~~	~~2150~~	~~1050~~	~~228~~
	9 K-1 Alipasino	2	5810	2900	673
	10 K-2 Alipasino	2	5810	2900	691
	11 K-3 Alipasino	2	5810	2900	544
	12 K-4 Alipasino	2	5810	2900	856
4	13 Alipasino Polje **	4	55820	21000	8359
4	14 Cengić Vila II**	3	26730	17000	2772
	15 Podvoznjak	4	13950	6500	1497
	16 Cengić Vila I	4	11520	5800	1226
2	17 Branko Blažek	3	20930	7000	1676
	18 Žička Josila	3	20930	7000	1137
	19 Dalovalica Krvi	3	23260	15000	1250
8	20 Hrasno **	5	33500	21000	4587 (50% OK)
	21 Borisa Kidrica	2	2320	2000	169
	22 Kosevo	3	8720	5800	700
	23 Park	2	3960	2000	282
	24 Drvarska	2	6000	2000	165
	25 Skenderija	2	4700	2300	161
	26 Zvijezda	2	12000	5580	350
	27 K-1 Dobrinja I*	2	3020	1500	335
	28 K-2 Dobrinja I*	2	3720	1800	216
	29 Mlade Bosne *	2	3020	1500	185
	30 Tome Medje *	2	2860	1500	229
	31 Mala Aleja *	3	6980	4600	346
	32 Luzani*	2	9300	4650	761
	33 Grbavica II*	2	13950	7000	1530
	34 Lenjinova *	3	28000	14000	2354
		TOTAL:	432535	318693	39320

3691

320 318 237 335 1210 [1]

2764 [2]

1827 [3]

* 33 substations not finished 5956 34,364

The boiler houses not using natural gas for fuel, like Otoka and Mose Pijade, are not the subject of present proposal, because in that case a conversion project would be necessary.

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Estimate to include spares

Revised List of Boiler Houses

	Boiler house name	Num. of boilers	Installed heat capacity	Minimal heat cap. required	Num. of flats
			kW	kW	
1	Dobrinja III-1	3	21000	7000	1846
2	K-1 Dobrinja I	2	3020	1500	335
3	K-3 Dobrinja I	2	2560	1300	320
4	K 4 Dobrinja I	2	2560	1300	310
5	K-7 Dobrinja I	2	2515	1300	237
6	K-1 Alipasino Polje	2	5810	2900	673
7	K-2 Alipasino Polje	2	5810	2900	691
8	K-3 Alipasino Polje	2	5810	2900	544
9	K-4 Alipasino Polje	2	5810	2900	856
10	K-5 Alipasino Polje	4	66820	21000	8359
11	Cengic Vila II	3	26730	17000	2772
12	Podvoznjak	4	13860	6500	1497
13	Cengic Vila I	4	11520	5800	1226
14	Branka Blazek	3	20930	7000	1676
15	Zivka Josila	3	20930	7000	1137
16	Darovalaca Krvi	3	23260	15000	1750
17	Hrasno	5	33500	21000	4587
18	Borisa Kidrica	2	2320	2000	169
19	Kosevo	3	8720	5800	700
20	Park	2	3960	2000	282
21	Drvarska	2	6000	2000	185
22	Skenderija	2	4700	2300	161
23	Zvijezda	2	12000	5580	350
24	Zetra	4	37200	9300	1063
25	Otoka*				
	TOTAL		336435	153280	31214

Boiler house marked with * (Otoka) is coal fired one. It is not real to have this boiler house operational next winter, because it should be necessary to supply it with 2900 MT of coal for the season. Our survey will answer is real and feasible to convert this boiler house to natural gas with existing boilers.

Boiler houses Otoka and Mose Pijade must be provided with a conversion project.

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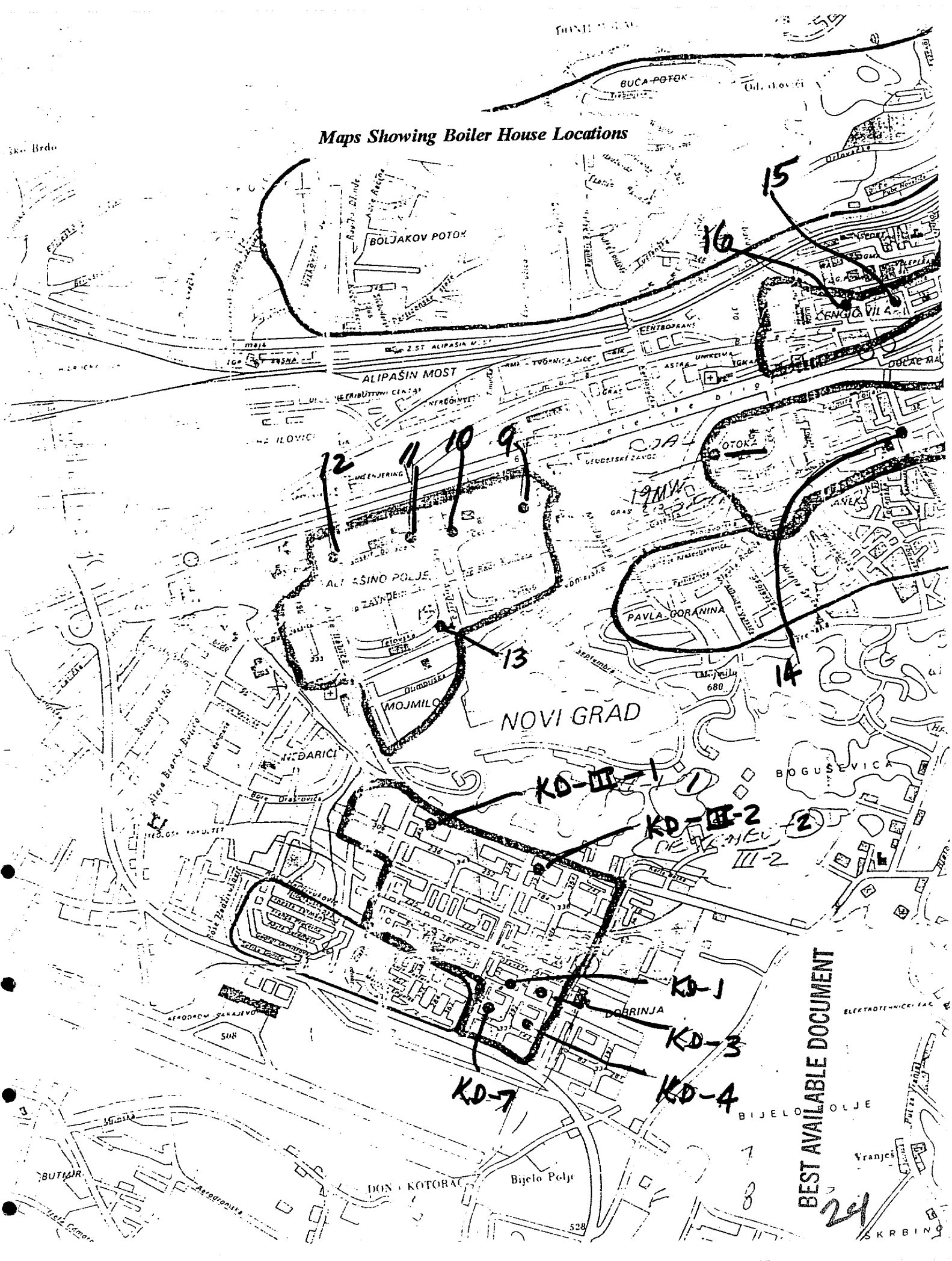
Maps Showing Boiler House Locations



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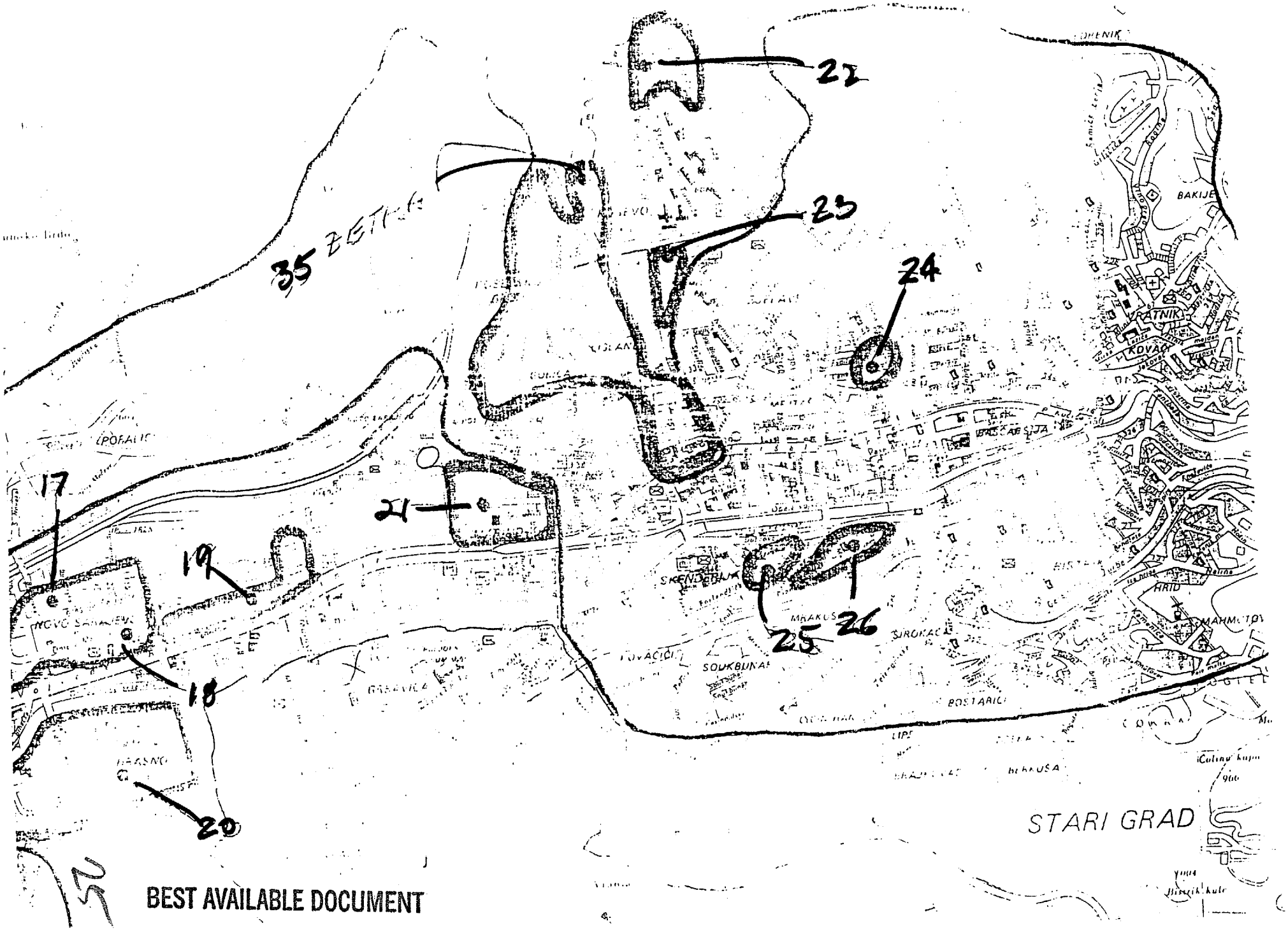

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Sample EGT Survey Boiler House
Dobrinja KD III-1

Legend for lists on proceeding pages:

(1) Equipment description
(2) Number, size, quantity
(3) Condition is good and needs no work
(4) Condition is defective and can be repaired
(5) Condition is defective and needs replacement
(6) Proposed solution and remarks

(BOILER HOUSE)

KOTLOVNICA: KD III-1

(ADDRESS)

ADRESA: DUBRINJA 3A

(INSTALLATION TYPE FUEL)

INSTALACIJA TEČNOG GORIVA

Gasna rampa i mjerni set/5

Oprema	Jed. mj kom. m2, m	Ocjena				Prijedlog Rješenja
		Ispravno	Oštećeno	Nedostaje		
Proizv.						
Napon mreže						
Doz. temp. ok.						
Sastavni dijelovi						
Generator programa						
Narudž. broj						
Meh. zaštita						
Vlast. potr. struje						
Membranska pumpa						
Narudž. broj						
Meh. zaštita						
Vlast. potr. struje						
Priključak						
Kontrola nepropusnosti						
Tip						
Proizv.						
Doz. temp. ok.						
Sastavni dijelovi						
Generator programa						
Narudž. broj						
Meh. zaštita						
Vlast. potr. struje						
Sigurnosna tlačna sklopka		3				
Tip GW						
Narudž. broj						
Pod. regul.						
Sigurnosna tlačna sklopka						
Tip DUNGS		3				
Narudž. broj						
Pod. regul.						
Izračni ventil						
Tip						
Narudž. broj						
Priključak						
Uredaj za pokazivanje nepropusnosti						
Narudž. broj						
Priključak						
MJERNI SET						
Mjerač protoka gasa	KOM			1	IZAZA	
Tip PONAR G 400						
Proiz.						
Veličina NSI 150						
Max. ul. prit.						
Korektor gasa	KOM			1	IZAZA	
Tip						
Proiz.						
Max. ul. prit. gasa 2-10 bara						
Veličina						
Kuglasta slavina	KOM	1				
Tip						
Proiz.						
Veličina NO 100 NP 16						
Filter za gas	KOM	1				
Tip						
Proiz.						
Veličina NO 100 NP 16						
Manometar	KOM		1		IZAZA	
Pod. mjer. 0-6 bara						
Priključ. 1/2"						
9100						
Proizv.						
Slavina za manometar	KOM		1		IZ	
Tip						
Proizv.						
Priključak 1/2"						

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Gasna rampa i mjerni set/4

Oprema	Jed. mj kom. m2, m	Ocjena				Prijedlog Rješenja
		Ispravno	Oštećeno	Nedostaje		
Prit. podešav.						
Sigurnosni-ispušni ventil						
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Prit. podešav.						
Prekidač pritiska za vazduh	KOM	2				
Tip						
Proiz.						
Reg. broj		-				
Narudž. broj						
Pod. regulacije						
Max. prit.						
Prekidač pritiska za vazduh	KOM					
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Pod. regulacije						
Max. prit.						
Manometar komplet sa spojnim cijevima i igličastim ventilom						
Tip						
Proiz.						
Pod. regulacije						
Narudž. broj						
Priključak						
Manometar komplet sa spojnim cijevima i igličastim ventilom						
Tip						
Proiz.						
Pod. regulacije						
Narudž. broj						
Priključak						
Manometar komplet sa spojnim cijevima i igličastim ventilom						
Tip						
Proiz.						
Pod. regulacije						
Narudž. broj						
Priključak						
Indikator propusnosti gasa 1/2"	KOM	3				
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Krajnji prekidač 7 bar	KOM	3				
Tip						
Proizv.						
Filter za gas	KOM	3				
Tip						
Proiz.						
Veličina NO 3 m NP 16						
Reg. broj						
Narudž. broj						
Kuglaste slavine						
Tip						
Proiz.						
Veličina						
NO NP 16	KOM	5				
NO 3/4" NP 16	-"-	12				
NO NP	-"-	9				
NO NP	-"-					
NO NP						
NO NP						
Kontrola nepropusnosti						
Tip						

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Gasna rampa i mjerni set/2

Oprema	Jed. mj kom. m2, m	Ocjena				Prijedlog Rješenja
		Ispravno	Oštećeno	Nedostaje		
Napon						
Meh.zaštita						
Rad. podr. prit.						
Temp. okoline						
Magnetni ventil						
Veličina NO NP						
Proiz.						
Tip						
Reg. broj						
Narudž. broj						
Napon						
Meh.zaštita						
Rad. podr. prit.						
Temp. okoline						
Regulator pritiska	Kom	3				
Veličina NO 50 NP 16						
Tip RTP 1-2						
Proiz. NAPROJEKT						
Reg. broj						
Narudž. broj						
Max. ul. prit.						
Podr. podeš.						
Regulator pritiska	Kom			3	II FAZA	
Veličina NO NP						
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Max. ul. prit. 10 KP/cm2						
Podr. podeš.						
Regulator pritiska						
Veličina NO NP						
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Max. ul. prit.						
Podr. podeš.						
Regulator pritiska						
Veličina NO NP						
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Max. ul. prit.						
Podr. podeš.						
Regulator pritiska						
Veličina NO NP						
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Max. ul. prit.						
Podr. podeš.						
Regulator pritiska						
Veličina NO NP						
Tip						
Proiz.						
Reg. broj						
Narudž. broj						
Max. ul. prit.						
Podr. podeš.						
Regulator pritiska						
Veličina NO NP						
Tip						
Proiz.						

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Gasna rampa i mjerni set/1

Oprema	Jed. mj kom. m2, m	Ocjena				Prijedlog Riješenja
		Ispravno	Oštećeno	Nedostaje		
Magnetni ventil	KOM	2				
Veličina NO 1/4" NP 10						
Proiz. [illegible] ZAGREB						
Tip [illegible]						
Reg. broj [illegible]						
Narudž. broj						
Napon 220V						
Meh.zaštita [illegible]						
Rad. podr. prit. 0-50 KPa						
Temp. okoline [illegible]						
Magnetni ventil		-				
Veličina NO 3/4" NP 10						
Proiz. [illegible] ZAGREB	KOM	1	1	IZVAN	IZVAN [illegible]	
Tip [illegible]					SPULE [illegible]	
Reg. broj [illegible]						
Narudž. broj						
Napon [illegible]						
Meh.zaštita [illegible]						
Rad. podr. prit. 0-50 KPa						
Temp. okoline [illegible]						
Magnetni ventil	KOM		2	IZVAN	IZVAN [illegible] ZAVISNIM	
Veličina NO [illegible] NP [illegible]					[illegible]	
Proiz. [illegible]						
Tip [illegible]						
Reg. broj						
Narudž. broj						
Napon [illegible]						
Meh.zaštita [illegible]						
Rad. podr. prit. [illegible]						
Temp. okoline [illegible]						
Magnetni ventil [illegible]	KOM	2				
Veličina NO NP						
Proiz. [illegible] ZAGREB						
Tip [illegible]						
Reg. broj						
Narudž. broj						
Napon [illegible]						
Meh.zaštita						
Rad. podr. prit.						
Temp. okoline						
Magnetni ventil	KOM	3				
Veličina NO 1/2" NP						
Proiz. [illegible]						
Tip [illegible]						
Reg. broj						
Narudž. broj						
Napon [illegible]						
Meh.zaštita						
Rad. podr. prit.						
Temp. okoline						
Magnetni ventil						
Veličina NO 12.5 NP 16						
Proiz. [illegible] ZAGREB	KOM	3	3		IZVAN	IZVAN [illegible] ZAVISNIM
Tip [illegible]						ŠPULA ELEKTROMA
Reg. broj						
Narudž. broj						
Napon [illegible]						
Meh.zaštita						
Rad. podr. prit. 0-20 KPa						
Temp. okoline						
Magnetni ventil	[illegible]					
Veličina NO NP						
Proiz.						
Tip						
Reg. broj						
Narudž. broj						

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KOTLOVNICA: KD III - 1

ADRESA: DOBRINJA 3A

GASNA RAMPA I MJERNI SET

Tip VY						
Proizv. REGULATOR TEMPERATURE						
Posuda za komp. zrak SA MANOMETROM	KOM					
Veličina TIP KT1 - REG. BREZOV						
Rad. pritisak						
Nivoregulator	KOM					
Tip NS 50 H=30mm						
Prolzv. [illegible] LJUBLJANA						
Priključak						
Elektromagnetni ventil						
NO NP						
Tip						
Prolzv.						

- POLAZNI KOTLOVSKI KOLEKTOR TOPLE VODE
  Ø [illegible] L [illegible] mm [illegible] KOM 3 ISPRAVNO
- POVRATNI KOTLOVSKI KOREKTOR TOPLE VODE
  Ø 300 L=1200mm RADNOG TOP. [illegible] 3 —"—
- SONDE ZA KONTROLU NISKOG NIVOA VODE U KOTLU
  DN 50 NA 16 ATM ZAGREB [illegible] 3 OŠTEĆENO
- TERMOMETAR KUTNI U MES. ČAURI
  0 - 1500°C [illegible] 6 ISPRAVNO I OŠTEĆENO
- TERMOMETAR Ø100
  0-160°C KOM 1 OŠTEĆEN I FAZA
- LIMENI KANAL DIMNIH GASOVA IZRAĐEN OD ČELIMA ZAVARENE KONSTRUKCIJE [illegible] 3 OŠTEĆENO I FAZA
- ELEKTRONSKI REGULATOR SISTEM 300 TIP R 3U C0 D "IMP" LJUBLJANA 1 OŠTEĆENO I FAZA
- POGON PEM 111/B 101-6V 220V "IMP" LJUBLJANA KOM 1 —"— I FAZA
- ORMAR ZA SMJEŠTAJ AUTOMATIKE KOM 1 —"— I FAZA
- VODOKAZNO STAKLO NA REZ VODE [illegible] KOM 3 —"— I FAZA

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NO 50			14			
NO 15		80				
NO						
NO						
Radna temperatura						
Odmuljne pumpe		2				
Tip						
God. pr.						
Proizv.						
Protok						
Napor						
El. motor						
Snaga						
Napon						
Meh. zaštita						
Nivoregulatori (za pumpe)						
Tip						
Proizv.						
Grejna tijela (za grijanje pratećih prostora kotlovnice)						
Radijatori		65				
Tip						
Veličina						
Grejni medij						
Proizvođač						
Čelične bešavne cijevi DIN-2448 (za grijanje pratećih prostora kotlovnice)						
NO 65 (76,1x2,9)						
NO 50 (63,5x2,9)						
NO 40 (48,3x2,6)						
NO 32 (42,4x2,6)						
NO 25 (33,7x2,6)		70				
NO 20 (26,9x2,6)		10				
NO 15 (21,3x2,0)		20				
Koljena čelična R=1,5xDx(90)						
NO 300						
NO 250						
NO 200						
NO 150		25				
NO 125						
NO 100		12				
NO 80						
NO 65						
NO 50						
NO 40						
NO 32						
NO 25						
Diktir pumpe		2				
Tip						
Godina proizvodnje						
Proiz.						
Protok						
Napor						
El. motor						
Snaga						
Napon						
Meh. zaštita						
Broj obrtaja						
Tip						
Proizv.						
Rezervoar vode		2				
Zapremina						
Dimenzije						
Proizv.						
Prestrujni ventil		1				
Veličina NO 65 NP 16						
Tip						
Proizv.						
Sigurnosni ventil		1				
Veličina NO NP 16						

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NO		NP			65			
NO		NP						
NO		NP						
NO		NP						
NO		NP						
NO		NP						
NO		NP						
Hvatači nečistoće								
Radni medij								
Radna temperatura								
Radni pritisak								
Proizv.								
NO		NP			3			
NO		NP	16		5			
NO		NP						
NO		NP						
NO		NP						
NO		NP						
NO		NP						
NO		NP						
Nepovratni ventili (ravne izvedbe)								
Radni medij								
Radna temperatura								
Radni pritisak								
Proizv.								
NO	200	NP	16		6			
NO	32	NP	16		2			
NO		NP						
NO		NP						
NO		NP						
		NP						
		NP						
NO		NP						
NO		NP						
Rezervoar za punjenje sistema vodom								
Zapremina								
Dimenzije								
Proizv.								
Prirubnice sa grlom za zavarivanje (DIN-2633)								
	250	NP	16		26			
	200	NP			52			
	100	NP	16		37			
	150	NP	16		10			
	80	NP	16		16			
	65	NP			12			
	50	NP			14			
	25	NP			50			
Izolacija (mineralna vuna)				kg	2500	1000		
Aluminijski lim debljine 0,5 mm				m²	320	150		
Ostalo				KOM		1		
			SUPTRAKT					
Proizv.								
Broj reg.								
Priključak								
Ostalo								
Broj reg.								
Priključak			SPOJEVI					
Spojnice od klingerita (sa prirubničke strane)								
Dimenzija								
	250				26			
	20				52			
	100				22			
	150				10			
	80							
	65							

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Tip							
Proizv.							
Reg. podr.							
Radni medij							
Radna temperatura							
Čelične bešavne cijevi DIN-2448							
NO 300 (323x7,1)							
NO 250 (267x6,3)							
NO 200 (219,1x5,9)		M	225				
NO 150 (159x4,5)		M	52				
NO 125 (133x4)							
NO 100 (114,3x3,6)		M	15				
NO 80 (88,9x3,6)		M	35				
NO 65 (76,1x2,9)							
NO 50 (63,5x2,9)		M	37				
NO 40 (48,3x2,6)							
NO 32 (42,4x2,6)		M	15				
NO 25 (33,7x2,6)		M	37				
NO 20 (26,9x2,6)		M	25				
NO 15 (21,3x2,0)		M	70				
Zatvarači zaporni leptirasti (disk-zatvarači)							
Radni medij							
Radna temperatura							
Radni pritisak							
Proizv.							
NO 250	NP 16	KOM	13				
NO 200	NP 16	KOM	17				
NO 150	NP 16	KOM	16				
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
Ravni zaporni ventili							
Radni medij							
Radna temperatura							
Radni pritisak							
Proizv.							
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
Zasuni		KOM	1				
Radni medij							
Radna temperatura							
Radni pritisak							
Proizv.							
NO 100	NP 16						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
NO	NP						
Kuglaste slavine							
Radni medij							
Radna temperatura							
Radni pritisak							
Proizv.							
NO 50	NP 16		9				
32	NP 16		2				
	NP 16						

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Radni medij						
Rad. pritisak						
Rad. temperatura						
Proizv.						
Temperaturni senzor (sa kapilarom)						
Priključak						
radni medij						
rad. pritisak						
rad. temperatura						
Termoleguratori bez pomoćne energije						
Termoregulacioni ventil						
Veličina NO NP						
Radni medij						
Rad. pritisak						
Rad. temperatura						
Proizv.						
Temperaturni senzor (sa kapilarom)						
Priključak						
radni medij						
rad. pritisak						
rad. temperatura						
Termoleguratori bez pomoćne energije						
Termoregulacioni ventil						
Veličina NO NP						
Radni medij						
Rad. pritisak						
Rad. temperatura						
Proizv.						
Temperaturni senzor (sa kapilarom)						
Priključak						
radni medij						
rad. pritisak						
rad. temperatura						
Otvorena ekspanziona posuda						
Dimenzije						
Zapremina						
Radna temperatura						
Manometri						
Prečnik						
Raspon mjerenja						
Priključak						
Proizv.						
Manometri						
Prečnik						
Raspon mjerenja						
Priključak						
Proizv.						
Termometri sa stakl. cijevi u mesinganoj čauri	KOH		8			
Priključak - RAVNI						
Pod. mjerenja 0-100°C						
Proizv.						
Nivoregulator						
Tip						
Proizv.						
Veličina						
Priključak otvora NO NP						
Raspon priključaka						
Nivoregulator						
Tip						
Proizv.						
Veličina						
Priključak otvora NO NP						
Raspon priključaka						
Nivoregulator						
Tip						
Proizv.						
Priključak						
Nivoregulator						
Tip						

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Tip						
Proizv.						
kVs =						
Radni medij						
Radni pritisak						
Radna temp.						
Veličina NO NP						
El. motor						
Snaga						
Napon						
Meh. zaštita						
Regulacioni el. motorni ventili trokraki	[illegible]		5		[illegible]	[illegible]
Tip [illegible]						
Proizv. [illegible]					[illegible]	
kVs =						
Radni medij [illegible]						
Radni pritisak						
Radna temp.						
Veličina NO [illegible] NP 16						
El. motor [illegible]						
Snaga						
Napon [illegible]						
Meh. zaštita						
Regulaciono pojačalo	[illegible]		5		[illegible]	
Tip [illegible]						
Proizv. [illegible]						
Podr. regul.						
El. snaga						
Napon						
Temperaturni senzor za spoljne uticaje	[illegible]	1				
Tip						
Proizv.						
Podr. regul.						
Temperaturni senzor za tečnost	[illegible]		2			
Tip						
Proizv.						
Radni medij						
Rad. temp.						
Rad. pritisak						
Rad. područje						
Temperaturni granični termostat						
Tip						
Proizv.						
Podr. regul.						
Radni medij						
Rad. temp.						
Rad. pritisak						
Regulacioni el. motorni ventili trokraki						
Tip						
Proizv.						
kVs =						
Radni medij						
Radni pritisak						
Radna temp.						
Veličina NO NP						
El. motor						
Snaga						
Napon						
Meh. zaštita						
Regulacioni el. motorni ventili trokraki						
Tip						
Proizv.						
kVs =						
Radni medij						
Radni pritisak						
Radna temp.						
Veličina NO NP						
El. motor						
Snaga						

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Broj obrtaja						
Tip						
Proizv.						
Aksijalni kompenzatori						
Tip						
Proizv.						
Veličina NO NP						
Veličina NO NP						
Veličina NO NP						
Veličina NO NP						
Razdjeljivač	KOM	1				
Proizv.						
Dimenzije						
Prečnik						
Dužina						
Radni medij	TOP. VODA					
Radni pritisak						
Radna temperatura						
Razdjeljivač	KOM	1				
Proizv.						
Dimenzije						
Prečnik						
Dužina						
Radni medij						
Radni pritisak						
Radna temperatura						
Razdjeljivač	KOM	1				
Proizv.						
Dimenzije						
Prečnik						
Dužina						
Radni medij						
Radni pritisak						
Radna temperatura						
Razdjeljivač	KOM	1				
Proizv.	UNIONINVEST					
Dimenzije						
Prečnik	Ø 700					
Dužina	3120 m.m					
Radni medij	TOD. VODA					
Radni pritisak	4 b					
Radna temperatura	100°					
Razdjeljivač	KOM	1				
Proizv.	UNIONINVEST					
Dimenzije						
Prečnik	Ø 700					
Dužina	2820 m.m					
Radni medij	TOP. VODA					
Radni pritisak						
Radna temperatura	100°C					
Razdjeljivač	KOM	2				
Proizv.	UNIONINVEST					
Dimenzije						
Prečnik	Ø 700 / Ø 700					
Dužina	3120 / H = 2500					
Radni medij	TOP. VODA					
Radni pritisak						
Radna temperatura	100° / 70°					
Globni kompenzatori						
	KOM	6				
Proizv.		6				
Radni pritisak		8				
Radna temp.		4				
Veličina	TD		3		TEKA	
	TD16/200/N/0 NP	3				
	GS16/250/N/0 NP	4				
	GS16/200/N/0 NP	KOM 1				
	NP					
Regulacioni el. motorni ventili trokraki						

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zmjenjivač toplote						
El. grijač						
Snaga						
"S" izvedba DA NE						
Medijski grijač						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp.						
Ogrijevna površina cijevnog registra						
Izmjenjivač toplote						
El. grijač						
Snaga						
"S" izvedba DA NE						
Medijski grijač						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp.						
Ogrijevna površina cijevnog registra						
emijska priprema vode						
mekšivač vode	KOM	2				
JP 2x4 m3/h						
roizvodač "MIVEL" BEOGRAD						
od. pr. 1986						
snovni podaci						
običajeni protok omekšane vode						
nimalni protok						
pacitet imeđu regeneracije						
sa za izmjenu jona						
edstvo za regeneraciju						
hinjska sol NaCl po jednoj regeneraciji)						
x. radni pritisak						
lj. na vod. mrežu						
ličina pijeska 1-2 mm						
ličina pijeska 5-7 mm						
mekšivač						
li						
ostruki						
ude za jonsku masu						
ude za sol 500	KOM	1				
tura na omekšivačima						
tili						
NP 16	KOM	8				
NP 16	KOM	2				
NP 16	KOM	2				
povratni ventil						
NP 16	KOM	1				
NP						
mjer						
k						
laj za doziranje hidrazina						
a posude 200 l	KOM	1				
HRASNIK "THI"		1				
a pupma						
TN 56B7814CBO						
ELEKTRO KOVINA						
let 2600 l/min						
0,09 kW						

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Tip						
Godina proizvodnje 1966						
Proiz. "MIDEL" BEOGRAD						
Topl. snaga 3,5 MW						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp.						
Ogrijevna površina cijevnog registra						
Izmjenjivači toplote		2				
Tip						
Godina proizvodnje						
Proiz.						
Topl. snaga 3,5 MW						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp. 100 °C						
Ogrijevna površina cijevnog registra						
Izmjenjivači toplote						
Tip						
Godina proizvodnje						
Proiz.						
Topl. snaga						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp.						
Ogrijevna površina cijevnog registra						
Izmjenjivači toplote						
Tip						
Godina proizvodnje						
Proiz.						
Topl. snaga						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp.						
Ogrijevna površina cijevnog registra						
Izmjenjivači toplote						
Tip						
Godina proizvodnje						
Proiz.						
Topl. snaga						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp.						
Ogrijevna površina cijevnog registra						

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sa hlađenjem						
bez hlađenja						
Pumpe za dopunu sistema vodom						
Tip						
Godina proizvodnje						
Proiz.						
Protok						
Napor						
Usis NO NP						
Potis NO NP						
El. motor						
Snaga						
napon						
Meh. zaštita						
Broj okretaja						
Pumpe za dopunu sistema vodom						
Tip						
Godina proizvodnje						
Proiz.						
Protok						
Napor						
Usis NO NP						
Potis NO NP						
El. motor						
Snaga						
napon						
Meh. zaštita						
Broj okretaja						
Pumpe za dopunu sistema vodom						
Tip						
Godina proizvodnje						
Proiz.						
Protok						
Napor						
Usis NO NP						
Potis NO NP						
El. motor						
Snaga						
napon						
Meh. zaštita						
Broj okretaja						
Pumpe za dopunu sistema vodom						
Tip						
Godina proizvodnje						
Proiz.						
Protok						
Napor						
Usis NO NP						
Potis NO NP						
El. motor						
Snaga						
napon						
Meh. zaštita						
Broj okretaja						
Izmjenjivači toplote KOTLU BR. 1	KOM 1	2				
Tip						
Godina proizvodnje 1988						
Proiz. HINEL BEOGRAD						
Topl. snaga						
Primar						
Medij						
Rad. pr.						
Rad. temp.						
Sekundar						
Medij						
Rad. pr.						
Rad. temp.						
Ogrijevna površina cijevnog registra						
Izmjenjivači toplote	KOM	2				

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Priključak						
Manometar	KOM		6		[illegible]	[illegible]
Proizv.						
Prečnik	[illegible]					
Rad. podr.	[illegible]					
Priključak						
Manometar na [illegible] cijevne	KOM		45		1 FAZA	ZAMJEDA
Proizv.						
Prečnik	[illegible]					
Rad. podr.						
Priključak						
Cirkulacione pumpe	KOM	4				
Tip	[illegible]					
Godina proizvodnje	[illegible]					
Proiz.	[illegible] ZAGREB					
Protok	10.0 l/s					
Napor	[illegible] m					
Usisna prirubnica NO NP						
Potisna prirubnica NO NP						
Radni medij	TOPLA VODA					
Rad. pritisak						
Rad. temperatura	[illegible] °C					
El. motor	[illegible] SUBOTICA					
Snaga	[illegible] kW					
napon	380 V					
Meh. zaštita	IP 54					
Broj okretaja	[illegible] o/min					
Pumpe						
temeljne	[illegible]					
linijske						
sa hlađenjem	[illegible]					
bez hlađenja						
Cirkulacione pumpe	KOM		2		1 FAZA	ZAMJEDA
Tip	[illegible]					
Godina proizvodnje						
Proiz.	[illegible]					
Protok	[illegible]					
Napor	[illegible]					
Usisna prirubnica NO NP						
Potisna prirubnica NO NP						
Radni medij	TOPLA VODA					
Rad. pritisak						
Rad. temperatura	80°C					
El. motor	MAX UVOH-4 - KONČAR ZAGREB					
Snaga	[illegible] kW					
napon	380 V					
Meh. zaštita	[illegible]					
Broj okretaja	[illegible] o/min					
Pumpe						
temeljne	[illegible]					
linijske						
sa hlađenjem	[illegible]					
bez hlađenja						
Cirkulacione pumpe						
Tip						
Godina proizvodnje						
Proiz.						
Protok						
Napor						
Usisna prirubnica NO NP						
Potisna prirubnica NO NP						
Radni medij						
Rad. pritisak						
Rad. temperatura						
El. motor						
Snaga						
napon						
Meh. zaštita						
Broj okretaja						

NEMIJENJATI DOKUMENT

God. pr.						
Proiz.						
Protok						
Napor						
El. motor						
Tip						
God. proiz.						
Proizv.						
El. snaga						
Napon						
Meh. zaštita						
Regulacioni termostat						
Tip						
Proiz.						
Radni medij						
Podr. regul.						
Regulacioni termostat						
Tip						
Proiz.						
Radni medij						
Podr. regul.						
Regulacioni termostat						
Tip						
Proiz.						
Radni medij						
Podr. regul.						
Regulacioni termostat						
Tip						
Proiz.						
Radni medij						
Podr. regul.						
Regulacioni termostat						
Tip						
Proiz.						
Radni medij						
Podr. regul.						
Armatura na kotlu						
Nepovratni ventil						
NO NP 16.	KOM	3				
NO NP						
NO NP						
NO NP						
NO NP						
Ravni zaporni ventil						
NO 200 NP 16	KOM	6				
NO 65 NP 16	KOM	9				
NO 50 NP 16	KOM	12				
NO 20 NP 16	KOM	12				
NO NP 16.	KOM	57				
Kuglaste slavine						
NO 80 NP 16	KOM	6				
NO 50 NP 16	KOM	2				
NO NP						
NO NP						
NO NP						
Manometar SA TROK. SLAVINOM 1/2"	KOM		3		I FAZA	[illegible]
Proizv.						
Prečnik Ø 200						
Rad. podr. 0-16						
Priključak 1/2"						
Manometar SA TROK. SLAVINOM 1/2"	KOM	3	3		I FAZA	[illegible]
Proizv.						
Prečnik Ø 200						
Rad. podr. 0-15 K						
Priključak 1/2"						
Manometar SA TROK. SLAVINOM 1/2"	KOM		3		I FAZA	[illegible]
Proizv.						
Prečnik Ø 100						
Rad. podr. 0-0,6N						

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Proiz.						
Ogrij. površina						
Radni medij						
Rad. pritisak						
Rad. temperatura						
Izmjenjivač toplote za kotao br.:						
Tip						
God. pr.						
Proiz.						
Ogrij. površina						
Radni medij						
Rad. pritisak						
Rad. temperatura						
Posuda za uzimanje uzoraka kotlovske vode	KOM	3				
Kotlovske pumpe	KOM	6				
Tip S8P520B-4						
God. pr. 1986						
Proiz. MZ. TITO - SKOPLJE						
Protok 61,8·10⁻³ l/s						
Napor 9m						
El. motor						
Tip 2k 90LH						
God. proiz.						
Proizv. SEVER SUBOTICA						
El. snaga 1,5 kW						
Napon Δ 380V						
Meh. zaštita IP 54						
Kotlovske pumpe						
Tip						
God. pr.						
Proiz.						
Protok						
Napor						
El. motor						
Tip						
God. proiz.						
Proizv.						
El. snaga						
Napon						
Meh. zaštita						
Kotlovske pumpe						
Tip						
God. pr.						
Proiz.						
Protok						
Napor						
El. motor						
Tip						
God. proiz.						
Proizv.						
El. snaga						
Napon						
Meh. zaštita						
Kotlovske pumpe						
Tip						
God. pr.						
Proiz.						
Protok						
Napor						
El. motor						
Tip						
God. proiz.						
Proizv.						
El. snaga						
Napon						
Meh. zaštita						
Kotlovske pumpe						
Tip						

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Meh. zaštita						
Nivoregulator za kotao br.: 2	KOM	1				
Tip						
God. pr.						
Proiz.						
Dimenzije priključaka						
NO NP						
Raspon priključaka						
Napon						
Meh. zaštita						
Nivoregulator za kotao br.: 3	KOM	1				
Tip 1120124						
God. pr. 1983						
Proiz. ATH ZAGREB						
Dimenzije priključaka						
NO NP						
Raspon priključaka						
Napon						
Meh. zaštita						
Nivoregulator za kotao br.:						
Tip						
God. pr.						
Proiz.						
Dimenzije priključaka						
NO NP						
Raspon priključaka						
Napon						
Meh. zaštita						
Nivoregulator za kotao br.:						
Tip						
God. pr.						
Proiz.						
Dimenzije priključaka						
NO NP						
Raspon priključaka						
Napon						
Meh. zaštita stakom						
Vodokaz (sa ~~staklom~~) SA KRUŽNICOM	KOM				JEDAN	ZAMJENA
Priključci USTAKLA 300 mm						
NO NP						
Raspon priključaka 450 mm						
Proizvođač TPL ZAGREB						
Izmjenjivač toplote za kotao br.: 1						
Tip						
God. pr.						
Proiz.						
Ogrij. površina						
Radni medij						
Rad. pritisak						
Rad. temperatura						
Izmjenjivač toplote za kotao br.:						
Tip						
God. pr.						
Proiz.						
Ogrij. površina						
Radni medij						
Rad. pritisak						
Rad. temperatura						
Izmjenjivač toplote za kotao br.:						
Tip						
God. pr.						
Proiz.						
Ogrij. površina						
Radni medij						
Rad. pritisak						
Rad. temperatura						
Izmjenjivač toplote za kotao br.:						
Tip						
God. pr.						

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Presostat za kotao br.: 1 - RADNI	KOM	1				
Tip						
Proiz. WANNDORF						
Podr. regul. 2 - 4 bara						
Presostat za kotao br.: 1 - GRANICNI	KOM	1				
Tip						
Proiz. WANNDORF						
Podr. regul. 2 - 4 bara						
Presostat za kotao br.:	KOM	1				
Tip						
Proiz. - GYR						
Podr. regul.						
Presostat za kotao br.: 2 - RADNI		1				
Tip						
Proiz.						
Podr. regul.						
Presostat za kotao br.:						
Tip						
Proiz. WANNDORF						
Podr. regul.						
Presostat za kotao br.:			1		TFAZA	
Tip QBE 21 102 - RA						
Proiz. LANDIS - GYR						
Podr. regul.						
Presostat za kotao br.: 3 - RADNI	KOM	1				
Tip 9322376						
Proiz. TRAFAK - AG						
Podr. regul. 0 - 4 bara						
Presostat za kotao br.: 3 - GRANICNI	KOM	1				
Tip 9322.376						
Proiz. TRAIAK - AG WANNDORF						
Podr. regul.						
Presostat za kotao br.: 3 - SIGURNOSNI	KOM		1			
Tip QBE 21.102 - RA						
Proiz. LANDIS - GYR						
Podr. regul.						
Presostat za kotao br.:						
Tip						
Proiz.						
Podr. regul.						
Presostat za kotao br.:						
Tip						
Proiz.						
Podr. regul.						
Presostat za kotao br.:						
Tip						
Proiz.						
Podr. regul.						
Presostat za kotao br.:						
Tip						
Proiz.						
Podr. regul.						
Presostat za kotao br.:						
Tip						
Proiz.						
Podr. regul.						
Nivoregulator za kotao br.: 1	KOM		1		LIMA	
Tip 1128124						
God. pr. 1983						
Proiz. - AGPCE						
Dimenzije priključaka						
NO NP						
Raspon priključaka						
Napon						

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Rad. medij TOPLA VODA						
Rad. pritisak						
Rad. temperatura 70°C TOPLE						
Sigurnosni ventil (na strani ~~vrele~~ vode) za kotao br.: 2 / KOH 1						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvaranja						
Ventil						
ugaoni DA						
ravni						
sa oprugom						
sa tegom						
NO 80 NP 16						
Rad. medij TOPLA VODA						
Rad. pritisak						
Rad. temperatura 70°C TOPLE						
Sigurnosni ventil (na strani ~~vrele~~ vode) za kotao br.: 3 / KOH 1						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvaranja 4 bara						
Ventil						
ugaoni DA						
ravni						
sa oprugom						
sa tegom DA						
NO 80 NP 16						
Rad. medij TOPLA VODA						
Rad. pritisak						
Rad. temperatura 70°C						
Sigurnosni ventil (na strani vrele vode) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvaranja						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani vrele vode) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvaranja						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani vrele vode) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvaranja						

BEST AVAILABLE DOCUMENT

Proiz.						
Fabrički broj						
Prit. otvar.						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani pare) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvar.						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani pare) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvar.						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani pare) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvar.						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani ~~vrele~~ TOPLE vode) za kotao br.: 1/KO 1						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvaranja						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						

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sa oprugom						
sa tegom DA						
NO 100 NP 16						
Rad. medij PARA						
Rad. pritisak 0,6 bar						
Rad. temperatura 100°C						
Sigurnosni ventil (na strani pare) za kotao br.:	3 KOM	3				
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvar. 0,6 bar						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij PARA						
Rad. pritisak bar						
Rad. temperatura 100°C						
Sigurnosni ventil (na strani pare) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvar.						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani pare) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvar.						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani pare) za kotao br.:						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Prit. otvar.						
Ventil						
ugaoni						
ravni						
sa oprugom						
sa tegom						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani pare) za kotao br.:						
Tip						
Godina proizvodnje						

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Elektromotor						
Tip						
God.pr.						
Proizv.						
Fab. br.						
El .snaga						
Napon						
Meh. zaštita						
Broj okretaja						
Kotao br.						
Tip						
Godina proizvodnje						
Proiz.						
Tvornički broj						
Nazivna snaga kW						
Primarni medij						
radni pritisak						
radna temperatura						
Sekundarni medij						
radni pritisak						
radna temperatura						
Gorionik						
Tip						
Godina proizvodnje						
Proiz.						
Tvornički broj						
Nazivna opterećenje						
Pot. teć. goriva						
Pot. prirodnog plina						
Ventilator za dobavu zraka						
Tip						
Godina proizvodnje						
Proiz.						
Fab.br.						
Dobava vaz.						
Raspo. prit.						
Elektromotor						
Tip						
God.pr.						
Proizv.						
Fab. br.						
El .snaga						
Napon						
Meh. zaštita						
Broj okretaja						
Sigurnosni ventil (na strani pare) za kotao br.:	1. KOM	3				
Tip VGT						
Godina proizvodnje						
Proiz.						
Tvornički broj						
Prit. otvar. [illegible]						
Ventil						
ugaoni DA						
ravni						
sa oprugom						
sa tegom DA						
NO NP						
Rad. medij						
Rad. pritisak						
Rad. temperatura						
Sigurnosni ventil (na strani pare) za kotao br.:	2. KOM	3				
Tip VGT						
Godina proizvodnje						
Proiz.						
Tvornički broj						
Prit. otvar. [illegible]						
Ventil						
ugaoni DA						
ravni						

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Proizv. SEVER SUBOTICA						
Fab. br.						
El .snaga 22 KW						
Napon Δ 380 V						
Meh. zaštita IP 54						
Broj okretaja 2918 o/min						
Kotao br.		1				
Tip TEMO						
Godina proizvodnje 1986						
Proiz. MINEL BEOGRAD						
Fabrički broj 4753						
Nazivna snaga ~~kW~~ 4 MW						
Primarni medij VISOKT. PARA						
radni pritisak 2,5 bara						
radna temperatura		-				
Sekundarni medij TOPLA VODA						
radni pritisak						
radna temperatura 100°C						
Gorionik		1				
Tip PT 100						
Godina proizvodnje 1985						
Proiz. TIK ZAGREB						
Fabrički broj 0196						
Nazivna opterećenje [illegible]						
Pot. teč. goriva 275 kg/h – 330 kg/h						
Pot. prirodnog plina [illegible]						
Ventilator za dobavu zraka		1				
Tip EVR 63						
Godina proizvodnje 1986						
Proiz. "MINEL" BEOGRAD						
Fab.br. 18863						
Dobava vaz. 2893 m³/s						
Rasp. prit. 48,66 mbar						
Elektromotor						
Tip ZK-180M2						
God.pr. 1986						
Proizv. SEVER" SUBOTICA						
Fab. br.						
El .snaga 22 kW						
Napon 380 V						
Meh. zaštita IP 54						
Broj okretaja 2918 o/min						
Kotao br.						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Nazivna snaga kW						
Primarni medij						
radni pritisak						
radna temperatura						
Sekundarni medij						
radni pritisak						
radna temperatura						
Gorionik						
Tip						
Godina proizvodnje						
Proiz.						
Fabrički broj						
Nazivna opterećenje						
Pot. teč. goriva						
Pot. prirodnog plina						
Ventilator za dobavu zraka						
Tip						
Godina proizvodnje						
Proiz.						
Fab.br.						
Dobava vaz.						
Rasp. prit.						

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B/1

Oprema	Jed. mj kom. m2, m	Ocjena: Ispravno	Oštećeno	Nedostaje		Prijedlog Riješenja
Kotao br. 1	KOM	1				
Tip TE 10						
Godina proizvodnje 1980						
Proiz. MINEL BEOGRAD						
Fabrički broj 1150						
Nazivna snaga kW 7	MW	7				
Primarni medij PARA NISKOTLAČNA						
Radni pritisak 0,5 b						
Radna temperatura 110°C						
Sekundarni medij TOPLA VODA						
Radni pritisak 3,2 b						
Radna temperatura 100°C						
Gorionik	KOM	1				
Tip OT 100						
Godina proizvodnje 1986						
Proiz. FABRIKA						
Fabrički broj 1[illegible]						
Nazivna opterećenje [illegible] max 950 kW						
Pot. teč. goriva [illegible] 336 kg/h						
Pot. prirodnog plina [illegible]						
Ventilator za dobavu zraka	KOM	1				
Tip EVR 63						
Godina proizvodnje						
Proiz. „MINEL" BEOGRAD						
Fab.br.						
Dobava vaz. [illegible] m³/h						
Rasp. prit. [illegible] mbara						
Elektromotor						
Tip ZK [illegible]						
God.pr.						
Proizv. [illegible]						
Fab. br.						
El .snaga [illegible]						
Napon [illegible]						
Meh. zaštita [illegible]						
Broj okretaja [illegible]						
Kotao br. 2	KOM	1				
Tip TE 10						
Godina proizvodnje 1986						
Proiz. „MINEL" BEOGRAD						
Fabrički broj 1[illegible]						
Nazivna snaga ~~kW~~ 7 MW	MW					
Primarni medij NISKOT. PARA						
radni pritisak 0,5 b						
radna temperatura [illegible]						
Sekundarni medij TOPLA VODA						
radni pritisak 3,2 [illegible]						
radna temperatura [illegible]						
Gorionik	KOM	1				
Tip						
Godina proizvodnje [illegible]						
Proiz. [illegible]						
Fabrički broj [illegible]						
Nazivna opterećenje [illegible] max 950 kW						
Pot. teč. goriva [illegible] kg/h – 336 kg/h						
Pot. prirodnog plina [illegible]						
Ventilator za dobavu zraka	KOM	1				
Tip PVR [illegible]						
Godina proizvodnje [illegible]						
Proiz. [illegible] BEOGRAD						
Fab.br. [illegible]						
Dobava vaz. [illegible] m³/h						
Rasp. prit. [illegible] mbara						
Elektromotor						
Tip [illegible]						
God.pr. [illegible]						

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KOTLOVNICA: KD III - 1

ADRESA: DOBRINJA 3A

UKUPNA SNAGA KOTLOVNICE 21 MW
UKUPNO OPTEREĆENJE KOTLOVNICE 24,4 MW

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54

NO 32 - (42,4x2,6)							
NO 25 - (33,7x4,6)	m1	90					
NO 20 - (26,9x2,3)							
NO 15 - (21,3x2,0)							
Izolacija cijevi							
Staklena vuna							
Al.lim 0.5 mm	m2	25					
Visokotlačne pumpe							
Tip:							
God.pr.							
Proiz.							
Protok							
Napor							
El.motor							
Snaga							
Napon							
Meh.zašt.							
Br.obrta							
Medijski dogrijač							
Tip:							
Proiz.							
Medij:							
Rad.priti.							
Rad.temp							
Električni dogrijač							
Tip:							
Proiz.							
Snaga:							
Napon:							
Posude za odvajanje zraka i plina	KOM	3					
Dimenzije:							

[illegible] L=1300mm KOM 6 ISPRAVNO

[illegible] Ø100 KOM 3 OŠTEĆENO

MANOMET. SKALINA 1/2 KOM 7 OŠTEĆENO 4+5 KOM ISPRAVNO

[illegible] KOM 3 ISPRAVNO

[illegible] KOM 3 OŠTEĆENO

[illegible] KOM 3 ISPRAVNO

[illegible] KOM 2 ISPRAVNO +1 KOM OŠTEĆEN

[illegible] KOM 3 ISPRAVNO

[illegible] KOM 1 —"—

[illegible] SKALINE 1/2" KOM 6 NEDOSTAJE

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Oprema	Jed. MJ kom. m2, m	Ocjena Ispravno	Oštećeno	Nedostaje		Prijedlog Riješenja	
Rezervoar goriva	KOM	1					
Zapremina V= 100m²							
Dimenzije							
Priključak za ulijevanje goriva	KOM	1					
SC 3"							
Odzračni ventili							
Ø 6/4"	KOM	1					
Mjerna letva							
zupčasta							
Cirkulacione pumpe	KOM	1	1		II FAZA		ZAMJENA
Tip: SZPD - 3							
God.pr.							
Proiz. METALOPRERADIVAČ - DRUVAR							
Protok Q - 3500 l/h							
Napor: 5 bara							
El.motor TIP 3KT 132 S-6							
Snaga 3 kW							
Napon 380 V							
Meh.zašt.							
Br.obrt. 980 O/min							
Prestrujni ventil	KOM	1					
Tip:							
Proiz.							
Prit.prestrujavanja 0,1-16							
Veličina: DN25 WP 40							
Filteri goriva	KOM	2					
Tip: PE40							
Proiz.							
Dupli DA							
Jednostruki							
Vakummetar							
Pod.mjer.							
Priključak							
Proizv.							
Manometar	KOM	5	4		I FAZA		
Pod.mjer. 0 - 40 bara							
Priključak M2"							
Proiz.							
Posude za odvajanje							
Plina i zraka							
Dimenzije							
Prestrujni ventil							
Tip:							
Proiz.							
Prit.prestruj.							
Veličina:							
Ravni zaporni ventili	KOM	3					
NO 40 NP 40	"	3					
NO 15 NP 40							
NO NP							
NO NP							
NO NP							
Kuglaste slavine							
NO NP 1"	KOM	16		2		I FAZA	
NO NP							
NO NP							
NO NP							
NO NP							
Hvatači nečistoče							
NO NP							
NO NP							
NO NP							
Cijevi čelične bešavne Din - 2448							
NO 50 - (63,5x2,6)							
NO 40 - (48,3x2,6)	m	80					

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A-1

Oprema (1)	Jed. MJ kom, m2, m (2)	Ocjena: Ispravno (3)	Oštećeno (4)	Nedostaje (5)		Prijedlog Rješenja (6)	
Rezervoar goriva	KOM	1					
Zapremina V= 100m3							
Dimenzije							
Priključak za ulijevanje goriva	KOM	1					
SC 3"							
Odzračni ventil							
Ø 6/4"	KOM	1					
Mjerna letva							
zupčasta							
Cirkulacione pumpe	KOM	1	1		I FAZA		ZAMJENA
Tip: SZPD - 3		-					
God.pr.							
Proiz. METALOPREDAJIVAC - DARUVAR		-					
Protok Q 3500 l/h		-					
Napor: 5 bara							
El.motor TIP 3KT 132 S-6							
Snaga 3 kW							
Napon 380 V							
Meh.zašt.							
Br.obrt. 980 0/min							
Prestrujni ventil	KOM	1					
Tip:							
Proiz.							
Prit.prestrujavanja 0,1-15							
Veličina: DN25 KVP 40							
Filteri goriva	KOM	2					
Tip: PE40							
Proiz.							
Duoli DA							
Jednostruki							
Vakummetar							
Pod.mjer.							
Priključak							
Proizv.							
Manometar	KOM	5	4		I FAZA		
Pod.mjer. 0 - 40 bara							
Priključak M2"							
Proiz.							
Posude za odvajanje							
Plina i zraka							
Dimenzije							
Prestrujni ventil							
Tip:							
Proiz.							
Prit.prestruj.							
Veličina:							
Ravni zaporni ventili	KOM	3					
NO 40 NP 16	"	3					
NO 25 NP 16							
NO NP							
NO NP							
NO NP							
Kuglaste slavine							
NO NP 1"	KOM	16		2		I FAZA	
NO NP							
NO NP							
NO NP							
NO NP							
Hvatači nečistoće							
NO NP							
NO NP							
NO NP							
Cijevi čelične bešavne Din - 2448							
NO 50 - (63.5x2.6)							
NO 40 - (48.3x2.6)	m	80					

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Gasna rampa i mjerni set/6

Oprema	Jed. mj kom, m2, m	Ocjena				Prijedlog Rješenja
		Ispravno	Oštećeno	Nedostaje		
Termometar	KOM		1		IZVAN	
Tip						
Proiz.						
Priključak						
Pod. mjer.						

A SLAVINA

MANOMETAR

DIN

CUMENO

DUZ

CIJEXNI

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APPENDIX B

Gas Connection Cost Estimates

Estimate Name: GAS5000

Qty	Description Craft@Hrs Unit	Material	Labor	Equip	Total
August 15, 1994					
Estimate for page 5 of IRC 5000 Proposal					
This estimate is to verify the estimate on page 5. The labor costs in the IRC estimate are based on 15% of the material costs.					
Top oof page 5 is for steel pipe and this estimate willalso be for steel pipe.					
1" threaded pipe installed on a clevis hanger every 7' and With a coupling each 20'					
14	M5@1.316 LF	26.32	52.78	0.00	79.10
3/4" threaded pipe installed on a clevis hanger every 7' and With an ell each 5'					
33	M5@5.511 LF	49.50	220.77	0.00	270.27
1/2" threaded pipe installed with a clevis hanger every 7' and With an ell each 5'					
33	M5@5.247 LF	44.22	210.21	0.00	254.43
Tees, 3/4" 150 lb, malleable iron					
1	M5@0.799 Ea	1.40	32.00	0.00	33.40
Couplings, 3/4" 150 lb, malleable iron					
3	M5@1.467 Ea	3.60	58.80	0.00	62.40
Ball valves, bronze, 150 lb steam working pressure, threaded, Teflon seat 1/2"					
2	M5@1.150 Ea	10.80	46.00	0.00	56.80
3/4"					
1	M5@0.617 Ea	8.15	24.70	0.00	32.85
Adapter PE/St 32/1" use 1" tee prices 150 lb, malleable iron					
1	M5@1.020 Ea	2.40	40.90	0.00	43.30
Double male connector 3/4" and Hollender 3/4" use 3/4" union prices 150 lb, malleable iron					
3	M5@1.632 Ea	21.75	65.40	0.00	87.15
Hose conn. 1/2" use 1/2" coupling prices 150 lb, malleable iron					
2	M5@0.864 Ea	2.00	34.60	0.00	36.60
Gas hose use flex. electric conduit prices 1/2"					
20	E4@0.780 LF	6.60	31.40	0.00	38.00
Hose clamps use IRC prices					
4	0.200 each	0.80	0.00	0.00	0.80

Total hours labor 21hr.
Total material costs $201.

Cost per user with steel pipes page 6 IRC proposal

Equipment from page 6 IRC	$272
Materials	$201
Labor 21 hours at $3.40/hr.	$ 72

Estimate Name: GAS5000

Total $545

IRC total for above is $491, Material estimate by IRC is about 50% low.
My labor cost at $3.40/hr is high by local standards.

Total Material, Labor, and Equipment:

21	177.54	817.56	0.00	995.10 *

Items Not Included in Material, Labor and Equipment: 0.00

Subtotal:		995.10 *
G&A %:	10.00	99.50
Profit%:	10.00	109.50
Estimate Total:		1,204.10**

APPENDIX C

List of People Contacted

PREDUZEĆE ZA INŽENJERING
U ENERGETICI 3E
71000 SARAJEVO
~~Gundulićeva 62, PP 65~~ V. PERIĆA 16
Tel./Fax 071 ~~216 036~~
664-261

Milovan GUTOVIĆ dipl. ing
Inženjer projekta

Stan: Vahide Maglajlić 1, Tel. 071 466 580

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U ENERGETICI 3E
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Inženjer projekta
Direktor

Stan: Bratstva i jedinstva 12, Tel. 071 529 942

idea

Technical Management Support to the
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U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

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19 78

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Murat HANJALIĆ, *dipl ecc.*
generalni direktor

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Technology, Resource, Application & Management consultants

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President

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Phone (818) 783-7368

Mirsad Sirća
~~prodaj. poslov. kolegj. organa~~
GEN. DIREKTOR
(071) 732-704

VITEX VISOKO

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RO TEKSTILNA INDUSTRIJA "VITEX" VISOKO
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Stan: 71300 Visoko, Delahmetovića 1a Telefon: (071) 732-655
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Fred J. Bieganski
Infrastructure Development Officer
Bureau for Europe
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63

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PUBLIC ENTERPRISE FOR TRANSPORT
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SARAJEVO - BOSNIA AND HERZEGOVINA

SELMANOVIC SALIH mech. eng
GENERAL MANAGER

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- 387 / 522820

ALDIJANA BUHIĆ
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APPENDIX D

Scope of Work Performed by Resource Management Associates

SARAJEVO REHABILITATION PROGRAM

ASSESSMENT OF ENERGY SUPPLY SITUATION
AND OF THE PROPOSED REHABILITATION PLANS
AND
SURVEY OF DISTRICT HEATING SYSTEMS
AND B/P STORAGE FACILITIES

SCOPE OF WORK

BACKGROUND

The International Rescue Committee (IRC), a U.S. non-governmental organization, has prepared plans for rehabilitation of the Sarajevo energy supply systems before the 1994/95 winter season. USAID plans to fund some of the rehabilitation activities in order to help satisfy the basic health, heating, cooking and safety needs of the people of Sarajevo. Other donors are expected to contribute to this purpose.

IRC proposes to implement the rehabilitation plans using Toplane and EGT Sarajevo as local subcontractors. IRC would manage the projects and be responsible for procurement and contracting.

OVERALL TASK

To visit Sarajevo and, working closely with IRC, UN Special Coordinator for Sarajevo (SCS), host country and USAID representatives, to conduct the necessary surveys, assessments, analyses in order to evaluate and, if necessary, to supplement and/or modify the IRC plans for emergency rehabilitation of the Sarajevo energy supply systems before the 1994/95 winter season. To coordinate plans with other donors working in Sarajevo. To prepare reports and recommendations.

SPECIFIC TASKS

1. To conduct a survey of up to 26 gas-fueled district heating systems - as many should be surveyed as necessary to reach conclusions related to the rehabilitation plans.

2. To assess IRC project plans for rehabilitation of the district heating systems.

3. To assess IRC project plans for replacement of makeshift terminal connections to 5,000 users.

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4. To analyze the performance and potential dangers of the natural gas transmission, distribution and internal building systems including burners, boilers, etc. and the district heating systems in the environment of gas supply interruptions and extremely low gas pressures as experienced during the 1993/84 winter.

5. To survey the Sarajevo butane-propane storage and distribution facilities and assess the IRC project plans for rehabilitation of the butane-propane storage and distribution facilities and for delivery of butane-propane to Sarajevo.

6. To confirm the IRC assessment of the energy supply situation including estimates of availability of electric power, coal, firewood and kerosene.

7. In case the IRC plans are not appropriate, to supplement them and/or offer alternative proposals.

8. To comment on the usefulness and practicality of providing building insulation/winterization materials.

9. To comment on IRC cost estimates.

10. To suggest, if appropriate, expansion of the plans for rehabilitation of the Sarajevo energy supply systems - this could be quantitative expansion (e.g. rehabilitation of more district heating systems) or additional related tasks. Rough cost estimates should be provided.

STAFFING REQUIREMENTS

An expert engineer experienced in urban gas distribution and heating systems. The engineer is expected to spend approximately 12 days in Sarajevo followed by one week in the U.S. preparing the final report and briefing USAID officials.

IN-COUNTRY COORDINATION AND COUNTERPARTS

The engineer will work closely with the USAID Representative for Bosnia, Mr. Dayton Maxwell, and with IRC, UN Special Coordinator for Sarajevo (SCS) and host country representatives. He will also meet and coordinate with other UN officials, other donors (in particular, UK and Dutch) and cognizant local authorities.

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REPORTS

Before leaving Sarajevo, the engineer shall prepare a draft summary report and make it available to the USAID Representative. A draft of the complete final report shall be submitted to USAID for review and comments within a week from the engineer's return to the U.S. Ten copies of the final report incorporating USAID comments shall be submitted 10 days after the receipt of USAID comments.

TRAVEL ARRANGEMENTS

The engineer will travel to Zagreb, Croatia, by commercial aircraft, arriving no later than 10:00AM on August 9, 1994. He will arrange to meet with the USAID Representative, Mr. Dayton Maxwell. From Zagreb to Sarajevo, travel will be on special aircraft under UN identity documents. Security protection in Sarajevo will be offered. In case security consideration so require, the engineer shall take direction from the USAID Representative with respect to any changes of the project schedule or travel routing.

ATTACHMENTS:

1. Summary Report on Delivery of Gas to Sarajevo, C.W. Wickland, IRC/I, December 18, 1993.

2. IRC-Sarajevo Gas Project Team Opinion and Recommendations - Relating Actual City Energy Supply Situation, IRC, July 12, 1994.

3. Urgent Repairs to the Public Heating - Project Proposal, IRC, July 1994.

4. Replacement of Makeshift Connections for 5,000 Beneficiaries - Project Proposal, IRC, July 1994.

5. Rehabilitation of Propane-Butane Storage Capacities and Delivery of Propane-Butane to the City of Sarajevo, IRC, July 11, 1994.

IRC

6. Final Report, Joint UK/US Civil Planning Mission to Sarajevo, May 1994.

40801RMA.SOW

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APPENDIX E

Report on the Status of Gas Delivery to Sarajevo
by Clayton W. Vickland (Pages 1-3)

Dayton Maxwell

REPORT ON THE STATUS OF GAS DELIVERY TO SARAJEVO FOR THE PERIOD FROM FEBRUARY 9, 1994 TO MARCH 15, 1994,

WITH

DISCUSSION OF RECONSTRUCTION STRATEGIES

Prepared by

Clayton W. Vickland

Intertect Relief and Reconstruction Company

International Rescue Committee

March 16, 1994

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I. INTRODUCTION

This report summarizes the findings of a continuing review of the delivery of natural gas to Sarajevo for the period from February 10, 1994 to March 16, 1994. The report expands upon two previous reports covering the period from November 16, 1993 to February 9, 1994.

II SUMMARY

A. Current Status

The current flow rate of natural gas to Sarajevo is approximately 24,000 cubic meters per hour (CMPH), which, because of the general warming trend in the weather, provides a sufficient quantity of gas to meet the needs of Sarajevo at the present time. The gas flow rate reached the level of 36,000 CMPH during the colder weather before the needs of the city were satisfied by the incoming gas flow rate. Gas is not provided to the Community of Sokolovic Kolonija or the cities of Zenica and Visoko.

Inadequate quantities of gas provided by the Yugoslavian Government during the coldest part of the winter, coupled with the partial closing of the Dogladi and Kasendolska Street valves by the Bosnian Serb side, resulted in a large number of illegal and unregulated gas connections by the people of Sarajevo. In order to cope with the cold winter weather, they devised many creative heating and cooking devices which accomplished their purposes but were extravagant in the consumption of gas. It is estimated by knowledgeable officials that upwards of 30% of the gas arriving in Sarajevo is wasted by these heating and cooking devices, leaks in the system and other sources of waste. The reconstruction of the city's gas system must therefore include a major effort to gain control of the unregulated connections, repair leakage, and restore apartment house boiler houses.

In order to prevent a recurrence of the problem, means must be established to ensure that adequate flow rates are received continuously from Yugoslavia during the remainder of the year, and especially as the next winter approaches.

B. Reconstruction Strategies

Reconstruction Strategies must carefully consider the sensitivities and concerns of both sides which have developed as the result of hostilities. Perceptions are held by the Serb side that the international community exhibits favoritism toward the Bosnian Government. Most of the city's government institutions are located in the Bosnian side, and most of the efforts of the international aid community have undoubtedly been directed toward the greatest need on the Bosnian side. Nonetheless, these actions have reinforced the perception of favoritism. Also, suspicions exist on both sides because each side believes the other side has deliberately closed valves or otherwise prevented utilities from operating normally. Most of these perceptions are not based upon fact, although some actions have occurred on both sides which justify mutual suspicions. Confidence building efforts must therefore be included in the efforts which will be undertaken in rebuilding the utilities infrastructure of Sarajevo.

Almost all reconstruction efforts will face strong feelings on the part of the Serb side, to the effect that the Serbs "own" the facilities located within their territory. Therefore, any actions on the part of the international community that appear to "unify" the utilities will be met with opposition.

Reconstruction activities involving the delivery of gas to Sarajevo should not be considered in isolation of other requirements for heating and cooking energy. Sections of greater Sarajevo

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still rely upon coal, wood and electricity for heating and cooking purposes. Instead, the needs of the city should be assessed in terms of the "energy equivalent requirements" of the various sections of the city. An excellent analysis of these requirements has been prepared by the Sarajevo based 3-E Company, a consortium of highly talented engineers and scientists. This group is represented by both Bosnian and Serbian engineers currently living on both sides of the confrontation line. The expertise of this group should be included in the planning for any reconstruction activities. Contact Mr. Sead Sirbubalo in Sarajevo or Dr. Momo Saranac in Ilidza for further information.

In order to ensure the cooperation of both sides, particularly the Serb side, an effective reconstruction strategy should be designed to include a comprehensive package of assistance to both sides. It should be developed using full participation of local engineers and officials from both sides who should be encouraged to work together to develop appropriate strategies within clearly defined reconstruction policy guidelines, reflecting Security Council Resolution 900. The package should be fair, if not equitable in the distribution of assistance to both sides. Conditions should be placed on approval of funding for each side to ensure that all steps in the approved plans are implemented. International representatives should also function as program evaluation staff to the various teams, objectively resolving issues of contention.

Projects are on going in Sarajevo to expand the pipeline network. However, emphasis must be placed on gaining control of the illegal connections, the installation of approved heating and cooking appliances, and the restoration of central boilers in large apartment houses and public facilities. Projects on the Serbian side include expansion of the gas network, restoration of central boiler systems and expansion of the gas pipeline to light industry.. However, these projects have not received the same emphasis given to projects on the Bosnian side because the humanitarian need was generally greater on the Bosnian side. In addition, documentation procedures for acquiring foreign assistance are not fully understood by officials on the Serbian side. This lack of understanding, coupled with a reluctance of the Serbs to ask for help, has led to the perception that the international community is biased toward the Bosnian side. To ensure cooperation in all efforts by both sides, project facilitators need to be sensitive to these perceptions and may need to provide guidance regarding project planning and equipment procurement procedures.

The reconstruction effort provides the opportunity to revitalize the light industry of the greater Sarajevo area and to encourage the interdependence of all sections of the city. For example, a gas regulator factory located in Blazuj is reported to be able to produce superior quality regulators at a fraction of the cost of European or American companies. Additionally, the Serb side has identified projects to extend the gas network to homes, and to provide gas for the Raylovac Bakery, the Blazuj plywood factory, an Ilidza carpet factory, the Ilidza brick factory and other projects. All of these projects provide the opportunity to create jobs and help to return the city to normal conditions.

III. ANALYSIS

A. Flow Rate Requirements of Sarajevo

The current flow rate of 24,000 CMPH is sufficient to meet the current needs of Sarajevo. However, adequate quantities were not regularly received from Yugoslavia during the winter months, and gas is still not provided to Zenica or Sokolovic Kolonija. It is clear that Yugoslavia is using approximately 37,000 CMPH for its own purposes, and if adequate quantities of gas are to be received to provide for these communities, the flow rate from

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