PD-ABF-467

WEC STAFF

TRIP REPORT

TO

HUNGARY AND CZECHOSLOVAKIA

NOVEMBER 28 - DECEMBER 9, 1992

JANUARY 1993

LIST OF REPORT DISTRIBUTION:

Ronald J. Greenberg, Chief, Bureau for Europe, Agency for International Development

James Taft, Project Officer, Bureau for Europe, Agency for International Development

Patricia A. Swahn, Acquisitions Manager, Agency for International Development

Lee Roussel, AID Representative, Prague, Czech Republic

David Cowles, AID Representative, Budapest, Hungary

Sandy Hale, Jr., Senior Environmental Advisor

James Scherer, Senior Environmental Advisor

Ludmila Hofmanova, WEC Prague Office, Prague, Czech Republic

Zsuzsanna Dorko, WEC Coordinator, Budapest, Hungary

Antony G. Marcil, WEC
Frank T. Wood, WEC
Romuald Michalek, WEC
Thomas J. McGrath, WEC
Bohdan Aftanas, WEC
Dorothy E. Chuckro, WEC
File (2)

TABLE OF CONTENTS

		Page
I.	Purpose of Trip	1
II.	Executive Summary	2-3
III.	Meetings and Discussions	4-10
IV.	Follow-up Actions	11
V.	Itinerary	12-13
VI.	Appendix	14

1. Malcolm Pirnie, Inc., Waste Minimization Demonstration Project at Chemopetrol, Interim Report;
2. List of Participants of Meeting at Chemopetrol;
3. Business Cards.

I. PURPOSE OF TRIP

The WEC staff, consisting of Mr. Thomas J. McGrath, Vice President and Dr. Bohdan Aftanas, Project Manager, traveled to Hungary to establish contact with industrial enterprises and to select, among them, candidates for planned Waste Minimization Demonstration Projects (WMDP). Also, they met with Hungarian government officials to inform them about the program, to obtain endorsement and to consult on the selection of enterprises.

Following his stay in Hungary, Dr. Bohdan Aftanas traveled to Czechoslovakia to the Chemopetrol Sp. Oil Refinery in Litvinov to participate in the Waste Minimization Oversight Committee meeting. During this meeting, WEC/Malcolm Pirnie, Inc. presented the results of the completed survey at the Aromatics Plant (portion of the oil refinery).

II. EXECUTIVE SUMMARY

Hungary

The Waste Minimization Program planned by WEC for Hungary was presented to the Ministry for Environment and Regional Policy, and the Ministry of Industry and Trade. Both ministries strongly endorsed the program and expressed their readiness to assist in the selection of industrial plants for demonstration projects. It was mutually agreed that the Akkumulator - es Szavazelemgyar-Battery Plant in Budapest and Moll Rt. Komaromi Finomito Petroleum Industrial Co. are proper candidates for such projects. However, WEC's suggestion to include the Tiszai Vegyi Kombinat Rt. (TVK) into the program was received by the Ministries with some reservations. The reason for this was that TVK was considered a relatively modern, well-run plant with only a few environmental problems. However, it should be mentioned that following the WEC staff's reconnaissance visit to the TVK, it was decided that this large chemical complex situated in the Borsod County, was still a proper candidate for the Waste Minimization Demonstration Project (WMP).

To identify candidates for future projects, WEC Staff visited the following five (5) plants where they presented WMP:

1. Akkumulator - es Szavazelemgyar - Battery Plant in Budapest;

2. Tiszai Vegyi Kombinat - Chemical Complex in Tiszanjvaros;

3. Moll Rt. Komaromi Finomito Petroleum Industrial Company in Szony-Komaron;

4. Raba Rt. - Machinery Manufacturing Plant in Gyor; and

5. Gardenia Lace Curtain Factory in Gyor.

All of the above plants have expressed great interest in the program and their strong desire to be considered for those projects. Based on the plant visits, including discussions with management and initial evaluation of information, the first three plants, since they complied with WEC's selection criteria, were identified as the best candidates for the Waste Minimization Demonstration Projects.

With the exception of the Budapest Battery Plant, collection and review of more specific information on the two remaining plants will be required to decide on final selection of the enterprises for the projects. Since WEC has previously

performed an environmental review at the Battery Plant, there is enough information available at this time, to determine that the first WMP in Hungary can be conducted at this enterprise; it is scheduled to be initiated in February, 1993.

Due to current negotiations to establish a joint venture at the "Pyrus" Company planned for this year at Aszod, a workshop on hazardous waste is not feasible. The new schedule will be established following conclusion of joint venture negotiations.

Czechoslovakia

The Waste Minimization Demonstration Project, consisting of a fugitive VOC emission survey at the Chemopetrol S.p. in Litvinov is underway. The project at the portion of the complex, Aromatics Plant, has been completed and the results were presented by the WEC/Malcolm Pirnie, Inc. team to the Oversight Committee on December 8, 1992. Approximately 2,500 fugitive VOC emission sources were surveyed. About 1% of the sources consisting of pumps are responsible for about 40% of the fugitive emissions, and about 50% of the potential savings. A potential reduction of about 70% in the current cost can result from implementation of the WMP. Approximately 90% of the potential savings results from reduced product losses and only 10% from avoided emission permit fees.

When savings results achieved at the Aromatics Plant are extrapolated to represent the rest of the refinery, annual savings can conservatively be estimated at $75,000. The Chemopetrol s.p. is going to continue the fugitive VOC emission survey throughout the entire complex by hiring a local consulting firm.

On the evening of December 8, 1992, the WEC/Malcolm Pirnie, Inc. team had a separate meeting with the Representatives of the U.S. Agency for International Development and the Czech Environmental Management Center. At this meeting, the status of the Chemopetrol WMP and results obtained at the Aromatics Plant were reviewed.

III. MEETINGS AND DISCUSSIONS

November 30 - Hungary

Akkumulator - es Szavazelemgyar - Battery & Dry Cell Plant

The plant is located in the city of Budapest. It was established in 1893 and employs about 1,000 people. It manufactures a full range of traction and stand-by lead-acid batteries on a license purchased from Globe-Union (USA), dry cells, and zinc carbon on a license bought from Vidor Company (England) with traditional opened type pocket Ni-CD batteries.

A meeting was held with Dr. Jozef Keri, General Director, Ms. Agnes Horvath, Head of International Department and Mr. Laszlo Solti, Head of Safety and Environmental Department.

At the beginning of the meeting, Ms. Agnes Horvath and Mr. Laszlo Solti expressed their appreciation for WEC's previous project performed for this plant. Implementation of that project's recommendations has led to several meaningful improvements; especially in the area of worker's health and safety. As an example, they cited the case of lead content in the factory worker's blood. After implementation of WEC expert's recommendations, the lead content in the worker's blood has been drastically decreased or almost eliminated. They also mentioned some other areas of improvement due to WEC's recommendations. The plant has expressed a strong interest in the Waste Minimization Project and would like to proceed as soon as possible. They also assured WEC staff of full cooperation.

WEC has received from the plant a letter confirming their request for participation in this new project.

December 1

Ministry for Environment and Regional Policy (MERP)

Met with Dr. Attila Kemeny, Deputy State Secretary, Mr. Peter Szanto, Deputy Head of Environmental Technology Department and Ms. Eszter Szovenyi, Chief Executive of Department for International Relations, all three from MERP.

MERP was very interested in WEC's waste minimization program. In discussing possible candidates for the waste minimization demonstration projects, they expressed some reservations about including the Tiszat Chemical Complex (TVK) in Borsod County. In MERP's opinion, this complex is one of the most modern facilities and has only very minor environmental problems. On the

other hand, they were supportive of WEC's consideration given to the Raba Rt. plant and other industrial enterprises in the Gyor and Komaron regions. MERP has offered help in selecting the plants and suggested that WEC should also consult the Regional Inspectors who may have some valuable information on environmental conditions at the plants. They were pleased with WEC's intention to conduct a waste minimization demonstration project at the Budapest Battery Plant. MERP suggested that it would be worthwhile to include some food processing plants in this new program. The food processing plants are under the jurisdiction of the Ministry of Agriculture and they represent a substantial sector of Hungarian industry.

In conclusion, MERP fully endorsed WEC's new program and requested that they be kept posted on its progress.

December 1

Ministry of Industry and Trade (MIT)

Met with Dr. Arpad Bakonyi, Head of Environmental Department and Ministerial Council, Ms. Eszter Paszto, Environmental Department and Mr. Peter Fabian, Economics Department, of the Ministry of Economy.

MIT has welcomed WEC's waste minimization program planned for Hungarian industrial plants. In their opinion, this type program could be very timely and useful. However, they expressed concern that a large number of plants are on the verge of bankruptcy and must be closed in the near future. It was agreed that only plants which are economically sound should be selected for the waste minimization demonstration project. MIT suggested that in selecting the candidates for projects, consideration should be given to tanneries, a machine manufacturing plant, a plant producing steam turbines, and possibly a textile plant. MIT expressed their concurrence with our selection of the Budapest Battery Plant and consideration given to Raba R.T. Plant and Komaron Oil Refinery. MIT did not recommend selecting the Tiszai Chemical Complex for the project. This plant is very well run and should not receive WEC's assistance.

In conclusion, MIT has fully endorsed the waste minimization program for Hungary planned by WEC.

December 1

Budapest

Met with Mr. Janos Egerszegi, Director of "Pyrus" Company, which owns and

operates a hazardous disposal site at Aszod. WEC and Pyrus Company were planning to organize a workshop on hazardous waste disposal. This workshop was to be a follow-up of the study tour in the U.S. sponsored and organized by WEC in 1992 for the managers of the Pyrus Company. Since the Aszod facility represents a modern up-to-date solution for hazardous disposal, it was planned that a workshop organized for Central and Eastern European countries could be a meaningful contribution toward disseminating technical information in this field.

In discussing the workshop program and schedule, it was concluded that it would not be feasible to plan and organize such a workshop in 1993. The main reason is that at the present time, Pyrus Company has initiated negotiations involving the establishment of a joint venture with an Austrian partner. Under such circumstances, the management of the company would prefer not to undertake any additional commitments at this time.

December 2

Moll R.t. Komaromi Finomito Petroleum Industrial Company

Met with Dr. Jeno Lengyel, Deputy Director of the company.

The Moll R.t. Company owns and operates three plants situated at different locations in Hungary. The headquarters of the company is at the plant in Szony-Komaron, approximately 120 km. northeast of Budapest. The plants are owned by the Hungarian government and employ about 1,000 people. The main products are as follows:

- fuel oil (about 2,000,000 ton/year);
- lubrication grease (about 100,000 ton/year);
- lubrication oil;
- transformer cooling oil; and
- polyethylene.

The first plant "Vacuum Oil Company" is located in the town of Almasfuzito and was established in 1909. The second plant, functioning as oil storage facilities, is in Szony-Komaron and was established in 1942. The third plant is known under the name of "Lardoline Oil - Grease and Chemical Factory".

The crude oil deliveries come from Hungarian oil fields explored by the Moll R.T.

Company and from purchases made from the Russian Republic. In both cases, the crude oil has a relatively high content of sulphur. The company is also involved in the exploration, storage and distribution of natural gas amounting to about 6,000,000 m^3/year. About 1,000,000 drums per year are being packed with grease and lubrication oil and distributed to consumers.

The company's environmental problems consist mainly of air pollution caused by emissions of VOC and SO_2 from the fixed roof storage tank vents. Another air pollution issue is caused by organic solvent vapors generated during the painting of drums and washing operations of storage tanks.

Sanitary sewage is treated at the existing water pollution control plants and process wastewater (from washing) after being decanted is discharged into the Danube River. However, the effluent doesn't meet current Hungarian discharge standards.

The production of colorless (white) oil generates sludges, of which a portion is burned at the plant incinerator and the remaining quantities are being stored at the open, unlined pond.

The company is very much interested in WEC's program and promised to send a formal letter requesting consideration.

December 2

Gardenia Lace Curtain Factory in Gyor

Met with Mr. Gabor Szabolcs, Technical Manager and Ms.Agnes Torpey.

The Company was interested in the WEC program. However, because of a joint venture with a foreign partner, it did not qualify for WEC's assistance.

December 3

Tiszai Vegyi Kombinat Rt. (TVK)

Met with Messrs. Pal Vanyo, Deputy General Manager, Gyorgy Kalman, Director and Laszlo Majerusez, Head of Energy and Environmental Departments.

The plant is located in the town of Tiszanjvaros in the Borsod County near the Tisza River, approximately 210 km. northeast of Budapest (about 30 km. southeast of Miskolc). The plant site covers approximately 1,200 acres. The

original facilities were built in 1961 and consisted of a paint factory. In 1969, a fertilizer plant was added, producing 200,000 tons/year of ammonium nitrate (containing 34% nitrogen). The plant also produces ammonia, oxygen and nitrogen. In 1974 an olefin plant was put into operation.

In total, the complex employed about 5,700 people with sales in 1991 amounting to $480 million. Almost half of the total products are exported to the world market.

The main products are olefins, polyethylene (PE) and polypropylene (PP) resins, plastic products from PE and PP and ammonium nitrate fertilizer. Part of the complex, the paint plant, is currently owned by the joint venture of a Dutch-Hungarian stock company. Also, it is anticipated that the plastics processing plant will enter into a joint venture with the foreign partner in the near future. It seems that the rest of the complex, with about 3,000 employees, will remain under Hungarian ownership. The output of the fertilizer plant (ammonium nitrate) has recently been drastically lowered to 10% of available capacity (from 500,000 tons/year to 50,000 tons/year). In general, this process line is not profitable now and the operation is maintained solely to provide employment for the workers.

The Olefin plant includes a naphta cracker (based on Linde technology) which produces feed stocks for polymers and basic raw materials for other petrochemical industries. Recently, alterations have been made to enable some furnaces at the plant to operate either with naphta or with natural gas.

The polyethylene oil plant, started in 1970, produces low-density polyethylene. The latest polyethylene plant uses BASF technology based on LDPE and went into operation in 1991.

The plastic processing plant began to operate in 1966 producing heavy duty bags for agriculture and other producers for diversified application.

TVK has some air pollution problems with emissions of nitric acids. Another source of air pollution is the incinerator which does not meet current, more stringent standards than previously applied. It seems that combustion temperature (which is 800° C) is too low and most likely the detention time of 2 seconds is insufficient. The third source of air pollution is the printing division where solvents are being used. TVK has a sewage treatment plant (WWT) for sanitary and production wastewater. The treatment plant includes mechanical, biological and chemical facilities consisting of primary settling tanks, activated sludge tanks with surface aerators, secondary settling tanks (Door diver type) and PH adjustments. In addition, WWT effluent is discharged into open ponds having 30 days of detention time. There the effluent is

directed into the Tisza River. For industrial wastewater, pre-treatment is being used prior to discharge into WWT. WWT effluent complies with current discharge standards.

Some solid waste such as plastics (non-hazardous) is being recycled. Most polluted plastic is burned. This part of the solid waste amounts to about 0.5% of the entire production.

The plant also generates hazardous waste such as solvents which are burned in the incinerator. The liquid portion of unrecovered lubrication oil is also burned at the incinerator. The exhaust from the incinerator is not sufficiently filtered and cannot meet new regulations. The main problem is dust and chlorine in the exhaust. Catalytic waste is a problem. It has chromium (6 valent).

Another hazardous waste is sludge from the wastewater treatment plant. This sludge is disposed of on the landfill containing ash from power plants. The sludge is deposited on the base of ash and then covered with a layer of sludge generated at the wastewater treatment plant. Until now, this method of hazardous sludge dispoal is acceptable to the environmental authority. Periodic analysis of hazardous waste is being performed. Production water has come from the Tisza River and potable water from the outside deep wells.

The company is interested in WEC's WMP and will send a letter expressing such interest.

December 2

Raba Rt. - Machinery Manufacturing Plant in Gyor

Met with Laszlo Szakal, Manager of Environmental and Surface Treatment Plant and Mr. Nandor Hofbauer, Head of Laboratory.

The plant is located approximately 130 km. northwest from Budapest. It was established in 1875, employs about 9,500 workers, and consists of 5 plants (4 smaller in Gyor) situated at different locations. Originally it started with the production of railroad cars; as of 1960, it produced tractors and trucks lorries. At present, the main products are diesel engines of 192 HP and up. Also the plant manufactures 250 HP tractors ("Raba Stegen") and axels for tractors. They export products to the U.S. Eaton for Rockwell - complete machine lorries (220-300 HP), lift forks and spare parts.

Between 1918 and 1939, the plant manufactured buses and trucks (on contract with "Mann" Company). During the production process, the plant

generates hazardous waste of which 80% are solids and the rest liquid. Part of the hazardous waste is treated at the plant, but the rest is collected in containers and sent for biological treatment. Metal cuttings are reused, sending them to foundries (the largest foundry is in Gyor and a smaller one in Budapest). The plant is very much interested in WEC's program and will send a formal request to be considered for the Waste Minimization Project.

December 8 - Czechoslovakia

Chemopetrol s.p. - Oil Refinery in Litvinov

In continuation of the ongoing Waste Minimization Demonstration Project, the WEC staff together with Mr. James Stouch of Malcolm Pirnie, Inc., attended the Waste Minimization Oversight Committee meeting at Chemopetrol. The purpose of this meeting was to present results of the comprehensive fugitive Volatile Organic Compound (VOC) emission survey conducted by the Chemopetrol team of the entire Aromatics Plant. In addition to the Malcolm Pirnie, Inc./WEC team, the meeting was attended by 16 people including Chemopetrol's management and representatives from the Czech Environmental Management Center (CEMC), other refinery/petroleum plants (Kaucuk-Kralupy, Spolana-Neratovice, Paramo-Parchmbice and Ostramo-Ostrava), engineering/consulting firms (Chemoprojekt-Praha, Chemconsult, and ChemPlant Technology). A list of attendees is enclosed (see Appendix). The results of the fugitive VOC emissions were quite impressive and Chemopetrol is going to continue WMP through the entire complex, with a completion date scheduled for early autumn 1993. To perform this work, the plant has decided to contract a local consulting engineering company. Following the presentation and discussion of the results concerning the survey of fugitive VOC emissions at the Aromatics Plant, the subject of fugitive emissions from loading platforms and storage tanks was brought up. Fixed versus floating storage tank covers, recovery systems, air pollution controls such as thermal oxidation and activated carbon were discussed. It was concluded that in all cases, preventive measures would involve relatively large capital expenditures.

On the evening of December 8th, a separate meeting was held with Mr. Jan Pisko of the U.S. Agency for International Development (USAID), Mr. Radomir Matyas of the Czech Environment Management Center and the WEC/Malcolm Pirnie, Inc. staff. During this meeting, the status of the WMP at Chemopetrol, s.p. was presented including results obtained, to date, at the Aromatics plant.

IV. FOLLOW-UP ACTION

- Chemopetrol s.p. Oil Refinery and Petrochemical Complex will continue to conduct the Waste Minimization Project on fugitive VOC emissions throughout the entire complex.

- WEC/Malcolm Pirnie, Inc. will follow the progress of the work and will be available for consultation.

- Upon completion of the project, which is scheduled for early autumn 1993, the Chemopetrol and WEC/Malcolm Pirnie, Inc. staffs will review and evaluate final results of the project.

- Appropriate publicity in Czechoslovakia will be given to the economic and environmental benefits achieved through this project.

V. ITINERARY

November 29, 1992 - Budapest

- Arrival in Budapest

November 30, 1992 - Budapest

- Visit to Akkumulator - es Szavazelemgyar - Battery Plant

December 1, 1992 - Budapest

- Meeting at the Ministry for Environment and Regional Policy
- Meeting at the Ministry of Industry and Trade
- Meeting with Mr. Janos Egerszegi, Director of "Pyrus" Company

December 2, 1992 - Gyor & Komarom

- Visit to "Raba" Rt. - Machinery Manufacturing Plant in Gyor
- Visit to Lace Curtain Factory in Gyor
- Visit to Moll Rt. Komarom Finomito Petroleum Industrial Company in Komarom

December 3, 1992 - Tiszanjvaros

- Visit to Tiszai Vegyi Kombinat - Chemical Complex

December 4 & 5, 1992

- In Budapest

Czechoslovakia

December 6, 1992

- Arrival in Prague

December 7, 1992

- In Prague

December 8, 1992

- Meeting at Chemopetrol s.p. Oil Refinery in Litvinov
- Meeting with USAID and CEMC representatives in Prague

December 9, 1992

- Return to U.S.

VI. APPENDICES

MALCOLM PIRNIE

February 4, 1993

Mr. Thomas J. McGrath
Vice President - Technical Programs
World Environment Center
419 Park Avenue South
Suite 1800
New York, NY 10016

RE: Chemopetrol Waste Minimization Project
Visit to Chemopetrol, Litvinov, Czech Republic
December 7 and 8, 1993
Project No. 2027-002

Dear Mr. McGrath:

Following is a summary of our observations and recommendations from the third trip to the petroleum refining complex at Chemopetrol in Litvinov, Czech Republic. The World Environment Center (WEC)/Malcolm Pirnie team consisted of Mr. Bohdan Aftanas, WEC Project Manager; Mr. James Stouch, Malcolm Pirnie Project Manager; and Ms. Ludmila Hofmanova, WEC Czech Representative. The visit to the refinery took place on December 7 and 8, 1992. This letter is intended to summarize our observations and findings from this trip.

Executive Summary

WEC has contracted with Malcolm Pirnie, Inc. to assist with a focused waste minimization project at Chemopetrol/Litvinov to reduce fugitive volatile organic compound (VOC) emissions in the refinery section of the complex. Chemopetrol/Litvinov is the largest refining and petrochemical complex in the Czech Republic.

The Aromatics Plant was chosen as a pilot location for training and analysis. Toluene and xylene are produced as finished products in this area while benzene is produced as an intermediate feedstock for other sections of the refinery. The purpose of this trip was to review fugitive

Printed on Recycled Paper

emissions data gathered by the Chemopetrol staff at the Aromatics Plant. Training of the Chemopetrol staff by the WEC/Malcolm Pirnie team in fugitive emission data collection techniques and preliminary analysis of results obtained during the training period was performed during a previous visit.

The comprehensive fugitive emissions survey of the entire Aromatics Plant was completed in mid-November. Chemopetrol staff entered emissions data into a spreadsheet for analysis and the WEC/Malcolm Pirnie team reviewed this data and made savings calculations on December 7, 1992. The results of the Aromatics Plant survey presented in this report were presented on December 8 at a meeting attended by Chemopetrol management, the WEC/Malcolm Pirnie team, and representatives from the Czech Environmental Management Center (CEMC), other refinery/petrochemical plants (Kaucuk-Kralupy, Spolana-Neratovice, Paramo-Pardubice, and Ostramo-Ostrava), and engineering/consulting firms (Chemoprojekt-Praha, Chemconsult, and ChemPlant Technology). Due to scheduling conflicts earlier in the day, a separate meeting to review the project results was held on the evening of December 8 in Prague with Mr. R. Matiyas of CEMC and Mr. Jan Pisko of the US Agency for International Development (USAID).

The results can be summarized as follows:

- The survey encompassed 2,489 fugitive emission sources consisting of flanges, valves, open end lines, and a pressure reducing valve.

- About 1% of the sources (pumps) are responsible for 38% of the fugitive emissions and 47% of the potential savings.

- Potential cost reductions of over 65% from current costs can result from implementation of the leak detection and repair program demonstrated during this project. One action item has a payback period of only two days.

- Approximately 90% of the potential savings accrues from yield improvements (reduced product losses) and only 10% from avoided emission permit fees. The latter will increase as the permit fees increase from their current 30% of maximum to 100% of maximum by 1998.

- When Aromatics Plant savings are extrapolated to represent the rest of the refinery, annual savings can conservatively be estimated at $75,000.

- Although difficult to quantify and separate from other factors at the site, negative impacts to maintenance and operations employee health and safety will be mitigated through reduced exposure to VOC's which include suspected carcinogenic compounds such as benzene.

Background

WEC has a Cooperative Agreement with the USAID to provide U.S. private sector expertise to transfer environmental and energy management technology and skills to Eastern European industry and government representatives. The expected results include:

- more effective pollution reduction.
- improved industrial health and safety practices.
- improved energy conservation and management.
- increased community awareness in environmental and energy related areas.

An initial WEC/Malcolm Pirnie team visit was conducted at the refinery from September 14 through 18, 1992. This visit clarified the scope of the project and provided a sense of Chemopetrol's objectives and capability to support the project. The objectives of the fugitive emissions/waste minimization project at Chemopetrol/Litvinov have been to:

o Provide the first opportunity for a WEC/US AID project in Eastern Europe to move beyond the study phase. That is, the project will provide measurable results following implementation by Chemopetrol. Improvement will be monitored in terms of:

- reducing Chemopetrol's exposure to Ministry of Environment emission fees and compliance related penalties, and

- reducing operating costs by narrowing process variability and improving yield by reducing fugitive VOC emissions.

o Provide the basis for transfer of these methods and technology to other enterprises in the Czech Republic by USAID or the Czech Environmental Management Center (CEMC). These organizations are members of an Oversight Committee created for this project along with WEC and Chemopetrol.

o Reduce the risk of worker and community exposure to airborne toxic compounds.

o Provide a basis for reporting fugitive hydrocarbon emissions as required by the Czech Ministry of the Environment.

On the basis of this initial visit, the scope of the project was refined to focus on the Aromatics Plant section of the refinery and the appropriate instrumentation was purchased for Chemopetrol's use. A second visit was conducted from October 25 through 31, 1992 during which time Chemopetrol staff was trained in the calibration and use of the fugitive emissions monitoring instrument and data management and reduction methods. Since this second visit Chemopetrol staff completed the survey of fugitive emission sources in the Aromatics Plant and entered the data into a spread sheet format for analysis. The analysis was conducted by Malcolm Pirnie and Chemopetrol staff on December 7 and the results presented to Chemopetrol and other government and industry representatives on December 8.

Observations and Findings

Emission Sources

A total of 2,489 fugitive emission sources in the Aromatics Plant were surveyed using a Foxboro Model 108 organic vapor analyzer/flame ionization detector (OVA/FID). A block flow diagram of the Aromatics Plant is included as Attachment 10. Emission sources included flanges, valves, open end lines, pumps, and a pressure reducing valve as follows and as shown on Attachment 1:

SOURCE TYPE	NO. OF SOURCES	% OF TOTAL SOURCES
Flanges	1,869	75%
Valves	543	22%
Open End Lines	56	2%
Pumps	20	1%
Pressure Reducing Valve	1	0%
TOTAL	2,489	100%

Correlating Concentration to Mass Flow Rate

There are several accepted methods for correlating VOC concentrations to mass flow rates. Two of these methods are the "average" and the more refined "stratified method". The differences between these methods were discussed in detail in the November 17, 1992 report. Because it offers a better approximation of the actual emission rate, the Stratified Method emission factors were used for the remainder of the analysis. A comparison table of Average and Stratified emission factors is shown on Attachment 8.

As shown on Attachment 2, the Stratified Method indicates a 14% lower fugitive emission rate than the Average Method (47.2 tonnes/yr as opposed to 54.9 tonnes/yr) when applied to the Aromatics Plant. This difference is explained further in Attachment 3 ahich shows how the Stratified Method yields lower emission rate correlations for flanges, valves, and the pressure reducing valve because of their better than average (for the petrochemical industry) leak rates at Chemopetrol, while pumps and open end lines at the Aromatics Plant exhibited higher than average leak rates.

Emission Rates and Potential Reductions/Savings

Emission rates by source are shown on Attachment 4. They are:

SOURCE TYPE	EMISSIONS (tonnes/yr)	% OF TOTAL EMISSIONS
Pumps	18.1	38%
Valves	15.4	33%
Flanges	12.1	26%
Open End Lines	1.4	3%
Pressure Reducing Valve	0.1	0%
TOTAL	47.2	100%

The impact of potential reductions in fugitive emissions was evaluated on the basis of all leaks being repaired. Repair options include:

Pumps:
- tighten packing
- replace packing with asbestos or graphite
- replace packing with a mechanical seal

Flanges:	-	tighten bolts
	-	replace gasket
Valves:	-	tighten packing
	-	replace packing

The result of these repairs would be a reduction in emissions of 32.8 tonnes/yr, from 47.2 tonnes/yr down to 14.4 tonnes/yr. This represents a savings for the Aromatics Plant of over 200,000 Kcs (over $7,500) per year as shown on Attachment 5. Attachment 6 shows that approximately 90% of the savings are associated with reduced product losses and only 10% are attributable to government imposed permit fees. This percentage will increase through 1998, however, since these fees are currently only at 30% of their 1998 maximum. Attachment 9 shows a typical cost savings calculation.

Attachment 7 displays cost reduction potential by source type. In declining order of savings potential the sources benefitting from a leak detection and repair program are: pumps, valves, flanges, open end lines, and pressure reducing valve. Pump and valve repairs have a significantly greater contribution to overall savings potential than repairs to the other source typres. Payback periods range from two days to four years depending on the specific action item taken as shown on the following table:

REPAIR ACTION	COST / SOURCE		SAVINGS/ YR	R.O.I. (% and Payback Period)
	LABOR[1]	MATERIAL		
Pumps:				
1) Tighten Packing	1 pers @ 0.75 Hrs = $1.69 PLUS Survey Cost=$2.78 $4.47	- 0 -	$870	19,463 % (2 days)
2) Replace Packing (Asbestos or Graphite)	1 pers @ 4 Hrs PLUS Survey Cost $61.78	$50.00	$870	1,408 % (26 days)

[1] Repair Labor Cost/Hr = $250/mo / 167 Hrs per mo * 1.5 (overhead factor)

= $2.25 / Hr

Fugitive Emission Survey Crew Labor Cost=2 pers.* $250/mo *12 mos/1980 Hrs per Yr

= $3.03 / Hr or $6,000 / Yr

Annualized Survey Costs:

Pumps = 20 / 2,489 * 6,000 * 3/52 = $2.78
(% sample) (Ann'l Cost)

Flanges = 1,869 / 2,489 * 6,000 * 3/52 = $260.00

Valves = 543 / 2,489 * 6,000 * 3/52 = $75.52

Open End Lines = 56 / 2,489 * 6,000 * 3/52 = $7.80

3) Replace with Mechanical Seal	2 pers @ 4 Hrs PLUS Survey Cost $20.78	$600.00	$870	140 % (8.5 months)
Flanges:				
1) Tighten Bolts	1 pers @ 0.75 Hrs = $1.69 PLUS Survey Cost @ $260 $261.69	- 0 -	$75	28.6 % 3.5 years
2) Replace Gasket	1 pers @ 4 Hrs PLUS Survey Cost $270	$30	$75	25 % 4 years
Valves:				
1) Tighten Packing	1 pers @ 0.75 Hrs = $1.69 PLUS Survey Cost @ $75.52 $77.21	- 0 -	$90	117 % 10.5 months
2) Replace Packing	1 pers @ 4 Hrs PLUS Survey Cost $85.52	$50	$90	66 % 1.5 years

Technology Transfer and Training

These results (in the form of the Attachments to this report) were presented and reviewed at a meeting on December 8 with the following representatives of Chemopetrol and other organizations and refinery/petrochemical complexes in the Czech Republic:

Name	Position	Company	Business
Fuchs	Vice Director, Plant Services	Chemopetrol	refinery, petrochemicals
Cir	Chief, Environmental Dept.	Chemopetrol	refinery, petrochemicals
Vanek	Engineer-Operations	Chemopetrol	refinery, petrochemicals
Kane	Chief, Aromatics Production	Chemopetrol	refinery, petrochemicals
Flegl	Engineer, Product Loading Racks	Chemopetrol	refinery, petrochemicals
Plechac	Specialist, Environmental Dept.	Kaucuk-Kralupy	refinery, petrochemicals
Koutny	Deputy Chief, Envir. Dept.	Spolana-Neratovice	refinery, petrochemicals
Bartonicek	Specialist, Tech. Development Dept.	Paramo-Pardubice	refinery, oil, asphalt
Vavrina	Specialist, Tech. Development Dept.	Paramo-Pardubice	refinery, oil, asphalt
Prokes	Specialist, Environmental Protection Dept.	Ostramo-Ostrava	lubricating oil
Pospisil	Designer	Chemoprojekt-Praha	engineering firm

Name	Position	Company	Business
Holada	President	Chemcons - Litvinov	consultant (representing C.E.M.C.)
Madron	President	ChemPlant Technology - Usti nad Labem	consultant
Eisler	Specialist	ChemPlant Technology - Usti nad Labem	consultant
Aftanas	Project Manager	World Environment Center	consultant
Hofmanova	Coordinator	World Environment Center	consultant
Stouch	Project Manager	Malcolm Pirnie, Inc.	consultant

The meeting included introductions of the attendees, an overview and history of the project by Mr. Holada, a description of Chemopetrol/Litvinov in general and the Aromatics Plant specifically by Mr. Cir, and a discussion of the results of project by Mr. Stouch.

Conclusions and Recommendations

The results of the project can be summarized as follows:

- The survey encompassed 2,489 fugitive emission sources consisting of flanges, valves, open end lines, and a pressure reducing valve.

- About 1% of the source types (pumps) are responsible for 38% of the fugitive emissions and 47% of the potential savings.

- Potential cost reductions of over 65% from current costs can result from implementation of the leak detection and repair program demonstrated during this project. One action item has a payback period of only two days.

- Approximately 90% of the potential savings accrues from yield improvements (reduced product losses) and only 10% from avoided emission permit fees.

- When Aromatics Plant savings are extrapolated to represent the rest of the refinery, annual savings can conservatively be estimated at $75,000[2].

- Although difficult to quantify and separate from other factors at the site, negative impacts to maintenance and operations employee health and safety will be mitigated through reduced exposure to VOC's include suspected carcinogenic compounds such as benzene.

- As per the terms of the Memorandum of Understanding between WEC and Chemopetrol, Chemopetrol will now continue with the fugitive emission reduction leak detection and repair program throughout the remainder of the refinery. They expect to complete this activity by June 1993.

---

[2] The Aromatics Plant represents approximately 6% of the total refinery output. Therefore, a factor of 10 times the savings potential for the Aromatics Plant was used to conservatively represent the savings potential for the entire refinery. A factor of 10 was selected to account for variables such as newer equipment and process units in other parts of the refinery (therefore less leakage), cold and windy weather during the Aromatics Plant survey, and varying volatility of intermediate and finished products throughout the refinery.

MALCOLM PIRNIE

We have enjoyed working with you on this project. Please feel free to call us if you have any questions.

Very truly yours,

MALCOLM PIRNIE, INC.

David Ellis, jr

David Ellis
Vice President
(914) 694-2100

James P. Stouch

James C. Stouch, P.E.
Associate
(717) 757-5111

cc: D. Potts/HAR
R. Klippel/SYR

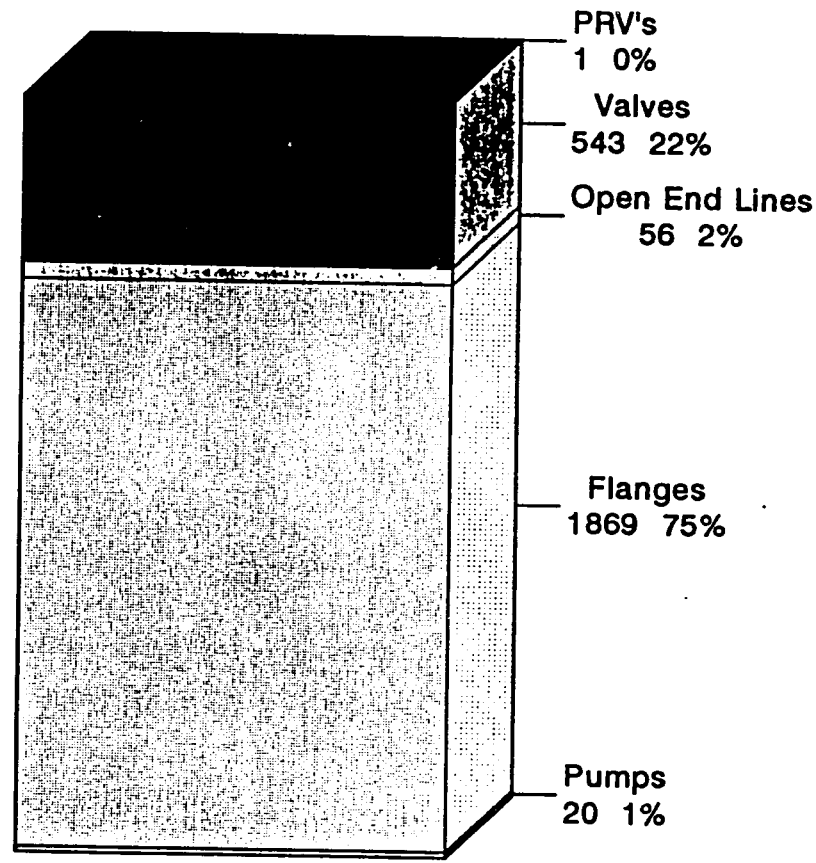
2027-002

Printed on Recycled Paper

ATTACHMENT 1

Aromatics Plant Fugitive Emissions Survey

Total Number of Sources Surveyed (2489)



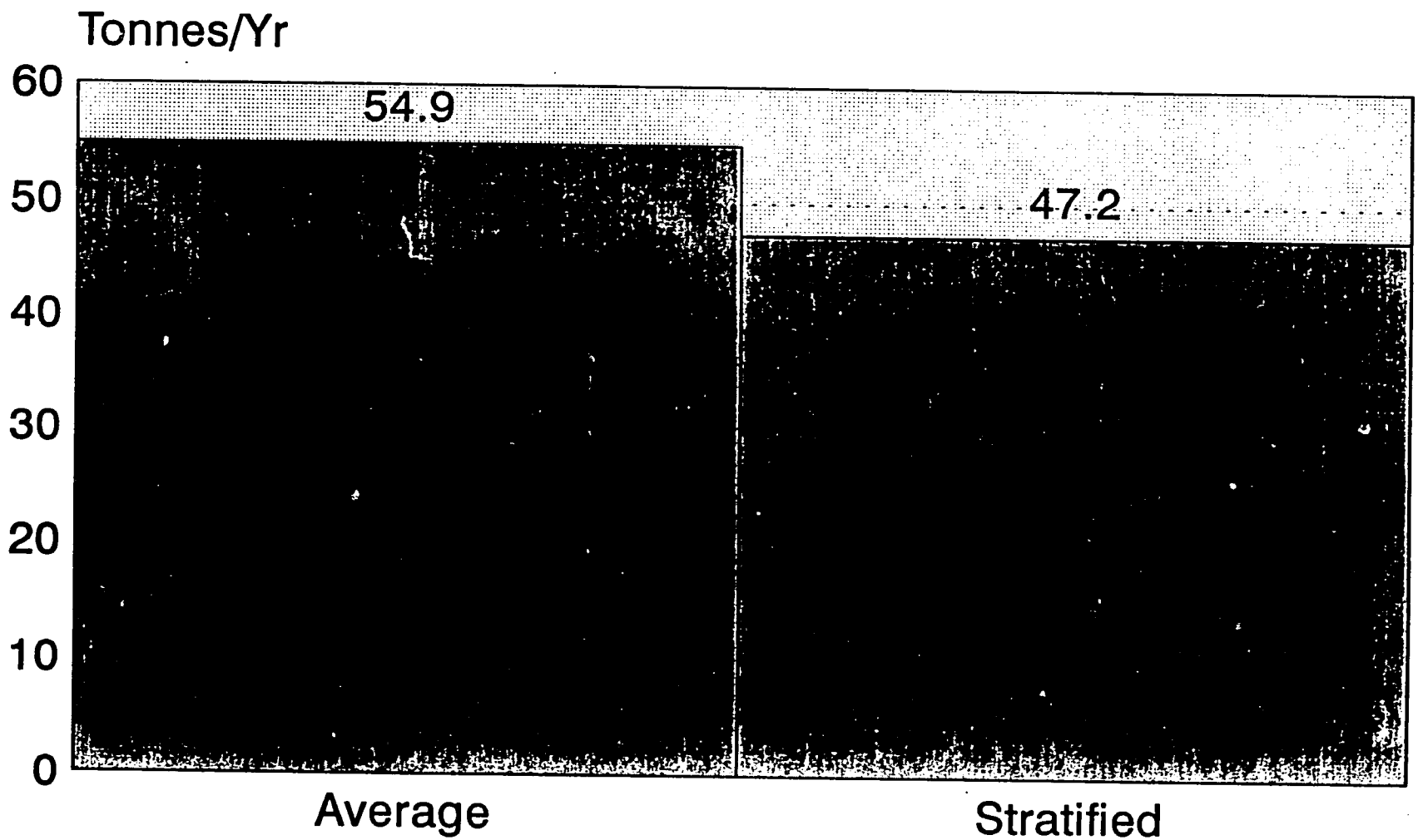
Types of Sources

SOURCQT[redacted]3

24,

Total Emissions

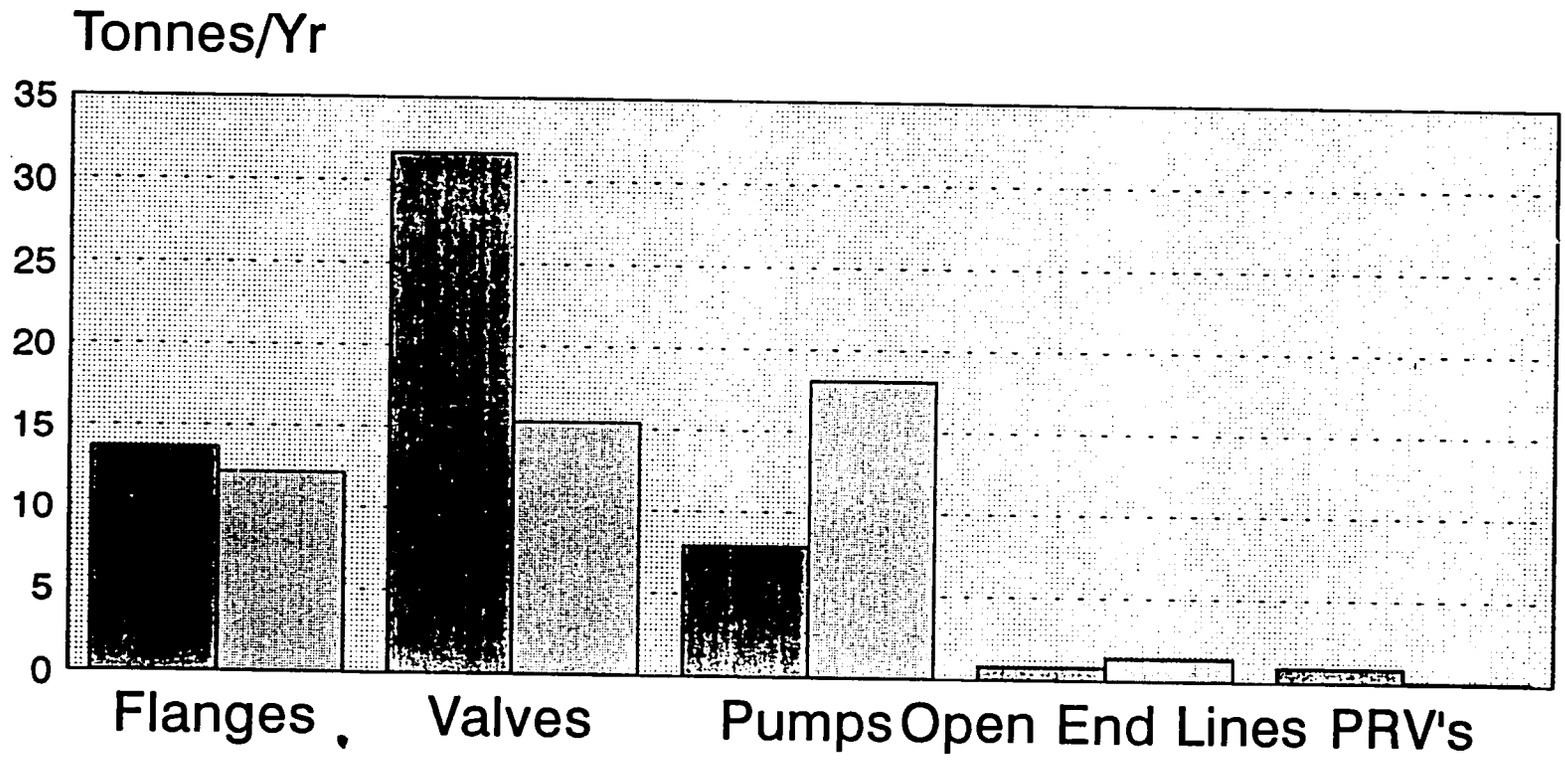
Average vs. Stratified Emission Factor Methods



EMISMETH.CH3

Average vs. Stratified Method

Emissions by Source



	Flanges	Valves	Pumps	Open End Lines	PRV's
Average	13.6	31.6	7.9	0.8	0.9
Stratified	12.1	15.4	18.1	1.4	0.1

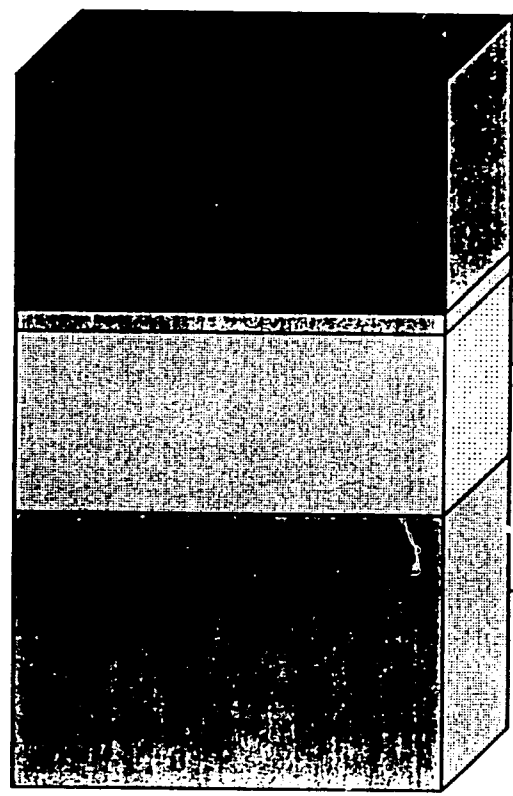
Sources

SRC-QTY[redacted]3

21

Emissions Comparison

Tonnes/Yr by Source



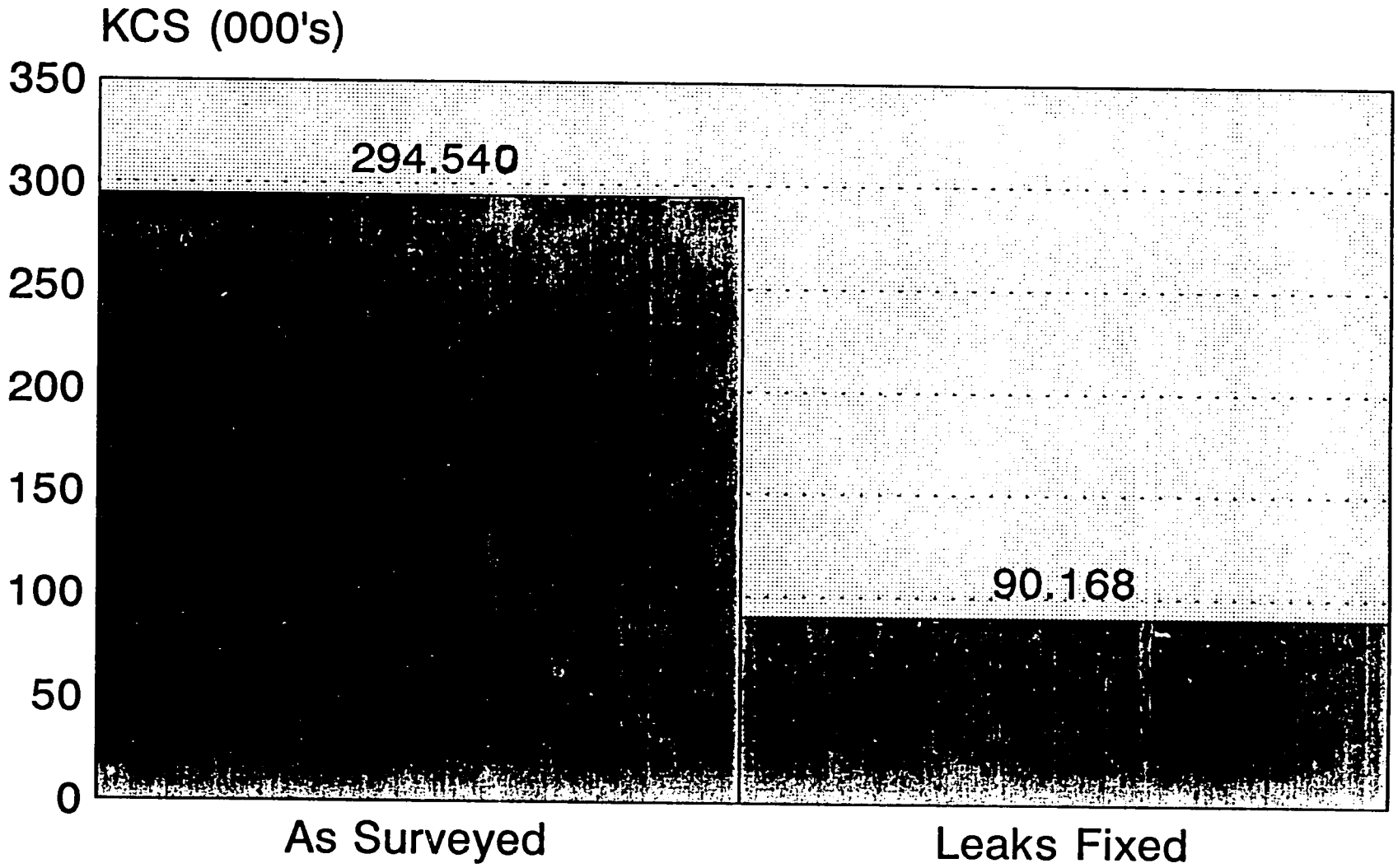
Stratified Method

32

SRCSTRAT.CH3

Potential Cost Reductions - All Sources

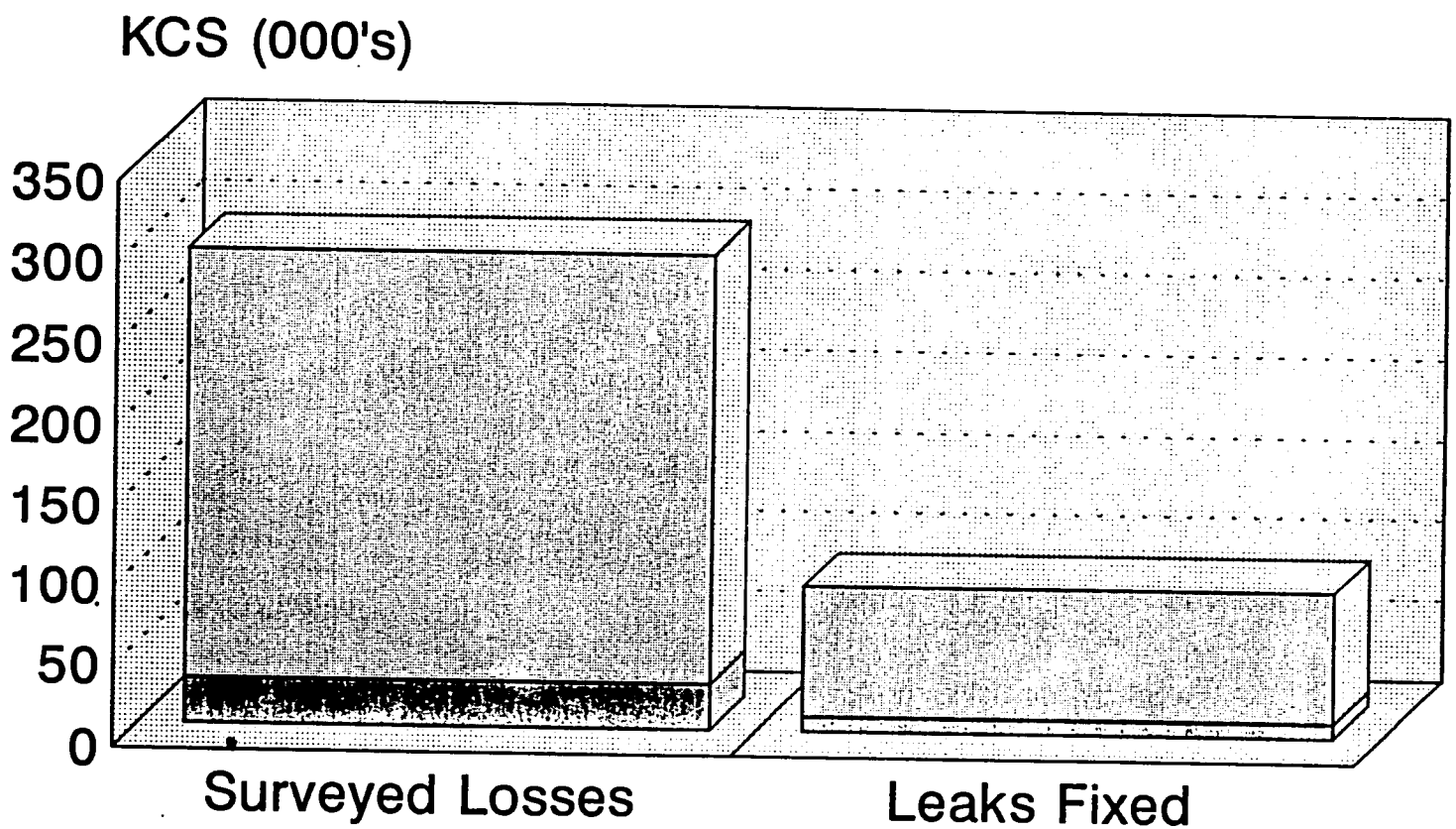
Repair "Leakers"



SAVE-TOT[illegible]3

Potential Cost Reduction

Permit Fees and Product Value



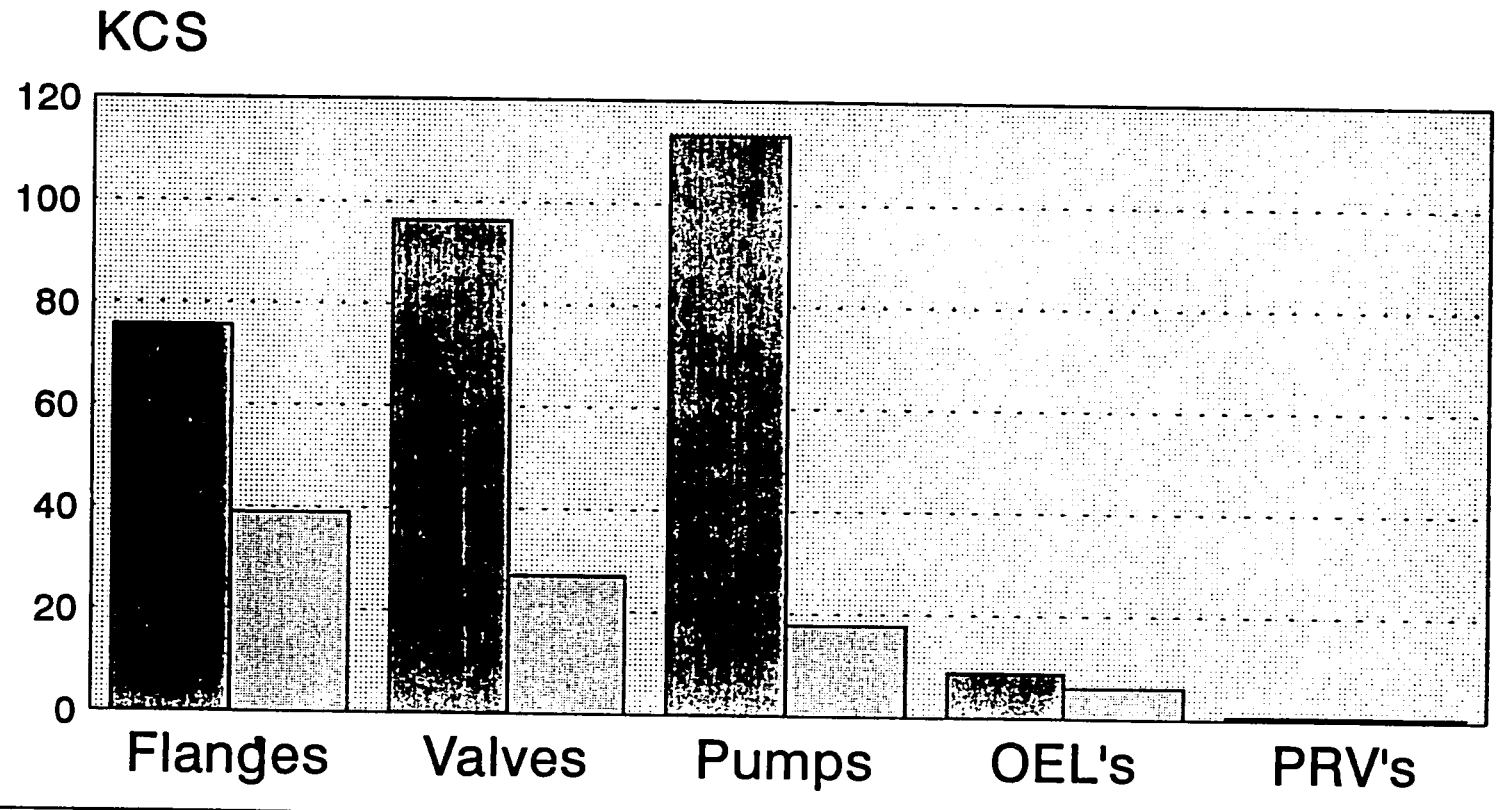
	Surveyed Losses	Leaks Fixed
Product Value	266.238	81.503
Permit Fees	28.303	8.664

SAVE-F-P.CH3

94

Potential Cost Reduction

By Source



	Flanges	Valves	Pumps	OEL's	PRV's
Surveyed	75.604	96.284	113.268	8.760	624
Leaks Fixed	38.91	26.914	17.633	6.056	624

Sources

ATTACHMENT 8

EMISSION FACTORS
(KG/HR/SOURCE)

COMPONENT	SERVICE	METHOD 1 EPA AVERAGE EMISSION FACTORS	METHOD 2 LEAK / NO LEAK EMISSION FACTORS >10000 PPM	METHOD 2 LEAK / NO LEAK EMISSION FACTORS <10000 PPM	METHOD 3 STRATIFIED EMISSION FACTORS 0-1000 PPM	METHOD 3 STRATIFIED EMISSION FACTORS 1001-1000 PPM	METHOD 3 STRATIFIED EMISSION FACTORS >10000 PPM
COMPRESSOR SEALS	GAS/VAPOR	0.228	1.608	0.0894	0.01132	0.264	1.608
PUMPS SEALS	LL	0.0494	0.437	0.012	0.00198	0.0335	0.437
	HL	0.0214	0.3885	0.0135	0.0038	0.0926	0.3885
VALVES	GAS	0.0056	0.0451	0.00048	0.00014	0.00165	0.0451
	LL	0.0071	0.0852	0.00171	0.00028	0.00963	0.0852
	HL	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023
FLANGES	ALL	0.00083	0.0375	0.00006	0.00002	0.00875	0.0375
PRV'S	GAS/VAPOR	0.104	1.691	0.0447	0.0114	0.279	1.691
OPEN ENDED LINES	ALL	0.0017	0.01195	0.0015	0.00013	0.00876	0.01195
SAMPLING CONNECTIONS	ALL	0.015	NOT EST.	NOT EST.	NOT EST.	NOT EST.	NOT EST.

NOTES:
1. "EMISSION FACTORS" ARE TAKEN FROM THE CHEMICAL MFRS. ASSN. PUBLICATION "IMPROVING AIR QUALITY: GUIDANCE FOR ESTIMATING FUGITIVE EMISSIONS FROM EQUIPMENT".

ESTIMATED SAVINGS FOR REDUCTIONS IN FUGITIVE
VOLATILE ORGANIC COMPOUND EMISSIONS
FROM PUMPS

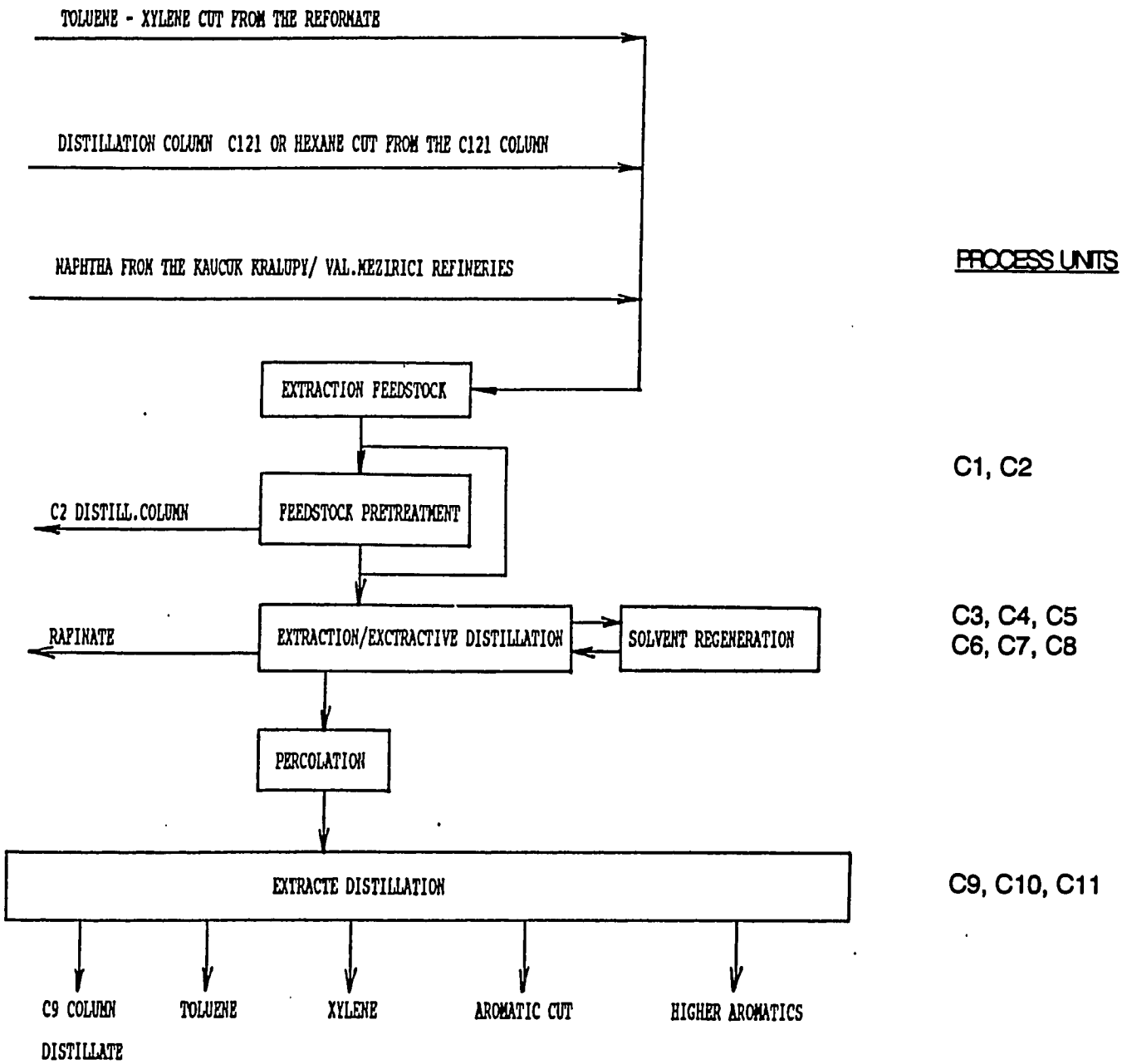
FEE PAID TO MIN. OF ENVIRONMENT FOR RELEASE OF HYDROCARBON EMISSIONS	2000 CKR/TONNE
% OF MAXIMUM EMISSION FEE CHARGED	30.0%
PRICE OF CRUDE OIL	$21.00 / $153.93 / TONNE
OVERALL PLANT YIELD =	75.0%
ESTIMATED VOC EMISSION REDUCTION	15.30 TONNES/YEAR
EXCHANGE RATE @ $1.00 =	27.00 CKR
ESTIMATED ANNUAL SAVINGS (See Note 1.)	$3,480 = 93,965 CKR

NOTES:

1. COST SAVINGS CALCULATION ($/YR) =

$$\frac{\text{(EMISSION REDUCTION IN TONNES/YR)} * \text{(FEE PAID TO GOVT AT 2000 CKR/TONNE)} * 30\%}{27.00\ \text{CKR/US\$}} + \frac{\text{(EMISSION REDUCTION IN TONNES/YR)} * \text{(VALUE OF CRUDE AT \$153.93/TONNE)}}{\text{PLANT YIELD AT 0.75}}$$

ATTACHMENT 10
BLOCK FLOW DIAGRAM - AROMATICS PLANT



List of the participants in the meeting
on 8.12.1992 in Chemopetrol-Litvínov

Name	Position	Firm	Specification of the Firm
Fuchs	vicedirector	Chemopetrol	refinery,petrochemistry
Cír	chief of the depart.for environment	"	" "
Vaněk	engineer for operation	"	" "
Káně	chief of arom. production	"	" "
Flégl	enginneer for fillingstation	"	" "
Plecháč	specialist from the environment protection dep.	Kaučuk-Kralupy	" "
Koutný	deputy chief of the environment depart.	Spolana-Neratovice	"
Bartoníček	specialist of the depart.for technical development	Paramo-Pardubice	" ,oil,asphalt
Vavřina	"	"	" " "
Prokeš	specialist from environment protection department	Ostramo-Ostrava	lubricating oil
Pospíšil	designer	Chemoprojekt-Praha	designing and engineering organization
Holada	president	Chemcons Litvínov	consulting firm
Madron	"	ChemPlant Technology Ústí n.Labem	"
Eisler	specialist	"	"

Prezentace demonstračního projektu "Minimalizace produkce plynných odpadů ze s. p. Chemopetrol" dne 8. 12.1992

Jméno	Podnik	Podpis
J. Bartoníček	Paramo	J. Bartoníček
VEJVÝLEK		
V. VANĚČEK	soukr. (za CEMCPha)	
FLÉGL	Chemopetrol	
KANÉ	CHEMOPETROL	
VANĚK	"	
HOLADA	CHEMCONS	
MADRON	ChemPlant	
EISLER	Chem Plant	
J. Stouch	Malcolm Pirnie Inc.	
Fuchs	Chemopetrol	
HOFMANOVÁ	WEC	
B. Aftanas	WEC	
POSTRIL	CHEMOTROVEKT	
KOUTNÝ	SPOLANA NERATOVICE	
PLECHÁČ	Kaučuk Kralupy	
PROKEŠ	OSTRAVO-OSTRAVA	
CÍR	CHEMOPETROL	
J. ŠKARKA	CEMC	Škarka

BUSINESS CARDS

RÁBA RT

Surface Treatment Plant

Dr. László SZAKÁL
Manager

Address 9002 Győr, Pf. 50.

Telefon: 96/14-635
Telex: 024255
Telefax: 96/14-311
11-905

RÁBA

Oberflächenbehandlungs Fabrik

Dipl. Chem. Ing. Nándor HOFBAUER
Laborleiter

Magyar Vagon- és Gépgyár
H–9002 Győr, Postfach 50.
Ungarn

Telefon: 36/96/16-333(42-96)
Telex: 61-24255
Telefax: 36/96/14-311/17-047

AKKU

Dr. JÓZSEF KÉRI
Generaldirector

Akkumulátor- és Szárazelemgyár
H 1138 Budapest, Váci út 135-139.
Phone: (36-1) 120-2279
Telex: 22-4596
Fax: (36-1) 120-2279

Privat:
H-1032 Budapest,
Zápor u. 82. IV/19.
Phone: (36-1) 168-5362

AKKU

SOLTI LÁSZLÓ
környezet- és munkavédelmi vezető
Leader of work safety and environ. division

Akkumulátor- és Szárazelemgyár
1393 Budapest, Váci út 135–139.

Tel.: 129-0421
Telex: 22-4596
Telefax: 120-2279

ESZTER SZÖVÉNYI M.A.
Senior Officer
Department for International Relations

Ministry for Environment
and Regional Policy
H–1394 Budapest
P.O.Box 351

Phone: (36-1)201-4133
Direct: (36-1)201-3764
Fax: (36-1)201-2846
Telex: 22-4879 kvm h

Dr. KEMÉNY Attila
helyettes államtitkár
Környezetvédelmi Hivatal

KÖRNYEZETVÉDELMI ÉS TERÜLETFEJLESZTÉSI MINISZTÉRIUM
1011 Budapest, I. Fő u. 44-50. Tel.: 201-2043, 201-4691 Fax: 201-2491

Dipl. Ing. Masch. LÁSZLÓ MAJERUSZ
Hauptabteilungsleiter

TISZAI VEGYI KOMBINÁT
Energiewirtschaft und Umweltschutz
H-3581 Tiszaújváros, Pf. 20
Telefon: +36 49 22 222
Telex: 22 6419
FAX: +36 49 21 322
UNGARN

Ministry for Environment and Regional Policy
Deparment of Environmental Technology

Péter SZÁNTÓ
dipl. civilengineer
Deputy Head of Dep.

H-1011 Budapest
Fő u. 44-50.

Phone: (36-1)-201-5180
Fax: (36-1)-201-2491

MOL RT. Komáromi Finomító

DR. LENGYEL JENŐ
termelési igazgatóhelyettes

Levélcím: 2922 Komárom, Kőolaj u. 2., Pf. 3.
Telex: 27-776
Telefax: (34) 43-880
Telefon: (34) 44-455

IPARI ÉS KERESKEDELMI MINISZTÉRIUM
Ipargazdasági Főosztály

FÁBIÁN P. PÉTER
minisztériumi tanácsos
council

2040.Budaörs
Patkó u. 5.
IV./38.

1024.Budapest
Margit krt.85.
Tel:15-58-482
15-65-566/21-40
Fax:17-50-219

György KÁLMÁN
director

TISZAI VEGYI KOMBINÁT RT.

H-3581 Tiszaújváros, P.O.B. 20
Telephone: +36 49 21 983
Telex: 22 6419
FAX: +36 49 21 322
HUNGARY

PÁL VANYÓ
DEPUTY GENERAL MANAGER

TISZAI VEGYI KOMBINÁT [redacted]
ENGINEERING DIVISION
H-3581 TISZAÚJVÁROS, P.O.B. 20
TELEPHONE: 36 (49) 21 702, 11 696
TELEX: 22 6419, FAX: 36 (49) 21 322
HUNGARY

E.C.E.I. 011-42-2-
-692-8513

Dipl. Ing. Ludmila Hofmanová

Ve Smečkách 30
111 27 PRAHA 1
tel.: 21 37 423
fax: 21 37 221

Privat:
140 00 Praha 4
Olbrachtova 1044
tel. / fax: 69 28 513

G A R D E N I A

SZABOLCS GÁBOR
Technical Manager

Gardenia Lacecurtain Factory PLC ■ H-9025 Győr ■ Csipkegyári út 11. Pf. 218
Tel.: (36-96) 12-233/52 ■ Tel., Fax: (36-96) 22-864 ■ Telex: 24-278

CHEMOPETROL
Státní podnik LITVÍNOV

Jiří M. FUCHS
property manager

CHEMOPETROL, s. p.
436 70 Litvínov
☎ 42-35-299-3067
Fax: 42-35-299-4282

CPT

František Madron
President

ChemPlant Technology spol. s r.o.
Anežky České 31
400 07 Ústí nad Labem
Czechoslovakia

Tel: (47) 218 4369