WORLD ENVIRONMENT CENTER

ENVIRONMENTAL ASSESSMENT

OF

RUNO-G, LTD. AND FINTEX LTD. PLANTS

GABROVO, BULGARIA

SEPTEMBER 27 - 30, 1993

By: Robert J. Hanson

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Ivan Nenov, Mayor of Gabrovo

File

DISCLAIMER

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

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

A visit to Gabrovo, Bulgaria was made during the period of September 27 through September 30, 1993 by Robert J. Hanson, P.E., DEE, to perform an environmental assessment of a wool scouring plant (Runo G. Ltd.) and a textile plant (Fintex Ltd.), with particular emphasis on the wastewater generated by these facilities, and their subsequent pretreatment prior to discharge to the Gabrovo municipal sewage treatment plant (STP).

The survey disclosed that air emissions and solid waste generation are minimal, and that exposure to industrial hygiene and safety hazards appear to be slight in both of these industrial plants.

Both of the Runo and Fintex plants are conservative of water used in the production areas, and further wastewater reduction would not be cost effective. A slight alteration in operating procedure combined with minimal piping changes could result in recovery of wool fat now lost to the sewer in the Runo plant, resulting in reduction of load to the pretreatment plant serving the two industries, as well as additional revenue.

The pretreatment plant, as well as the Gabrovo municipal sewage treatment plant (STP), are lacking in basic instrumentation which impairs their operation. A change in flocculent chemical and improvement in the frequency and technique of laboratory operating tests (i.e. pH and solids determinations) would also enhance the industrial wastewater pretreatment plant efficiency.

Construction of the STP serving Gabrovo should be completed (anaerobic digesters and gas holders) by the time additional sewering of the city and industries is accomplished. The responsibility of operation of this facility should be placed in one governmental entity, namely the City of Gabrovo.

II. INTRODUCTION

The primary purpose of this project was to inspect the production areas and wastewater pretreatment facility of the Runo G. Ltd. and Fintex Ltd. Shop #1 plants located in close proximity to one another in Gabrovo, Bulgaria. (The Runo Ltd. is a wool scouring facility which receives sheep skins from farms in Bulgaria, and Fintex Ltd. manufactures wool type yarns and fabrics.) The review was accomplished during the period of September 27 - 30, 1993 by Robert J. Hanson, P.E., DEE, pro bono specialist, under the auspices of the World Environment Center and the U.S. Agency for International Development (A.I.D.).

Other purposes of the project included reviewing all available data concerning water usage, wastewater generation, air pollution and solid waste generation and disposal, and worker health and safety conditions.

The volunteer specialist was assisted by Madame Mariana Strugarova, Ph.D., who was hired by the Bulgaria W. E. C. representative, Mr. Christian Spassov, to service as interpreter. Her help was invaluable.

III. FINDINGS

A. Runo Ltd. Plant

The Runo Ltd. plant is government owned and, prior to Bulgaria's break with communist rule, was part of the adjacent Fintex Ltd. textile plant. It is headed by Madame Tsonka Boevska-Stefanova, President, assisted by Mr. Vasil Kavalov, Chief of Department, both of whom were very cooperative. Current production is from 12-15 tonnes of scoured wool per day, with all production going to Fintex Ltd. A minor operation which results in no waste production consists of fabricating wool lined comforters, with the covers purchased from outside sources.

This plant has four (4) scouring machines, one of Belgian make and three of Polish make (only two are currently operating due to low demand for the product). The preliminary hand-sorted wool enters the first of five scouring tanks where the dirt and wool fat (lanolin) is removed. Water flow through the scour tanks is counter-current to the wool flow with soda ash added to the first tank, additional soda ash and detergent added to the second tank, and detergent added to the third tank. Temperature in these three tanks is maintained at 50-55 degrees centigrade by injection of live steam. Fresh water is added to the fifth tank. The effluent from the first tank, containing the highest level of contaminates, flows to the sewer, passing through a rough screen to remove fibers, and through a fine screen to remove smaller particles before discharging to a sewer which carries the scour wastewater and a small portion of sanitary wastewater to the pretreatment plant. Screened materials are disposed of with trash and garbage to the Gabrovo "land fill." The major portion of the sanitary wastewater (toilet and shower wastewater) is discharged directly to the Yantra River.

The use of counterflow washing is good technology and it minimizes the water use. Water is supplied by the Gabrovo municipal system and is metered as it enters the plant. There is no metering of the wastewater flow.

The scoured wool is then dried in steam heated driers and no other operations produce wastewater.

The wastewater is alkaline, contains wool fat and grease, and the soil removed from the wool results in suspended solids. The fat and grease, suspended solids, and biochemical oxygen demand (BOD) are the pollutants of concern in the wastewater.

All scour tanks are drained at the end of the working shift. These dumps represent only a small percentage of the daily wastewater volume but a considerable percentage of the pollutant load, particularly fat and grease. From analyses obtained from the plant (one set only) made of the batch dumpings, it is calculated that about 90 KG/day of wool fat is scoured, and that about 93% of that total is contained in this end-of-shift dumping. Wool fat is a saleable material, but usually requires purification prior to sale. However,

from discussions held with Dr. Thorstensen, a W.E.C. volunteer expert performing an environmental review of the Leve Tannery in Gabrovo, it is believed that the tannery could use the unpurified fat in their leather operations.

General observation of the Runo Ltd. facilities disclosed little actual or potential air pollution, and the working conditions, while not up to American standards, were not alarming from a safety or industrial hygiene aspect. Steam is purchased by the City plant.

B. Fintex Textile Plant

The Fintex Ltd. General Manager was unavailable during this visit but a Mr. Ivanov, Mechanical Manager, discussed their operations and provided a guide for our visit to Shop #1 to view the operations. He stated that 1,190,000 m^3 of water is purchased from the City annually and is used for industrial purposes and that about 590,000 m^3 is used for sanitary purposes. Most of the sanitary wastewater is discharged to the Yantra River untreated.

This textile plant produces both wool and synthetic textile yarns and fabrics. It includes the standard operations of spinning, weaving, dyeing, washing, drying, thermal fixation and carbonizing. Dyes, soaps and detergents, acetic, formic and sulfuric acids, caustic soda and sodium bisulfites are used in certain steps in the textile production. Dyeing is performed in enclosed, high pressure vats, and the washing and rinsing proceeds in the same vats. While certain of the dyes contain heavy metals, the amount of dye lost to the sewers is minimal. No colored wastewaters were observed and the plants technical people state that all of the dye is absorbed by the product prior to washing and rinsing. The additives, added during the dyeing operation, which include the acetic and formic acids, and in some instances potassium dichromate, are not absorbed, however, and are discharged with the wash waters to the sewer.

The only source of wastewater is the dyeing, washing and rinsing operations, and the washing and centrifuging of the wool and polyester batts. No complete analyses are available to determine the extent of heavy metal and chromium contamination, but it is adjudged to be minimal and should not present an environmental problem in the pretreatment and city treatment plant sludges. BOD, pH and solids have been analyzed, but only one analyses of the Fintex wastewater was available.

The operating areas were found to be very clean, especially in the dyeing rooms. The only area observed with liquid on the floor was the "thick wool and polyester" dye area, and the amount was moderate. No air pollution potential was observed, and while employee safety and industrial hygiene did not appear to have formalized programs, they did appear to be satisfactory. All textile scraps are recycled and solid waste disposal was minimal, consisting mainly of garbage from the plant lunch rooms.

C. Pretreatment Facility

The pretreatment facility was installed about 15 years ago as an experiment by the Bulgarian Textile association and was originally meant only to treat Fintex Ltd. wastes, according to a Fintex spokesman. In 1987, a Sofia based consulting firm prepared a "modernization" design which has not been implemented due to lack of funds. Their report contains a list of design parameters, but no chemical analyses on which they were based. It is probable that the parameters are based on limits suitable for discharge to the city STP.

Runo wastewaters are mixed with Fintex wastewaters in a common sewer about 500 meters upstream from the Pretreatment plant (P.P.). A formal agreement has existed between the two firms for some years regarding the sharing of costs. Currently there is disagreement between spokesmen of the firms regarding the validity of the cost allocation. This includes disagreement on the relative amount of flow contributed by each, and on the division of cost.

The P.P. is designed for 40 liters per second inflow and three shift operation. (Neither Fintex nor Runo is on three shifts currently). It consists of manually cleaned rough screening, screw pump lifting to a fine screen fiber catcher, turbine pumping to 2-500 m^3 aerated mixing (equalization) basins, gravity flow to a 4 m^3 chemical (alum and lime) mix tank, passing into 2 - 10 m^3 flocculation tanks (air mixed), and thence into 2 - 500 m^3 rectangular settling basins equipped with bottom and surface scrapers. Bottom sludge and floating solids are pumped to drying lagoons, and the dried materials are periodically removed to the city solid waste disposal area (land-fill). The P.P. flow is not metered at either influent or effluent, and is sewered across the Yantra River to the city sewage treatment plant. The P.P. operates three shifts, and is substantially underloaded under current Fintex and Runo production schedules.

The P.P. has an inadequate laboratory. pH is determined by use of wide range pH paper. Suspended solids and total solids are determined crudely by use of filter paper stuffed in a volumentic cylinder. Tare weight of the filter paper is not determined, and the water contained in the filter paper is not accounted for. pH and solids are the only two analyses performed. Coagulant and lime dosage is independent of inflow and pH.

Only one analyses is available for the P.P. effluent, that of 5/18/93, consisting of a grab sample analyzed by the Regional Authority. It shows pH - 7.5 BOD-408, COD-400, S.S. -499.2, Cl-78.1 SO4-1368, and Fe-2.8. All concentrations except pH in mg/l. The analyses is somewhat in doubt because it is impossible for COD to have a lower concentration than BOD. If the parameter of suspended solids is accurate, however, poor operation of the P.P. is indicated as lower concentration levels should be obtained. However, there is little incentive to lower the solids level because the city plant does not analyze, nor charge, for excess solids entering their facility. In addition, one cannot blame the P.P. operations as they have no tools, i.e., metering, proper pH

instrumentation, and proper laboratory equipment, to guide them in their operation. The P.P. supervisor, Mr. Michovsky, reported that 80 m^3 of 5% solids is removed to the drying beds daily. How this quantity is determined, other than by estimate, is unknown. Photographs of the P.P. are included in the Appendix to this report.

D. Gabrovo City Sewage Treatment Plant (STP)

Because the Fintex P.P. discharges to the Gabrovo STP, it was decided to view its operations and determine if any deleterious effects of the P.P. would be expected. The STP influent consists of sanitary sewage and industrial wastes from a minority of the industrial facilities in the city. Not all of the city domestic waste is sewered. The flow is reported to be 750 l/s on week days, and 500 l/s on weekends, but these are estimates as the influent Parshall Flume instrumentation has been allocated to deteriorate and flow is estimated by a head gage once per shift.

The wastewater is screened by mechanical rough screens and fine screens, flows through a grit chamber, thence to a metering and sampling channel where a continuous sampler is employed, but the originally installed electometric pH and flow recorders have been allowed to deteriorate. The flow is then divided into 2 - 30 meter diameter by 4 meter deep primary clarifiers equipped with bottom and surface scrapers. The flow is directed to one of eight rectangular diffused aeration tanks. (Four of these tanks are being used as aerobic sludge digesters). The activated sludge effluent is then directed to 2 final clarifiers, 35 meters in diameter and 4 foot depth. Waste activated sludge and primary sludge are pumped to a thickener, and the thickened sludge flows to the four aerobic sludge digesters mentioned previously. The sludge thickener was originally intended for primary sludge only, but the anaerobic sludge digesters are only half finished and inoperative, due to lack of funds, as is a post chlorination building. All aerobically digested sludge is directed to drying beds and removed to the city disposal area, as are screenings and grit.

The STP laboratory is moderately well equipped to perform BOD, COD, solids, including volatiles, nitrogen species, and some metals. pH is obtained with pH paper.

The plant appears to be operating satisfactorily with a good looking, clean effluent. Effluent suspended solids are reported at less than 10 mg/l. The plant is considerably underloaded, but as additional wastewater from industries and from unsewered portions of the city are collected and introduced, it will be imperative that the anaerobic digesters and gas holders be completed and reversal to the original design be accomplished in order to meet regional effluent standards.

At present much compressed air is wasted into the atmosphere because the air blowers have no means of moderating their output. This wastes KWH and obviously adds to unnecessary cost. Reportedly U.S. A.I.D. is providing 2 new smaller blowers and two of the existing blowers are being dismantled for sale.

The city charges industry for excess BOD only. The basis of charge is as follows:

up to 200 mg/1 BOD	-	1.7 Lev/m^3 of city water purchased
200-600 mg/1 BOD	-	2.5 Lev/m^3 of city water purchased
over 600 mg/1 BOD	-	3.4 Lev/m^3 of city water purchased

The rates are being increased and apparently are in effect for 6 month periods and then reviewed.

The Mayor of Gabrovo indicated that responsibility for operation of the STP is divided among several governmental agencies. Sole responsibility for the operation and maintenance is necessary in order to assure proper management of the utility.

IV. CONCLUSIONS AND RECOMMENDATIONS

1. The Runo Ltd. should reach agreement with the Leve Tannery to accept their wool fat. This will require that Runo make necessary operating and piping changes to direct the scouring tanks wastewater dumps from tanks 1 and 2 to drums or to holding tanks for transfer to Leve Tannery.

2. My calculations of waste loadings of BOD and suspended solids in the Runo wastewater compared with these loadings of the Fintex wastewater indicates that from 42 - 50% of the BOD loading discharged to the Gabrovo STP is due to Runo, and that on the same basis 48 - 55% of the Suspended Solids introduced to the P.P. are due to Runo. These calculations are based solely on the single analyses available of the Runo and Fintex waste streams prior to mixing. These analyses should be repeated periodically and should serve as a basis for the allocation of wastewater costs and payment between the two companies.

3. The number of analyses of Runo and Fintex wastewater, the P.P. influent and effluent are woefully inadequate, and should be done at least monthly to allocate costs and to verify the Gabrovo STP charges to them.

4. Removal of 80 - 90% of the Runo wool fat will aid in improving the P.P. operation, and should provide some revenue to Runo.

5. The P.P. operation should be improved by using iron sulfates rather than alum as a coagulant. In addition, the operation would benefit from increased and improved lab analyses of pH, and solids determinations. Every effort should be made to obtain funds for an electrometric pH meter and for lab vacuum filtration glassware.

6. The Gabrovo STP should obtain and maintain an electrometric recording of pH meter, a dissolved oxygen meter, and a Parshall flume flow recording indicator and totalizer.

7. Efforts to obtain new air blowers and to complete the anaerobic digesters, gas holder and sludge heating facility at the STP should continue.

8. The STP laboratory should periodically analyze the heavy metals in the influent, effluent and sludge.

9. The dried sewage sludge is an excellent soil conditioner and should be given or sold to farmers for land application. The metal content will determine the land application rates.

10. The city of Gabrovo should be solely responsible for the operation and maintenance of the STP, and should continue its policy of cooperation with the Gabrovo industries in working towards compliance with the Regional Authorities discharge limits.

V. COSTS AND TIMING

Accurate cost estimates for implementation of recommendations are not possible due to the limited time available at the plants. Most of the recommendations would not result in additional costs, but would produce savings. The cost of laboratory equipment recommended would be less than $10,000 in the U.S. The cost of completion of the Gabrovo STP is beyond the scope of this review and report.

The timing of implementation of the recommendations is dependent mainly on the willingness of the two industries to implement them.

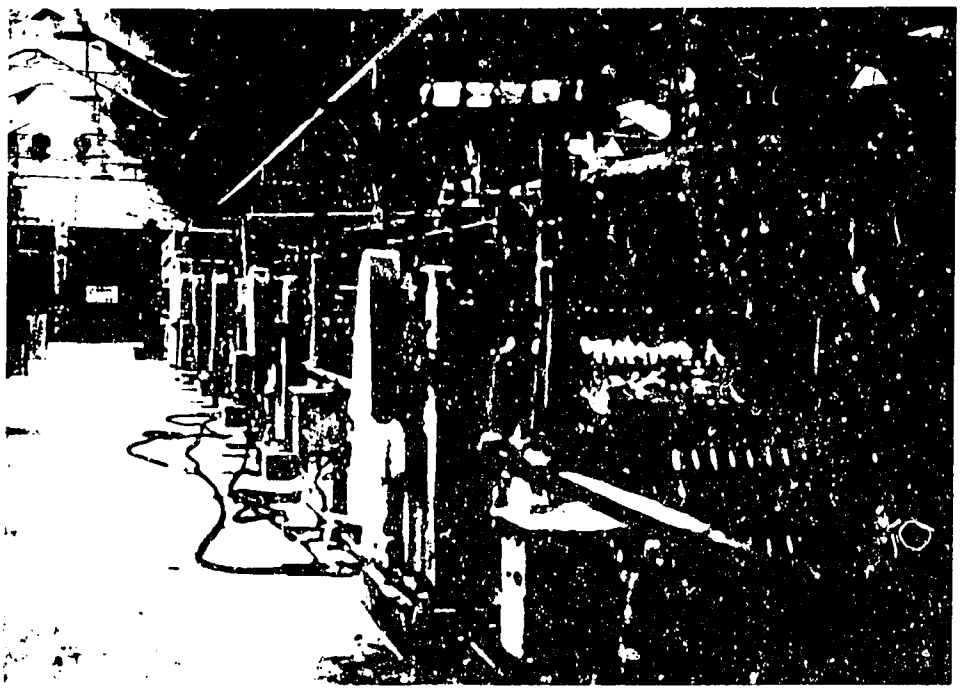
VI. APPENDICES

A. Photographs

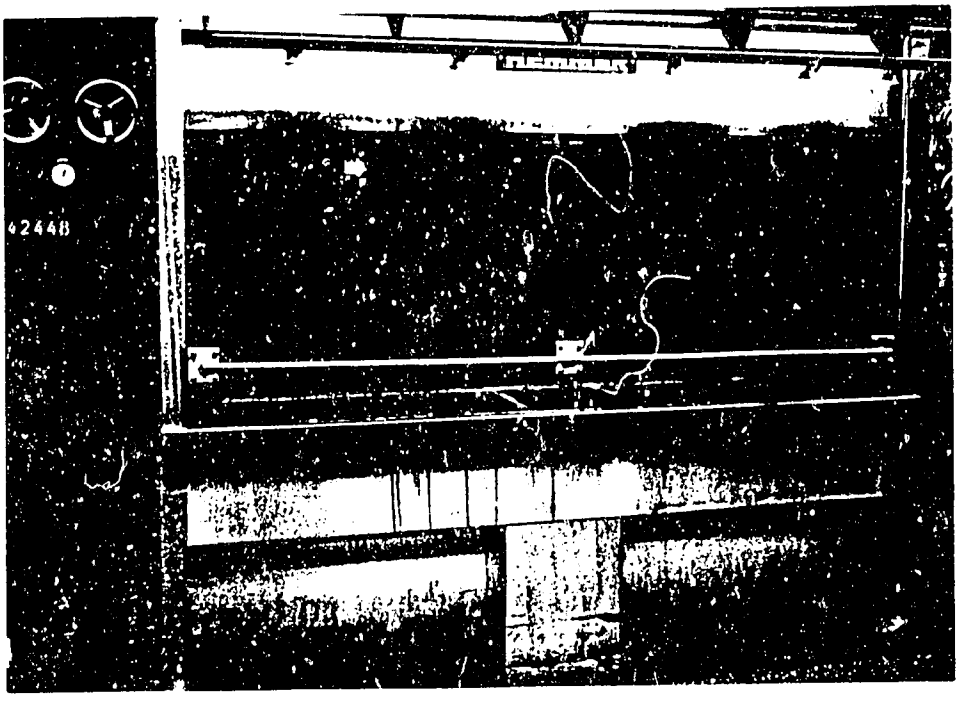
B. Persons & Organizations Visited

C. Business Cards of Persons Contacted

D. Curriculum Vitae

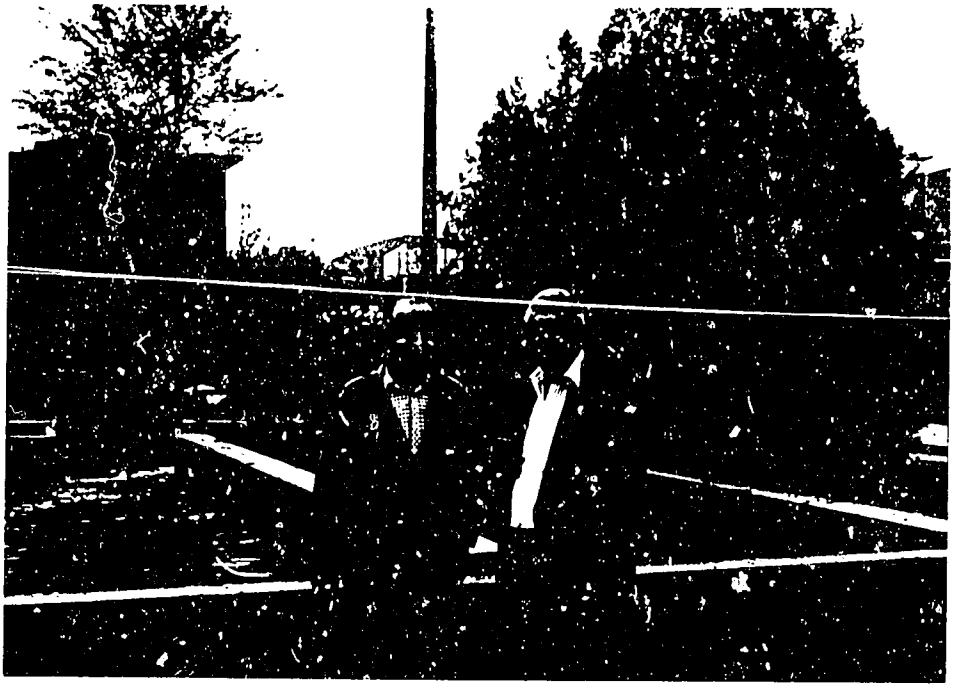


WOOL SCOURING MACHINE
RUNO PLANT

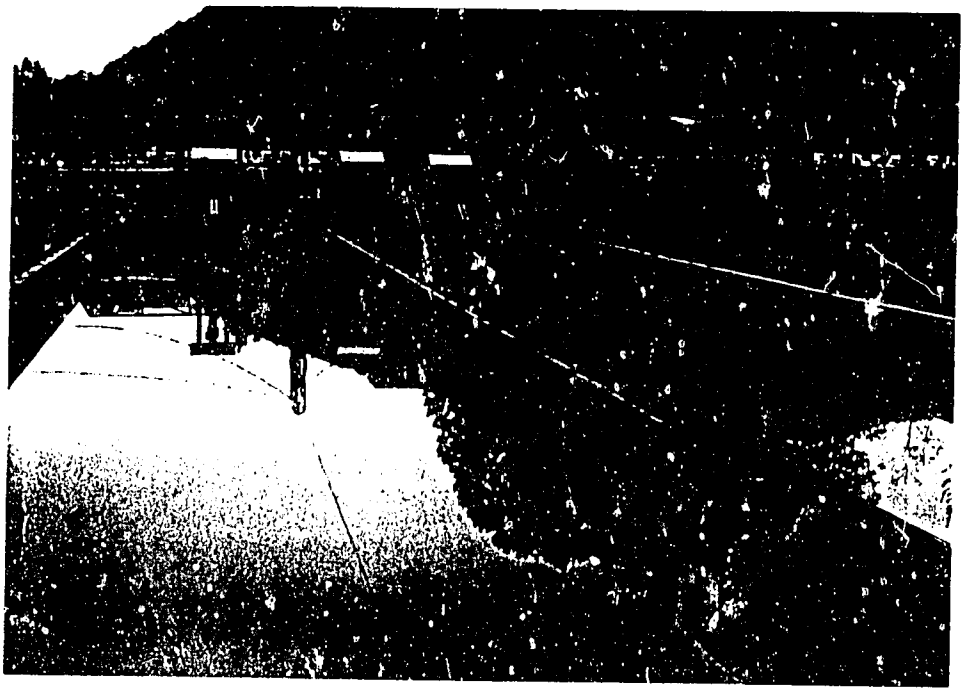


DYING MACHINE
FINTEX PLANT

PRETREATMENT PLANT
CHEMICAL DOSING



PRETREATMENT PLANT
FLOCCULATION TANK
R.J. HANSON WITH MR. MICHOVSKY, SUPR.



PRETREATMENT PLANT
FINAL CLARIFIER TANKS

B. Persons and Organizations Visited

1.	Mariana Strugarova	-	Interpreter
2.	Mme. Boevska-Stefanova	-	Runo G Ltd.
3.	Mr. Basil Kavalov	-	Runo G Ltd.
4.	Mr. Ivanov	-	Fintex, Ltd.
5.	Mr. Gospodinov	-	Environmental Specialist, Regional Environmental Org.
6.	Mayor Ivan Nenov	-	City of Gabrovo

C. Business Cards of Persons Contacted

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D. Resume of Robert J. Hanson, P.E. DEE

EDUCATION: B.S. Civil Engineering w Sanitary Engr. Option
Univ of Wisconsin-1948
M.S. Civil Engineering w Sanitary Engr. Option
Univ of Wisconsin-1949

EXPERIENCE: Research Assistant-Univ of Wisconsin-1949
Sanitary Engineer-Indiana State Board of Health-1949 to 1951
Sanitary Engineer-Hq. Air Material Command U.S. Air Force Dayton Ohio 1951 to 1955
Mgr of Environmental Engr & Envir. Quality-ICI Americas Predecessor Company Atlas Chemical Industries 1955 to 1987
Projects with Int'l Executive Service Corps in Egypt and Mexico. Environmental Assistance. 1988to present

PROFESSIONAL: Licensed Professional in Missouri, Ohio
Diplomate-American Academy of Environmental Engineers
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Past Chrman Chemical Manufacturers Assn Water Resources Committee
Past Member-Water Quality Standards Task Group
Past Member-Water Policy Task Group
Life Member-Water Environment Federation
Past Member-Industrial Wastes Committee
Past Member-Government Affairs Committee
Past Member-Program Committee
Past President-Water Resources Association of the Delaware River Basin
Past Member-U.S. Geological Survey Advisory Committee on Water Data for Public Use
Member of Board of Directors of the Delaware Solid Waste Authority
Member- Chi Epsilon Honorary Civil Engineering Fraternity