KRAKÓW, POLAND

WATER / WASTEWATER PROJECT

1990 - 1997

Final Project Report
April 1997

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

MUNICIPAL
ASSISTANCE
BRANCH
(4204)

April 24, 1997

MEMORANDUM

SUBJECT: Kraków, Poland, Water/Wastewater Project

FROM: Charles E. Gross

TO: Ron Hoffer

Here are five (5) copies of my final report on this project. Two (2) copies are for EPA's Office of International Activities OIA), two (2) are for the Agency for International Development (AID), and one (1) copy is for you. I am counting on you to handle the distribution to OIA and AID.

As the report indicates, the project is essentially complete. However, some relatively minor "house-keeping" items remain. These include: assuring that our Polish partner, MPWiK, has been successful in registering the equipment with the Polish Office of Technical Inspection; assuring that PCI Ozone & Control Systems, Inc. has fulfilled its obligations prior to expiration of the warranty period on August 29, 1997; and final close-out of our Interagency Agreement with the Corps of Engineers, Trans-Atlantic Programs Office. I would expect these items to be completed no later than September 30. 1997.

I have been pleased to be a part of this project. I believe we have had a positive effect on public health and the environment in the Kraków area, and, perhaps, we have also helped some American business enterprises establish a market in Central/Eastern Europe. Even though EPA's official obligations on this project are coming to an end, I have assured our colleagues at MPWiK that I will remain available to help them in any way I can should problems arise.

Any questions on the report should be directed to me on 202-260-7370.

F:\USER\CGROSS\KRAKOW\HOFF0424.97 April 24, 1997

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Final Report
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EXECUTIVE SUMMARY

Under the Support for Eastern European Democracies (SEED) Act of 1989, EPA helped the City of Kraków, Poland, upgrade two drinking water treatment plants, two wastewater treatment plants, and a central laboratory which supports drinking water and wastewater facilities. EPA provided equipment, supplies, replacement parts, and appropriate training for Kraków personnel. The approximate value of the project is $4 million. The primary Polish partner is Miejskie Przedsiębiorstwo Wodociągow i Kanalizacji (MPWIK), the water and sewer utility serving the city of Kraków.

In February 1990, a team of EPA and Polish technical experts met in Kraków to jointly develop a work plan for the expenditure of the US funds to be provided under this program. The work plan, entitled *Technical Delegation Recommendations,* became the blue print for the project. The SEED Act authorized funding over three years -- FY-90, FY-91, and FY-92. Procurement began in FY-90 and continued through FY-94 in accordance with a schedule negotiated with Kraków officials. Installation of equipment continued into FY-95 and FY-96. Equipment acquisition and delivery was closely coordinated with design and construction activities for which the City of Kraków was responsible.

The Army Corps of Engineers, through its Trans-Atlantic Programs Center in Winchester, Virginia, assisted EPA in this project by acquiring equipment and arranging for its shipment to Kraków. A private engineering firm (Parsons Engineering Science, Inc.) under contract to EPA helped select the equipment and prepared technical specifications used in its purchase.

As of early April 1997, the project is essentially complete. All major items of equipment have been delivered and placed in service. Belt filter presses and related equipment and supplies for the Raba drinking water treatment plant and the Myslenice wastewater treatment plant, originally included in the project, cannot be provided due to insufficient funds. Balancing this "shortfall" is our ability to provide more chlorination equipment than was originally envisioned. Our Polish colleagues were able to use this additional equipment at the storage/rechlorination facility at Siercza which is situated between the Raba treatment plant and the city of Kraków. Tables showing the *Technical Recommendations* and the equipment actually purchased can be found in Appendix 1.

Overall, the project has been a great success. It has achieved most of its original objectives including: improving the quality of drinking water produced; providing the ability to monitor raw water before it enters the treatment process; enhancing the ability of the water and wastewater utility in Kraków to do a full-range of analytical tests to monitor the quality of raw water entering the water treatment processes and to measure the effectiveness of the treatment processes; and providing American firms the opportunity to introduce their equipment and services into a new market.

US investment in equipment and services was matched "dollar-for-dollar" by Polish investment in design and construction of buildings in which the equipment is housed. Polish investment is a combination of funds provided by the National Foundation of Environmental Protection, the Regional Foundation of Environmental Protection, and MPWiK funds.

BACKGROUND

The genesis of the Kraków Water and Wastewater Project was a proposal, offered by President Bush during his visit to Poland in July 1989, that the United States work with Poland to reclaim Kraków from air and water pollution. Statutory authority for the project is provided by the Support for Eastern European Democracies (SEED) Act of 1989 (P.L. 101-179).

The approximate value of the water/wastewater project is $4 million. Approximately $1 million was provided for an air quality monitoring network in the Kraków region and has been the subject of other, separate reports.

Pursuant to Bush's proposal, a delegation from the United States visited Poland from October 30 to November 3, 1989, and developed a "Protocol" for the proposed air and water projects. The "Protocol" is included in Appendix 2.

Pursuant to the "Protocol," US and Polish technical representatives met in Kraków from January 29 to February 2, 1990, to develop a work plan for the expenditure of $4 million to address the water pollution and drinking water problems of Kraków. The work plan, entitled *Technical Delegation Recommendations*, is included in Appendix 3 This document became the blueprint for the project.

The project was managed by the U.S. Environmental Protection Agency. Funding for the project was provided to EPA by the U.S. Agency for International Development (AID) under an Interagency Agreement (IAG). Under a separate IAG, the US Army Corps of Engineers Trans-Atlantic Programs Center (CETAC) in Winchester, Virginia, assisted EPA by acquiring equipment arranging for its shipment to Kraków. A private engineering firm (Parsons-Engineering Science, Inc.) under contract to EPA helped select the equipment and prepared technical specifications used by CETAC in its purchase. The primary Polish partner is Miejskie Przedsiębiorstwo Wodociągow i Kanalizacji (MPWIK), the water and sewer utility serving the city of Kraków.

The SEED Act authorized funding over three years --FY-90, FY-91, and FY-92. Procurement began in FY-90 and continued through FY-94 in accordance with a schedule negotiated with Kraków officials. Procurement activities were conducted in the United States by CETAC using appropriate US procurement regulations. Installation of equipment continued into FY-95 and FY-96. Equipment acquisition and delivery was closely coordinated with design and construction activities for which MPWiK was responsible.

DETAILED PROJECT DESCRIPTION

Following is a discussion of the specific facilities assisted by this project and the project objectives:

Rudawa Drinking Water Treatment Plant

This plant draws water from the Rudawa River and provides about one fourth of Kraków's water supply. Prior to the inception of the project, it had to shut down several times per year due to the presence of contaminants (e.g. organics and ammonia) in the river. The plant capacity is 70,000 m^3/day (~18.5 mgd[1]).

The equipment EPA provided for this plant has a value of $187,894 and includes: chemical storage tanks and feed pumps, a plot ozone generator, analytical equipment to control plant operations, analytical equipment and other facilities for a remote monitoring station located upstream of the plant.

The equipment provided by the US, combined with MPWiK's own investments, enable the plant to produce a higher quality of drinking water than it could produce prior to the initiation of the program. MPWiK-financed improvements include a reservoir on the Rudawa River upstream of the treatment plant and a substantial building to house the sampling equipment the US provided.

Raba Drinking Water Treatment Plant

This is a relatively new plant that was completed in 1986. The plant capacity is 160,000 - 170,000 m^3/day (42-45 mgd) and provides about one-half of Kraków's water supply. It is a modern coagulation/filtration plant; however, coagulant chemicals are added only during periods of high influent turbidity.

The equipment EPA provided for this plant had a total value of $2,457,824 and includes: air blowers, chlorinators[2], ozonation equipment, analytical equipment to control plant operations, and analytical equipment and other facilities for a remote monitoring station at the water intake. A belt filter press and polymer feed equipment for improved sludge dewatering that had been included in the original program could not be purchased due to lack of funds.

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[1] mgd stands for million gallons per day. In the US, both drinking water and wastewater treatment facilities would be designed on the basis of 100 gallons per person per day, and a plant of 1.0 mgd capacity would serve a population of 10,000 people.

[2] Chlorinators have been installed at two locations: (1) a separate building at Raba to chlorinate (for disinfection) the water as it leaves the plant and (2) at the Siercza water storage/rechlorination facility to maintain adequate chlorine residuals in the water in the distribution system. Siercza is located about half way between Raba and Kraków.

Myslenice Wastewater Treatment Plant

The Myslenice wastewater treatment plant is located on the headwaters of the Raba reservoir from which the Raba plant draws its water. The Myslenice wastewater treatment plant has a capacity of 9500 m^3/day (2.5 mgd) which used an activated sludge treatment process. The plant was converted to a biological nutrient removal system. In addition to improving the wastewater treatment facility, the City of Kraków installed a monitoring station and an early warning system for the Raba reservoir at the Myslenice site.

The equipment EPA provided for this plant has a total value of $163,617 and includes: mechanical aerators, mechanical mixing equipment, chemical feed equipment, and analytical laboratory equipment. This equipment upgraded this facility to provide organic carbon and phosphorous removal. These improvements will help provide greatly improved protection for the reservoir which serves as the main drinking water source of Kraków. A belt filter press for sludge dewatering which was part of the original program could not be provided due to insufficient funds. A centrifuge for sludge dewatering has since been provided by others.

Płaszow Wastewater Treatment Plant

The major portion of this plant is a primary facility, but there is a secondary plant that treats approximately 0.3% (1,680 m^3/day or 0.4 mgd) of the flow. The secondary treatment system was converted to a demonstration plant for biological nutrient removal studies to determine how to produce effluent for industrial reuse. An existing building on the site was used for studies to investigate the physical/chemical treatment of the secondary effluent to remove additional phosphorus and suspended solids by coagulation with metal salts and filtration.

The equipment EPA provided for this plant has a total value of $294,759 and includes: mechanical blowers and diffusers for aeration tanks, mixers and pumps, chemical feed equipment, and analytical and process control equipment.

This equipment enabled the treatment plant operators to investigate biological phosphorous removal and additional physical/chemical processes to attain the lowest possible effluent phosphorous and suspended solids levels.

Central Laboratory

The City of Kraków had a number of laboratories that run routine chemical analyses. The laboratories did not have the facilities to measure the concentration of specific compounds, and most of the wet chemical analyses employ slow, manual techniques. In view of the high level of pollution in the waters used for human consumption, more definitive and faster analytical techniques were required to identify the magnitude of the pollution problem and help protect public health.

The equipment EPA provided for the Central Laboratory has a total value of $221,295 and includes: instruments to measure turbidity, total organic carbon, and chemical oxygen demand, instruments to measure pH and presence and concentration of specific ions, an atomic absorption spectrometer, a gas chromatograph, a gas chromatograph/mass spectrograph. This laboratory supports the analyses conducted at four water treatment plants and several wastewater treatment plants. The equipment EPA provided has helped, and will continue to help, identify the type of pollutants, their concentration and the plausible sources of the contaminants. The effective use of the high quality laboratory equipment is a cost effective way to protect health as Poland implements an improved pollution control program.

PROJECT PLANNING & OVERSIGHT

The *Technical Recommendations* developed in February 1990 was the primary planning and scheduling tool for the project. The *Recommendations* were reviewed, refined, and modified periodically throughout the project. The following is a summary of the major review steps.

October 1990	A 6-person delegation from Kraków visited the US. During the visit they: (1) participated in technical discussions related to remaining equipment purchases, (2) attended the annual conference and exposition of the Water Pollution Control Federation (now known as the Water Environment Federation, (3) visited a water treatment facility in Myrtle Beach, SC, that uses ozone, and (4) visited the EPA laboratory in Cincinnati.
April 1991	A delegation from US visited Kraków for discussions on project schedule and technical details for all remaining equipment except chlorination and ozonation. A representative of EPA's Office of Drinking Water confirmed that the use of ozone at Raba was appropriate. The laboratory equipment the US had provided was dedicated during this visit.
April 1993	A delegation from the US visited Kraków for detailed discussions related to the technical specifications for the chlorination and ozonation equipment.
December 1994	A delegation from the US visited Krakow to review all equipment in place and to facilitate detailed discussions between MPWiK and PCI Ozone which was fabricating the ozonation system. See report of visit included in Appendix No. 4.
July 1996	A delegation from the US visited Kraków for a final review of the project and to attend the dedication ceremony for the ozonation system.

SIGNIFICANT PROJECT MILESTONES

July 1990	Initial Interagency Agreement with U.S. Army Corps of Engineers
September 1990	Award of 15 contracts totaling approximately $421,800 for various pieces of laboratory and analytical equipment. (Note that analytical equipment was provided for the treatment plant laboratories and monitoring stations in addition to the Central Laboratory..
December 1990	Initial shipment of laboratory/analytical equipment arrived in Kraków.
April 1991	Delivery of remaining laboratory/analytical equipment and dedication ceremony at Central Laboratory.
December 1991-January 1992	Award of eight contracts totaling approximately $600,974 for treatment equipment, process control equipment, and monitoring equipment.
October 1992	Treatment equipment, process control equipment, and monitoring equipment arrives in Kraków.
September 1994	Contracts for chlorination system and ozonation equipment awarded.
October 1994	Dedication of the monitoring station upstream of the Rudawa water treatment plant. The building was constructed at MPWiK expense but houses monitoring equipment provided by the US.
March 1995	Chlorination equipment arrived in Kraków.
Spring/Summer '95	New chlorination system placed in service ...just as old system at Raba gave out!
October 1995	Equipment for ozonation system arrives in Kraków. Installation of equipment in building erected at MPWiK expense commences.
July 9, 1996	Dedication ceremony for ozonation system.

DOCUMENTATION OF EQUIPMENT DELIVERY

Upon delivery of the equipment to Kraków, or shortly thereafter, representatives of MPWiK and the Corps of Engineers took an inventory to assure delivery and safe arrival of all equipment that had been shipped. They then signed a "Transfer and Acceptance of U.S. Government Property." The document includes the statement ". . .

the United States Government transfers to the Government of Poland all of its right, title and interest in the property. Upon such transfer, the Government of Poland shall be solely responsible for all loss, damage or expense to persons or property caused by possession or use of such property." Copies of the "transfer documents" have been retained in EPA's files; the originals are in the files of CETAC. It should be noted that the equipment was procured for the U.S. Government by CETAC as part of its IAG with EPA, and the method of transfer for this project is consistent with CETAC practices on its other projects.

PROJECT ASSESSMENT

Overall, the project has been a great success. US investment in equipment and services was matched "dollar-for-dollar" by Polish investment in design and construction of buildings in which the equipment is housed. Polish investment is a combination of funds provided by the National Foundation of Environmental Protection, the Regional Foundation of Environmental Protection, and MPWiK funds.

Poles are a bright and energetic people. EPA participants were greatly impressed by their skills and ability. Polish design engineers are as good as, or better than, any found in the US. The US and Polish participants developed a true sense of respect, cooperation, and friendship during the project.

Chlorination equipment installed at the Raba treatment plant and at the Sierza storage/rechlorination facility allowed MPWiK to reduce the volume of chlorine used at these facilities by about 25 percent. Consequently, operating costs have been reduced.

The process equipment provided by the US has greatly improved the quality of drinking water and the protection of water sources. Better drinking water is often cited as an important factor in attracting tourism and industry to cities.

The sophisticated laboratory equipment provided for the Central Laboratory to conduct a full-range of analytical tests which was not previously possible. Under a separate initiative the director of MPWiK's laboratories attended short courses in the US on advanced analytical methods, water quality control, and laboratory management. That experience may enable MPWiK laboratories to be accredited.

This project led to other cooperative efforts such as: the Water Technical Exchange Program which provides training and opportunities for sharing of professional practices between specialists in the US and Kraków and some limited demonstrations of improved agriculture and water management practices in the Raba watershed.

MPWiK has agreed to be a "showplace" for US equipment/technologies which may have a positive effect on environmental exports. This project provided the opportunity for PCI Ozone to install its equipment for the first time in Central/Eastern Europe. As result, that firm may be able to establish a foothold in a new marketing area.

As a result of this project and other factors, Parsons Engineering Sciene has opened an office in Kraków and is actively seeking business throughout Central and Eastern Europe from that office.

Distance and language differences made communications difficult in the early stages of the project. Communications improved when we learned we could communicate with MPWiK directly by fax and improved even more when the Director of MPWiK engaged an English-speaking assistant.

The project led to the development of the Interagency Agreement with the Corps of Engineers, Trans-Atlantic Programs Center (CETAC). That Agency's experience with contracting, procurement of equipment, and moving equipment acquired in the US to Europe and the Middle East contributed greatly to the success of this project. As the result of its participation in this project, CETAC has been asked to help resolve problems with a flue gas desulfurization project at Skawina.

EPA has verified that, with only a few exceptions, the treatment equipment provided by the US has been installed in the intended place for the intended purpose. Treatment equipment that has not yet been installed can be accounted for, and there are valid reasons why the equipment has not been installed or placed in service. For more details, see the report in Appendix No. 4.

The laboratory equipment provided under this project can be accounted for. It's obvious that it is being used effectively and has been well cared for. The original manuals provided with the equipment are still available, and many have been translated into Polish.

We were unable to provide the belt filter presses and related equipment and chemicals for Raba and Myslenice as originally envisioned due to shortage of funds. Early on in the project, the EPA Project Officer decided to defer procurement of this equipment until we had firm prices for the chlorination and ozonation equipment which were among the most important project elements to MPWiK. MPWiK was informed of this decision as soon as it was made and reminded of it often. Looking back, it seems as if this was a wise decision because had we procured the belt filter presses when originally scheduled, there would not have been sufficient funds for the chlorination and ozonation systems.

The ammonia and ammonia/nitrate monitors provided for the three remote monitoring stations[3] are not in use because they are not capable of detecting and/or measuring the low concentrations that now need to be measured. Whether this problem developed because of a misunderstanding of the need at the outset of the program or the needs of MPWiK have changed is not important. What is important to recognize is that these instruments do function as they were designed to function, but they cannot be readily adapted to detect and measure the low levels of ammonia and

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[3] At Rudawa near the retention basin now being constructed, adjacent to the Myslenice wastewater treatment plant at the headwaters of the Raba reservoir, and at the intake structure providing raw water to the Raba treatment plant.

nitrates that are now desired. It is unlikely that there is any automated equipment for continuous monitoring on the market at a reasonable price that can measure and detect the low levels now desired. We have recommended that the monitors provided be used in the laboratory, most likely one serving a wastewater treatment plant.

The Chemical Oxygen Demand (COD) analyzer provided for the Rudawa remote monitoring station does not provide reliable results on water. The MPWiK had proposed exchanging the COD meter with the City of Zgiersz for a phosphorous monitor and EPA approved such a "swap." However, a suitable agreement could not be reached, and the swap did not occur.

We had discussed the possibility of providing additional accessories and spare parts for the fluorimeters, the gas chromatograph/mass spectrophotometer, and the Total Organic Carbon (TOC) meters should there be any funds remaining after all other procurement actions had been completed. Unfortunately, there were not sufficient funds remaining to purchase these additional parts and accessories, but they should have top priority should any other funds become available in the near future.

A reflection on the project reveals some things that might have been done differently or better:

- It was probably overly-optimistic to anticipate that the program could have been implemented in only three years as originally envisioned. Actual procurement and delivery of the equipment took almost five years, and it's unlikely our Polish partners could have accommodated a faster delivery schedule.

- There should have been a line item in the project budget for packing and shipping the equipment. This turned out to be a significant cost item.

- There should have been a specific line item in the budget for "contingencies" to account for inflation and unanticipated events.

- Developing technical specifications and carrying out procurement actions in accordance with US regulations was far more difficult, expensive, and time consuming than originally envisioned.

- The need for extensive follow-up action by suppliers of major equipment items or systems, such as the ozonation system, after installation and initial start up should not be overlooked.

- Given the split in design, procurement, and construction responsibilities between the Polish and American partners, the project was vulnerable to failure and finger-pointing if/when things went wrong. Fortunately, it didn't happen in this project, but it's something to be aware of should another such project be undertaken.

KEY PROJECT CONTACTS

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APPENDIX NO. 4

Report on
December 1994 Visit to Kraków

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Nothing Included at Tab 5

APPENDIX No. 1

Tables Comparing Recommended vs Actual Project

SUMMARY
KRAKOW WATER AND WASTEWATER TREATMENT PROJECT

	RECOMMENDED	ACTUALLY PURCHASED
RUDAWA DRINKING WATER TREATMENT PLANT		
Plant Process Equipment	92,900	81,136
Remote Monitoring Station	39,700	101,848
Plant Laboratory Equipment	3,000	4,910
Subtotal	**135,600**	**187,894**
RABA DRINKING WATER TREATMENT PLANT		
Plant Process Equipment	2,522,200	2,385,204
Remote Monitoring Station @ Intake	42,800	67,711
Plant Laboratory Equipment	3,000	4,910
Subtotal	**2,568,000**	**2,457,824**
MYSLENICE WASTEWATER TREATMENT PLANT		
Plant Process Equipment	412,750	100,292
Plant Laboratory Equipment	4,700	6,276
Raba River Remote Monitoring Station	24,400	57,049
Subtotal	**441,850**	**163,617**
PLASZOW DEMONSTRATION WASTEWATER TREATMENT PLANT		
Plant Process Equipment	220,350	218,012
Plant Laboratory Equipment	53,400	76,747
Subtotal	**273,750**	**294,759**
CENTRAL LABORATORY	**181,100**	**221,295**
MISCELLANEOUS EQUIPMENT & SUPPLIES	**30,000**	**8,203**
PACKING & SHIPPING	**0**	**181,325**
Subtotal 1 - Equipment & Shipping	**3,630,300**	**3,514,918**
PROCUREMENT ASSISTANCE	**200,000**	**300,182**
Subtotal 2	**3,830,300**	**3,815,100**
CONSULTING ENGINEERING SERVICES	**96,000**	**247,892**
TRAINING	**70,000**	**52,330**
EPA TRAVEL TO KRAKOW	**0**	**9,781**
TOTALS	**3,996,300**	**4,125,103**

RUDAWA DRINKING WATER TREATMENT PLANT

ITEM	RECOMMENDED*		ACTUALLY PURCHASED			US ARMY	SHIPPED	ARRIVED	SEE
	No.	$ Est.	No.	Unit Price $	Total $	CONTR. NO.**		KRAKOW	NOTE
Process Equipment:									
Ozone analyzer (Water)	1	6,000	1	5,100.00	5,100.00	-90-M-0322	12/10/90	12/21/90	
Ozone analyzers (Air)	2	18,000	2	1,100.00	2,200.00	-90-M-0322	12/10/90	12/21/90	
Ozone-pilot & compressor	1	3,000	1	7,461.11	7,461.11	-92-C-0008	09/26/92	10/13/92	
Pumps-chemical feed	3	30,000							3
Alum (500 gph) & calibr. units		0	3	7,196.00	21,588.00	-92-C-0013	09/26/92	10/13/92	
Alum (25gph) & calibr. units		0	3	2,998.00	8,994.00	-92-C-0013	09/26/92	10/13/92	
Streaming Current Detector	2	15,500	1	6,520.00	6,520.00	-90-M-0324	12/10/90	12/21/90	
Streaming Current Detector			2	6,000.00	12,000.00	-92-C-0012	09/26/92	10/13/92	
Tanks-batch chemical	6	17,600	-		0.00				4
Tank Mixers/Stands			-		0.00				4
3570 gal	0		3	2,402.19	7,206.57	-92-C-0008	09/26/92	10/13/92	
360 gal	0		3	1,461.66	4,384.98	-92-C-0008	09/26/92	10/13/92	
Turbidimeter-finished water	2	2,800	2	1,225.00	2,450.00	-90-M-0328	12/10/90	12/21/90	
Turbidimeter-raw water	0	0	1	3,231.40	3,231.40	-92-C-0008	09/26/92	10/13/92	29
Subtotal	17	92,900	22		81,136.06				
Remote Monitoring Station Equipment:									
Computer	0	0	1	4,423.52	4,423.52	-92-C-0008	09/26/92	10/13/92	5
Data Acquisition/Reporting System	0	0	1	11,569.00	11,569.00	-92-C-0015	09/26/92	10/13/92	6
Insp/start-up & training	-	0	-		29,702.00	-92-C-0015	09/26/92	10/13/92	7
Fluorometer	1	6,700	1	5,520.15	5,520.15	-90-F-0097	12/10/90	12/21/90	
Ammonia/Nitrate Monitor	1	2,000	1	29,244.17	29,244.17	-92-C-0008	09/26/92	10/13/92	8
ISE meters	1	2,000	0		0.00				8
Signal trans/remote readout	1	7,500	0		0.00				9
TOC Meter-continuous	1	18,500	1	20,020.00	20,020.00	-90-C-0010	12/10/90	12/21/90	
Turbidimeter-raw water	1	3000	1	1,369.00	1,369.00	-90-M-0328	12/10/90	12/21/90	30
Subtotal	6	39,700	6		101,847.84				
Plant Laboratory Equipment:									
Spectrophotometer (Hach)	1	3,000	1	4,909.63	4,909.63	-90-M-0335	12/10/90	12/21/90	
TOTAL	**24**	**135,600**	**29**		**187,893.53**				

RABA DRINKING WATER TREATMENT PLANT

ITEM	RECOMMENDED *		ACTUALLY PURCHASED			US ARMY	SHIPPED	ARRIVED	SEE
	No.	$ Est.	No.	Unit Price $	Total $	CONTR. NO.**		KRAKOW	NOTE
Process equipment:									
Air Blowers	2	25,000	2	32,000.00	64,000.00	-92-C-0014	09/26/92	10/13/92	
Belt filter press, etc.	1	275,000	0		0.00	N/A	N/A	N/A	10
Chlorinators, etc.	5	150,000	10	NA	266,178.00	-94-C-0022	02/02/95	03/10/95	
Ozone-full scale	2	2,000,000	4	N/A	2,038,955.72	-94-C-0023	08/05/95	10/06/95	
Ozone-pilot scale	1	2,500	1	1,100.00	1,100.00	-90-M-0320	12/10/90	12/21/90	
Polymer	1	50,000	0		0.00	N/A	N/A	N/A	11
Streaming current detector	2	15,500	1	6,520.00	6,520.00	90-M-0324	12/10/90	12/21/90	
Streaming current detector	-	0	1	6,000.00	6,000.00	-92-C-0012	09/26/92	10/13/92	
Turbidimeter-finished water	2	4,200	2	1,225.00	2,450.00	-90-M-0328	12/10/90	12/21/90	
Subtotal	16	2,522,200	21		2,385,203.72				
Remote Monitoring Station @ intake:									
Computer	0	0	1	4,423.52	4,423.52	-92-C-0008	09/26/92	10/13/92	5
Data aquisition/reporting system	0	0	1	11,569.00	11,569.00	-92-C-0015	09/26/92	10/13/92	6
DO meter-continuous	1	3,500	1	3,598.40	3,598.40	-90-M-0327	12/10/90	12/21/90	
Fluorometer	1	6,700	1	5,520.15	5,520.15	-90-F-0097	02/01/91	04/18/91	
ISE meter/Ammonia monitor	1	3,100	1	19,667.67	19,667.67	-92-C-0008	09/26/92	10/13/92	8
pH Meter-continuous	1	3,500	1	1,543.00	1,543.00	-92-C-0015	09/26/92	10/13/92	
Signal transmitter/alarm	1	4,500	1			-92-C-0015	09/26/92	10/13/92	9
TOC Analyzer	1	18,500	1	20,020.00	20,020.00	-90-C-0010	02/01/91	04/18/91	
Turbidimeter-continuous/raw	1	3,000	1	1,369.00	1,369.00	-90-M-0328	12/10/90	12/21/91	
Subtotal	7	42,800	9		67,710.74				
Plant Laboratory Equipment:									
Spectrophotometer (Hach)	1	3,000	1	4,909.63	4,909.63	-90-M-0335	12/10/90	12/21/90	
TOTAL	**24**	**2,568,000**	**31**		**2,457,824.09**				

MYSLENICE WASTEWATER TREATMENT PLANT

ITEM	RECOMMENDED *		ACTUALLY PURCHASED			US ARMY	SHIPPED	ARRIVED	SEE
	No.	$ Est.	No.	Unit Price $	Total $	CONTR. NO*.*		KRAKOW	NOTE
Process Equipment:									
Aerators-mechanical	6	60,000	12	4,164.00	49,968.00	-92-C-0009	09/26/92	10/13/92	
Mixers-anaerobic tank	2	40,000	4	8,280.00	33,120.00	-92-C-0011	09/26/92	10/13/92	
Chemical feed system	-	12,000	0		0.00				12
132 gph chem feed pumps/calibrators	-	23,750	2	4,182.00	8,364.00	-92-C-0013	09/26/92	10/13/92	
Belt filter press	1	250,000	0		0.00				10
Mixer-sludge blend tank	1	5,000	0		0.00				10
Pumps-sludge	2	12,000	0		0.00				10
Polyelectrolyte	1	10,000	0		0.00				11
Static mixer -30"	0	0	1	8,840.34	8,840.34	-92-C-0008	09/26/92	10/13/92	
Subtotal	13	412,750	19		100,292.34				
Plant Laboratory Equipment:									
D.O. Meter-portable	1	700	1	1,366.00	1,366.00	-90-M-0329	12/10/90	12/21/90	
Spectrophotometer (Hach)	1	4,000	1	4,909.63	4,909.63	-90-M-0335	12/10/90	12/21/90	
Subtotal	2	4,700	2		6,275.63				
Raba River Monitoring Station:									
TOC analyzer	1	18,000	1	20,020.00	20,020.00	-90-C-0010	12/10/90	12/21/90	
Turbidimeter-raw water	1	3,000	1	1,369.00	1,369.00	-90-M-0328	12/10/90	12/21/90	
pH/ISE meter/Ammonia monitor	1	2,400	1	19,667.67	19,667.67	-92-C-0008	09/26/92	10/13/92	8
Alarm system	1	1,000	0	0.00	0.00				13
Data acquisition/reporting system	0	0	1	11,569.00	11,569.00	-92-C-0015	09/26/92	10/13/92	6
Computer	0	0	1	4,423.52	4,423.52	-92-C-0008	09/26/92	10/13/92	5
Subtotal	4	24,400	5		57,049.19				
TOTAL	**19**	**441,850**	**26**		**163,617.16**				

PLASZOW DEMONSTRATION WASTEWATER TREATMENT PLANT

ITEM	RECOMMENDED *		ACTUALLY PURCHASED			US ARMY	SHIPPED	ARRIVED	SEE
	No.	$ Est.	No.	Unit Price $	Total $	CONTR. NO.**		KRAKOW	NOTE
Process equipment:									
Blowers	-	18,200	2	7,000.00	14,000.00	-92-C-0014	09/26/92	10/13/92	
Blowers-backwash system	1	10,000	1	7,000.00	7,000.00	-92-C-0014	09/26/92	10/13/92	
Chemical feed systems (tanks, etc.)	2	4,400	0		0.00				14
Chemical tank mixers (500 Gal)	-		2	2,039.46	4,078.92	-92-C-0008	09/26/92	10/13/92	
Chemical tank mixers (360 Gal)	-		2	1,461.66	2,923.32	-92-C-0008	09/26/92	10/13/92	
Chemical dosing pumps	3	9,750	-						
Lime pumps (105 gph)	-		2	3,068.00	6,136.00	-92-C-0013	09/26/92	10/13/92	
Polymer/alum pumps (12 gph)	-		1	3,796.00	3,796.00	-92-C-0013	09/26/92	10/13/92	
Diffusers/piping	125	16,500	1	20,972.00	20,972.00	-92-C-0008	09/26/92	10/13/92	
D.O. monitoring system	3	10,500	3	2,912.01	8,736.03	-92-C-0016	09/26/92	10/13/92	
Hoist	-	0	1	736.82	736.82	-92-C-0016	09/26/92	10/13/92	15
Mixers (anaerobic/anoxic tanks)	4	40,000	4	4,860.00	19,440.00	-92-C-0009	09/26/92	10/13/92	
Polyelectrolyte	1	10,000	0		0.00				11
Pumps-internal recycle	3	51,000	2	5,248.00	10,496.00	-92-C-0011	09/26/92	10/13/92	
Pump-sludge recycle	-		0		0.00				16
Suction sludge collector	2	50,000	1	117,109.36	117,109.36	-92-C-0008	09/26/92	10/13/92	17
Travel/per diem for Start-up/training		0	-	2,588.00	2,588.00				
Subtotal	144	220,350	22		218,012.45				
Laboratory equipment:									
Autoanalyzer (Lachat)	1	26,000	1	53,534.90	53,534.90	-90-F-0099	12/10/90	12/21/90	18
D.O. analyzers (laboratory)	3	2,700	3	1,366.00	4,098.00	-90-M-0329	02/91	04/18/91	
Microscope	1	2,700	1	834.29	834.29	-90-M-0321	12/10/90	12/21/90	
Microscope transformer	0	0	1	72.00	72.00	-90-M-0321	12/10/90	12/21/90	
Spectrophotometer, etc.	1	4,000	1	4,909.63	4,909.63	-90-M-0335	12/10/90	12/21/90	
TOC analyzer	1	18,000	1	13,298.00	13,298.00	-90-C-0010	02/91	04/18/91	
Subtotal	7	53,400	8		76,746.82				
TOTAL	**151**	**273,750**	**30**		**294,759.27**				

CENTRAL LABORATORY

(Located at the Bielany Drinking Water Treatment Plant)

ITEM	RECOMMENDED *		ACTUALLY PURCHASED			US ARMY	SHIPPED	ARRIVED	SEE
	No.	$ Est.	No.	Unit Price $	Total $	CONTR. NO.**		KRAKOW	NOTE
Laboratory turbidimeter	1	1,500	1	1,072.50	1,072.50	-90-M-0328	12/10/90	12/21/90	
Laboratory TOC meter	1	18,000	1	13,298.00	13,298.00	-90-C-0010	02/91	04/18/91	
COD analyzer	1	18,500	1	17,655.00	17,655.00	-90-C-0010	02/91	04/18/91	
pH/ISE meter with 6 probes	1	3,100	1	3,810.00	3,810.00	-90-M-0329	12/10/90	12/21/90	31
Gas chromatograph	1	20,000	1	37,480.00	37,480.00	-90-F-0102	02/91	04/18/91	19
Atomic absorption spectrometer	1	32,000	1	33,976.00	33,976.00	-90-F-0101	02/91	04/18/91	20
Hach spectrophotometer	1	3,000	1	4,909.63	4,909.63	-90-M-0335	12/10/90	12/21/90	
Gas Chromatograph//Mass Selective Detector (GC/MS)	1	85,000	1	109,094.20	109,094.20	-90-F-0102	02/91	04/18/91	21
TOTAL	**8**	**181,100**	**8**		**221,295.33**				

ENGINEERING, TRAINING AND MISCELLANEOUS

ITEM	RECOMMENDED*		ACTUAL EXPENSES			US ARMY	SHIPPED	ARRIVED	SEE
	No.	$ Est.	No.	Unit Price $	Total $	CONTR. NO.**		KRAKOW	NOTE
Consulting Engineering Service				N/A					
Workplan Development		50,000		N/A		N/A	N/A	N/A	
Design/Specification Review		23,000		N/A		N/A	N/A	N/A	
Equipment Selection and Review		23,000		N/A		N/A	N/A	N/A	
Subtotal		96,000			247,892	See Detail Sheet which follows			
Procurement Assistance					CETAC				
US ARMY CORPS OF ENGINEERS (IAG)					IAG				
FY-1990									
FY 1991									
FY-1992									
FY-1993									
FY-1994									
FY-1995									
FY-1996									
FY-1997									
Subtotal		200,000		N/A	300,182.19				
Training									
Visits of 8 Polish specialists to US ...		30,000		N/A		N/A	N/A	N/A	
Conference Attendance AWWA		5,000		N/A		N/A	N/A	N/A	
Specialty Confernces in USA		10,000		N/A		N/A	N/A	N/A	
Training courses in USA		25,000		N/A		N/A	N/A	N/A	
Subtotal		70,000		N/A	52,330	See Detail Sheet which follows			
Miscellaneous									
4 personal computers/software ...	4	30,000	3	N/A					22
Adapter cord sets	0	0	80	23.95	1,916.00	-90-M-0342	12/10/90	12/21/90	23
Transformers	0	0	2	311.48	622.96	-90-M-0343	12/10/90	12/21/90	23
Flow control doors for Fluorimeters	0	0		N/A	714.00				24
Second service call & replacement part kits for								08/28/92	25
TOC analyzers	0	0		N/A	4,950.00	-92-M-0360			
Subtotal	4	30,000			8,202.96				
Packing / Shipping Costs									26
Shipping of FY-90 Equipment	0	0			10,040.82	-90-M-0338			
Shipping of FY-91 Equipment	0	0			24,351.22				27
Packing/shipping of chlorination equipment					7,290.02				28
Shipping of ozonation equipment					139,643.41				
Subtotal		0			181,325.47				
EPA Travel to Krakow									
Gross - April 1991					1,756.00				
Clark - April 1991					1,534.00				
Gross - April 1993					1,540.00				
Gross - December 1994					2,509.17				Non SEED
Gross - July 1996					2,442.12				Non SEED
Subtotal		0			9,781.29				
Total		396,000			799,714				

ENGINEERING ASSISTANCE & TRAINING -- DETAILS

	$ Amount	Account Number	DCN No.	
ENGINEERING				
Parsons-Engineering Science, Inc.				
Contract 68-C8-0022				
Work Assignment 1-14	32,770	0ZYA13A000	BU008	
Work Assignment 1-07	30,000	0ZYA13A000	BU007	
Work Assignment 2-15	18,221	1ZYA13A000	ZY0018	
Work Assignment 2-17	35,000	AJ3D11A000	Z004	
Work Assignment 2-17 (amendment)	15,800	1ZYA13A000	ZY0033	
Work Assignment 2-18	15,625	1ZYAA3A00	ZY0034	
Sub Total	**147,416**			
Contract 68-C2-0102				
Work Assignment 1-02	13,700	2ZYA13A000	CD0016	
Work Assignment 1-02 (amendment)	12,340	3L6Q13AZZ	CD001	
Work Assignment 1-02 (amendment)	24,210	3L6Q13AZZ	CD0001	
Work Assignment 2-14/3-14	24,000	4L6Q13AZZ	CD002	
Work Assignment 3-14 (amendment)	2,800	5L6Q13AZZ4	KAR001	
Work Assignment 3-20	18,426	5L6Q13AZZ4	KAR001	Non SEED Funds
Sub Total	**95,476**			
Malcolm Piernie -- Contract 68-C8-0062				
Work Assignment 1-12	**5,000**	2ZYA13A000	CD0015	
GRAND TOTAL	**247,892**			

TRAINING -- POLES IN USA				
2-Person Delegation in September 1990				
Olko	1,131	0ZYA13A000	BU0056	
Kordeusz	479	0ZYA13A000	BU0057	
Gross (escort)	206	0ZYA13A000	N/A	
Sub Total	**1,816**			
6-Person Delegation in October 1990				
Kompass Resources (original)	19,000	0ZYA13A000	N/A	
Kompass Resources (amendment)	13,000	N/A	N/A	
WPCF Registration fees	1,725	0ZYA13A000	BU0069	
Sub Total	**33,725**			
Studnicki - June 1991				
Kompass Resources	**3,200**	N/A	N/A	
No break-out available	**13,589**	N/A	N/A	
GRAND TOTAL	**52,330**			

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KRAKOW WATER AND WASTEWATER TREATMENT PROJECT

EXPLANATORY NOTES

* From "Technical Recommendations" dated 2/2/90

** DACA78 precedes all contract numbers shown. Several pieces of equipment purchased under some contracts

3. Poles requested additional chemical feed pumps during discussions in USA in October '90.
4.. Poles want mixers/stands in lieu of batch chemical tanks - per discussions in USA in October '90. Stands deleted per April 91 discussions.
5. Needed to collect, store, and analyze data from ammonia/nitrtate monitor.
6.. Hardware/software to manage data from ammonia/nitrate monitor.
7. For all 3 systems (Rudawa, Raba RMS @ Myslenice, and Raba RMS @ intake); includes air fare & perdiem.
8. Ammonia/nitrate monitor provided in lieu of electronic ph/ISE meter for cost reasons.
9. Included in data acquisition/reporting system.
10. Belt filter presses and related equipment deleted due to insufficient funds.
11. Poles will purchase polyelectrolyte.
12. Included with chemical feed pumps
13. Alarm is included in data acquisition/reporting system.
14. Poles will purchase/provide chemical tanks. They prefer U.S.G. to provide mixers/stands.
15. Hoist added per discussions in USA in October 1990.
16. Added in October 1990; deleted in April 1991.
17. Price includes installation and start-up services.
18. Price includes training valued at $5,750 --to be provided under Contract DACA78-90-M-0323. Installed at Krakow Technical University.
19. Price for Gas Chromatograph includes training valued at $6,500.
20. Price for Atomic absorption spectrometer includes set-up and training valued at $7,295.
21. Price for GC/MS includes training ($6,500) and maintenance agreement ($5,068).
22. Three computers purchased and included earlier in listing.
23. Adapter cords and transformers needed to adapt equipment to Polish system -- 220 Volt, 5 Amp.
24. "Flow control doors" needed to make fluorimeters meet project objectives.
25. Metering range on TOC analyzers furnished was not appropriate for TOC encountered. One service call furnished gratis. Replacement parts kit was recommended by manufacturer's service representative.
26. "Recommendations" did not identify shipping as separate item. This contract covers 12/90 and 2/91 shipments.
27. Original estimate for shipping was inadequate.
28. Includes mailing specifications and some supplemental equipment to Krakow.
29. Now in use at remote monitoring station.
30. Now in use at treatment plant.
31. Now in use at the laboratory at Dlubnia water treatment plant.

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APPENDIX No. 2

Project Protocol

PROTOCOL

Of the visit to Poland October 30 - November 3, 1989, by a delegation of the United States Environmental Protecton Agency (EPA)

Pursuant to proposals made by President of the United States of America George Bush in July 1989, a delegation of EPA officials held discussions with the Ministry of Environmental Protection and Natural Resources (MOSZN) in Warsaw and with the Mayor of the City of Krakow and other officials and environmental specialists in Krakow October 30 - Novermber 3, 1989. The United States and Polish participants are listed in Appendix I.

The primary objective of the discussions was to establish a framework for implementing the proposal by President Bush for the United States to work with Poland to help reclaim Krakow from air and water pollution, and to outline possible specific projects. The list of candidate projects is given at Appendix II. In the course of discussions, representatives of EPA, MOSZN and Krakow municipal and expert groups agreed to the following basic priniciples and initial steps:

1. The projects selected should be designed to make a measurable improvement in Krakow's environment and to respond to priorities determined by environmental specialists and managers in Krakow. These efforts should also be compatible with Polish national environmental policies and programs.

2. The U.S. side will make available approximately $5,000,000 over three years to carry out the program. Both sides agreed that the U.S. contribution should be used exclusively for hard currency expenses associated with the projects, while the Polish side will provide for local currency expenses. Hard currency expenses may include, but are not limited to:

purchase of equipment, spare parts and supplies; shipping costs; contractual services; training fees and materials; travel expenses for Polish specialists in the United States (i.e., lodging, subsistence, intra-country transportation); and international airfare for U.S. specialists visiting Poland.

Zloty expenses may include, but are not limited to:

lodging, subsistence, intra-country transportation costs of U.S. specialists visiting Poland under this initiative; international airfare for Polish specialists when visiting the U.S.; design and construction costs associated with agreed projects; the purchase of those equipment components generally available on the Polish market; costs of testing and research carried out in Polish facilities.

3. Specific costs, responsible parties, division of labor, and schedule for implementing each project shall be agreed to in workplans.

4. The U.S. side will determine the dollar costs of each candidate project

listed in Appendix II. In consultation with the Polish side, specific projects will be selected on the basis of greatest environmental improvement and cost effectiveness.

5. Implementation of the projects shall be the responsibility of Polish and American specialists designated to serve on a joint Steering Committee. An Executive Board of the Steering Committee shall communicate or meet as necessary to select projects, review progress, and consider additional measures. The Executive Board shall also consider ways to coordinate the United States - Polish effort with the cooperative environmental programs of other U.S. agencies as well as other countries and organizations active in Poland. Steering Committee and Executive Board members are listed in Appendix III.

6. The Steering Committee Executive Board and appropriate technical representatives will meet in Poland in the first quarter of 1990 to finalize the initial allocation of resources. In advance of the meeting, the United States side will prepare a workplan (called for in paragraph 3 above) for the emergency air monitoring system proposal. In advance of the meeting, both sides will also collect information on costs and assess environmental benefits of possible other air quality projects and the water quality projects.

Signed in Warsaw this 3rd day of November, 1989, in English and Polish versions of equal authenticity.

For the U.S. side:

John R. Davis, Jr.
Ambassador of the
United States of America

For the Polish side:

Bronisław Kaminski
Minister for Environmental
Protection and Natural Resources

APPENDIX I

U.S. DELEGATION

Ray Ludwiszewski, head of delegation, Chief of Staff to Deputy Administrator;

Dan Beardsley, Deputy Assistant Administrator for Policy, Planning and Evaluation;

Peter Preuss, Director, Office of Technology Transfer and Regulatory Support, Office of Research and Development;

Paul Baltay, Director, Municipal Facilities Division, Office of Water;

William Laxton, Director, Technical Support Division, Office of Air Quality Planning and Standards;

Gary Waxmonsky, Acting Chief, Bilateral Staff, Office of International Activities;

Amy Evans, East European Programs Manager, Office of International Activities;

Coleman Nee, Science Counsellor, US Embassy, Warsaw;

Algis Avizienis, Consul, US Consulate General, Krakow;

Michael Barry, Consul General, US Consulate General, Krakow

Marek Czerski, Political and Economic Specialist, US Consulate General, Krakow

POLISH DELEGATION

Tadeusz Salwa, Mayor of Krakow;

Marek Paszucha, Deputy Mayor of Krakow, responsible for environmental protection;

Marian Kulig, Deputy Mayor of Krakow, responsible for municipal services;

Jerzy Kaznica, representative of the City Council Committee for Environmental Protection and Municipal Engineering;

Jerzy Wertz, Director of the City Office Department of Environmental Protection, Water Management and Geology;

Bogdan Cisak, Deputy Director of the City Office Department of Environmental Protection, Water Management and Geology;

Janusz Iwanicki, City Office Department of Environmental Protection, Water Management and Geology;

Krzysztof Bolek, Director of City Office Center of Ecological Research and Control;

Janusz Kala, Deputy Director of the Krakow Department of Municipal Services and Housing;

Stanislaw Malota, Director of the City of Krakow's Water Management and Sewage Systems;

Wojciech Studnicki, Deputy Director of the City of Krakow's Water Management and Sewage Systems;

Prof. Jerzy Kurbiel, Institute of Environmental Engineering and Protection, Krakow Technical University;

Prof. Stanislaw Juchnowicz, President of the Polish Ecological Club;

Dr. Jerzy Bielecki, Chairman of the Krakow Department of the Polish Ecological Club;

Marian Sala, Director of City Office for Municipal Designing;

Prof. Stanislaw Rybicki, City Office for Municipal Designing, representative of regional Solidarity's Ecological Committee;

Jerzy Banas, City Office for Municipal Designing;

Prof. Jozef Gega, Institute of Environmental Protection, Academy of Mining and Metallurgy, representative of regional Solidarity's Ecological Committee;

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Prof. Jacek Walczewski, Institute of Meteorology and Water Management, representative of regional Solidarity's Ecological Committee;

Dr Edward Garscia, Editor-in-Chief of the ecological monthly "Aura"

Maciej Nowicki, Vice Minister, Ministry of Environmental Protection and Natural Resources, Warsaw;

Andrzej Gerhardt, Director, Office of Foreign Cooperation, Ministry of Environmental Protection and Natural Resources, Warsaw;

Waclawa Wojciechowska-Dintorf, Director, Department of Air Protection, Ministry of Environmental Protection and Natural Resources, Warsaw,

Grazyna Mitosek, Air Protection Divisipn, Insitute of Environemtal Protection;

MEMBERS OF THE EXECUTIVE BOARD
(Polish side)

Marek Paszucha, Deputy Mayor of Krakow, responsible for environmental protection, (Co-Chairman);

Marian Kulig, Deputy Mayor of Krakow, responsible for municipal services;

Jerzy Wertz, Director of the City Office Department of Environmental Protection, Water Management and Geology;

Prof. Stanislaw Rybicki, City Office for Municipal Designing, representative of regional Solidarity's Ecological Committee;

Prof. Jozef Gega, Institute of Environmental Protection, Academy of Mining and Metallurgy, representative of regional Solidarity's Ecological Committee;

Janusz Bielakowski, Director, Department of Water Management, MOSZN.

MEMBERS OF THE EXECUTIVE BOARD
(American side)

Ray Ludwiszewski, head of delegation, Chief of Staff to Deputy Administrator;

Dan Beardsley, Deputy Assistant Administrator for Policy, Planning and Evaluation;

Peter Preuss, Director, Office of Technology Transfer and Regulatory Support, Office of Research and Development;

Gary Waxmonsky, Acting Chief, Bilateral Staff, Office of International Activities;

Richard Liroff, Conservation Foundation, Washington D.C.;

MEMBERS OF THE STEERING COMMITTEE
(American Side)

Ray Ludwiszewski, head of delegation, Chief of Staff to Deputy Administrator, EPA;

Dan Beardsley, Deputy Assistant Administrator for Policy, Planning and Evaluation, EPA;

Peter Preuss, Director, Office of Technology Transfer and Regulatory Support, Office of Research and Development, EPA;

Gary Waxmonsky, Acting Chief, Bilateral Staff, Office of International Activities, EPA;

Paul Baltay, Director, Municipal Facilities Division, Office of Water, EPA;

William Laxton, Director, Technical Support Division, Office of Air Quality Planning and Standards, EPA;

Richard Liroff, Conservation Foundation, Washington D.C.;

Thomas Hartlage, Environmental Monitoring Systems Laboratory, EPA, Research Triangle Park, N.C.

MEMBERS OF THE STEERING COMMITTEE
(Polish Side)

Marek Paszucha, Deputy Mayor of Krakow, responsible for environmental protection;

Marian Kulig, Deputy Mayor of Krakow, responsible for municipal services;

Jerzy Wertz, Director of the City Office Department of Environmental Protection, Water Management and Geology;

Prof. Stanislaw Rybicki, City Office for Municipal Designing, representative of regional Solidarity's Ecological Committee;

Prof. Jozef Gega, Institute of Environmental Protection, Academy of Mining and Metallurgy, representative of regional Solidarity's Ecological Committee;

Jerzy Kaznica, representative of the City Council Committee for Environmental Protection and Municipal Engineering;

Bogdan Cisak, Deputy Director of the City Office Department of Environmental Protection, Water Management and Geology;

Janusz Iwanicki, City Office Department of Environmental Protection, Water Management and Geology;

Krzysztof Bolek, Director of City Office Center of Ecological Research and Control;

Janusz Kala, Deputy Director of the Krakow Department of Municipal Services and Housing;

Stanislaw Malota, Director of the City of Krakow's Water Management and Sewage Systems;

Wojciech Studnicki, Deputy Director of the City of Krakow's Water Management and Sewage Systems;

Prof. Jerzy Kurbiel, Institute of Environmental Engineering and Protection, Krakow Technical University;

Prof. Stanislaw Juchnowicz, President of the Polish Ecological Club;

Dr. Jerzy Bielecki, Chairman of the Krakow Department of the Polish Ecological Club;

Marian Sala, Director of City Office for Municipal Designing;

Jerzy Banas, City Office for Municipal Designing;

Appendix II

CANDIDATE PROJECTS

Joint projects selected from the following lists will be funded from the resources enumerated in para. 2 of the accompanying protocol.

I. Air Pollution

The first set of measures is designed to improve Krakow's air pollution monitoring capability. Both sides agree that accurate and meaningful air monitoring data are key to assessing current conditions and determining the most effective actions for air quality improvements, and as an element of the planned emergency response system. The excellent working relationship between air monitoring specialists of the EPA, the Institute of Environmental Protection and environmental managers and specialists in Krakow has laid the groundwork for agreement on steps needed to improve Krakow's air monitoring network. The sides agree that the network should include the following components:

An appropriate number of monitoring stations, to inlcude a minimum of six stations equipped to monitor for SO2, NOx, CO, TSP, PM10.

Additional equipment to monitor for ozone and hydrocarbons at two of the stations.

Equipment for one mobile station to monitor SO2, NOx, CO, O3, aliphatic and aromatic hydrocarbons, organic chlorines, alcohols and solvent fumes.

One system to measure stack emissions at a power plant. Data from the stack monitor will be fed into the ambient monitoring network and used to determine when air quality emergency conditions exist.

Laboratory equipment:
Correlation spectrometer

In addition, the two sides agreed:

a) to leave open the possibility of additional continuous emission monitors at other large point sources, after evaluating the success of the first monitor;

b) to help develop links between the City of Krakow and cities in the U.S. which have existing emergency response systems for air pollution.

c) to conduct discussions with the U.S. National Park Service and the Krakow curator of monuments to investigate the usefulness of additional instrumentation at the monitoring stations. The U.S. side will present proposals in this regard.

d) that low-level sources merit study. The Polish side will prepare a proposal outlining the type of analyses that might be useful. The U.S. side will conduct discussions with other U.S. and international agencies (e.g., the World Bank) in anticipation of receiving the Polish proposal.

e) to conduct further discussions on the relation of children's health and air pollution. The U.S. and Polish air pollution and health experts will explore the value of additional monitoring, emergency response activities, and long-term solutions.

f) to consider cooperative efforts to model air pollution episodes.

II. Water Pollution

The sides agreed that the overall priority for the water quality program in Krakow would be to improve the effectiveness and reliability of the Raba and Rudawa treatment plants. The Polish side has identified the following priority projects, for which the U.S. side will provide initial cost estimates by December 1989. If deemed useful, an EPA water quality team will visit Krakow in late 1989 or early 1990 for on-site technical assessments After the cost of each proposed project has been determined, the sides will select the combination of projects which will offer the maximum environmental improvement for the investment. Following are the projects proposed by the Polish side, given in priority order:

Drinking Water

1. Equipment for removing sludge deposits and scaling in the water distribution system.

2. Monitoring equipment for the Raba and Rudawa intakes, plus analytical laboratory equipment.

3. Automatic dosing equipment for ozonation, coagulation equipment, and high efficiency chlorinators for the water supply system for Krakow

4. Devices for de-watering water purification sludge.

5. Automated equipment for process control at the Raba and Rudawa plants.

Waste Water

1. Equipment and technical support for the pilot water recycle/reuse project at the Plaszow plant, including analytical equipment.

2. Modernization of the wastewater treatment plant at Mislenice to improve the quality of treated water flowing into the Raba reservoir.

APPENDIX No. 3

Technical Delegation Recommendations
February 1990

TECHNICAL DELEGATION RECOMMENDATIONS

As a follow-up to the November 3, 1989 Protocol between the United States' Environmental Protection Agency and the Polish Ministry of Environmental Protection and Natural Resources, US and Polish technical representation met January 29 through February 2, 1990 to develop a workplan to address the water pollution and drinking water problems of Krakow. The Technical Workgroup members are listed in attachment I.

The technical Workgroup focused on the specific projects needed to improve the environmental results of the Raba and Rudawa drinking water plants, the Plaszow and Myslenice wastewater treatment plants and the analytical laboratories which support them. The facilities were visited and discussions were held to develop a list of the equipment and other related items to be provided under the Protocol. This report describes the recommendations of the Technical Workgroup.

The specific recommendations are discussed below. In these recommendations, the Workgroup identified the type of equipment that is to be purchased. Detailed specifications for purchase will be prepared after these recommendations have been reviewed and approved by the Steering Committee. As stated in the Protocol the services and equipmnent provided by the American side will total US 4,000,000 dollars. The recommendations described below may vary somewhat depending on the results of the final design and laboratory work to be completed for acceptance of this workplan by the Steering Committee.

COST ESTIMATES

This workplan summarizes the items to be purchased and services to be provided by the US side and the services or items to be purchased by the Polish side. In some cases the nature of the items to be purchased is known, therefore the timing and cost can be estimated at this time. For other items, however, the Polish side must conduct laboratory tests or conduct detail design before the final specifications can be made. For these items more general estimates are provided. It was agreed that upon adoption of this workplan by the Steering Committee, final design will be completed. That includes specifications necessary to purchase the equipment.

Certain of the items included in the recommendations may be subject to US export restrictions and thus may require specific approval before delivery to Poland. In the event that a particular item is unavailable for export, the technical Workgroup will recommend a substitute.

RESPONSIBILITIES

All items in Tables 1 through 6 will be purchased or provided by the American side. This will include the purchase price plus installation, spare parts, expendable supplies necessary for operation of the equipment, and training of operators or technicians. The American side will also provide consulting engineering services to develop this workplan, to work with the Polish side to review the final designs and assist the Poles in the final specification and procurement of equipment. The American side will also pay for Polish specialists to attend the Water Pollution Control Federation conference in October, 1990 and the American Water Works Association conference in June, 1990, excluding air travel cost as per the Protocol .

In addition, the American side will arrange and pay for visits to a number of US facilities that utilize similar treatment processes and equipment for orientation of Polish engineers. Finally, specialized training of Polish representatives will be provided by attendance at engineering, analytical and/or operations seminars and short courses.

The Polish side will undertake design of the facilities including the process, electrical, structural, civil, plumbing and architectural drawings of the project. They will also participate in the preparation of the equipment bid packages and provide all construction necessary to accomodate the equipment. The Polish side will also provide all associated piping and electrical wiring necessary for installation.

RUDAWA DRINKING WATER TREATMENT PLANT

Process and monitoring equipment will be provided to assist in the upgrading of the Rudawa treatment facility to provide a higher quality drinking water than it can presently produce. This improvement will be attained through new monitoring and control instrumentation,

improved raw water processing equipment and necessary facilities to perform feasibility studies toward further process improvements. These facilities, along with improved operating procedures, should greatly improve the quality and reliability of this facility which presently provides almost one-fourth of the City of Krakow's water supply.

RABA DRINKING WATER TREATMENT FACILITY

Monitoring and process equipment are being provided which will allow this modern water treatment facility to further upgrade its performance. Items included in this improvement include new monitoring and control instrumentation, new process equipment, facilities for studying further improvements in processing and improved technology for sludge management. These improvements will permit the production of an extremely high quality of water on a consistent basis for more than one-half of the City of Krakow, while minimizing any environmental impacts resulting from the residuals produced.

MYSLENICE WASTEWATER TREATMENT PLANT MODERNIZATION

Monitoring and process equipment will be provided to upgrade the Myslenice wastewater treatment facility to permit organic carbon and phosphorus removal along with sludge management capability. This will be accomplished through conversion of existing aeration facilities to alternating anaerobic and aerobic processing, chemical treatment, new aeration and mixing units, chemical/mechanical sludge dewatering, advanced monitoring/control and analytical instrumentation. These improvements will serve to provide greatly improved protection for the Dobczyce reservoir which serves as the main drinking water source for Krakow.

WASTEWATER RECLAMATION PILOT PLANT IN PLASZOW

Process and monitoring equipment will be installed at the Plaszow wastewater treatment facility to investigate how to implement full scale advanced wastewater treatment and reuse processes. These investigations will consist of advanced biological treatment design to remove the nitrogen, phosphorus and carbon nutrients to maximum attainable levels through the use of anaerobic and aerobic sequencing and recycling. These systems will be followed

by a physical-chemical treatment system to attain the lowest possible phosphorus and suspended solids levels. The high effluent quality resulting from these combinations of treatment will hopefully render the effluent suitable for a wide variety of reuse applications.

CENTRAL LABORATORY

New analytical equipment will be provided for the Central Laboratory to improve its capability to identify various types of potential pollutants. With this new equipment, the staff will be able to analyze for pesticides and herbicides, heavy metals, other specific organics, oil, phosphates, nitrogen and many other chemicals. This enhanced analytical capability will allow the Central Laboratory to more effectively support the other facilities, reduce the intake of harmful chemicals as well as reduce the potential impact of water or wastewater facility upsets. This equipment will also be most important for conducting the experimental studies that are necessary to finalize equipment purchase decisions in years two and three. Therefore, most of this equipment will be purchased early in this program to facilitate these studies. Such studies include jar tests for coagulation, ozonation testing, sludge dewatering evaluations and others.

The following summarizes the estimated budget for purchases for each facility or category listed.

ESTIMATED BUDGET

Facility/Location/Activity	Cost
Plaszow Wastewater Treatment	$273,150
Myslenice Wastewater Treatment Plant	$441,850
Rudawa Water Treatment Plant	$135,600
Raba Water Treatment Plant	$2,568,000
Central Laboratory	$181,100
Engineering/Training/Misc.	$396,000
Total	$3,995,700

NOTE:

1. Wastewater and Water Plant Laboratory Items are included in the estimate for that particular facility.

2. Remote sensing equipment for raw drinking water supply sources are included in the estimates for the Rudawa and Raba Treatment facilities, and the Raba monitoring station is included in the Myslenice Plant.

TOTALS BY YEAR

TOTALS BY YEAR	1st Year	2nd Year	3rd year
Plaszow	$153,800	$119,350	$0.00
Myslenice	124,850	40,000	277,000
Rudawa	135,600	0.00	0.00
Raba	52,500	190,500	2,325,000
Central Laboratory	206,000	0.00	0.00
Eng./Tng/Misc	192,000	140,000	59,000
ANNUAL TOTALS	$853,850	$489,850	$2,652,000
TOTAL			$3,997,700

TABLE Nr. 1

RUDAWA WATER TREATMENT PLANT

Description	Total Cost	Year
A. Process		
Pilot ozone generator (1)	$3,000	1
Chemical Feed Pumps (3)	30,000	1
Batch Chemical Tanks (6)	17,600	1
Streaming Current Detector (2)	15,500	1
Ozone Analyzers (1 - water)	6,000	1
Ozone Analyzer (2 - air)	18,000	1
Finished Water Turbidity (2)	2,800	1
SUBTOTAL PART A.	$ 92,900	
. Remote Monitoring Station		
Turbidity - Raw (1)	$3,000	1
Fluorometer	6,700	1
ISE [ammoniaa (1)	2,000	1
TOC Continuous (1)	18,500	1
ISE [nitrate] (1)	2,000	1
Signal Transmission with remote readout	7,500	1
SUBTOTAL PART B.	$39,700	
C. Plant Laboratory		
Hach Spectrophotometer	3,000	1
TOTAL PART A + B	$135,600	
Total Table 1		
1st Year	$135,600	
2nd Year	0.00	
3rd Year	0.00	
TOTAL	$135,600	

TABLE Nr. 2

RABA WATER TREATMENT PLANT

A. PROCESS

Description	Total Cost	Year
Air Blowers (2)	$25,000	2
Chloronators with associated piping, controls manifolds(5)	150,000	2
Ozone Generators* for 3600L/S at 2 $g/m^3/hr$	2,000,000	3
Pilot Ozone Generator (1)	2,500	1
Finished Water Turbidity (2)	4,200	1
Belt Filter Press with piping and feed equipment (1)	275,000	3
Polymer	50,000	3
Streaming Current Detector (2)	15,500	2
SUBTOTAL PART A.	$2,522,200	

B. RABA REMOTE MONITORING STATION at water intake

Description	Total Cost	Year
Continuous Turbidity Raw(1)	$3,000	1
ph Continuous	3,500	1
Specific ION (1)	3,100	1
TOC Analyzer (1)	18,500	1
Fluorometer (1)	6,700	1
D.O. Continuous (1)	3,500	1
Alarm Transmitter via existing lines	4,500	1
SUBTOTAL PART B.	$42,800	

C. Plant Laboratory Hach Spectrophotometer	3,000	1
TOTAL FOR RABA PLANT	$2,568,000	

TOTAL ESTIMATE FOR TABLE 4

1st Year	$52,500
2nd Year	190,500
3rd Year	2,325,000
GRAND TOTAL	$2,568,000

Can be used for Raba or Rudawa Water Plants depending on the results of pilot studies.

TABLE Nr. 3

MYSLENICE WASTEWATER TREATMENT PLANT

PLANT LABORATORY

Description	Total Cost	Year
Portable D.O. Meter (1)	$700	1
Hach Spectrophotometer with digester and chemicals (1)	4000	1

REMOTE RABA RIVER MONITORING STATION

Description	Total Cost	Year
TOC Analyzer	18,000	1
Turbidity Meter-Raw Water	3,000	1
pH/ISE Meter (ammonia)	2,400	1
Alarm System	1,000	1
TOTAL ANALYTICAL COST		
1st Year	$29,100	
2nd Year	0.00	
3rd Year	0.00	
SUBTOTAL	$29,100	

TABLE Nr. 3 (cont)

EQUIPMENT FOR MYSLENICE
WASTEWATER TREATMENT PLANT

Description	Total Cost	Year
Floating Mechanical Aerators (6)	$60,000	1
Anaerobic Tank Mixers (2)	40,000	2
Chemical Feed System	12,000	1
Chemical Dosing Pumps	23,750	1
Belt Filter Press (1)	250,000	3
Sludge Blend Tank Mixer (1)	5,000	3
Sludge Pumps (2)	12,000	3
Polyelectrolyte	10,000	3
SUBTOTAL	$412,750	
Laboratory equipment	$29,100	
TOTAL	$441,850	
1st Year	$124,850	
2nd Year	40,000	
3rd Year	$277,000	

TABLE Nr. 4

PLASZOW WASTEWATER TREATMENT PLANT
ANALYTICAL EQUIPMENT - PLANT LABORATORY

Description	Total Cost	Year
TOC Analyzer (1)	$18,000	1
Spectrophotometer with digestors and chemicals (1)	4,000	1
Latchet Autoanalyzer (1)	26,000	1
D.O. Analyzers - Lab (3)	2,700	1
Laboratory Microscope (1)	2,700	1
ANALYTICAL EQUIPMENT TOTAL		
1st Year	$52,800	
2nd Year	0.00	
3rd Year	0.00	
TOTAL	$52,800.00	

TABLE Nr. 4 (cont)

EQUIPMENT FOR PLASZOW
DEMONSTRATION WASTEWATER TREATMENT PLANT

Description	Total Cost	Year
Blowers (3)	$18,200	2
Diffusers/Piping (125)	16,500	2
Internal Recycle Pumps (3)	51,000	1
Mixers (4)	40,000	2
Chemical Dosing Pumps (3)	9,750	2
Chemical Feed Systems (2)	4,400	2
Polyelectrolyte	10,000	2
D.O. Monitoring System (3)	10,500	2
Suction Sludge Collector (2)	50,000	1
Blowers/Physical Chemical	10,000	2
SUBTOTAL	$220,350	
Laboratory Equipment	$52,800	
TOTAL	$273,150	
1st Year	$153,000	
2nd Year	$119,350	
3rd Year	$0	

TABLE Nr. 5

CENTRAL LABORATORY

Description	Total Cost	Year
Laboratory Turbidity (1)	$1,500	1
Laboratory TOC (1)	18,000	1
COD Analyzer (1)	18,500	1
lpH/ISE Meter with probes (6)	3,100	1
Gas Chromatograph (1)	20,000	1
Atomic Absorptrion (1)	32,000	1
Hach Spectrophotometer (1)	3,000	1
GC-MS (1)	85,000	1

TOTAL ESTIMATED COST TABLE NR. 5

1st Yr	$181,100
2nd Yr	0.00
3rd Yr	0.00
TOTAL	$181,100.00

TABLE Nr. 6

ENGINEERING, TRAINING AND MISC

Description	Total Cost	Year
Consulting Engineering Services		
- Workplan development	$50,000	1
- Design/Specification Review	23,000	1
- Equipment Selection Review	23,000	
- Procurment and technical assistance	75,000	1
	100,000	2
	25,000	3
Training		
- Visits of eight Polish specialists to US to visit operating facilities to observe installation of recommended equipment	$30,000	1
- Conference attendence AWWA	5,000	1
- Specialty conferences in U.S.	10,000	2
- Training courses in U.S.	25,000	3
Miscellaneous		
- Four personal computers with software to assist in operations of both drinking water and wastewater facilities	$30,000	2
TOTAL	$396,000	
1st Year	$206,000	
2nd Year	140,000	
3rd year	50,000	
TOTAL	396,000	

Signed in Krakow this 2nd day of February, 1990 in English and Polish versions of equal autenticity.

For the US side

Lee I. Pasarew
US EPA

For the Polish side

Marian Kulig
Vice Mayor of Krakow

ATTACHMENT I

POLISH DELEGATION

Marek Paszucha, Deputy Mayor of Krakow, responsible for environmental protection;

Marian Kulig, Deputy Mayor of Krakow, responsible for municipal services

Jerzy Wertz, Director of the City Office Department of Environmental Protection, Water Management and Geology;

Bogdan Cisak, Deputy Director of the City Office Department of Environmental Protection, Water Managment and Geology

Wojciech Studnicki, Deputy Director of City of Krakow's Water Management and Sewage Systems;

Prof. Jerzy Kurbiel, Institute of Environmental Engineering and Protection, Krakow Technical University;

Marian Sala, Director of City Office for Municipal Designing;

Prof. Stanislaw Rybicki, City Office for Municipal Designing, representative of regional Solidarity's Ecological Committee;

Jerzy Banas, City Office for Municipal Designing;

Mariusz Olko, Manager for Central Laboratory

Waclaw Kordeusz, General Designer, City Office for Municipal Designing

Krzysztof Bolek, Director of the Environmental Control and Research Center

U.S. DELEGATION

Lee Pasarew, head of delegation, Office of Water, Office of Minicipal Pollution Control, US EPA

James Kreissl, Office of Research and Development, risk Reduction Engineering Laboratory, US EPA

Joseph Cotruvo, Office of Water, Office of Drinking Water, US EPA

Melvin Hockenbury, Vice-President, Engineering Science, Inc. (consultant to US EPA)

Billy Kornegay, Technical Manager, Engineering Science, Inc. (consultant to US EPA)

Algis Avizienis, Consul, U.S. Consulate General, Krakow

Marek Czerski, Political and Economic Specialist, U.S. Consulate General, Krakow

APPENDIX No. 4

Report on December 1994 Visit to Kraków

Krakow Water & Wastewater Project
Report of Technical Review
December 1994

1. Background:

Under the Support for Eastern European Democracies (SEED) Act of 1989, the United States government has been helping the City of Krakow upgrade 2 drinking water treatment plants, 2 wastewater treatment plants, and a central laboratory. The parties primarily responsible for the program are the Environmental Protection Agency for the United States and MPWiK (the municipal water utility) for Krakow.

The USA is providing equipment, supplies, replacement parts, and appropriate training. The equipment being provided was selected by a team of Polish and American engineers in 1990. (See Technical Delegation Recommendations dated 2 February 1990.) The U.S. Army Corps of Engineers (USACoE), under an Inter-Agency Agreement, assists EPA by procuring the equipment and arranging for shipment of the equipment to Krakow. Parsons Engineering-Science, a private American consulting engineering firm under contract to EPA, has helped develop the program in 1990 and developed the technical specifications used in its purchase. The actual purchases were made by the USACoE using American procurement procedures.

Total value of equipment and services (such as shipping, training, engineering and procurement assistance) to be provided is approximately $4 million. As of December 1994, equipment and services with an approximate value of $1.5 million have already been provided. Chlorination and ozonation equipment valued at approximately $2.2 million have been ordered and are now being fabricated. Engineering and procurement services and shipping will consume most of the remaining $0.3 million.

A technical delegation of 3 persons[1] visited Krakow from 6 December to 14 December 1994 to review the progress of the program to date. This review was not initiated because of a suspicion that anything was "wrong" in Krakow. Rather the review was initiated in

the interest of good stewardship to document "for the record" that the Polish-American partnership was receiving good value for the money expended and to learn from any mistakes that may have been made. The team also used the visit to discuss technical details for the chlorination and ozonation equipment now being fabricated.

2. General Summary of Findings:

The team is very impressed by the progress made by our Polish partners since the program began. Investment in engineering and construction is worth many times the value of the equipment provided by the USA. Construction work and installation of equipment is very well done. For example:

- the biological system (aeration tanks) at Myslenice has been totally renovated and a centrifuge for sludge dewatering, purchased at MPWiK expense, has been installed.

- The Płaszow biological system has been augmented by a physical/chemical system financed largely by MPWiK. Only the chemical mixers in this system were provided by the USA.

- The remote monitoring station for Rudawa is an impressive two-story structure with monitoring equipment and laboratories on the ground floor and two apartments on the upper floor.

Except for the Raba intake structure and the laboratory at the Krakow Technical University, the team visited all facilities where the equipment is installed. With certain exceptions, the treatment equipment provided by the USA has been installed in the intended place for the intended purpose. Treatment equipment that has not yet been installed can be accounted for and there are valid reasons why the equipment has not been installed or placed in service. (Equipment not installed or in use is discussed separately below.)

Laboratory equipment can be accounted for. It's obvious that it is being used effectively and has been well cared for. Original manuals provided with the equipment are still available and many have been translated into Polish.

The team was impressed to see inventory control numbers on laboratory equipment purchased by MPWiK as well as that furnished by the USA. It indicates the efforts on the part of MPWiK to carefully inventory and account for the equipment.

Analyses are conducted in a professional manner with great care and ingenuity and are consistent with good scientific practices. Quality control/quality assurance (QA/QC) procedures need to be improved in order to document for the record the accuracy and reliability of the results. Documented QA/QC efforts will be necessary to substantiate the laboratory data if they are ever questioned. Recommendations and suggestions for improving analytical procedures are contained in the "Recommendations" and "Follow-up Actions" sections below. The recommendations and suggestions are similar to those commonly provided to publicly owned treatment plants in the United States.

3. Equipment not installed or in use at present:

Two pilot ozone generators and 2 ozone monitors for air and 1 ozone monitor for water:

These were provided to conduct pilot studies on ozone treatment at Raba and Rudawa. The pilot studies at Raba have been completed. (Pilot studies were used to affirm the size of the units now being fabricated.) The pilot studies at Rudawa will continue after major renovations now in the planning stage are completed. The ozone generators and monitors were accounted for and remain available for future studies. The air and water monitors could also be used in the full scale facility at Raba.

2 Ammonia monitors and 1 ammonia/nitrate monitors:

These monitors were provided for the three remote monitoring stations[2]. They are not currently in use at these locations because they are not capable of detecting and/or measuring the low concentrations that now need to be measured. Whether this "problem" developed because of a misunderstanding of the need at the outset of the program or the needs of MPWiK have changed is not important. What is important is to recognize that these instruments do function as they were designed to function, but they cannot be readily adapted to detect and measure the low levels of ammonia and nitrates that is now desired. It is unlikely that there is any automated equipment for continuous monitoring on the market at a reasonable price that can measure and detect the low levels desired. The team recommends that the monitors provided be used in the laboratory, most likely one serving a wastewater treatment plant.

Dissolved Oxygen (DO) meters:

Three DO meters were provided for the Płaszow wastewater treatment plant on the assumption that it would be necessary to measure oxygen levels in all three aeration tanks. It was subsequently determined that it is necessary to measure oxygen levels only in the final tank so 2 instruments are not used for the original purpose. One is used as a portable unit for DO and BOD analyses and the third remains available for use elsewhere.

Mixers, chemical feed pumps, and streaming current detectors:

This equipment was delivered in 1992 for installation in the Rudawa drinking water treatment plant. The equipment has not yet been installed. We were assured that the equipment has been stored in controlled conditions and will be installed when major renovations proceed in 1995.

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Hoist:

A hoist was provided to facilitate installation of other equipment (such as pumps and aeration diffusers) at the Płaszow wastewater treatment plant. It was used for that purpose and is available for use in routine maintenance as required.

Leeds & Northrup (L&N) Micromax Data Acquisition System:

Three units were provided for use at the remote monitoring stations. The unit at Rudawa is not currently being used because this equipment requires the installation of a communication line. This communication link is scheduled for installation in January. Currently the results from continuous monitoring equipment as the turbidimeter, TOC analyzer and fluorometer are recorded manually.

The unit at Myslenice does not relay information to Raba because a dedicated phone line has not been installed. Warnings of adverse conditions, as indicated from the continuous monitors, can be relayed by the operators via a phone call from Myslenice to Raba.

5. Other issues:

The Chemical Oxygen Demand (COD) analyzer provided for the Rudawa remote monitoring station does not seem to provide reliable results on water. MPWiK proposed exchanging the COD meter with the City of Zgiersz for a phosphorous analyzer. In principle, this is okay, but Mr. Studnicki, or other appropriate person, should send a formal proposal to USEPA (c/o Ed Gross) and receive formal approval before the trade is made.

The pH/ISE meter provided for the Central Laboratory is in use at the Dlubnia treatment plant.

6. Additional equipment and spare parts:

MPWiK has expressed interest in receiving additional accessories and spare parts for the fluorimeters, Gas Chromatograph/Mass Spectrophotometer (GC/MS) and the Ionics TOC meters within the approved overall budget. USEPA has agreed in principle that the additional purchases are reasonable, but has deferred action on procurement pending completion of the purchase of the chlorination and ozonation equipment. Pending available of funds, procurement of the additional equipment and spare parts will proceed in the following order:

- Additional accessories and spare parts for the fluorimeters. (Top priority because the fluorimeter model provided is no longer manufactured and accessories and spare parts will be available for only a limited amount of time.)

- Additional accessories for the GC/MS^3.

- Additional spare parts for the Ionics TOC meters.

8. Follow-up actions for MPWiK:

- MPWik should investigate increasing the flow through the continuous monitoring equipment, especially the turbidimeter. This would reduce the lag time between taking the sample and measurement and, perhaps, reduce the fouling the flow cells in the instruments.

- MPWiK should consider implementing the suggestions on laboratory procedures contained in the Appendix.

9. Follow-up actions for the USEPA:

- Determine availability and cost of a variable resistor for the speed control unit of the suction sludge collector provided for Plaszow. (MPWiK had difficulty locating this part when a

replacement was needed.) Provide part if possible within the approved overall budget.

- Contact[4] Leeds & Northrup, the supplier of the Micromax data acquisition units, and assure it:

  = returns the parts L&N removed from the Micromax units for repair or examination at start-up,

  = provides information (in written form or via phone call) on programming language (Forth) for the Micromax units, and

  = provides banking information needed for MPWiK to pay for additional spare parts provided. (Since international transfer of money is required, MPWiK cannot pay the bill directly.)

- Proceed with procurement of accessories and spare parts as discussed in Section 4.

- Determine if there is a programming language other than Forth for use with the L & N Micromax units.

- Determine if a head space analyzer is the most appropriate device for measuring trihalomethanes and other volatile organic compounds.

- Provide general guidance on the piping system for chlorination including type and class of pipe, materials of construction, valve and fitting requirements, and support requirements.

- Explore the possibility of providing EPA Quality Control samples/ampules.

- Provide VHS training videos on several analytical techniques.

- Confirm the number and type of chlorine analyzers to be provided with the chlorination system equipment.

- Provide a recommended arrangement for the on-site alarm box at the chlorination system. (To be provided in english, MPWiK will translate to Polish.)

- Investigate ways to determine the residual chlorine content in 500 kg chlorine containers.

- Determine what spare parts are included with the chlorination equipment. MPWiK is especially concerned about the membranes for the expansion chambers.

10. People with whom the team met:

Wojciech Studnicki; Director, MPWIK
Marek Przytulski; Assistant to Mr. Studnicki
Mariusz Olko; Supervisor of Laboratories, MPWiK
Waldemar Kalka, Assistant to Mr. Olko
Krzytof Łuszchek; Director, Rudawa Water Treatment Plant
Janusz Szlachta; Director, Plaszow Wastewater Treatment Plant
Jan Smaczny; Director, Raba Water Treatment Plant
Jan Stelmach; Director, Laboratory at Raba
Kazimiersz Sas; Supervisor of Operations Division, MPWiK
Wacław Kordeusz; Designer, BPBK[5]

7. Acknowledgements:

The team wishes to acknowledge the very genial and cooperative assistance of Mr. Wojciech Studnicki and his very capable, English-speaking assistant, Mr. Marek Przytulski. Without them, this visit could not have been successful.

Endnotes

1. Charles E. Gross; Environmental Engineer, USEPA Office of Water; Washington, D.C.

   Joseph Slayton; Senior Scientist/Technical Director, USEPA Region III Laboratory; Annapolis Maryland

   Billy H. Kornegay; Vice President, Parsons Engineering-Science; Fairfax, Virginia

2. At Rudawa near the retention basin now being constructed; adjacent to the Myslenice wastewater treatment at the headwaters of the Raba reservoir; at the intake structure providing raw water to the Raba treatment plant.

3. We must first determine if a head space analyzer is the most appropriate device for measuring trihalomethanes and other volatile organic compounds.

4. Fax sent to USACoE on 9 December asking it to follow up with Leeds & Northrup. (USACoE awarded the contract to L & N.)

5. Meeting about ozonation system scheduled for Tuesday & Wednesday, 13/14 December.

Krakow Water / Wastewater Project
Extra Parts for
Hewlett-Packard Gas Chromatograph/Mass Selective Detector
Model 5890A[1]

Item	Quan.	Part No.	Description
1	1	HP7694	Headspace Sampler 44 vial capacity, constant heat time, nickel 1 & 3 sample loop, 60 cm nickel transfer line, vialagitation, **power source 220 volt, 50 Hz**
2	1[2]	OPT 002	Substitute for 220 V 50 Hz operation. **(May not be needed if included in Item 1.)**
3	1[2]	OPT 030	Table designed to support Headspace sampler above the MSD in a GS/MSD system **(May not be needed if Item 1 can be mounted on same level as GC/MS.)**
4	1	?[3]	General purpose cable to transmit vial ID code in BCD
5	1	?[3]	Vial kit KT
6	1	?[3]	Septa, Headspace 144/pk
7	1	?[3]	Crimper, 20 mm seals
8	1	?[3]	Decapper, 20mm
9	1[2]	HP 300-257	DAN Line heated transfer (May not be needed if included in Item 1.)
10	0	-	Electron capture detector and fittings **(No longer needed; Poles have it.)**
11	1	HP 59943A	NIST PBM Library, Rev B.02.00 on DDS Cassete HP-UX Chemstation OP SYS Software. [Computer hardware is Unix HP 9000-Model 345 with disc driver 6000-Model 330S, Option 003 (tape drive)

[1] Purchased under MEAPO/TAD Contract DACA7890F0102

[2] Item need not be ordered separately if already included in Item 1.

[3] Can provide part numbers that applied to HP19395 headspace sampler, but don't know if same part numbers apply to HP7694 headspace sampler.

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Appendix

Suggestions on Analytical Procedures

Analyses are conducted in a professional manner with great care and ingenuity and are consistent with good scientific practices. Quality control/quality assurance (QA/QC) procedures need to be improved in order to document for the record the accuracy and reliability of the results. Documented QA/QC efforts will be necessary to substantiate the laboratory data if they are ever questioned. Detailed recommendations and suggestions for improving analytical procedures are provided below. The recommendations and suggestions are similar to those commonly provided to publicly owned treatment plants in the United States.

Managerial/Institutional:

- The analysts were meticulous and showed great skill and technique in their analyses. It is suggested that the water authority consider establishing a position of a "Quality Control Officer". This position would ideally be independent of the management of the various wastewater and drinking water laboratories. The focus of this position would be quality assurance and control activities including training, establishing a formal QA program, and writing standard operating procedures (SOPs), etc. to help assure quality and uniformity of analytical results.

- The laboratories have a routine program of analyzing "split samples". Aliquots of preserved samples are distributed to several laboratories/analysts and are analyzed independently. The results are compared to assess analytical variability and to help detect and correct analytical difficulties. These results should be routinely compiled and shared among the various laboratories/analysts.

- The laboratory should prepare a written quality control manual. Such a manual would delineate the routine quality control procedures that are to be conducted and the frequency that they are to be performed, e.g.;

    = calibration of thermometers against a reference thermometer,

    = records of drying oven, incubator water bath and sterilizer temperatures,

    = records of reference weight results

    = precision measures (analysis of samples in duplicate) and

"spike" analyses (addition of a know amount of the material to a sample). It is suggested that one sample in each batch of 20 or fewer samples be analyzed in duplicate and one sample spiked. Quality control limits should be established to systematically determine whether the analytical systems are performing properly or whether the analyses should be repeated. For analytes with holding times shorter than the time to perform the test, e.g., BOD and coliform, etc., when the QC results are unacceptable, yet the samples cannot be reanalyzed, then such analytical results should be highlighted with a footnote which indicates that an analytical problem occurred and what corrective action steps have been taken.

- A laboratory certification program should be established. It was indicated that such a program was being considered on a national level. It is suggested that the experts from the Krawkow, with their significant expertise, play a role in such developments. If these national efforts do not materialize then a similar effort should be developed locally.

Procedures:

- The extra/backup turbidimeter at the Rudawa water plant could be calibrated for a higher concentration range for use with ambient monitoring.

- The inventory of analytical equipment (currently numbered) could be extended to include an electronic data base. Such a data base could include the date of purchase and value. This could also help with the prioritization of future laboratory equipment purchases.

- The laboratories had schedules for calibration and other laboratory operations. It is suggested that this listing be expanded to include a routine schedule for cleaning and maintenance.

- Additional analytical records may be warranted:

    = Equipment maintenance records (what was done when and by whom);

    = In addition to the copies of the analytical methods (specified by regulation) and the detailed instructions for the analytical procedures available in the instrument manuals, there could be a listing of the unique techniques/aspects of each procedure performed at each laboratory (Standard Operating Procedures--SOPs), e.g., preparation of dilutions; listing of procedures different

from those mandated by regulation (use of an alternate chemistry for nitrate as opposed to cadmium reduction); instructions for the preparation of calibration standards; and quality control procedures to be employed.

- The frequency of calibration is consistent with the instrument manufacturer's recommendations. In addition, it is recommended that the routine calibration of instruments should be verified by at least two reference calibration standards and a blank with each set of samples. The concentrations of these calibration standards, e.g., reference pH buffers, phthalic acid solutions for TOC, reference oils for the fluorometers, etc. should be selected so as to closely bracket the concentrations measured in the samples. As instruments are routinely calibrated, a record of such calibrations should be maintained to document this critically important step in the analyses. It is suggested that "bench sheets" (records completed for each analysis as it is performed which includes the results of all weighings, and other measurement) be prepared for routine use by the analysts. These are often helpful in a fill-in-the-blank format.

- Quality Control Samples (with the results known by the various laboratories/analysts) should be purchased and analyzed quarterly. Performance Evaluation Samples (QC samples for which the laboratories do not know the true result) should be analyzed yearly.

- A deionization system should be considered for purchase to prepare reagent (laboratory pure) water. These type of systems have proven especially beneficial in the analyses of metals and ammonia nitrogen. The addition of a carbon scrubber cartridge to such a system should enable the water to be used for the analysis of organic constituents.

- It was indicated that a phosphorus analyzer was needed and that this could be obtained by trading equipment with another authority. A letter detailing this plan should be forwarded to Ed Gross and a copy should be retained on file at the appropriate laboratory.

- It is suggested that mixed standards of the various organic compounds (THMs, pesticides) be analyzed <u>with each set of samples.</u>

- The laboratory should continue using the liquid/liquid (L/L) extraction technique for the analysis for the analysis of trihalomethanes (THMs) until a head space analyzer or a purge-and-trap device is procured.

- The laboratory should consider using ion-selective electrodes

for the analysis of ammonia and nitrate.

- The GC/MS "mass tune" (relative intensity of masses) needs to be calibrated each day the instrument is used. Decafluorotriphenyl phosphene (DFTPP) is useful for the analysis of extractable organics and bromofluorobenzene (BFB) is useful for volatile organics.

- When testing chlorinated effluent for BOD, a glucose/glutamic acid standard should be analyzed with each set of samples.

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