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TRIP REPORT #2 CHEMOPETROL

LITVINOV, CZECH REPUBLIC

WASTE MINIMIZATION PROJECT

WORLD ENVIRONMENT CENTER
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DECEMBER 1992

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II. EXECUTIVE SUMMARY

The team consisting of WEC staff, Dr. Bohdan Aftanas and Ms. Dorothy Chuckro, and Messrs. James Stouch and David Potts both from Malcolm Pirnie, Inc., consulting engineers visited oil refinery and petrochemical plant - Chemopetrol, s.p. in Litvinov, Czechoslovakia. The purpose of the visit was to begin implementation of Waste Minimization Demonstration Project (WMP) at that plant.

The basic steps of the start-up phase included meetings with the Project Oversight and Project Implementation Committees, presentations and discussion of the project procedure, presentation of monitoring equipment, and on-site training plant personnel in conducting field measurements.

The WMP was started at the Aromatics plant by identifying the emission sources and quantifing the amount of fugitive volatile organic compounds (VOC). The field work of the Aromatic plant is projected to be completed by December 8, 1992. Chemopetrol's fugitive emission team will be in contact with the consulting engineer while conducting the work to obtain assistance in resolving problems they may encounter. WEC staff and consulting engineers will return to Chemopetrol upon completion of the Aromatics plant's survey to analyze the data and review its results. It is anticipated that the plant will continue the WMP throughout the entire refinery.

III. MEETINGS

October 26, 1992 - Litvinov

Travel to oil refinery and petrochemical plant - Chemopetrol, s.p. in Litvinov to start a Waste Minimization Demonstration Project.

Met with plant management and the Waste Minimization Oversight Committee which included the following persons:

Jaroslav Cir, Head of Department of Environmental Protection, Chemopetrol

Milan Vitvar, Technical Manager, Refinery Unit, Chemopetrol

Jan Hurych, Operating Manager, Chemopetrol

Ladislav Holada, Consultant, Chemcons

Frantisek Madron, President, ChemPlant Technology spol. s.r.o.

Radomir Matyas, President, Czech Environment Management Center

Jan Pisko, Project Manager, USAID

James Stouch, Associate, Malcolm Pirnie, Inc.

David Potts, Environmental Scientist, Malcolm Pirnie, Inc.

Ludmila Hofmanova, in-country Coordinator, WEC

Bohdan Aftanas, Project Manager, WEC

Dorothy Chuckro, Deputy Project Manager, WEC

Mr. Cir welcomed WEC and Malcolm Pirnie, Inc. representatives for the start-up of the Waste Minimization Demonstration Project. Dr. Aftanas explained WEC's waste minimization program and introduced James Stouch as the technical expert and director of the WMP.

Mr. James Stouch presented in detail the project indicating that the objective of this WMP is to improve efficiency of the process by reducing product waste

(reduce fugitive emissions) and, at the same time, to reduce air pollution with subsequent decrease of discharge and penalty fees paid to the Ministry of Environment (MOE). It will also provide the realistic basis for reporting fugitive volatile organic compounds emissions as required by MOE. In addition, it will reduce the worker's and community's exposure to airborne toxic compounds. The Waste Minimization Project will initially focus its emission survey effort in the Aromatic plant. This will act as a demonstration program which will be expanded to the other Chemopetrol operations. The schedule for the week was to meet with the Plant Implementation Committee and present project procedures and the use of the monitoring equipment; conduct a "hands-on" field training sessions with the emission survey plant personnel, conduct and monitor data collection; and assist in logging field meansurement results. The scope of work for the first week was to complete as much of the Aromatic plant survey as is feasible.

Mr. Stouch and Mr. Potts demonstrated how to operate and calibrate the Organic Vapor Analyzer with Flame Ionization Detector which was provided by the World Environment Center, and upon completion of the project, will be donated to Chemopetrol. The Organic Vapor (OV) analyzer is designed to quantify the amount of fugitive VOC emissions. An optional data logger can be used in conjunction with the analyzer to automatically store field data while taking the measurements. At a later time, the field data could be transferred into the main computer's quality/material process database and used to construct the basis for implementing future leak detection and repair program. Future leak detection and repair program can quantitatively demonstrate the impact of pollution reduction and the resultant economical benefits of product cost savings and reduced MOE discharge charges and fines.

Mr. Stouch also explained the development and difference in methodology (single source method, leak-no-leak method, stratified method) of calculating emission fees and penalties which U.S. industry must comply to and which are enforced by the United States Environmental Protection Agency (USEPA).

<u>October 27, 1992 - Litvinov</u>

Meeting with Waste Minimization Implementation Committee at Chemopetrol, s. p.

Attendees: Jaroslav Cir

Milan Vitvar, Technical Manager

Jan Hurych, Operating Manager

Dr. Ryskova, Environmental Lab

(2) Persons from Operating Department

Frantisek Madron, Consultant

James Stouch, Malcolm Pirnie, Inc.

David Potts, Malcolm Pirnie, Inc.

Bohdan Aftanas, WEC

Dorothy Chuckro, WEC

Mr. Cir introduced the emission survey team. Mr. Stouch explained in detail the survey data sheet and background information on the operation of the OV analyzer. Mr. Potts demonstrated the unit calibration procedures. There was a question and answer session. Mr. Stouch presented Chemical Manufacturers Association's (CMA) "Improving Air Quality: Guidance for Estimating Fugitive Emissions for Equipment" manual for plant environmental specialist, which was given to Mr. Cir to be used as a reference source.

The Implementation Committee then went to the Aromatic plant to start field training. Mr. Stouch and Mr. Potts demonstrated the hands-on use of OV analyzer and began the field measurements. The OV analyzer was used to measure VOC emissions around the pump seal, valve and flange connection. By the end of the day, the OV analyzer detected several sources of fugitive emissions.

<u>October 28, 1992 - Most</u>

Czechoslovakian National Holiday.

<u>October 29, 1992 - Litvinov</u>

Continuing work at Chemopetrol, s.p. The plant management has assigned two persons from the Maintenance Department to join the fugitive emission detection team to take immediate corrective action when a leak is detected. This made it possible for the detection team to measure the effect of immediate repair in terms of reduced emissions. The Chemopetrol personnel survey team operated the OV analyzer and conducted the measurements while the WEC team oversaw their activities and provided assistance when needed.

The WEC staff met with Mr. Jari Zahradka, Deputy Head of Safety Department

at Chemopetrol. Mr. Zahradka explained the organizational structure of his department which consists of 14 employees in the Safety Group and 28 employees in the Inspection Group. The Inspection Group is responsible among other things for the electrical pressure vessels, hydraulic lifts and gas equipment. He advised that there are mandatory annual physical checks of all workers. In case of an accident, the patient is treated at an on-site emergency medical clinic which has four medical personnel. In case of a major accident, the patient is transported to a medical clinic in the town of Most (10 km. from Litvinov). The clinic in Most is partially funded by Chemopetrol and uses laboratory equipment and personnel donated by Chemopetrol. Mr. Zahradka said that presently there are no nationally enforced safety laws. Recently, Mr. Zahradka's department toured German petrochemical facilities to review their existing safety programs. As a result of the tour, Chemopetrol's first Safety Committee Meeting is scheduled for November 15, 1992. Mr. Zahradka welcomed any assistance WEC can provide in this area.

October 30, 1992 - Citibank, Prague

Attendees: Karel Noheil, Relationship Manager, CITIBANK

Ludmila Hofmanova, WEC

Dorothy Chuckro, WEC

The meeting was held with CITIBANK officer to discuss the possibility and procedures for opening a WEC account at a Prague branch.

October 30, 1992 - U.S. Embassy, Prague

Attendees: Lee Roussel, USAID Representative

Jan Pisko, Project Manager, USAID

James Scherer, Senior Environmental Advisor

Dorothy Chuckro, WEC

Bohdan Aftanas, WEC

Dr. Aftanas informed Ms. Roussel on the progress of the Waste Minimization Demonstration Project at Chemopetrol, s.p. in Litvinov. Ms. Roussel was pleased with the initial success of the project and requested WEC's input on the best way to publicize this program. She also requested to know which other enterprises WEC has chosen for the next WMP. Dr. Aftanas indicated

that WEC wants to obtain meaningful measurable results at Chemopetrol and then select other plants for WMP. WEC anticipates that the other enterprises will be identified in January 1993. Mr. Scherer indicated that he could recommend several plants which may be viable candidates for WMP.

Ms. Roussel will be informed about our selection for her comments and recommendations.

IV. FOLLOW-UP ACTIONS

The Chemopetrol's fugitive emission detection team will continue to conduct the survey of the Aromatics plant after the WEC's team visit. During the survey, the team will stay in contact with WEC and Mr. Stouch, consulting engineer, to provide an update on their progress and discuss any problems they may encounter. The survey of the Aromatic plant is projected to be completed by December 8, 1992.

At the time of completion, WEC staff and the consulting engineer will visit Chemopetrol to conduct follow-up meetings and training of the survey team, review and analyze data from the emission survey, report the survey's outcome to the Oversight Committee indicating the resultant economical benefits.

The logistics of surveying the remaining refinery will also be discussed at that time. The survey of the remaining refinery is projected to take from six to eight months to complete. There are several means of reducing this period, one of them is adding a second shift of the survey team. When Chemopetrol's survey team completes the survey of the entire refinery, the WEC team will hold a closing session with both committees and the results will be publicized.

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VI. MALCOLM PIRNIE, INC. REPORT

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

YORK, PENNSYLVANIA

November 17, 1992

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

RE: Chemopetrol Waste Minimization Project
Visit to Chemopetrol, Litvinov, Czech Republic
October 25 through 31, 1992
Project No. 2027-002

Dear Mr. McGrath:

Following is a summary of our observations and recommendations from the second trip to the petroleum refining complex at Chemopetrol in Litvinov, Czech Republic. The World Environmental Center (WEC)/Malcolm Pirnie team consisted of Mr. Bohdan Aftanas, WEC Project Manager; Ms. Dorothy Chuckro, WEC Deputy Project Manager; Mr. James Stouch, Malcolm Pirnie Project Manager; and Mr. David Potts, Malcolm Pirnie Environmental Scientist. The visit to the refinery took place from October 26 through 30, 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, the largest refining and petrochemical complex in the Czech Republic. The project will focus on reducing fugitive volatile organic compound (VOC) emissions in the refinery section of the complex. This report summarizes the findings and recommendations from a visit to the Chemopetrol refinery from October 26 through 30, 1992.

The purpose of this trip was to begin the training of Chemopetrol staff and introduce their management and other interested parties in the Czech Republic to the methods of reducing fugitive VOC emissions. WEC purchased an organic vapor analyzer/flame ionization detector (OVA/FID) as specified by Malcolm Pirnie for use by Chemopetrol. Chemopetrol staff was trained in the calibration and use of this instrument during the first two days of this visit. The Chemopetrol survey team became proficient in the use of this instrument and recording VOC emission concentrations in the Aromatics Plant area of the refinery by the end of the week.

The comprehensive fugitive emissions survey of the Aromatics Plant should be completed in approximately two weeks. Preliminary evaluation of the data for one of the 11 process units in the Aromatics Plant concluded that potential reductions in emission fees and product losses greater than 25% of current costs can be expected.

Also, the current approach by the Czech Ministry of the Environment to use average emission factors to estimate fugitive emissions may seriously over or understate emissions. For example, comparing this Average Emission Factor approach with the more refined, or "Stratified Method", showed the potential overstatement of fugitive emissions for this specific section of the Aromatics Plant using the Average Emission Factor Approach by approximately 400%. Additional work with the Ministry of the Environment regarding this issue is recommended.

BACKGROUND

WEC has a Cooperative Agreement with the US Agency for International Development (US AID) to provide U.S. private sector expertise to transfer technology and skills to Eastern European industry and government representatives. The expected results include:

- more effective pollution reduction.

- 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 W.E.C. and Chemopetrol.

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

- Provide a basis for reporting fugitive VOC emissions as required by the Ministry of the Environment.

OBSERVATIONS AND FINDINGS

A kick off meeting was held at Chemopetrol, Litvinov on 26 October with the Oversight Committee. Attendees included:

Mr. Radimir Matyas, President
Czech Environmental Management Center (CEMC)

Ing. V. Vanecek, Csc., Consultant
CEMC (formerly with the Hydrocarbon Research Institute assigned to Chemopetrol)

Dr. Bohdan Aftanas, Project Manager
W.E.C. - New York

Ms. Dorothy Chuckro, Deputy Project Manager
W.E.C. - New York

Dipl Ing Ludmila Hofmanova, Technical Coordinator
W.E.C. - Prague

Mr. Jan Pisko, Liaison, Energy, Environment & US Business
(on loan from the Czech government to US AID)

Mr. James Stouch, Associate
Malcolm Pirnie, Inc. - York, PA

Mr. David Potts, Environment Scientist
Malcolm Pirnie, Inc. - Hartford, CT

Ing. Jaroslav Cir, Head of Environmental Protection Department
Chemopetrol

Ing. Milan Witvar, Technical Manager - Refinery Units
Chemopetrol

Mr. Jan Hurych, Operating Manager - Waste Treatment
Chemopetrol

Mr. Ladislav Holada, Consultant
CHEMCONS consulting
(former Managing Director of Chemopetrol)

The meeting included introductions of the attendees, their backgrounds, and roles in the project. Mr. Stouch then presented a summary of the goals of the project, background information about

the evolution of fugitive emission control activities in the U.S., potential refinements and future potential activities at Chemopetrol, and an overview of the planned activities for the week. The schedule which was used to guide our activities is included as Attachment 1.

The instrument for detecting and measuring fugitive hydrocarbon emission concentration was purchased by WEC for Chemopetrol at Malcolm Pirnie's recommendation. It had been delivered to the refinery on October 23, 1992. The German distributor for the Foxboro "Century 108" organic vapor analyzer/flame ionization detector (OVA/FID) also furnished the services of a technician from Bratislava, Slovak Republic to assist with check out of the instrument on site. Following the meeting with the Oversight Committee, the instrument was checked out by the WEC/Malcolm Pirnie team and found to be in working order.

On the second day, a meeting was held with the Chemopetrol Management Committee for the project. The purpose of this group is to assure that communication regarding the project flows properly among affected departments (e.g., among environmental, operations, and maintenance). Second, the Management Committee will assure that the appropriate resources are assigned to the project. These resources include the survey team from the Environmental Department; a process technician from the Operating Department to point out specific lines, valves, and pumps in the process units; and a repairman from the Maintenance Department to make repairs to leaking valves, flanges, and pumps.

The Management Committee meeting was attended by Mr. Cir, Head of the Environmental Department; Mr. Witvar, Technical Manager - Refinery; Mr. Ducek, Head of Maintenance for the Aromatics Plant; Head of Operations for the Aromatics Plant; Mr. Frantisek Madron, President of CPT (a process control consulting firm working at Chemopetrol); two staff members from Mr. Cir's environmental laboratory; and the WEC and Malcolm Pirnie team. The project approach and objectives were reviewed, followed by a demonstration of the OVA/FID.

The next activity involved training the survey team. The Chemopetrol survey team consisted of two staff members from the environmental department. In addition, Aromatics Plant operations provided a technician full time to the effort to point out the specific process elements to be surveyed and during the first day, the maintenance department furnished a repairman to demonstrate the effect of repairs on reducing fugitive emissions.

The first part of the demonstration consisted of calibrating the OVA using two different methane calibrant gases of 95 ppm and 9500 ppm concentration as supplied by the instrument manufacturer. These concentrations represent the lower end and the upper end of the instrument's range. Charging the instrument's on board flame fuel cylinder with high purity hydrogen was also demonstrated. The hydrogen (99.99% pure H_2) was furnished by Chemopetrol which keeps the gas on hand for use in their own laboratory.

Next, Mr. Potts and Mr. Stouch from Malcolm Pirnie demonstrated the use of the instrument on the "sources" to be measured at the Aromatics Plant, namely, pumps, valves, flanges, open ended lines, and pressure relief valves. The use of the survey form and data taking method (see Attachment 2 for a sample survey form) was also demonstrated. Approximately 100 sources were surveyed during the first afternoon. The demonstration continued with the Chemopetrol survey team transitioning into performing all functions by the middle of the second day. Leaking sources (i.e. sources exhibiting VOC concentrations greater than 10,000 ppm) were tagged with red-orange "Repair Required" tags for follow up identification by maintenance personnel.

The Aromatics Plant generally consists of 10 separation columns and one solvent extraction column which uses diethylene glycol as the extraction solvent. A generalized block flow diagram for the process is included as Attachment 3 to this report. The initial survey activity focused on sources entering and leaving column C1 and its associated process equipment (heat exchangers, reboilers,

condensers, relief valves, sample lines, and pumps). Column C1 is the initial refinery reformate separation step in the Aromatics Plant.

We next decided that during this first week we should also survey the end phases of the process which are handling higher concentrations of volatile organic compounds. Column C10, the toluene extraction column, was selected. Sources on the inlet and discharge lines, including the product tank farm were surveyed. This part of the survey was conducted entirely by Chemopetrol staff with Malcolm Pirnie staff observing.

The results from the first one and one half days of fugitive emissions survey on C1 column (i.e., those conducted by Malcolm Pirnie) were reviewed and summarized. These results were discussed on the final day in meetings with Ing. Vladimir Skacha, Director of Strategic Development (Ing. Cir reports to Ing. Skacha), Ing. Cir, and Malcolm Pirnie personnel. In addition, a meeting was held the same day with Mr. Frantisek Madron from CPT Consultants to review these results, information on data loggers, and supplemental software that would improve fugitive emission survey productivity. Chemopetrol may request Mr. Madron's firm to assist in developing systems support tools for data evaluation, reporting, and using the survey data on fugitive losses in the daily refinery mass balance model (developed by Mr. Madron). The discussion during these meetings led by Malcolm Pirnie staff centered around Attachments 4 through 8.

Attachment 4 contains mass flow emission factors for three different measurement and estimation approaches which are used in the U.S. to quantify fugitive emissions in refineries and chemical plants. They are taken from the Chemical Manufacturers' Association publication entitled "Improving Air Quality: Guidance for Estimating Fugitive Emissions from Equipment". The column titled Method 1, EPA Average Emission Factors represents emission factors based on industry wide averages for each potential source, such as valves, pump seals, and flanges.

Method 2 on Attachment 4 is called the "leak/no leak" method of estimating fugitive emissions. This is based on correlation studies performed at a number of plants which relate mass flow rate to measured concentrations of hydrocarbons using an instrument (e.g. organic vapor analyzer/flame ionization detector) calibrated on a methane standard. It uses two levels of mass flow emission factors based on whether the measured hydrocarbon concentration is less than 10,000 ppm ("no leak") or greater than 10,000 ppm ("leak"). This method represents a refinement over the single average emission factor per source approach in Method 1.

Method 3 on Attachment 4 is called the "Stratified Method" of estimating fugitive emissions. It is a further refinement over Methods 1 and 2 in that emission factors have been developed for correlations to hydrocarbon concentrations at three different levels: 0 to 1,000 ppm; 1,001 to 10,000 ppm; and over 10,000 ppm. This is the approach which we have recommended for Chemopetrol. The difference in results between using Method 1 and Method 3 is discussed below and can be significant depending on the actual number of "leaking" sources compared with overall industry averages for each source.

We also discussed an approach which refines emission factors even further. Sources are encapsulated and actual mass flow measurements are recorded for a statistically significant number of sources in the refinery, or even in specific sections of the refinery. The purpose for taking this approach is to determine plant-specific emission factors, which better represent the actual situation at the facility, rather than using industry-wide data. This method is more time consuming and costly and may not yet be acceptable to the Czech Republic Ministry of Environment. However, it may be worth conducting this industry survey in the Czech Republic rather than accepting single average emission factors based on European Community or German standards. The merits of this are discussed below and in the Recommendations section of this report.

Another important factor to consider when evaluating the results of this phase of the project using the emission factors on Attachment 4 is the difference between the Czech definition of a fugitive hydrocarbon versus the USEPA definition of a volatile organic compound (VOC). Although within the last year the USEPA definition of a VOC has been changed to include virtually any photochemically reactive carbon compound except carbon monoxide (CO), certain chloroflorocarbon compounds (CFCs), and certain hydrochloroflorocarbon compounds (HCFCs), the common ground with the Czech definition can be found in the prior EPA definition. This definition included any hydrocarbon compound whose vapor pressure was greater than 0.1 mm Hg (0.013 kPa) at 20 deg C.

The Czech Republic definition of fugitive hydrocarbons includes those compounds whose vapor pressure is greater than 0.13 kPa at 20 deg C. Therefore, the emission factors in Attachment 4 that are based on U.S. experience include more compounds by definition than the Czech Republic regulations. However, the primary value of this project is to demonstrate the savings that can result from first identifying and quantifying fugitive emission sources and implementing a leak repair program. These combined activities are referred to in the U.S. as a leak detection and repair (LDAR) program. Potential savings are discussed further below.

Attachments 5, 6, and 7 show the potential savings resulting from the repair of leaking pump seals in light liquid service, valves in gas service, and flanges. The basis for these calculations starts with the stratified emission factors (Method 3 on Attachment 4) for a greater than 10,000 ppm leaking source that was repaired and now exhibits a concentration of less than 1,000 ppm. The savings include avoided emission fees which, for 1992 and 1993, are 30% of the maximum of 2,000 CKR (Czech crowns) per tonne of hydrocarbons emitted. Also included in the savings calculations is a conservative allowance for the value of lost product based on a plantwide yield of 75%, crude oil priced at $21.00 per barrel, and an exchange rate of 26.00 CKR to US$1.00. Annual savings for repairing a single leaking pump in light liquid service (shown on Attachment 5) is approximately

US$ 870 (22,622 CKR); repairing a leaking valve in gas service (shown on Attachment 6) is approximately US$ 90 (2,338 CKR); and repairing a leaking flange (shown on Attachment 7) is approximately US$ 75 (1,949 CKR).

A summary of the data gathered during the first two days of the survey on the C1 column is presented in Attachment 8. A total of 198 sources were surveyed, including 47 valves, 1 pressure relief valve, 1 pump, 6 open ended lines, and 143 flanges. The data is presented two ways to illustrate the difference between using two of the methods for quantifying fugitive emissions. First, using the single average emission factor per source method (Method 1 on Attachment 4) an annual emission rate of 5.14 tonnes was calculated and represents an annual cost of approximately US$ 1,294 (33,847 CKR). Second, using the Stratified Method (Method 3 on Attachment 4), an emission rate of only 1.1 tonnes per year was calculated which represents an annual cost of approximately US$ 274 (7,131 CKR).

Of these sources surveyed, only one was leaking (i.e., >10,000 ppm). The effect of repairing this single leaking flange would reduce the annual cost by approximately 27%, from US$ 274 (7,131 CKR) to US$ 199 (5,174 CKR). As the number of leaking sources detected and repaired increases, greater savings will be realized.[1] Survey activities on the C10 toluene separation column were conducted at the end of this first week. At least eight (8) additional leaking sources were observed in this section of the Aromatics plant.

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[1] In our report from the September trip to Chemopetrol, rough estimates of cost savings potential for the entire refinery were US$50,000 to US$100,000 (1,300,000 CKR to 2,600,000 CKR).

CONCLUSIONS AND RECOMMENDATIONS

1) The proficiency of the Chemopetrol survey team in using and calibrating the OVA/FID was excellent by the end of this training period. This combined with the preliminary analysis of the results and potential savings led to the agreement with Mr. Skacha and Mr. Cir that the survey should continue uninterrupted through the balance of the Aromatics Plant. This should take approximately three more weeks. At the conclusion of this phase, a meeting will take place with Chemopetrol and WEC/Malcolm Pirnie to review and evaluate the data gathered to date, draw preliminary conclusions, review "lessons learned" from the initial survey in terms of instrument performance and maintenance, and problems encountered including the potential solutions. Finally, the schedule for surveying the remainder of the refinery will be discussed. It is our understanding that the Oversight Committee, including representatives from other chemical plants in the Czech and Slovak Republics may be invited to this meeting.

   At the meeting on 30 October with Messrs. Skacha and Cir of Chemopetrol and Messrs. Stouch and Potts of Malcolm Pirnie, a tentative completion schedule of six to eight months for the entire refinery was discussed. Also discussed were methods of reducing this time period by adding a second shift to the survey effort and/or, under the proper climatic conditions, by using the "No Detectable Emission" method for screening sources as described in USEPA "Method 21 - Determination of Volatile Organic Compounds Leaks", a copy of which was left at Chemopetrol. Further, Chemopetrol may seek outside assistance from Mr. Madron's firm, CPT, to complete the survey for the balance of the refinery.

2) According to refinery personnel, the Ministry of the Environment of the Czech Republic intends to use the single average emission factor approach to having plants estimate and pay fees on their fugitive hydrocarbon emissions. As shown above, this may misrepresent plant-

specific conditions which are driven by factors such as the age of equipment or preventive maintenance practices. Consideration should be given to conducting a statistically significant number of actual mass flow measurements at Chemopetrol and/or other refineries and chemical plants in the Czech Republic to demonstrate the validity of this conclusion, and to provide the basis for regulations permitting the use of more refined methods for determining fugitive hydrocarbon emissions. These results could then be shared with industry and the Ministry of the Environment throughout the Czech Republic. This issue will be evaluated in greater detail at the conclusion of the Aromatics Plant survey in early December 1992.

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

Very truly yours,

MALCOLM PIRNIE, INC.

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R. Klippel/SYR

2027-002

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ATTACHMENT 1

SCHEDULE FOR FUGITIVE EMISSIONS SURVEY
CHEMOPETROL, LITVINOV
26 October - 30 October 1992

MONDAY 26 OCT	TUESDAY 27 OCT	WEDNESDAY 28 OCT	THURSDAY 29 OCT	FRIDAY 30 OCT
AM • Travel to Chemopetrol, Litvinov PM • Meeting w/ Oversight Committee • Review Survey Checklist with Survey Team (WEC & Chemopetrol) • Check out & test OVA	AM • Complete check out & test of OVA. • Train Chemopetrol Survey Team PM • "Dry run" sampling with Chemopetrol Survey Team. • Start Survey at Aromatics Plant	AM • Continue survey in Aromatics Plant PM • Continue survey in Aromatics Plant	AM • Continue survey in Aromatics Plant PM • Continue survey in Aromatics Plant	AM • Continue survey in Aromatics Plant • Meet with Mr. Skacha and Mr. Cir to review the preliminary results of the Aromatics Plant Survey • Meet with Mr. Cir and Mr. Madron re CPT's involvement with systems support for the project. PM • Continue survey in Aromatics Plant

ACHMENT 2
SAMPLE FORM

FUGITIVE EMISSIONS SURVEY
DATA SHEET

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INSTRUMENT TYPE: OVA 108
AVG. BACKGROUND PPM: 10 ppm
CAL. READING: 95/9500 ppm
PLANT: Old Refinery

TEST DATE / RETEST DATE	AREA	SUBAREA	TAG NO.	PROCESS STREAM	PART	SIZE	SERVICE	MEASURED PPM	RESPONSE FACTOR	CORRECTE PPM	COMMENTS
2/9/92	AROMATICS PLANT	I	Cl Reblr. Rtn.	Cl Reboiler (A) Return	FL	8"	HL	20			
			Cl Reblr. Blank FL.		FL	8"	HL	20			
			Cl Reblr. Press Gage		FL	3/4"	HL	10			
					V		HL	100			
					FL		HL	10			
			Valve @ Cl on Reblr.		V	8"	HL	1000			
			Valve @ 2nd Cl Reblr.	Cl Reboiler (B) Return	V	8"	HL	>10,000			Leaker
					(A) FL			NR			
					(A) FL			NR			
					(B) FL			NR			
					(B) FL			NR			
			Cl Reblr. Drain	Cl Reblr. (A) Drain	FL	4"		10			
					V	4"		10			
					FL	4"					
					FL	2"					
					V	2"					
					FL	2"					

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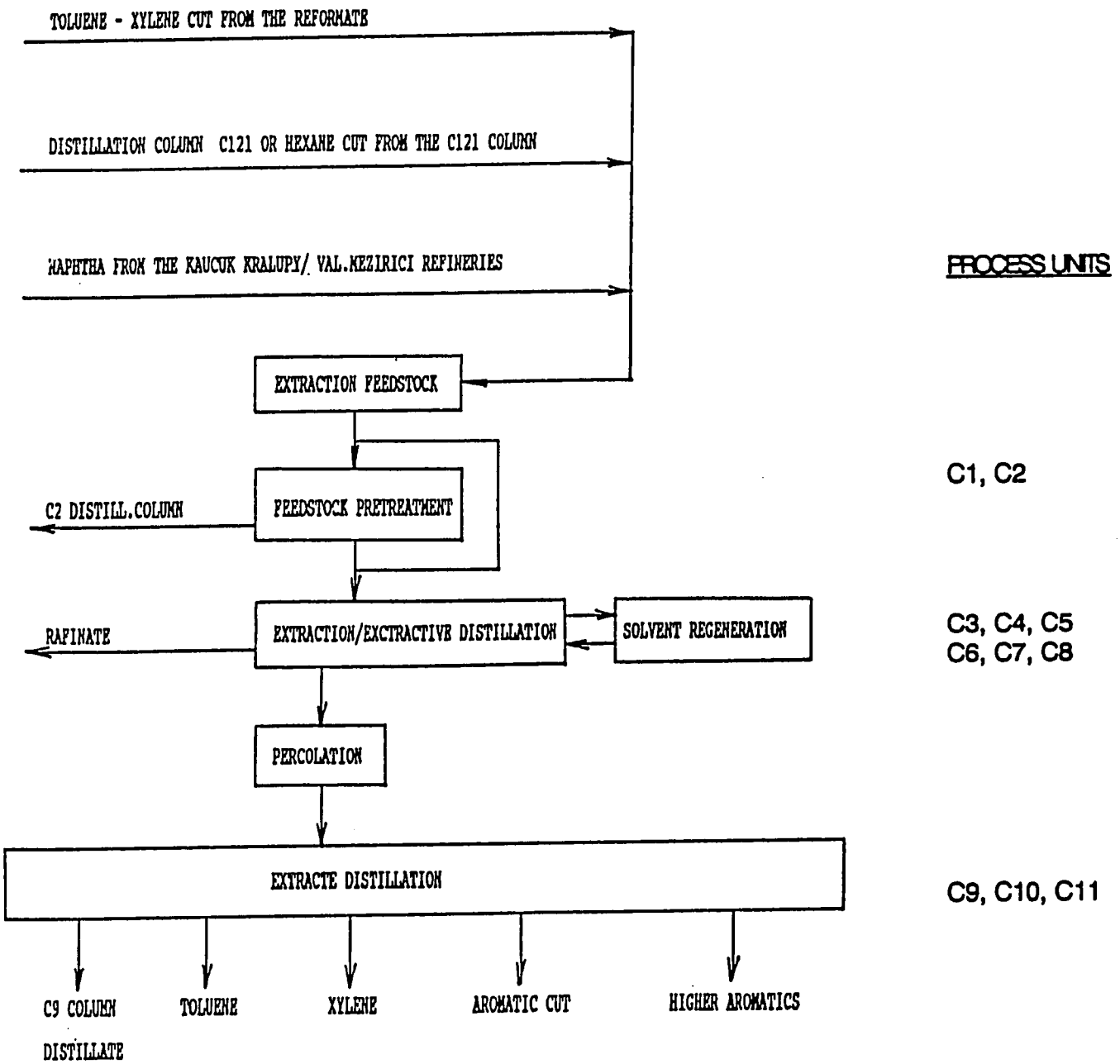
ATTACHMENT 3
BLOCK FLOW DIAGRAM - AROMATICS PLANT



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ATTACHMENT 4

EMISSION FACTORS
(KG/HR/SOURCE)

		METHOD 1	METHOD 2		METHOD 3		
			LEAK / NO LEAK EMISSION FACTORS		STRATIFIED EMISSION FACTORS		
COMPONENT	SERVICE	EPA AVERAGE EMISSION FACTORS	>10000 PPM	<10000 PPM	0-1000 PPM	1001-1000 PPM	>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".

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ATTACHMENT 5

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		3.81 TONNES/YEAR
EXCHANGE RATE @ $1.00	=	26.00 CKR
ESTIMATED ANNUAL SAVINGS (See Note 1.)		$870 = 22,622 CKR

NOTES:

1. COST SAVINGS CALCULATION ($/YR) =

$$\frac{\text{(EMISSION REDUCTION IN TONNES/YR)} * \text{(FEE PAID TO GOVT AT 2000 CKR/TONNE)} * 30\%}{26.00\ \text{CKR/US\$}} + \frac{\text{(EMISSION REDUCTION IN TONNES/YR)} * \text{(VALUE OF CRUDE AT \$153.93/TONNE)}}{\text{PLANT YIELD AT 0.75}}$$

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ATTACHMENT 7

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

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		0.33 TONNES/YEAR
EXCHANGE RATE @ $1.00	=	26.00 CKR
ESTIMATED ANNUAL SAVINGS (See Note 1.)		$75 = 1,949 CKR

NOTES:

1. COST SAVINGS CALCULATION ($/YR) =

$$\frac{\text{(EMISSION REDUCTION IN TONNES/YR)} * \text{(FEE PAID TO GOVT AT 2000 CKR/TONNE)} * 30\%}{\text{26.00 CKR/US\$}} + \frac{\text{(EMISSION REDUCTION IN TONNES/YR)} * \text{(VALUE OF CRUDE AT \$153.93/TONNE)}}{\text{PLANT YIELD AT 0.75}}$$

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ATTACHMENT 8

FUGITIVE EMISSIONS SURVEY DATA SUMMARY
AROMATICS PLANT -- C1 SUBAREA

	SINGLE SOURCE METHOD				STRATIFIED METHOD				
	EMISSIONS		COST		EMISSIONS		COST		NO. OF SOURCES
	KG/HR	T/YR	$	CKR	KG/HR	T/YR	$	CKR	
VALVES	0.33	2.9	735	19107	0.028	0.2	62	1602	47
PRV'S	0.104	0.9	229	5955	0.011	0.1	25	653	1
PUMP	0.021	0.2	47	1225	0.004	0.1	8	218	1
OPEN END LINES	0.01	0.1	22	584	0.009	0.1	21	539	6
FLANGES	0.119	1.04	261	6976	0.072	0.6	158	4119	143
TOTALS	0.584	5.14	1294	33847	0.124	1.1	274	7131	198