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TRIP REPORT #1, CHEMOPETROL

LITVINOV, CZECH REPUBLIC

WASTE MINIMIZATION PROJECT

**THOMAS J. MCGRATH
VICE PRESIDENT
WORLD ENVIRONMENT CENTER**

SEPTEMBER 1992

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I. ITINERARY

September 13, 1992 - Prague

- Meeting with Mr. Radomir Matyas, President, Czech Environmental Management Center

September 14, 1992 - Prague

- Meeting with Mr. James Scherer, WEC advisor to Minister, Czech Ministry of Environment
- Meeting with USAID Mission Representative, Mrs. Lee Roussel and her staff
- Visit WEC Office

September 15 - 18, 1992 - Litvinov

- Meeting with various managers at Chemopetrol

September 18, 1992 - Prague

- Meeting with Mr. Radomir Matyas and Mrs. Ludmila Hofmanova, WEC Coordinator

II. EXECUTIVE SUMMARY AND OBSERVATIONS

Chemopetrol, the largest petrochemical complex in the Czech Republic, has agreed to participate in a waste minimization demonstration project in the heavily polluted area of Northern Bohemia.

The project will involve fugitive volatile organic compounds (VOC) in the oil refinery. Chemopetrol limited our project to the oil refinery because it is involved in privatization and joint venture discussions for part or all of its chemical plant. The potential western partners and Chemopetrol are discussing the type of technology that would be used in the future, but they have not reached an agreement. Chemopetrol suggested that WEC return, after agreement has been reached on the technology, to conduct additional waste minimization projects.

WEC and Chemopetrol agreed on a Memorandum of Understanding which commits the enterprise to future waste minimization projects to be conducted by Chemopetrol employees.

We estimate that the WEC VOC waste minimization demonstration project will result in reductions of VOC in the range of 25 to 50% with resultant costs savings of \$50,000 to \$100,000. It should be noted that less than 1% of VOCs comprise the total emissions, most of latter are not suitable for waste minimization as they require major capital expenditures to solve their pollution problems. However, savings in the estimated ranges for this small fraction of emissions are significant.

Mr. Skacha informed us that Chemopetrol considers the problem of fugitive VOCs to be very important because of the health risks and heavy fines they will be subjected to in 1993.

AID's objective of linkage of AID funded programs could be accomplished at Chemopetrol. I mentioned the training programs of the other AID contractors involved in Central and Eastern Europe. Chemopetrol management and the Czech Environmental Management Center expressed interest in learning more about these programs.

III. MEETINGS

Sunday, September 13

Meeting with Radomir Matyas, President of Czech Environment Management Center. Discussed waste minimization demonstration project and the involvement of CEMC. Mr. Jaroslav Cir, Chemopetrol, will be the CEMC representative in the project. Mr. Matyas will join the WEC team at Chemopetrol on Friday, September 18, when we meet with Mr. Dusan Nepejchal, the new General Director of Chemopetrol.

Monday, September 14

Messrs. Scherer, Feder, Stouch and I met with Ms. Lee Roussel, AID Representative, Mr. Jim Bednar, her deputy, and Mr. Jan Pisko, a new employee who will have responsibility for environmental matters.

The AID representative endorsed the waste minimization demonstration project at Chemopetrol. I informed Ms. Roussel that we will keep her staff fully informed of our progress with the project and wish to work closely with them.

Chemopetrol

Met with Mr. Vladimir Skacha, Director of Strategic Development and Mr. Jaroslav Cir, Head of Department of Environmental Protection. The project was explained and Mr. Skacha pledged Chemopetrol's support.

Tuesday, Wednesday and Thursday, September 15, 16 & 17

The WEC team toured all areas of the refinery. It met with personnel from operations, maintenance, factory management and the environmental department and with Mr. Miroslav Kornalic, Deputy General Director and Managing Director for management, organization and automation. Business cards of the Chemopetrol personnel are included with this report.

The result of the visit was an agreement to conduct a waste minimization project in accordance with the Memorandum of Understanding which is included with this trip report.

There will be a number of other interested organizations that may participate in the project as observers. Some of these organizations may be other chemical enterprises, Czech consultants, research firms and the Czech

Environmental Management Center. The observers on the Oversight Committee will be finalized before the start of the project.

The technical details of the trip are contained in Jim Stouch's report which is included.

Linkage

I explored the possibility of linking other AID contractors, primarily the Environmental Training Program, to this project. Chemopetrol's reaction was favorable and WEC will explore this with the AID contractors and Chemopetrol after the project is underway.

The following documents were received from Chemopetrol:

1. Map
2. Confidential report on its process units
3. Confidential report on mass balance of VOC
4. Confidential report on the Review of Environmental Conditions of the Chemopetrol facility
5. Confidential report on tanks
6. Confidential report on penalty fees
7. Confidential report on emissions SO₂, NO_x and Dust
8. Chem-Plant Technology - Distributed Balancing System
9. Act 389 of the Czech National Council on the State Administration of Air Protection and Charges for the Pollution of Air - September 10, 1991
10. Czechoslovakia Federal Waste Act 22 May 1991
11. Law Concerning the Protection of the Atmosphere N. 309/91 July 9, 1991.

IV. BUSINESS CARDS OF CONTACTS



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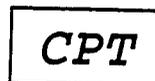
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V. MEMORANDUM OF UNDERSTANDING

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**Memorandum of Understanding
between
World Environment Center and Chemopetrol, s.p. Litvinov
concerning
Waste Minimization Project**

INTRODUCTION

The World Environment Center (WEC) New York, N.Y., U.S., sent a team consisting of Mr. James C. Stouch, Associate, Malcolm Pirnie, Inc., Consulting Engineers, Doctor Raymond L. Feder and Thomas J. McGrath, Vice President, WEC, to discuss with Chemopetrol management a Waste Minimization Project for Volatile Organic Compounds (VOC) in the oil refinery. The visit took place from September 14-18, 1992.

The purpose of the visit was to review the oil refinery operations and agree to conduct a waste minimization demonstration project which would identify and recommend actions that would reduce VOCs at Aromatics plant in the oil refinery with resultant cost savings and health benefits. Chemopetrol managers, employees and Czech consultants would be trained in waste minimization procedures.

AGREEMENT

This Memorandum of Understanding (MOU) includes the points of agreement reached between the World Environment Center and Chemopetrol, Litvinov on September 18, 1992. In attendance were Mr. Miroslav Kornalik, Management, Organization and Automation Director, Mr. Vladimir Skacha, Mr. Jaroslav Cir, Head of Department of Environmental Protection, Mr. James Stouch, Malcolm Pirnie, Inc., Dr. Raymond Feder and Thomas J. McGrath, WEC.

1. The WEC waste minimization specialist for this project is Malcolm Pirnie, Inc., represented by Mr. James Stouch, who is the project director, and with assistance from Dr. Raymond Feder and WEC staff, will conduct a waste minimization demonstration project at Chemopetrol. The project will involve fugitive Volatile Organic Compounds emissions at Aromatics plant in the Oil Refinery.
2. It was determined during the visit that in order to quantify fugitive VOC emissions, presently and after corrective action has been taken, WEC will purchase and provide an American made Organic Vapor Analyzer/Flame Ionization Detector. At the conclusion of the project, ownership of the equipment will be transferred to Chemopetrol.
3. Messrs. Stouch and Feder estimate that the amount of fugitive VOC emissions at the oil refinery is

approximately 1,300 metric tons. The goal of the waste minimization project for the oil refinery is to reduce fugitive VOC emissions between 25 and 50 percent.

4. The estimated savings from implementing the VOC waste minimization program that may be realized from lost product and reduced penalty fees is between \$50,000 and \$100,000.
5. An Oversight Committee will be established to guide the project. The committee will include representatives from Chemopetrol, WEC, Czech Environment Management Center, the consulting company Chemcons, the Chemical Plant of Technology Co. at Usti n/L and other interested organizations which will be identified at a later date.
6. A Waste Minimization Implementation Committee will be organized at Chemopetrol to work with WEC on this project. WEC recommends that representatives from the following departments be members of this committee: Environment, Operations, Maintenance, Wastewater Treatment, Accounting, Management, Information Systems and other departments not presently identified.
7. WEC will provide waste minimization training to insure that the responsible Chemopetrol employees become fully acquainted with the details of implementing a Waste Minimization Program and the use of the monitoring equipment. WEC recommends that the training take place in the Aromatics plant.

The Chemopetrol Waste Minimization Implementation Committee will assign two or three employees full-time to this training effort. It is expected that these employees will complete the initial survey of the refinery or will train others to complete the initiated survey and conduct follow-up monitoring.
8. The Waste Minimization Project will begin October 26, 1992 and conclude when the Waste Minimization Implementation Committee agrees that the project is completed including corrective actions.
9. Progress reports from the Chemopetrol Waste Minimization Implementation Committee will be sent to WEC.
10. The frequency of visits by Malcolm Pirnie Inc. and WEC staff during the project will be determined after the project has started. However, it is agreed that the WEC in-country coordinator, Dipl. ing. Ludmila Hofmanova, will make weekly visits to Chemopetrol during the first month of the project in her role as liaison between

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Chemopetrol and WEC. Mrs. Hofmanova will inform WEC of the results of each of her visits.

11. Chemopetrol agrees that it will make its best effort to comply with the WEC instructions and directions during the project on VOCs. WEC will work closely with Chemopetrol when the Aromatics plant is assessed. When the demonstration at the Aromatics plant has been completed, Chemopetrol will complete the project by having its employees, who have been trained during the Aromatics plant assessment, train other employees and complete the project on VOCs at the oil refinery with assistance from WEC.
12. Since fugitive emissions account for less than one percent of all emissions at Chemopetrol and the petrochemical factory is not included in the project at this time, Chemopetrol agrees that at a later time it will implement a Waste Minimization Program throughout the petrochemical plant and inform WEC of its progress during the project. Also, the estimated amount of pollution reduction and costs savings when that project is completed will be reported to WEC.
13. WEC agrees not to disclose to any third party confidential information obtained from Chemopetrol in the course of performing the Waste Minimization Demonstration Project at the Aromatics plant.
14. WEC agrees to provide advice when requested during the petrochemical plant waste minimization project, but it is not obligated to send consultants to Chemopetrol to assist in that project.

For Chemopetrol s.p.
Litvinov

Vladimír Škácha
Director for Strategic
Development

Date: 10/29/92

For World Environment Center

(116)
Antony G. Marcil
President & CEO

Date: 10/23/92

VI. MR. STOUCH, MALCOLM PIRNIE, INC. REPORT

October 5, 1992

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

RE: Chemopetrol Waste Minimization Project
Visit to Chemopetrol, Litvinov, Czechoslovakia
September 14 through 18, 1992

Dear Mr. McGrath:

Following is a summary of our observations and recommendations from the trip to the petroleum refining complex at Chemopetrol in Litvinov, Czechoslovakia. The purpose of this letter is to document these summary observations and to define the scope of work for the remainder of the Waste Minimization project at Chemopetrol.

BACKGROUND

Chemopetrol is the largest refining and petrochemical complex in Czechoslovakia. The World Environmental Center (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.
- improved industrial health and safety practices.
- improved energy conservation and management.
- increased community awareness in environmental and energy related areas.

World Environmental Center has contracted with Malcolm Pirnie, Inc. to assist with the program. The subject waste minimization project will concentrate on reducing fugitive volatile organic compound emissions in the refinery section of the complex.

An initial visit was conducted at the refinery from September 14 through 18, 1992. The WEC team consisted of Mr. Thomas J. McGrath, Vice President, WEC; Dr. Raymond L. Feder, Consultant; and Mr. James C. Stouch, Associate, Malcolm Pirnie, Inc. The project goals, which have been clarified by this visit, are to:

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- o Provide the first opportunity for a WEC/US AID project in Eastern Europe to move beyond the study phase. That is, the project should 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 the Chemopetrol project as a training example for other enterprises in Czechoslovakia.
- o Reduce the risk of worker and community exposure to airborne toxic compounds.
- o Provide a basis for reporting fugitive VOC emissions as required by the Ministry of the Environment.

SUMMARY OF OBSERVATIONS AND FINDINGS

Interviews were held with the following people in Prague and at Chemopetrol, Litvinov:

Prague

Mr. Jim Scherer, US EPA Region VIII Administrator
(on loan as Advisor to the Czech Ministry of Environment)

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

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

Ms. Lee Roussel, Director, Czechoslovakia
US AID, State Department, US Embassy

Mr. James Bednar, Dep. Dir., Czechoslovakia
US AID, State Department, US Embassy

Mr. Jan Pisko, Liaison, Energy, Environment & US Business

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World Environmental Center

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(on loan from the Czech government to US AID)

Chemopetrol, Litvinov

Ing. Jaroslav Cir, Head of Environmental Protection Department
Chemopetrol

Ing. Vladimir Skacha, Director of Strategic Development
Chemopetrol

Ing. Milan Witvar, Technical Manager - Refinery Units
Chemopetrol

Mr. Pavel Tuma, Supervisor - Maintenance
Chemopetrol

Mr. Jan Hurych, Operating Manager - Waste Treatment
Chemopetrol

Mr. Frantisek Madron, Csc, President
ChemPlant Technology spol. sro

Mr. Novotny, Manager - New Refinery
Chemopetrol

Mr. Hawalka, Technical Manager - New Refinery
Chemopetrol

Mr. Miroslav Kornalik, Management, Organization, & Automation Director
Chemopetrol

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

Overview of Chemopetrol

The Chemopetrol complex at Litvinov consists of two refineries ("old refinery" and "new refinery"), a petrochemical plant, (e.g., polyethylene and polypropylene production), and a fertilizer plant (urea

and ammonia based fertilizers). Currently the entire operation has 10,000 employees. The petrochemical and fertilizer operations are not included in the WEC study.

The Old and New Refineries have a combined crude processing capacity of 5 million tonnes per year (tpy). The Old Refinery was completed in 1942 as a coal (lignite) liquefaction plant to produce diesel fuel. In the early 1960's a crude oil pipeline was completed from the USSR and the use of lignite as feedstock was phased out. The last lignite gasification unit was taken off line in the mid-1970's. Major renovations were completed in the Old Refinery in 1967 and its current capacity is 1.7 million tpy. Turnarounds are scheduled on a 24 month cycle.

The New Refinery was completed in 1980 and a new hydrocracker unit (UNOCAL technology) was brought on line in 1988 bringing its current crude capacity to 3.3 million tpy. A new continuous catalytic reformer (French CCR technology) is under construction to produce unleaded gasoline and is expected to come on line in 1994.

Primary products from the Chemopetrol refinery include:

- Gasoline
- Diesel and fuel oils
- Asphalt
- Kerosene
- Lube base stock
- LPG
- Hydrogen gas
- Aromatics (toluene, and xylene)
- Naphtha
- Sulfur

Domestic consumption of refinery output is approximately 12% of the total with approximately 70% distributed outside the country via pipeline to Germany. The remainder is distributed via rail or truck.

Regulatory Setting

Environmental regulations in Czechoslovakia are codified in approximately seven different laws. They are structured such that limits are set for different pollutants in different in the three media (air, water, and waste) and must be met by certain dates (e.g. 1998 for SOx). Environmental compliance costs borne by manufacturing facilities include payments to regulatory bodies consisting of "fees", "penalties", and "indemnities". For example, emission "fees" are paid by manufacturing facilities on an annual basis as follows:

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World Environmental Center

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1,000 Kcs/tonne SO_x
800 Kcs/tonne NO_x
3,000 Kcs/tonne dust
600 Kcs/tonne CO
2,000 Kcs/tonne hydrocarbons (including VOCs)

Fees are also paid in the amount of 220 Kcs/tonne of hazardous waste generated and 40 Kcs/tonne of solid waste generated.

In order to phase in the full impact of these environmental regulations, increasing percentage rates apply to the total amount owed for each year up through 1998. That is, 30% of the full amount in 1991 and 1992, 60% in 1993 through 1995, 80% in 1996 and 1997, and 100% beginning in 1998. In addition to the emission fee structure, "penalties" are assessed by the government for accidental releases. "Indemnities" are also charged to the operation for environmental damage to the neighboring population or agricultural assets.

Environmental Overview of Chemopetrol

No company-wide environmental policy statement exists although there appears to be a general awareness of the importance of environmental issues at the middle management level and above. The environmental department staff consists of 18 people, including 8 laboratory personnel, a toxicologist, and 9 air/water/waste people. The laboratory has GC/MS capability consisting of analysis by activated carbon desorption methods. The plant continuously monitors SO_x emissions from its two power plants. Currently, testing for fugitive VOC, benzene, and ammonia emissions is performed with Draeger tubes and a hand pump. Chemopetrol does not possess or have ready access to portable analyzers such as photoionization detectors (PID) or flame ionization detectors (OVA/FID).

Industrial hygiene (indoor air) sampling, ambient air sampling (at the fence line and at a government imposed 500 meter buffer zone outside the plant), and water quality sampling (once per shift) are conducted by plant personnel. The local health authorities also conduct ambient air monitoring for benzene and ammonia outside the 500 meter buffer zone. Medical surveillance examinations are conducted yearly examinations for production employees and every five years for management.

In 1991, Chemopetrol paid a total of 85,000,000 Kcs in permit fees. This included 48,000,000 Kcs for air emissions, 17,000,000 Kcs for wastewater, and 20,000,000 Kcs for hazardous and solid waste. Total fees in 1992 fees are projected to be 100,000,000 Kcs with a peak fee payment projected to occur in 1998 of 200,000,000 Kcs (approximately \$8,000,000).

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World Environmental Center

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Of the 48,000,000 Kcs fee paid in 1991 for air emissions, about 5% is attributed hydrocarbon (mostly VOC) emissions. The rest is based almost entirely on SOx emissions from the two power plants on site. These power plants burn locally mined lignite and are equipped with two stage electrostatic precipitators running at about 80% capture efficiency according to refinery personnel. A major project is underway to evaluate business ventures with Texaco for a coal gasification plant or Power International Inc. for a fluidized bed combustion-based power plant with flue gas desulfurization to replace the existing power plants. Either of these options involve cogeneration to produce power for the public utility grid. If no deal can be worked out, Chemopetrol will be forced to install flue gas scrubbers on the existing power plants.

As mentioned above, about 5% of the total air emissions from the entire complex (refinery, petrochemical, and fertilizer operations) are attributable to hydrocarbons, or approximately 6,000 tonnes in 1991. The largest single contributor to this quantity is fugitive VOCs from the refinery. For purposes of reporting to the Ministry of Environment and as the basis for emission fees, this amount was calculated to be 2,635 tonnes. However, this calculation was based on throughput rates for intermediate and finished product storage tanks and loading operations ONLY. It does not include fugitive VOC emissions from flanges, valves, pump seals, or pressure relief valves. According to refinery personnel, they must begin reporting a number to the government this year for these fugitive sources.

Chemopetrol has started projects to address the storage tank and loading rack emissions. They are installing internal floating roofs on fixed roof tanks and are evaluating a Danish technology vapor recovery unit for the loading operations. The fugitive emission sources, however, remain unquantified and require a means of identifying leaks and establishing an ongoing repair program to reduce emissions from these sources.

From very rough estimates of the number and types of sources (valves, flanges, relief valves, and pump seals) and US EPA-developed emission factors for individual source types, the Malcolm Pirnie/WEC team estimates that fugitive VOC emissions from the refinery are on the order of 1,300 tonnes per year. By identifying and quantifying these sources and implementing an aggressive repair program, a reduction goal of 25% to 50% is reasonable. Savings, based conservatively on the world market price of crude oil, would be on the order of \$50,000 to \$100,000 (1,250,000 Kcs to 2,500,000 Kcs).

RECOMMENDATIONS

Following are recommendations for proceeding with the Waste Minimization/Fugitive VOC Emission Reduction Project at Chemopetrol, Litvinov:

1. An Oversight Committee consisting of Chemopetrol managers and representatives from WEC, Ministry of Industry, Czech Environmental Management Center (CEMC), and other chemical companies and consultants should be established to develop operating procedures, ensure that technology transfer goals of the Ministry of Environment and CEMC are met throughout the Czech Republic, and guide the project.
2. A Waste Minimization Management Committee should be formed consisting of Chemopetrol operations, maintenance, environmental, and other key management personnel. The objective of this group should be to ensure that the appropriate resources are committed to the project from within Chemopetrol.
3. The project should proceed by focusing on a specific area of the refinery as a pilot program. This will keep the effort focused during the training phase. Malcolm Pirnie recommends that the Aromatics Plant (toluene and xylene production facility) be chosen for this effort. Chemopetrol should assign two or three people full time to the training effort and follow up fugitive emission survey efforts. The objective is for Chemopetrol to survey the entire refinery within the next six months in order to quantify the magnitude of fugitive VOC emissions, provide the basis for an ongoing follow up survey and corrective action program, and provide the basis for monitoring and documenting emission reductions and savings attributable to the program.
4. Malcolm Pirnie will develop a specification and obtain price quotes for an Organic Vapor Analyzer/Flame Ionization Detector (Foxboro Century 108, or equal) to be purchased by WEC and furnished to Chemopetrol for this project. A flame ionization detector (FID) has been selected over other instrument types because of its capability to operate in high relative humidity conditions, in the presence of methane gas, and in the presence of electric fields (high horsepower pump motors).
5. Malcolm Pirnie and WEC will conduct an orientation meeting for the Oversight and Waste Minimization Management Committees at Chemopetrol, Litvinov and will give a demonstration of the equipment and discuss the objectives of program.
6. Malcolm Pirnie will develop and conduct an initial week long "hands on" training session for Chemopetrol staff assigned to work on the project. Malcolm Pirnie will monitor the Chemopetrol emission survey staff, review with them the use of the information in their overall waste minimization program, help log survey results and be available for "coaching" during the training session. The goal during this first week will be to complete as much of the Aromatics Plant survey as is possible while Malcolm Pirnie personnel are on site. It is currently anticipated that this activity will take place on or about the week of October 26, 1992 (including the orientation meeting referred to above in item 5).

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7. In preparation for the training in item 5, Malcolm Pirnie will prepare a Fugitive VOC Emission Survey form and a Leak Report form to assist in survey data taking. Malcolm Pirnie will also develop a spread sheet (Lotus 1-2-3) which will aid in calculating the benefits of the program as it proceeds. The terminology and "node" numbering sequence from ChemPlant Technology's Distributed Balancing System model for Chemopetrol, Litvinov will be used as much as is practical for this model.
8. In addition to the preparation and training discussed in items 4 through 7, Malcolm Pirnie will be available for telephone consultation and data review throughout the initial survey of the refinery. Malcolm Pirnie will plan for two additional trips to Chemopetrol, Litvinov during the course of the project. One trip will serve as an "on call" visit to assist in resolution of problems which arise during the initial or follow up work. The other trip will be a final visit prior to project close out with objective of giving and receiving feedback on the overall program.
9. Interim field reports (two are anticipated) and a final summary report will be submitted to WEC. Malcolm Pirnie expects to complete our involvement in the project on or before September 30, 1993.

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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cc: R. Klippel/SYR

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