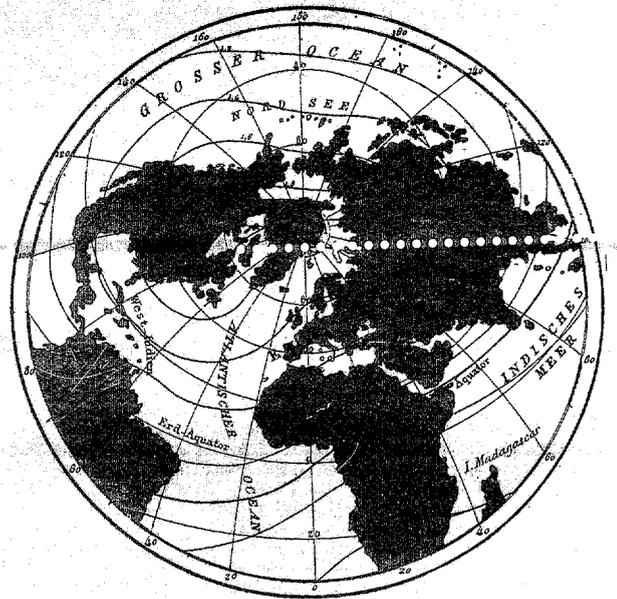


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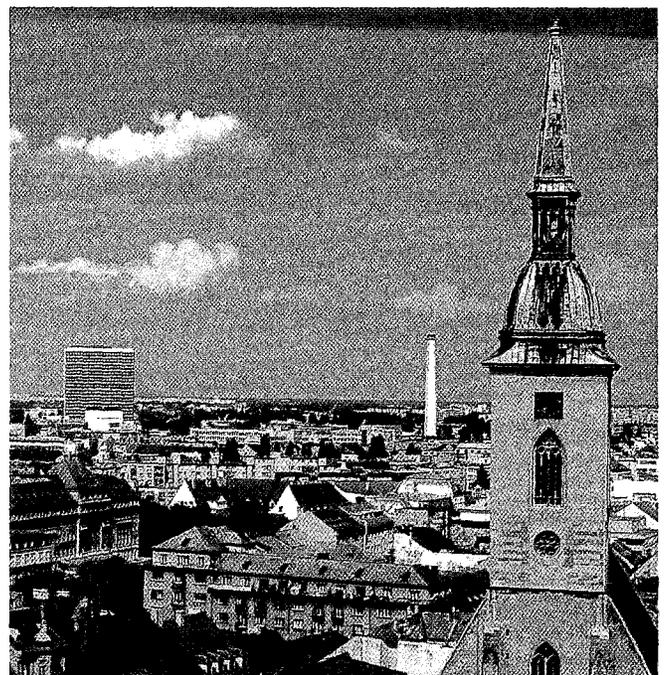
WORLD ENVIRONMENT CENTER

Waste Minimization Program

Monetary & Environmental Benefits



THE GOAL IS ZERO



A

STATUS REPORT - 1996
WASTE MINIMIZATION PROGRAM
MONETARY & ENVIRONMENTAL BENEFITS

This Status Report summarizes the monetary and environmental benefits resulting from the implementation of WEC's Waste Minimization Program in 6 Central and Eastern European countries. The benefits were achieved from completing a total of 143 projects in 51 companies.

ABOUT THE WORLD ENVIRONMENT CENTER

The World Environment Center is an independent, not-for-profit, non-advocacy organization which contributes to sustainable development worldwide by strengthening industrial and urban environment, health and safety policy and practices. Over three decades, WEC has quietly evolved into an effective, proactive and hands-on organization by innovatively linking the "Four E's":

- Environment,
- Energy,
- Education, and
- Economics.

WEC, through the three following complementary programs, serves as a bridge for exchange of information and expertise among the industry, government, non-governmental organizations and the community:

- The International Environment Forum (IEF),
- The International Environment and Development Service (IEDS), and
- The WEC Gold Medal for International Corporate Environment Achievement.

WEC is headquartered in New York City with offices in Bangkok, Jakarta, Mexico City, and Washington, D.C.

WEC & USAID

WEC has a cooperative agreement with the United States Agency for International Development (USAID) for the sharing of U.S. waste minimization accomplishments with the industries and governments of Central and Eastern Europe. The mutual exchange of know-how and technology has contributed to successful cooperative efforts which have significantly improved:

- Reduction of industrial pollution,
- Toxic waste management procedures,
- Industrial health and safety practices,
- Energy management and conservation, and
- Community awareness in conservation of natural resources.

In its Waste Minimization Programs, WEC uses experts from many multinational organizations, including the following companies that participate in the International Environment Forum:

| | |
|----------------------------------|-----------------------------------|
| Air Products & Chemicals, Inc. | Hoechst Celanese Corporation |
| Akzo Nobel Inc. | "Holderbank" |
| AlliedSignal, Inc. | IBM Corporation |
| Amoco Corporation | ICI Americas Inc. |
| AMP Incorporated | Intel Corporation |
| Anheuser-Busch Companies, Inc. | Johnson & Johnson |
| ABB Asea Brown Boveri | Johnson Matthey p.l.c. |
| Ashland, Inc. | LaFarge S.A. |
| AT&T | Minerals Technologies Inc. |
| Baxter International | Mobil Oil Corporation |
| The BFGoodrich Company | Noranda Inc. |
| BHP Minerals | Northern Telecom Limited |
| Black & Decker Corporation | Occidental Petroleum Corporation |
| Borden, Inc. | Pfizer Inc |
| The British Petroleum Co. p.l.c. | The Procter & Gamble Company |
| Bristol-Myers Squibb Company | Rohm & Haas Company |
| Cemex, S.A. | Sandoz Technology Ltd. |
| Ciba-Geigy Limited | Schering-Plough Corporation |
| The Coca-Cola Company | S.C. Johnson & Son, Inc. |
| Compaq Computer Corporation | Solectron Corporation |
| Digital Equipment Corporation | Statoil |
| The Dow Chemical Company | Texaco Inc |
| Duracell Inc. | 3M |
| Eastman Kodak Company | TRW Inc. |
| Edison Mission Energy | United Technologies |
| E.I. du Pont De Nemours & Co. | Unocal Corporation |
| Elf Aquitaine | Volvo Cars of North America, Inc. |
| Exxon Corporation | Warner-Lambert Company |
| F. Hoffmann-La Roche AG | Whirlpool Corporation |
| Ford Motor Company | W.R. Grace & Co. |
| Glaxo Wellcome plc | Zeneca Limited |

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POLLUTION PREVENTION CENTER ACTIVITIES

With funding from USAID/WEC, Pollution Prevention Centers (PPC) have been established in Bulgaria, Czech Republic, Hungary, Romania and Slovakia.

The PPC is designed to be a self-sustaining environmental center that can provide industry with the following activities:

- Development and implementation of environmental protection/waste minimization programs,
- Industry-wide workshops to demonstrate cost-effective environmental protection programs,
- Training programs in environmental management,
- Access to international environmental protection reports, and
- Disseminating information regarding environmental protection programs with similarly oriented organizations worldwide.

POLLUTION PREVENTION CENTERS

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SECTION I

WASTE

MINIMIZATION

PROGRAM

SUMMARY

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WEC New York City Staff 184

NOTES

1. The **WEC Waste Minimization Program** involves a two-phase approach to waste minimization and includes two types of projects as described below:

- **Waste Minimization Demonstration Project (WMDP):**

Involves projects accomplished at a plant selected by WEC to demonstrate the effectiveness of the waste minimization concept. WEC, with the assistance of the plant, identifies the project, selects and trains the waste minimization teams, and with USAID funds, supplies the required monitoring equipment. **The plant accomplishes the project with the assistance and direction of WEC.**

- **Waste Minimization Impact Program (WMIP):**

Consists of projects accomplished by a plant after management personnel have been trained at a WEC workshop. **The projects are identified, implemented, and managed by the plant with periodic on-site review of progress by WEC experts.**

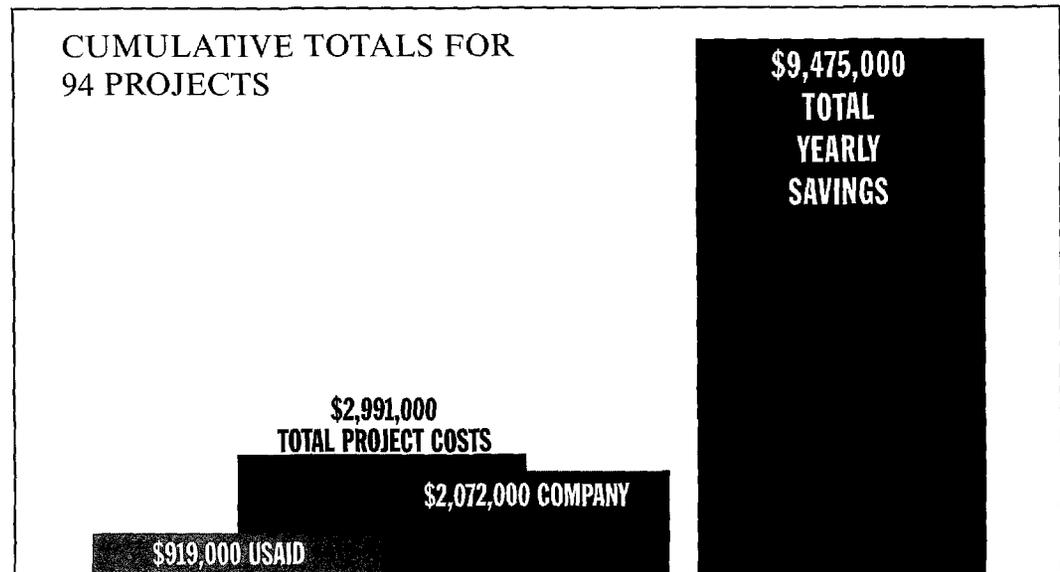
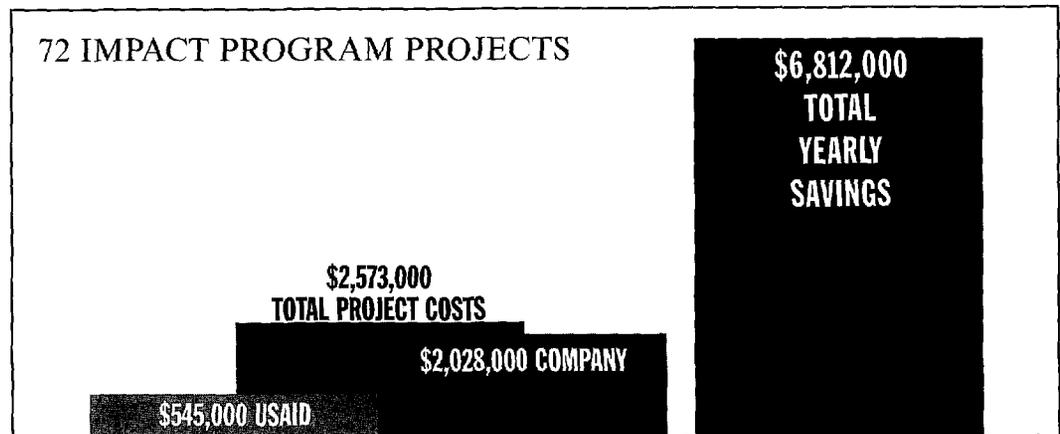
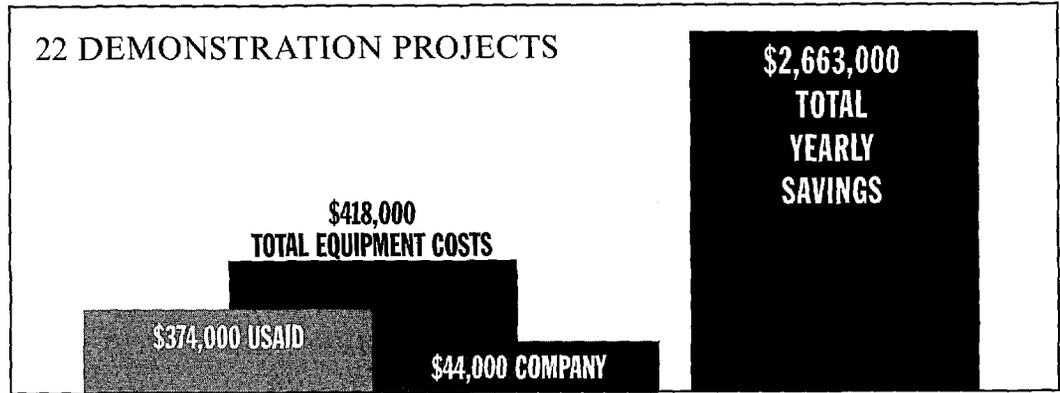
2. The "Payback Period" noted in this Status Report **reflects the time required to recover the equipment/project costs only!**
3. For brevity, some of the charts included in this Status Report use the following abbreviations for the country:

| | |
|---------------------------|---------------------|
| B = Bulgaria | R = Romania |
| C = Czech Republic | S = Slovakia |
| H = Hungary | U = Ukraine |

**WASTE MINIMIZATION PROGRAM
COMPANIES PARTICIPATING IN WMIP**

| NO. | COMPANY | COUNTRY | PLUS A WMDP |
|-----|---------------------------------|----------------|----------------|
| 1 | Acumulatorul | Romania | × |
| 2 | Agrobiochim | Bulgaria | × |
| 3 | Alkaloida | Hungary | |
| 4 | Arpechim | Romania | × |
| 5 | Astra Romana | Romania | |
| 6 | Borsodchem | Hungary | × |
| 7 | Budapest Chemical Works | Hungary | |
| 8 | Chemes | Slovakia | |
| 9 | Chemko | Slovakia | × |
| 10 | Chemolak | Slovakia | × |
| 11 | Chemopetrol | Czech Republic | × |
| 12 | Chemosvit | Slovakia | |
| 13 | Chimco | Bulgaria | |
| 14 | Chimcomplex | Romania | |
| 15 | Duslo | Slovakia | |
| 16 | Farmakon | Czech Republic | |
| 17 | Istrochem | Slovakia | |
| 18 | Lachema | Czech Republic | |
| 19 | Magyar Viscosagyar | Hungary | × |
| 20 | Markochim | Ukraine | × |
| 21 | Moravske Chemicke Zavody (MCHZ) | Czech Republic | |
| 22 | Neftochim | Bulgaria | × |
| 23 | Neochim | Bulgaria | |
| 24 | Nitrokemia | Hungary | |
| 25 | Novacke Chemicke Zavody (NCHZ) | Slovakia | |
| 26 | Oltchim | Romania | |
| 27 | Ostramo | Czech Republic | |
| 28 | Orgachim | Bulgaria | |
| 29 | Perion | Hungary | × |
| 30 | Petar Karaminchev | Bulgaria | |
| 31 | Petrobrazi | Romania | |
| 32 | Petrochema | Slovakia | × |
| 33 | Petrotel | Romania | |
| 34 | Pharmacia | Bulgaria | × |
| 35 | Plama Pleven Oils | Bulgaria | |
| 36 | Povazske Chemicke Zavody (PCHZ) | Slovakia | |
| 37 | Rafinaria Darmanesti | Romania | |
| 38 | Sidex | Romania | × |
| 39 | Silur | Ukraine | × |
| 40 | Sindat | Czech Republic | |
| 41 | Slovnaft | Slovakia | |
| 42 | Sopharma | Bulgaria | |
| 43 | Spolana | Czech Republic | × |
| 44 | Spolchemie | Czech Republic | |
| 45 | Stirol | Ukraine | 4× |
| 46 | Svilosa | Bulgaria | × |
| 47 | Tiszai Vegyi Kombinat | Hungary | |
| 48 | United Chemical Works | Hungary | |
| 49 | Viadrus | Czech Republic | |
| 50 | Vidachim | Bulgaria | |
| 51 | Yenakievo (EMZ) | Ukraine | × |

**SUMMARY OF PROJECT COSTS AND YEARLY SAVINGS
FOR WASTE MINIMIZATION PROGRAM**



**REDUCTION OF POLLUTANTS INTO ENVIRONMENT
SUMMARY FOR TOTAL OF 22 DEMONSTRATION PROJECTS**

| POLLUTANT | ENVIRONMENT AFFECTED | POLLUTANT REDUCTION TONS/YEAR | COUNTRY |
|-------------------------------|----------------------|-------------------------------|--------------------------|
| Acetone | Water | 170 | B |
| Acrylic Polymer Powder | Air | 10.5 | H |
| Acrylic Polymer Powder | Water | 16 | H |
| Ammonia | Water | 270 | U |
| Ammonium Nitrate | Water | 60 | U |
| Ammonium Sulfate | Water | 18 | C |
| Benzene | Air | 1,068 | S |
| Carbon Dioxide | Air | 2,500 | U |
| Carbon Disulfide | Air | 43 | B |
| Carbon Monoxide | Air | 1,026 | B & U |
| Coke Oven Gases | Air | NA | R & U |
| Contaminated Steam Condensate | Water | 27,000 | R |
| Contaminated Waste Water | Water | 86,000 | U |
| Copper | Water | 3 | U |
| Hazardous Waste | Land | 4,080 | C |
| Hydrogen | Air | NA | U |
| Hydrogen Sulfide | Air | 40 | B |
| Lead | Air | NA | H |
| Lead | Water | 0.5 | H |
| Lead Oxide | Air | 132 | R |
| Natural Gas | Air | 850 | U |
| Nitrogen Oxides | Air | 312 | B & U |
| Sulfur Dioxide | Air | 350 | B & S |
| Sulfur Dioxide | Land | 185 | S |
| Vinyl Chloride | Air | 240 | H |
| Volatile Organic Compounds | Air | 1,672 | B, C & S |
| Volatile Organic Compounds | Land | NA | C |
| | | MINIMUM TOTAL | 126,046 TONS/YEAR |

Note: NA indicates totals to be determined.

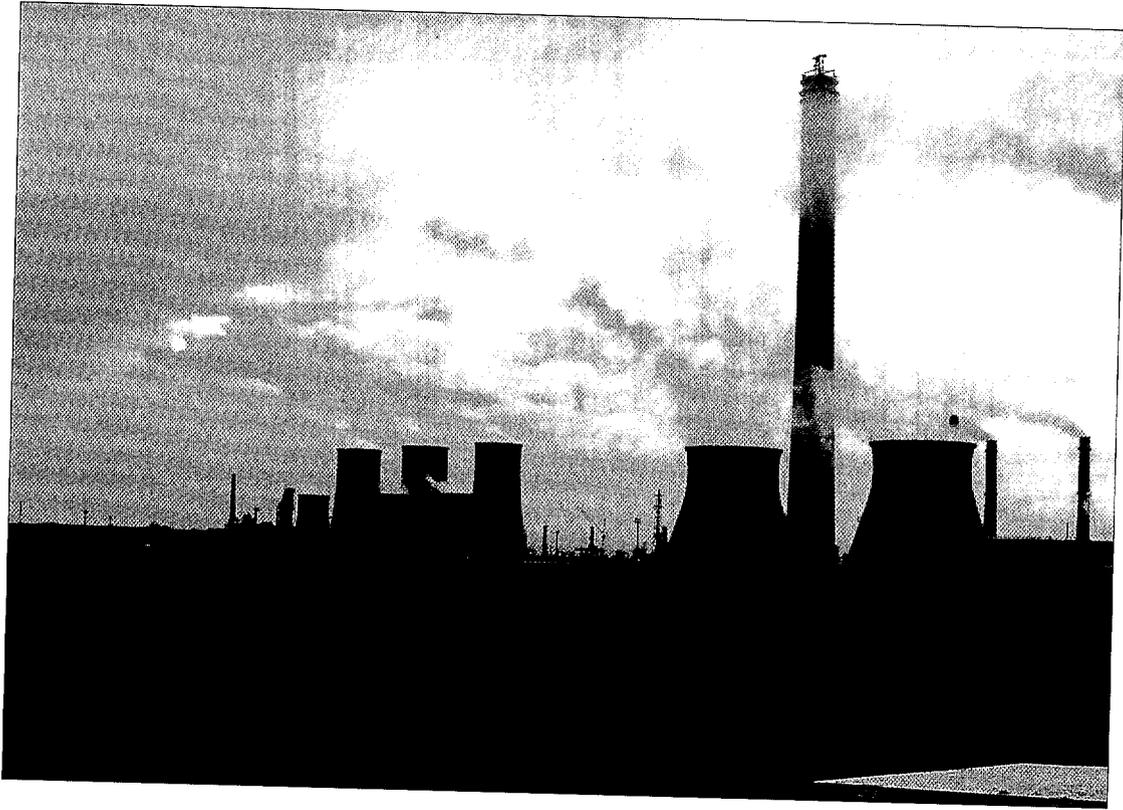
**MANUFACTURING OPERATIONS INVOLVED IN
REDUCING ENVIRONMENTAL POLLUTION
SUMMARY FOR TOTAL OF 143 PROJECTS**

| MANUFACTURING OPERATION | COUNTRY | | | | | | TOTALS |
|--|---------|----|---|----|---|----|-----------|
| | B | C | H | R | S | U* | |
| Provide or Modify Production Equipment | 8 | 7 | 6 | 12 | 4 | 4 | 41 |
| Modify Process | 4 | 11 | 5 | 10 | 5 | 0 | 35 |
| Revise Operating Practices | 3 | 6 | 6 | 6 | 8 | 0 | 29 |
| Recover & Recycle Product | 4 | 8 | 0 | 5 | 6 | 0 | 23 |
| Improve Preventative Maintenance Program | 6 | 5 | 3 | 0 | 1 | 0 | 15 |
| Improve Process Control Procedures | 3 | 2 | 3 | 1 | 0 | 7 | 16 |
| Substitute Raw Material | 1 | 5 | 1 | 2 | 4 | 0 | 13 |
| Improve Quality Control | 2 | 0 | 1 | 0 | 0 | 0 | 3 |

**PROJECTS CONTRIBUTING TO
CONSERVATION OF NATURAL RESOURCES
SUMMARY FOR TOTAL OF 143 PROJECTS**

| NATURAL RESOURCES CONSERVED | COUNTRY | | | | | | TOTALS |
|-----------------------------|---------|----|----|----|----|----|-----------|
| | B | C | H | R | S | U* | |
| Raw Materials | 21 | 22 | 14 | 15 | 17 | 4 | 93 |
| Energy | 1 | 5 | 7 | 15 | 6 | 2 | 36 |
| Landfill Sites | 2 | 9 | 3 | 3 | 8 | 0 | 25 |
| Fresh Water | 8 | 2 | 3 | 5 | 3 | 2 | 23 |

**All 7 Ukraine projects have not been completed and therefore totals are estimates only.*



SECTION II

WASTE

MINIMIZATION

DEMONSTRATION

PROJECTS

DESCRIPTION OF A WASTE MINIMIZATION DEMONSTRATION PROJECT

The objective of the USAID sponsored Waste Minimization Demonstration Project (WMDP) is to illustrate to both company management and plant personnel that the concept of waste minimization — eliminating or reducing pollution at its source rather than after it becomes waste — does really work. Not only is the generated waste costly to dispose of, but it also could have a significant impact on environmental pollution.

The pollution prevention concept, whenever it has been initiated, has proven extremely successful in demonstrating:

- Conserving natural resources results in monetary benefits to industry.
- Reducing industrial environmental pollution thereby improves the health and safety of the workers and the community.

To many, the idea of saving money by reducing pollution first must be proven. To substantiate this concept, WEC has selected a few companies in each of the Central and Eastern European Countries, and with their assistance and cooperation, has implemented WMDPs.

To assist the selected companies in establishing a WMDP, WEC provides:

- A team comprised of WEC Staff Personnel and U.S. Industrial Experts to help the selected company identify and develop a WMDP,
- Assistance and guidance in the important function of selecting and training the waste minimization teams assigned to the WMDP,
- Appropriate training involving the principles and concepts required to implement a WMDP,
- The monitoring equipment required to complete the designated project, which is later given to the plant at the project's close-out ceremony, and
- Regular monitoring and on-site assistance as may be required during the life of the project, usually lasting up to twelve months.

As detailed in this Status Report, impressive results have attracted the attention of other companies who have initiated their own waste minimization programs based on WEC training. This is addressed in the Waste Minimization Impact Program (WMIP), which is explained in Section III.

As of July 1996, 22 demonstration projects were initiated in 6 countries, 12 of which have been completed. WEC supplied monitoring equipment at a total cost of \$374,000, which resulted in a yearly savings of \$2,663,000 and made a significant impact on reducing environmental pollution. See page 12 for details.

The WMDP demonstrated to the companies how the WEC waste minimization concept can be initiated at their facility at essentially no cost. The completed demonstration projects have laid the foundation for the WMIP, which is initiated and accomplished by the individual companies after management personnel have been trained at a WEC workshop.

Since the Waste Minimization Program is in its early stage in the Ukraine, the impact program will be started at a later date.

* * * * *

WEC appreciates the cooperative efforts of the companies who have participated in the WMDP. The companies showed a high level of trust in welcoming foreigners into their plants, particularly ones who advocated a different approach to solving pollution problems.

**WASTE MINIMIZATION DEMONSTRATION PROJECTS SUMMARY
EQUIPMENT COSTS AND SAVINGS FOR TOTAL OF 22 PROJECTS**

| COUNTRY | COMPANY | INDUSTRY | EQUIPMENT COSTS-US\$ | | | YEARLY SAVINGS-US\$ | PAYBACK MONTHS |
|---|---------------------|------------------------------|----------------------|-----------------|------------------|---------------------|----------------|
| | | | USAID | COMPANY | TOTAL | | |
| Bulgaria | Agrobiochim | Chemical | 17,000* | -0- | 17,000* | 40,000* | 6 |
| | Neftochim | Oil Refinery & Petrochemical | 30,249 | -0- | 30,249 | 150,000 | 2 |
| | Pharmacia | Pharmaceutical | 15,273 | -0- | 15,273 | 75,000 | 2 |
| | Svilosa | Chemical | 12,413 | -0- | 12,413 | 50,000 | 3 |
| | | Totals | 74,935 | -0- | 74,935 | 315,000 | |
| Czech Republic | Chemopetrol Spolana | Oil Refinery & Petrochemical | 19,365 | -0- | 19,365 | 185,000 | 1 |
| | | Chemical | 26,161 | -0- | 26,161 | 386,000 | 1 |
| | | Totals | 45,526 | -0- | 45,526 | 571,000 | |
| Hungary | Borsodchem | Chemical | 11,280 | -0- | 11,280 | 144,000 | 1 |
| | Magyar Viscosagyar | Synthetic Fibers | 18,636 | -0- | 18,636 | 29,000 | 8 |
| | Perion | Battery | 25,977 | -0- | 25,977 | 72,000 | 4 |
| | | Totals | 55,893 | -0- | 55,893 | 245,000 | |
| Romania | Acumulatorul | Battery | 30,172 | 40,000 | 70,172 | 670,000 | 1 |
| | Arpechim | Oil Refinery & Petrochemical | 34,485 | 4,000 | 38,485 | 112,000 | 4 |
| | Sidex | Steel | 21,000 | -0- | 21,000 | 34,000* | 7 |
| | | Totals | 85,657 | 44,000 | 129,657 | 816,000 | |
| Slovakia | Chemko | Chemical | 8,292 | -0- | 8,292 | 125,000 | 1 |
| | Chemolak | Chemical | 12,000* | -0- | 12,000* | 30,000* | 5 |
| | Petrochema | Petrochemical | 26,557 | -0- | 26,557 | 35,000 | 9 |
| | | Totals | 46,849 | -0- | 46,849 | 190,000 | |
| Ukraine | Markochim | Coke & Chemical | 17,095 | -0- | 17,095 | 78,000* | 3 |
| | Silur | Steel Wire & Cable | 9,269 | -0- | 9,269 | 26,000* | 4 |
| | Stirol | Chemical | 6,034 | -0- | 6,034 | 80,000* | 1 |
| | Stirol | Chemical | 1,714 | -0- | 1,714 | 150,000* | 1 |
| | Stirol | Chemical | 2,000 | -0- | 2,000 | 150,000* | 1 |
| | Stirol | Chemical | 9,000 | -0- | 9,000 | 10,000* | 11 |
| | Yenakievo (EMZ) | Steel | 20,567 | -0- | 20,567 | 32,000* | 8 |
| | | Totals | 65,679 | -0- | 65,679 | 526,000 | |
| TOTALS FOR 22 DEMONSTRATION PROJECTS | | | \$374,539 | \$44,000 | \$418,539 | \$2,663,000 | |

*Estimates, projects not completed.

BULGARIA



COMPANIES WITH A WASTE MINIMIZATION DEMONSTRATION PROJECT

AGROBIOCHIM

STARA ZAGORA

NEFTOCHIM

BOURGAS

PHARMACIA

DUPNICA

SVILOSA

SVISHTOV

| | |
|---|-----------------|
| AGROBIOCHIM | BULGARIA |
| Chemical Industry MODIFICATIONS TO MONITORING EQUIPMENT REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: Improved efficiency of two (2) coal burning boilers in order to reduce coal consumption.

PROJECT START DATE: March 1996 COMPLETION DATE: To be determined

| MONETARY BENEFITS | | | | |
|--------------------------|---------|---------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 17,000* | -0- | 17,000* | 40,000* | 6 |

* Estimated, project not completed.

MONETARY BENEFITS RESULT FROM: Reduced coal consumption by 4,000 tons/year.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Carbon Monoxide | 1,000 tons | --- | --- |
| Nitrogen Oxides | 300 tons | --- | --- |
| Sulfur Dioxide | 280 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to toxic emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
Stack Gas Analyzers (2).

| COMPANY PROFILE | |
|--|----------------------------|
| LOCATION: Stara Zagora, approximately 120 miles east of Sofia. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1963 |
| LATEST ANNUAL SALES: US\$75 million | NUMBER OF EMPLOYEES: 3,000 |

| | |
|--|-----------------|
| NEFTOCHIM | BULGARIA |
| Oil Refinery & Petrochemical Industry REVISIONS IN MAINTENANCE PROCEDURES REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: Reduce the discharge of volatile organic compounds into the atmosphere by detecting and repairing equipment leaks.

PROJECT START DATE: July 1993

COMPLETION DATE: October 1995

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 30,249 | -0- | 30,249 | 150,000 | 2 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Volatile Organic Compounds | 672 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to volatile organic compound emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
Organic Vapor Analyzer w/ Trainer, Polycorder and Calibration Gas.

| COMPANY PROFILE | |
|---|-----------------------------|
| LOCATION: Bourgas, on the Black Sea, approximately 230 miles east of Sofia. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1963 |
| LATEST ANNUAL SALES: US\$ NA | NUMBER OF EMPLOYEES: 11,000 |

PHARMACIA**BULGARIA**

Pharmaceutical Industry
**REVISIONS IN MANUFACTURING CONTROL PROCEDURES
 REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT**

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the Vitamin C Manufacturing Facility, reduce the acetone content in the waste water.

PROJECT START DATE: February 1994 **COMPLETION DATE:** September 1996

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 15,273 | -0- | 15,273 | 75,000 | 2 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials and waste disposal. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|----------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Acetone | --- | 170 tons | --- |

NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved water quality due to a 20% reduction in the acetone content in the waste water.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 Liquid Density Transducer.

| COMPANY PROFILE | |
|---|----------------------------|
| LOCATION: Dupnica, approximately 40 miles southwest of Sofia. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1971 |
| LATEST ANNUAL SALES: US\$4 million* | NUMBER OF EMPLOYEES: 2,500 |

* Reflects only sales for Vitamin C Facility.

| | | |
|---|--------------------------|-----------------|
| SVILOSA | Chemical Industry | BULGARIA |
| REVISIONS IN MAINTENANCE PROCEDURES | | |
| REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT | | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: In the spinning hall, reduce the discharges of carbon disulfide and hydrogen sulfide.

PROJECT START DATE: October 1993 **COMPLETION DATE:** December 1994

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 12,413 | -0- | 12,413 | 50,000 | 3 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Carbon Disulfide & Hydrogen Sulfide | 83 tons | --- | --- |

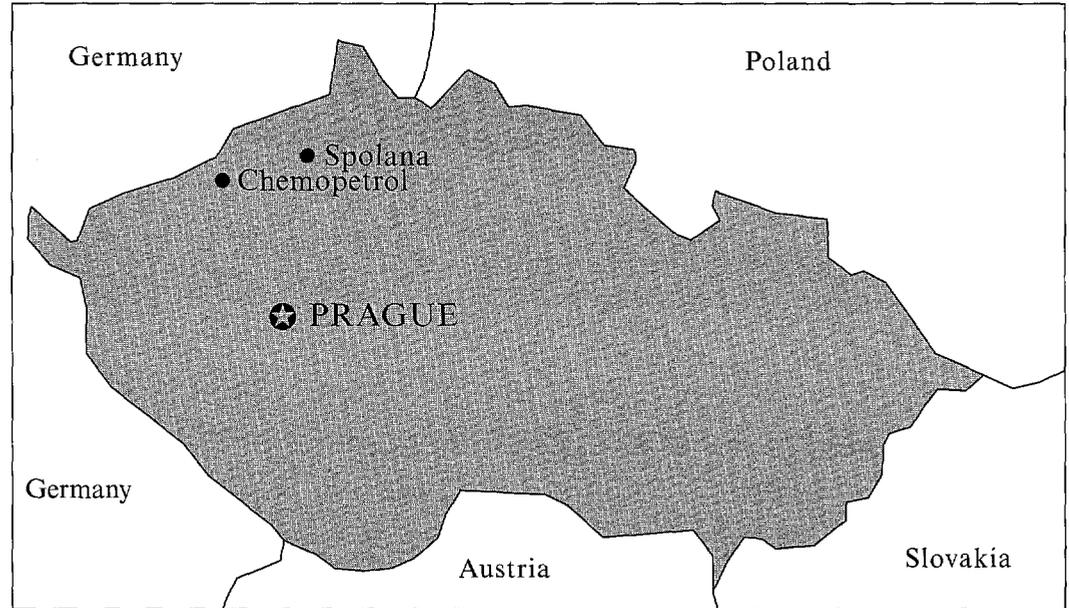
NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
Hazardous Waste Detector w/ Accessories, Airflow Meter and Air Monitor.

| COMPANY PROFILE | |
|---|-----------------------------------|
| LOCATION: Svishtov, on the Danube River, approximately 150 miles northeast of Sofia. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1966 |
| LATEST ANNUAL SALES: US\$20 million | NUMBER OF EMPLOYEES: 3,400 |

CZECH REPUBLIC



COMPANIES WITH A WASTE MINIMIZATION DEMONSTRATION PROJECT

CHEMOPETROL

LITVINOV

SPOLANA

NERATOVICE

CHEMOPETROL

CZECH REPUBLIC

Oil Refinery & Petrochemical Industry
REVISIONS IN MAINTENANCE PROCEDURES
REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT

WASTE MINIMIZATION DEMONSTRATION PROJECT: Detect and repair equipment leaks in the Oil Refinery to reduce the discharge of volatile organic compounds into the atmosphere, as well as reduce the quantity of waste material.

PROJECT START DATE: September 1992 **COMPLETION DATE:** March 1994

MONETARY BENEFITS

| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
|------------------------|---------|--------|-----------------------|-------------------|
| USAID | Company | Total | | |
| 19,365 | -0- | 19,365 | 185,000 | 1 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials, incineration and waste disposal. Production efficiency was also improved.

ENVIRONMENTAL BENEFITS

| Pollutant | Yearly Reductions Into | | |
|----------------------------|------------------------|-------|------|
| | Air | Water | Land |
| Volatile Organic Compounds | 970 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Energy and Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to volatile organic compound emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:

Organic Vapor Analyzer and Data Logging Monitor.

COMPANY PROFILE

LOCATION: Litvinov, approximately 50 miles northwest of Prague.

OWNERSHIP: Private

YEAR PLANT START-UP: 1939

LATEST ANNUAL SALES: US\$73 million

NUMBER OF EMPLOYEES: 8,000

SPOLANA**CZECH REPUBLIC**

Chemical Industry
**REVISIONS IN MANUFACTURING PROCESS & MAINTENANCE PROCEDURES
 REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT**

WASTE MINIMIZATION DEMONSTRATION PROJECT: Consists of two (2) parts:
 1. Reduce production of the by-product ammonium sulfate in the manufacture of caprolactam.
 2. Reduce the discharge of volatile organic compounds by detecting and repairing equipment leaks.

PROJECT START DATE: September 1993

COMPLETION DATE: February 1996

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 26,161 | -0- | 26,161 | 386,000 | 1 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|---------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Ammonium Sulfate | --- | 18 tons | --- |
| Volatile Organic Compounds | 30 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Fresh Water and Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to volatile organic compound emissions, as well as reduced amount of ammonium sulfate discharged into the Elbe River.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 On-line Densitometer, Ionizable Detector and Isobutylene Gas.

| COMPANY PROFILE | |
|---|-----------------------------------|
| LOCATION: Neratovice, on the Elbe River, approximately 25 miles northwest of Prague. | |
| OWNERSHIP: Private | YEAR PLANT START-UP: NA |
| LATEST ANNUAL SALES: US\$ NA | NUMBER OF EMPLOYEES: 4,200 |

HUNGARY



COMPANIES WITH A WASTE MINIMIZATION DEMONSTRATION PROJECT

BORSODCHEM

KAZINCBARCIKA

MAGYAR VISCOSAGYAR

NYERGESUJFALU

PERION

BUDAPEST

BORSODCHEM**HUNGARY**

Chemical Industry
**REVISIONS IN MAINTENANCE PROCEDURES
 REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT**

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the PVC Facility stripper column, reduce the vinyl chloride emissions by detecting and repairing equipment leaks.

PROJECT START DATE: December 1994

COMPLETION DATE: June 1995

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 11,280 | -0- | 11,280 | 144,000 | 1 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials and energy. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Vinyl Chloride | 240 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Energy and Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to carcinogenic pollutant emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 Oxygen Analyzer w/ Trainer.

| COMPANY PROFILE | |
|--|---------------------------|
| LOCATION: Kazincbarcika, approximately 50 miles northeast of Budapest. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1949 |
| LATEST ANNUAL SALES: US\$ NA | NUMBER OF EMPLOYEES: NA |

| | |
|--|----------------|
| MAGYAR VISCOSAGYAR | HUNGARY |
| Synthetic Fibers Industry REVISIONS IN OPERATING PROCEDURES REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the polymer powder dryer unit, reduce the discharge of acrylic polymer powder by detecting and repairing equipment leaks.

PROJECT START DATE: November 1993 **COMPLETION DATE:** February 1995

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 18,636 | -0- | 18,636 | 29,000 | 8 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|---------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Acrylic Polymer Powder | 10.5 tons | 16 tons | --- |

NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to pollutant emissions. In addition, reduced risk of fire and/or explosion in the plant.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 Continuous Particulates Monitor w/Trainer and Portable Air Velocity Kit.

| COMPANY PROFILE | |
|--|----------------------------|
| LOCATION: Nyergesujfalu, on the Danube River, approx. 30 miles west of Budapest. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1941 |
| LATEST ANNUAL SALES: US\$60 million | NUMBER OF EMPLOYEES: 1,900 |

PERION**HUNGARY**

Battery Industry
REVISIONS IN OPERATING PROCEDURES
REDUCED WATER CONSUMPTION & DISCHARGE OF POLLUTANTS

WASTE MINIMIZATION DEMONSTRATION PROJECT: Reduce consumption of fresh water, as well as reduce the quantity of waste water and lead discharged into the environment.

PROJECT START DATE: August 1993

COMPLETION DATE: March 1995

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 25,977 | -0- | 25,977 | 72,000 | 4 |

MONETARY BENEFITS RESULT FROM: Reduced fresh water costs by 38%. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|----------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Lead | NA | 0.5 tons | --- |

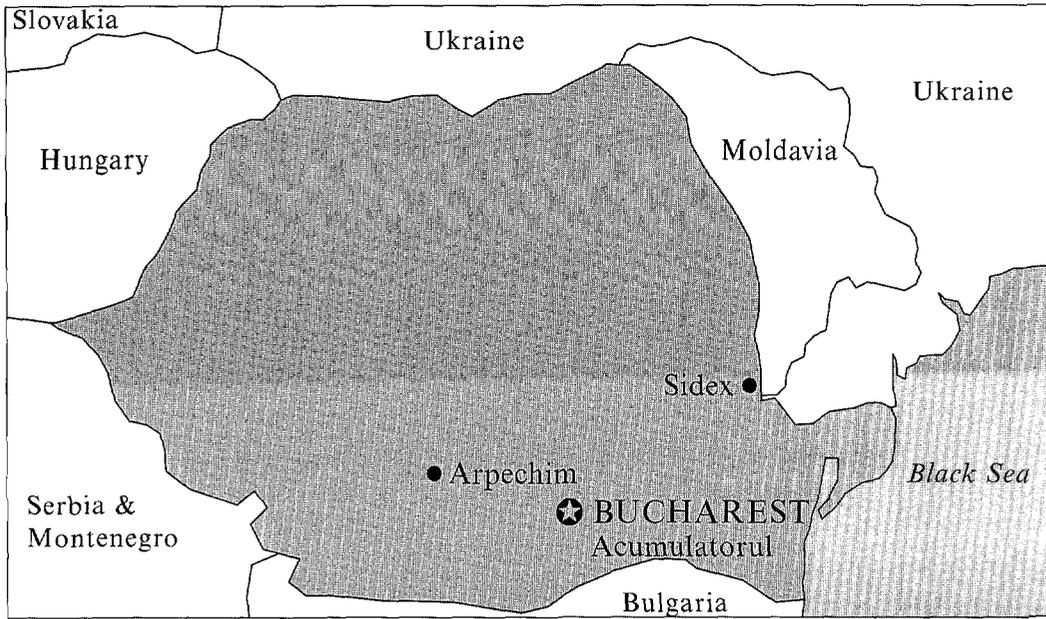
NATURAL RESOURCES CONSERVED: Fresh Water

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to toxic emissions resulted in a significant reduction in employee sick days.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 Automatic Waste Water Samplers, Flow Meters and Toxic Gas Detector.

| COMPANY PROFILE | |
|------------------------------|---------------------------|
| LOCATION: City of Budapest. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1895 |
| LATEST ANNUAL SALES: US\$ NA | NUMBER OF EMPLOYEES: 650 |

ROMANIA



COMPANIES WITH A WASTE MINIMIZATION DEMONSTRATION PROJECT

ACUMULATORUL

BUCHAREST

ARPECHIM

PITESTI

SIDEX

GALATI

ACUMULATORUL**ROMANIA**

Battery Industry

**REVISIONS IN OPERATING PROCEDURES & VENTILATION SYSTEM
REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT**

WASTE MINIMIZATION DEMONSTRATION PROJECT: In the Lead Oxide Production Facility, improve the ventilation system to reduce the pollutants discharged in the battery assembly area.

PROJECT START DATE: March 1993

COMPLETION DATE: March 1995

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 30,172 | 40,000 | 70,172 | 670,000* | 1 |

* Yearly savings possible when plant is working at 50% capacity.

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Lead Oxide | 132 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to lead oxide emissions resulted in a 50% reduction in employee sick days.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:

Vacuum System w/ Filter Bags, Air Sampling Equipment and Air Purifying Respirators.

| COMPANY PROFILE | |
|--------------------------------------|----------------------------|
| LOCATION: City of Bucharest. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1911 |
| LATEST ANNUAL SALES: US\$112 million | NUMBER OF EMPLOYEES: 2,200 |

| | |
|--|----------------|
| ARPECHIM | ROMANIA |
| Oil Refinery & Petrochemical Industry REVISIONS IN OPERATING PROCEDURES REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: In the Refinery Plant, reduce the quantity of steam condensate contaminated with organic compounds.

PROJECT START DATE: March 1993 **COMPLETION DATE:** October 1996

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 34,485 | 4,000 | 38,485 | 112,000 | 4 |

MONETARY BENEFITS RESULT FROM: Increased sales of recycled condensate to the steam supplier.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Contaminated Steam Condensate | --- | 27,000 tons | --- |

NATURAL RESOURCES CONSERVED: Fresh Water

HEALTH AND SAFETY BENEFITS: Improved working conditions due to reduced exposure to contaminated steam condensate. For the same reason, quality of waste water discharged into the Arges River was improved.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
Organic Carbon Analyzer w/ Trainer and Conversion Kit.

| COMPANY PROFILE | |
|---|----------------------------|
| LOCATION: Pitesti, approximately 70 miles northwest of Bucharest. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1949 |
| LATEST ANNUAL SALES: US\$350 million | NUMBER OF EMPLOYEES: 8,000 |

SIDEX**ROMANIA**

Steel Industry
**MODIFICATIONS TO DUST COLLECTION SYSTEM
 REDUCED ENERGY CONSUMPTION & DISCHARGE OF POLLUTANTS**

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the Coke Chemical Plant dust control system, reduce pollutant emissions into the air and energy requirements resulting from an inefficient fan motor.

PROJECT START DATE: May 1996

COMPLETION DATE: November 1996

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 21,000 | -0- | 21,000 | 34,000* | 7 |

* Estimated, project not completed.

MONETARY BENEFITS RESULT FROM: Reduced costs for energy, plus deleting requirement for an additional 1,000 KVA transformer at a cost of \$12,000.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Coke Oven Gases | NA | --- | --- |

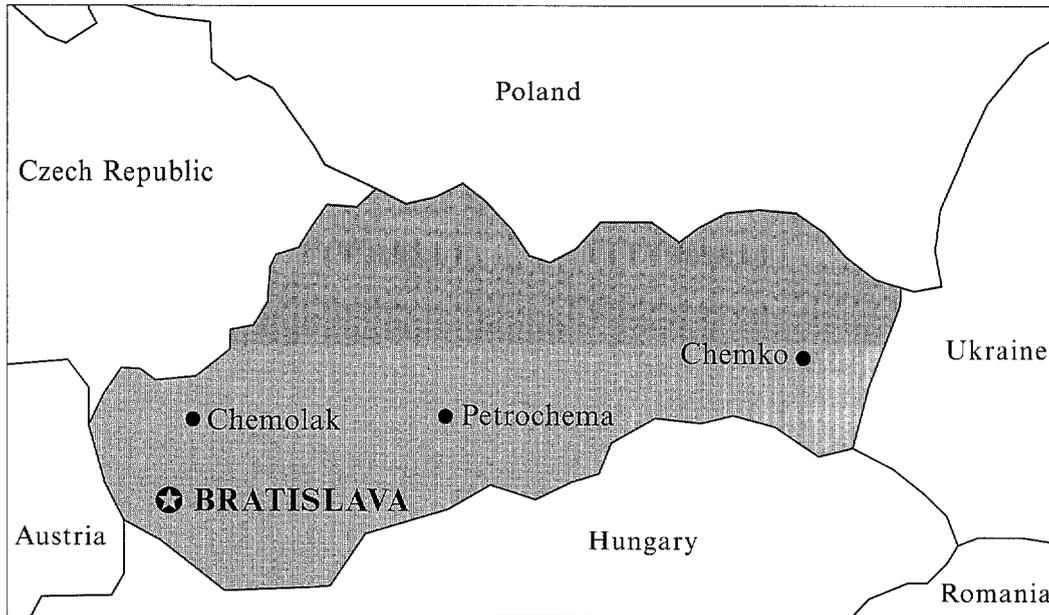
NATURAL RESOURCES CONSERVED: Energy

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to coke oven gas emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 Variable Frequency Drive.

| COMPANY PROFILE | |
|---|------------------------------------|
| LOCATION: Galati, on the Danube River, approximately 155 miles northeast of Bucharest. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1966 |
| LATEST ANNUAL SALES: US\$43 million | NUMBER OF EMPLOYEES: 36,700 |

SLOVAKIA



COMPANIES WITH A WASTE MINIMIZATION DEMONSTRATION PROJECT

CHEMKO

STRAZSKE

CHEMOLAK

SMOLENICE

PETROCHEMA

DUBOVA

| | |
|--|-----------------|
| CHEMKO | SLOVAKIA |
| Chemical Industry REVISIONS IN MAINTENANCE PROCEDURES REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the Cyclohexanone Facility, reduce the fugitive organic discharges.

PROJECT START DATE: March 1993

COMPLETION DATE: May 1994

| MONETARY BENEFITS | | | | |
|--------------------------|---------|-------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 8,292 | -0- | 8,292 | 125,000 | 1 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Benzene | 1,068 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to carcinogenic pollutant emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
Organic Vapor Analyzer.

| COMPANY PROFILE | |
|--|----------------------------|
| LOCATION: Strazske, approximately 350 miles northeast of Bratislava. | |
| OWNERSHIP: State | YEAR PLANT START-UP: 1952 |
| LATEST ANNUAL SALES: US\$110 million | NUMBER OF EMPLOYEES: 3,200 |

| | |
|---|-----------------|
| CHEMOLAK | SLOVAKIA |
| Chemical Industry REVISIONS IN OPERATING PRACTICES REDUCED POLLUTANTS DISCHARGED INTO ENVIRONMENT | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: Reduce the discharge of volatile organic compounds into the atmosphere by detecting and repairing equipment leaks.

PROJECT START DATE: JUNE 1996 **COMPLETION DATE:** To be determined

| MONETARY BENEFITS | | | | |
|--------------------------|---------|---------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 12,000* | -0- | 12,000* | 30,000* | 5 |

* Estimated, project not completed.

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Volatile Organic Compounds | NA | --- | --- |

NATURAL RESOURCES CONSERVED: Raw Materials

HEALTH AND SAFETY BENEFITS: Improved working conditions due to reduced exposure to pollutant emissions. In addition, reduced risk of fire and/or explosion in the plant.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
Organic Vapor Analyzer.

| COMPANY PROFILE | |
|--|---------------------------|
| LOCATION: Smolenice, approximately 45 miles northeast of Bratislava. | |
| OWNERSHIP: Joint Stock Company | YEAR PLANT START-UP: 1883 |
| LATEST ANNUAL SALES: US\$50 million | NUMBER OF EMPLOYEES: 800 |

PETROCHEMA**SLOVAKIA**

Petrochemical Industry
REVISIONS IN PROCESS EQUIPMENT
REDUCED DISCHARGE OF POLLUTANTS & GENERATION OF WASTE

WASTE MINIMIZATION DEMONSTRATION PROJECT: Consists of two projects at the White Oil Facility as follows:

1. Neutralization of the "Goudron" sludge to reduce the discharge of sulfur dioxide, and
2. Optimization of the production of sulfur trioxide.

PROJECT START DATE: December 1993

COMPLETION DATE: July 1994

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 26,557 | -0- | 26,557 | 35,000 | 9 |

MONETARY BENEFITS RESULT FROM: Reduced costs for raw materials and waste disposal. Production efficiency was also improved.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|----------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Sulfur Dioxide | 70 tons | --- | 185 tons |

NATURAL RESOURCES CONSERVED: Landfill Sites and Raw Materials

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:

SO₂ Analyzer, Heated Stack Filter w/ Probe & Cooler, Heat Line Hose and Calibration Gas.

COMPANY PROFILE

LOCATION: Dubova, approximately 140 miles northeast of Bratislava.

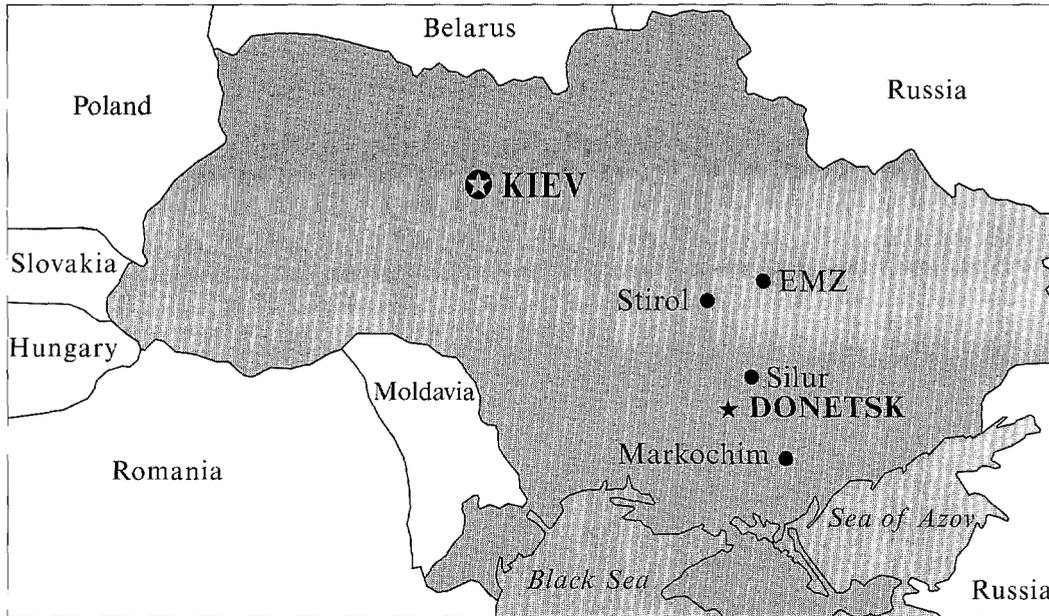
OWNERSHIP: State

YEAR PLANT START-UP: 1938

LATEST ANNUAL SALES: US\$50 million

NUMBER OF EMPLOYEES: 570

UKRAINE



COMPANIES WITH A WASTE MINIMIZATION DEMONSTRATION PROJECT

MARKOCHIM

MARIUPOL

SILUR

KHARTSYZSK

STIROL

GORLOVKA

YENAKIEVO (EMZ)

YENAKIEVO

MARKOCHIM**UKRAINE**

Coke & Chemical Industry
IMPROVEMENT IN COMBUSTION EFFICIENCY
REDUCED ENERGY CONSUMPTION & DISCHARGE OF POLLUTANTS

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the No. 1 Coke Oven Battery, reduce energy consumption and pollutant emissions into the air.

PROJECT START DATE: October 1995 **COMPLETION DATE:** To be determined

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 17,095 | -0- | 17,095 | 78,000* | 3 |

* Estimated, project not completed.

MONETARY BENEFITS RESULT FROM: Reduced costs for energy.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Carbon Dioxide | 2,500 tons | --- | --- |
| Coke Oven Gases | NA | --- | --- |
| Hydrogen | NA | --- | --- |
| Methane | NA | --- | --- |

NATURAL RESOURCES CONSERVED: Energy

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to carbon dioxide, coke oven gases, hydrogen and methane emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 On-Line Combustion Gas Analyzer and Combustion Efficiency Analyzer.

| COMPANY PROFILE | |
|---|-----------------------------------|
| LOCATION: Mariupol, on the Azov Sea, approximately 125 miles southeast of Donetsk. | YEAR PLANT START-UP: 1936 |
| OWNERSHIP: State | NUMBER OF EMPLOYEES: 3,200 |
| LATEST ANNUAL SALES: US\$ NA | |

| | |
|--|----------------|
| SILUR | UKRAINE |
| Steel Wire & Cable Industry IMPROVEMENT IN PROCESS CONTROL PROCEDURES REDUCED LOSS OF RAW MATERIAL | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the Welding Wire Plant, reduce copper losses.

PROJECT START DATE: November 1995 COMPLETION DATE: To be determined

| MONETARY BENEFITS | | | | |
|--------------------------|---------|-------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 9,269 | -0- | 9,269 | 26,000* | 4 |

* Estimated, project not completed.

MONETARY BENEFITS RESULT FROM: Reduced costs for raw material.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|--------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Copper | --- | 3 tons | --- |

NATURAL RESOURCES CONSERVED: Fresh water and raw materials

HEALTH AND SAFETY BENEFITS: Improved quality of waste water due to reduction of copper content.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
 Plating Solution Analysis Procedure, Plating Thickness Tester, Plating Rate Monitor and Electronic Micrometers.

| COMPANY PROFILE | |
|--|----------------------------|
| LOCATION: Khartsyzsk, approximately 20 miles northeast of Donetsk. | |
| OWNERSHIP: Joint Stock Company | YEAR PLANT START-UP: 1949 |
| LATEST ANNUAL SALES: US\$ NA | NUMBER OF EMPLOYEES: 6,000 |

STIROL**UKRAINE**

Chemical Industry
**IMPROVEMENT IN MONITORING EQUIPMENT
 REDUCED CONSUMPTION OF RAW MATERIALS & ENERGY**

WASTE MINIMIZATION DEMONSTRATION PROJECT: Consists of four (4) projects:

1. Reduce the losses of ammonium nitrate at the Ammonium Nitrate Plant,
2. Improve quality of condensed vapors at the Sodium Nitrate/Nitrite Plant,
3. Reduce losses of ammonia at the Ammonia Plant, and
4. Reduce consumption of natural gas at the Sodium Nitrate/Nitrite Plant.

PROJECT START DATE: October 1995 **COMPLETION DATE:** To be determined

| MONETARY BENEFITS | | | | | |
|--------------------------|---------|-------|-----------------------|-------------------|--|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months | |
| USAID | Company | Total | | | |
| 1. 6,034 | -0- | 6,034 | 80,000* | 1 | |
| 2. 1,714 | -0- | 1,714 | 150,000* | 1 | |
| 3. 2,000 | -0- | 2,000 | 150,000* | 1 | |
| 4. 9,000 | -0- | 9,000 | 10,000* | 11 | |

* Estimated, project not completed.

MONETARY BENEFITS RESULT FROM:

1. Reduced costs for raw materials,
2. Reduced costs for energy and waste heat boiler make-up water,
3. Reduced costs for raw materials, and
4. Reduced costs for energy.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| 1. Ammonium Nitrate | --- | 60 tons | --- |
| 2. Contaminated Waste Water | --- | 86,000 tons | --- |
| 3. Ammonia | --- | 270 tons | --- |
| 4. Natural Gas | 850 tons | --- | --- |

| | | |
|---------------|------------------|----------------|
| STIROL | Continued | UKRAINE |
|---------------|------------------|----------------|

NATURAL RESOURCES CONSERVED:

1. Raw materials,
2. Fresh water,
3. Raw materials, and
4. Raw materials.

HEALTH AND SAFETY BENEFITS:

1. Reduced worker exposure to contaminated waste water,
2. Reduced worker exposure to contaminated waste water,
3. Reduced worker exposure to contaminated waste water, and
4. Reduced worker exposure to toxic emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:

1. pH Controller & Analyzer,
2. In-Line Automatic Conductivity Meter,
3. In-Line Automatic Conductivity Meter, and
4. Combustion Efficiency Analyzer.

| COMPANY PROFILE | |
|---|----------------------------|
| LOCATION: Gorlovka, approximately 140 miles northwest of Donetsk. | |
| OWNERSHIP: Joint Stock Company | YEAR PLANT START-UP: NA |
| LATEST ANNUAL SALES: US\$ NA | NUMBER OF EMPLOYEES: 5,500 |

| | |
|--|----------------|
| YENAKIEVO IRON & STEEL WORKS (EMZ) | UKRAINE |
| Steel Industry | |
| IMPROVEMENTS IN PROCESS CONTROL PROCEDURES | |
| REDUCED CONSUMPTION OF ENERGY & DISCHARGE OF POLLUTANTS | |

WASTE MINIMIZATION DEMONSTRATION PROJECT: At the soaking pit unit, improve the controlling of the blast furnace gas and natural gas required in the manufacturing process.

PROJECT START DATE: October 1995 **COMPLETION DATE:** To be determined

| MONETARY BENEFITS | | | | |
|--------------------------|---------|--------|-----------------------|-------------------|
| Equipment Costs - US\$ | | | Yearly Savings - US\$ | Payback In Months |
| USAID | Company | Total | | |
| 20,567 | -0- | 20,567 | 32,000* | 8 |

* Estimated, project not completed.

MONETARY BENEFITS RESULT FROM: Reduced costs for energy.

| ENVIRONMENTAL BENEFITS | | | |
|-------------------------------|------------------------|-------|------|
| Pollutant | Yearly Reductions Into | | |
| | Air | Water | Land |
| Carbon Monoxide | 26 tons | --- | --- |
| Nitrogen Oxides | 12 tons | --- | --- |

NATURAL RESOURCES CONSERVED: Energy

HEALTH AND SAFETY BENEFITS: Improved air quality and working conditions due to reduced exposure to toxic emissions.

EQUIPMENT SUPPLIED BY USAID TO COMPANY FOR PROJECT:
Calorimeter, and Digital Process Controller.

| COMPANY PROFILE | |
|---|-----------------------------|
| LOCATION: Yenakievo, approximately 50 miles northeast of Donetsk. | |
| OWNERSHIP: Joint Stock Company | YEAR PLANT START-UP: 1858 |
| LATEST ANNUAL SALES: US\$ NA | NUMBER OF EMPLOYEES: 11,000 |

SECTION III

WASTE

MINIMIZATION

IMPACT

PROGRAM

PROJECTS

DESCRIPTION OF THE WASTE MINIMIZATION IMPACT PROGRAM

The objective of the Waste Minimization Impact Program (WMIP) is to take advantage of the success of the Waste Minimization Demonstration Projects (WMDP) and expand that concept throughout the various industries of each country in Central and Eastern Europe. This is now being accomplished by:

- Training programs sponsored by WEC,
- Activities of WEC's Pollution Prevention Centers,
- WEC's in-country coordinators,
- Ministries of Environment and Industry of each country, and
- USAID Missions.

The first expansion of the impact program in the chemical and refinery sectors of each country has been successfully completed. The information on the progress of the waste minimization projects was obtained directly from each participating company.

In Section II, which summarizes the demonstration projects, the measurable results of reduced pollution and monetary benefits were readily available because of WEC's direct involvement in each project.

The companies in the impact program are developing their own programs based on study tours of industries in the U.S. and two workshops presented in their own country. At the conclusion of these workshops, WEC requested that the participating companies accomplish three assignments:

- Issue a policy statement on waste minimization from the General Director,
- Prepare a company-wide waste minimization program by identifying waste minimization teams for appropriate sections of their plants, and
- Initiate the program by having one team identify five small projects that could be completed within ninety days.

This section details the progress of the impact programs at the selected companies.

All the General Directors have issued, or are in the process of developing, a company policy statement. The Arpechim Refinery in Romania has published the following statement in its latest Annual Report:

"ARPECHIM S.A.'s competitiveness can be achieved, both now and in

the future, by a complete change in our employees' mentality regarding the matter of MINIMIZING LOSSES AND RESIDUES, as well as through a better and more efficient control of the material and energy resources, thus contributing to a cleaner, less polluted atmosphere."

It should be noted that most of the companies had already started some sort of environmental protection program before WEC's waste minimization program was introduced. However, all the companies credit the systematic approach of WEC's Ten Point Waste Minimization Program for helping them improve the efficiency of their own programs. See page 45 for details.

Some of the listed projects were simple, and the solutions appear obvious. However, the problems now being resolved by the WMIP have existed for years, but were never addressed until the initiation of WEC's waste minimization programs.

An important aspect of the WMIP is that factory workers are being educated to the importance of small projects, i.e., ones that may produce only a yearly saving of \$500 and contribute to a minimum reduction of pollution. However, these small projects are important because hundreds of these small projects can be accomplished at minimal or no cost in a very short time frame. When these small projects are totaled at year-end, the cumulative results can be impressive.

There are now 51 companies participating in the WMIP, which has grown from the initial 14 companies. The participants in WEC's Impact Program have developed 121 projects and have to-date provided their monetary results on 72 projects.

Since the impact program is a new concept, and the reporting workers are not used to establishing the data required for a complete project report, 49 of the noted projects do not include monetary details. WEC expects that in the future more precise cost and savings data will be recorded as the workers gain more experience in waste minimization.

To ensure confidentiality and cooperation of all participants, WEC has not identified the companies and their respective projects. However, all the companies participating in the impact program are noted.

In all countries except the Ukraine, where the program is in the introductory phase, representatives from all the companies in the impact program have shared their successful experiences at WEC's Pollution Prevention Center sponsored seminars and workshops. More than 500 additional companies have expressed their interest in participat-

ing in the next impact program, and over 100 of them paid to send their employees to a special waste minimization workshop.

WEC expects that the next Status Report will include equally impressive results from the new participants in the USAID/WEC Waste Minimization Programs.

* * * * *

WEC expresses its appreciation to all the participating companies for their outstanding cooperation.

WEC'S TEN-POINT WASTE MINIMIZATION PROGRAM

The WEC Waste Minimization Program has been developed by selecting the most efficient waste minimization functions from earlier programs as practiced in various U.S. industries and adapting these elements to accommodate the Central and Eastern European industrial environment. The ultimate objective of the Waste Minimization Program is to develop no/low cost recommendations that not only will reduce environmental pollution, but also generate monetary benefits to the company. The resulting Ten-Point Waste Minimization Program described below is the procedure used to implement the program.

Waste Minimization is best accomplished by applying common sense, logic and a systematic approach to a problem. The key to being effective is to compile appropriate information about the waste stream and its causes before applying a solution. This procedure requires that employees with a wide range of expertise be involved in identifying the solution as members of the companies' Waste Minimization Teams.

To develop the WEC Ten-Point Waste Minimization Program, planning is essential and company management must appreciate the program and provide the required leadership.

The Ten-Point Waste Minimization Program, in principle, is applicable to both small and large plants, with some adjustments to be made depending on size of plant, variety of products, and characteristics of the waste streams.

The Waste Minimization Teams must accept that not all projects can be accomplished immediately. Therefore, the program should be divided into projects that can be started and completed within a given time frame.

Examples of Project Timing:

TODAY: Revisions in job practices or procedures routinely applied in cleaning a process vessel can be accomplished immediately.

TOMORROW: A minor process modification may require design and engineering efforts which could require a few months to complete.

FUTURE: A major process change could necessitate a project involving the designing, procurement of new equipment, fabrication and installation, which could require long range planning.

The three time periods are logical divisions that WEC recommends companies incorporate into their waste minimization program.

When initiating a waste minimization program, it has been advantageous to start "small" with projects that can be completed in a relatively short period of time. "Small" means selecting one area or department of a plant to implement the waste minimization program. This experience can then be used to expand the program to the rest of the plant.

In summation, the required elements in the **WEC Ten Point Waste Minimization Plan** include:

1. Develop a Policy and Management Commitment
2. Establish the Waste Minimization Organization and Select a Site Steering Team
3. Divide the plant into logical areas for the creation of area teams
4. Develop and train the area teams
5. Identify and account for the waste
6. Implement cost accounting procedures
7. Establish initial priorities and goals
8. Initiate Waste Minimization analysis and planning
9. Develop implementation schedule
10. Follow-up

**WASTE MINIMIZATION IMPACT PROGRAM PROJECTS SUMMARY
FOR A TOTAL OF 72 PROJECTS - WITH MONETARY DETAILS**

| PROJECT NUMBER | DETAIL PAGE | COUNTRY | INDUSTRY | COMPANY COSTS - US\$ | YEARLY SAVINGS - US\$ | PAYBACK MONTHS |
|----------------|-------------|----------------|--------------------------|----------------------|-----------------------|----------------|
| 1 | 52 | Bulgaria | Refinery & Petrochemical | 2,000 | 100,000 | 1 |
| 2 | 53 | | Refinery | 1,500 | 45,000 | 1 |
| 3 | 54 | | Chemical | 1,000 | 7,000 | 2 |
| 4 | 55 | | Chemical | 15,000 | 95,000 | 2 |
| 5 | 56 | | Rubber & Plastic | 0 | 75,000 | 12 |
| 5 | 56 | | USAID Funds - \$73,000 | | | |
| Totals | | | | \$19,500 | \$322,000 | |
| 6 | 78 | Czech Republic | Chemical | 2,500 | 320,000 | 1 |
| 7 | 79 | | Chemical | 15,000 | 500,000 | 1 |
| 8 | 80 | | Chemical | 1,000 | 19,000 | 1 |
| 9 | 81 | | Pharmaceutical | 1,500 | 19,000 | 1 |
| 10 | 82 | | Foundry | 16,000 | 210,000 | 1 |
| 11 | 83 | | Pharmaceutical | 400 | 4,000 | 1 |
| 12 | 84 | | Oil Recovery | 1,500 | 14,000 | 1 |
| 13 | 85 | | Chemical | 2,000 | 8,000 | 3 |
| 14 | 86 | | Pharmaceutical | 9,000 | 52,000 | 2 |
| 15 | 87 | | Chemical | 37,000 | 192,000 | 2 |
| 16 | 88 | | Chemical | 74,000 | 370,000 | 2 |
| 17 | 89 | | Chemical | 10,000 | 40,000 | 3 |
| 18 | 90 | | Pharmaceutical | 4,000 | 8,000 | 6 |
| 19 | 91 | | Pharmaceutical | 5,500 | 10,000 | 7 |
| 20 | 92 | Chemical | 30,000 | 44,000 | 8 | |
| 21 | 93 | Pharmaceutical | 900 | 1,000 | 11 | |
| 22 | 94 | Chemical | 925,000 | 633,000 | 18 | |
| Totals | | | | \$1,135,300 | \$2,444,000 | |
| 23 | 106 | Hungary | Chemical | 1,500 | 217,000 | 1 |
| 24 | 107 | | Chemical | 1,000 | 13,000 | 1 |
| 25 | 108 | | Chemical | 4,200 | 15,000 | 3 |
| 26 | 109 | | Chemical | 4,200 | 7,000 | 7 |
| 27 | 110 | | Chemical | 500 | 1,000 | 6 |
| 28 | 111 | | Chemical | 25,000 | 21,000 | 14 |
| 29 | 112 | | Synthetic Fiber | 125,000 | 84,000 | 18 |
| 30 | 113 | | Synthetic Fiber | 30,000 | 20,000 | 18 |
| 31 | 114 | | Chemical | 100,000 | 56,000 | 21 |
| 32 | 115 | | Chemical | 133,000 | 68,000 | 24 |
| Totals | | | | \$424,400 | \$502,000 | |
| 33 | 128 | Romania | Refinery & Petrochemical | 2,000 | 590,000 | 1 |
| 34 | 129 | | Chemical | 1,000 | 99,000 | 1 |
| 35 | 130 | | Chemical | 1,500 | 72,000 | 1 |
| 36 | 131 | | Chemical | 2,000 | 45,000 | 1 |
| 37 | 132 | | Refinery | 3,000 | 37,000 | 1 |
| 38 | 133 | | Refinery & Petrochemical | 1,500 | 33,000 | 1 |
| 39 | 134 | | Refinery & Petrochemical | 3,500 | 30,000 | 1 |
| 40 | 135 | | Chemical | 2,500 | 25,000 | 1 |

**WASTE MINIMIZATION IMPACT PROGRAM PROJECTS SUMMARY
FOR A TOTAL OF 72 PROJECTS - WITH MONETARY DETAILS**

| PROJECT NUMBER | DETAIL PAGE | COUNTRY | INDUSTRY | COMPANY COSTS - US\$ | YEARLY SAVINGS - US\$ | PAYBACK MONTHS |
|--|-------------|------------------|---------------------------|----------------------|-----------------------|----------------|
| 41 | 136 | Romania (cont'd) | Refinery | 4,000 | 17,000 | 3 |
| 42 | 137 | | Refinery & Petrochemical | 3,000 | 16,000 | 2 |
| 43 | 138 | | Refinery | 1,800 | 18,000 | 1 |
| 44 | 139 | | Chemical | 8,000 | 75,000 | 1 |
| 45 | 140 | | Refinery | 4,000 | 8,000 | 6 |
| 46 | 141 | | Refinery & Petrochemical* | 178,182 * | 1,210,000 * | 2 |
| 47 | 142 | | Refinery & Petrochemical* | | | |
| 48 | 143 | | Refinery & Petrochemical* | | | |
| 49 | 144 | | Refinery & Petrochemical* | | | |
| 50 | 145 | | Refinery & Petrochemical* | | | |
| 51 | 146 | | Refinery & Petrochemical* | | | |
| 52 | 147 | | Refinery & Petrochemical* | | | |
| 53 | 148 | | Refinery & Petrochemical* | | | |
| 54 | 149 | | Refinery | 6,000 | 40,000 | 2 |
| 55 | 150 | | Chemical | 20,000 | 131,000 | 2 |
| 56 | 151 | | Refinery & Petrochemical | 3,250 | 9,000 | 4 |
| 57 | 152 | | Refinery | 10,700 | 18,000 | 7 |
| Totals | | | | \$ 255,932 | \$ 2,473,000 | |
| 58 | 162 | Slovakia | Chemical | 2,500 | 126,000 | 1 |
| 59 | 163 | | Chemical | 3,000 | 86,000 | 1 |
| 60 | 164 | | Chemical | 2,000 | 70,000 | 1 |
| 61 | 165 | | Chemical | 1,500 | 53,000 | 1 |
| 62 | 166 | | Chemical | 3,500 | 38,000 | 1 |
| 63 | 167 | | Chemical | 3,500 | 123,000 | 1 |
| 64 | 168 | | Chemical | 2,500 | 21,000 | 1 |
| 65 | 169 | | Chemical | 5,000 | 17,000 | 4 |
| 66 | 170 | | Chemical | 21,200 | 300,000 | 1 |
| 67 | 171 | | Chemical | 1,800 | 19,000 | 1 |
| 68 | 172 | | Chemical | 4,500 | 7,000 | 8 |
| 69 | 173 | | Chemical | 1,500 | 7,000 | 3 |
| 70 | 174 | | Chemical | 10,000 | 27,000 | 5 |
| 71 | 175 | | Chemical | 500 | 2,000 | 3 |
| 72 | 176 | | Chemical | 130,000 | 175,000 | 9 |
| Totals | | | | \$ 193,000 | \$ 1,071,000 | |
| TOTALS FOR 72 IMPACT PROGRAM PROJECTS | | | | \$ 2,028,132 | \$ 6,812,000 | |

*Totals for Projects 46 thru 53 are included in Project No. 46.

**WASTE MINIMIZATION IMPACT PROGRAM PROJECTS SUMMARY
FOR A TOTAL OF 49 PROJECTS - WITH MONETARY DETAILS TO BE FINALIZED**

| PROJECT NUMBER | DETAIL PAGE | COUNTRY | INDUSTRY | COMPANY COSTS - US\$ | YEARLY SAVINGS - US\$ | PAYBACK MONTHS |
|----------------|-------------|-----------------|---------------------------|----------------------|-----------------------|----------------|
| 73 | 57 | Bulgaria | Chemical | | | |
| 74 | 58 | | Chemical | | | |
| 75 | 59 | | Chemical | | | |
| 76 | 60 | | Chemical | | | |
| 77 | 61 | | Chemical | | | |
| 78 | 62 | | Refinery & Petrochemical | | | |
| 79 | 63 | | Chemical | | | |
| 80 | 64 | | Chemical | | | |
| 81 | 65 | | Chemical | | | |
| 82 | 66 | | Rubber & Plastic | | | |
| 83 | 67 | | Rubber & Plastic | | | |
| 84 | 68 | | Chemical & Pharmaceutical | | | |
| 85 | 69 | | Refinery | | | |
| 86 | 70 | | Refinery | | | |
| 87 | 71 | | Chemical | | | |
| 88 | 72 | | Chemical | | | |
| 89 | 73 | | Chemical | | | |
| 90 | 74 | Chemical | | | | |
| 91 | 75 | Synthetic Fiber | | | | |
| 92 | 95 | Czech Republic | Chemical | | | |
| 93 | 96 | | Chemical | | | |
| 94 | 97 | | Chemical | | | |
| 95 | 98 | | Chemical | | | |
| 96 | 99 | | Chemical | | | |
| 97 | 100 | | Chemical | | | |
| 98 | 101 | | Chemical | | | |
| 99 | 102 | | Chemical | | | |
| 100 | 103 | | Pharmaceutical | | | |
| 101 | 116 | | Hungary | Chemical | | |
| 102 | 117 | Chemical | | | | |
| 103 | 118 | Chemical | | | | |
| 104 | 119 | Chemical | | | | |
| 105 | 120 | Chemical | | | | |
| 106 | 121 | Chemical | | | | |
| 107 | 122 | Synthetic Fiber | | | | |
| 108 | 123 | Synthetic Fiber | | | | |
| 109 | 124 | Chemical | | | | |
| 110 | 125 | Chemical | | | | |
| 111 | 153 | Romania | Refinery & Petrochemical | | | |
| 112 | 154 | | Refinery | | | |
| 113 | 155 | | Refinery | | | |
| 114 | 156 | | Refinery | | | |
| 115 | 157 | | Chemical | | | |
| 116 | 158 | | Chemical | | | |
| 117 | 177 | Slovakia | Chemical | | | |
| 118 | 178 | | Chemical | | | |
| 119 | 179 | | Chemical | | | |
| 120 | 180 | | Chemical | | | |
| 121 | 181 | | Chemical | | | |

BULGARIA



COMPANIES PARTICIPATING IN THE WASTE MINIMIZATION IMPACT PROGRAM

| | |
|--------------------------|---------------------|
| CHIMCO | VRATZA |
| NEFTOCHIM | BOURGAS |
| NEOCHIM | DIMITROVGRAD |
| ORGACHIM | ROUSSE |
| PETAR KARAMINCHEV | ROUSSE |
| PHARMACIA | DUPNICA |
| PLAMA PLEVEN OILS | PLEVEN |
| SOPHARMA | SOFIA |
| SVILOSA | SVISHTOV |
| VIDACHIM | VIDIN |



BULGARIA
REFINERY & PETROCHEMICAL
PROJECT NO. 1

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$2,000 |
| TOTAL YEARLY SAVINGS | \$100,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Water from the nitrogen-oxygen separator is discharged into the river. Eliminate/reduce the quantity of water presently discharged from the nitrogen-oxygen separator into the river.

SOLUTION

Recycle the water from the nitrogen-oxygen separator to the Power Plant for use in producing steam.

YEARLY SAVINGS RESULTS FROM

Reduced fresh water consumption.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.
OTHER: Reduced waste water discharged into the river.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

BULGARIA

REFINERY

PROJECT NO. 2

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,500 |
| TOTAL YEARLY SAVINGS | \$45,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce the quantity of waste water discharged from the plant.

SOLUTION

Install a tank, with required pumps and piping to allow for separation of waste water, and then recycle. All required equipment available at plant.

YEARLY SAVINGS RESULTS FROM

Reduced fresh water consumption.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.
OTHER: Reduced waste water discharged from plant.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

**BULGARIA
CHEMICAL
PROJECT NO. 3**

| | |
|---------------------------------------|----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,000 |
| TOTAL YEARLY SAVINGS | \$7,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

At the ammonium nitrate evaporator, improve the quality of the steam condensate to allow recycling to the evaporator.

SOLUTION

Install a mist eliminator on the overhead steam vapor line from the evaporator to return liquid droplets to the evaporator.

YEARLY SAVINGS RESULTS FROM

Reduced losses of ammonia and ammonium nitrate in the condensate.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Fresh Water.
OTHER: Reduced quantity of waste water discharged from the plant.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

BULGARIA
CHEMICAL
PROJECT NO. 4

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$15,000 |
| TOTAL YEARLY SAVINGS | \$95,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

Reduce the ammonia content in the waste water resulting from carbamide production to under 35 mg/liter.

SOLUTION

Reconstruct the hydrolysis stripper section (HSS) of the carbamide line.

YEARLY SAVINGS RESULTS FROM

Reduced costs for ammonia.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Improved quality of waste water due to reduced concentration of ammonia.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic pollutant in waste water.

BULGARIA
RUBBER & PLASTIC
PROJECT NO. 5

| | |
|-------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY USAID | \$73,000 |
| TOTAL YEARLY SAVINGS | \$75,000 |
| PAYBACK PERIOD IN MONTHS | 12 |

DESCRIPTION OF PROBLEM

Increase the quantity of steam condensate returned to the Steam Plant for use as boiler feed water.

SOLUTION

Provide and install an Armstrong Condensate Station to replace the five centrifugal condensate return pumps.

YEARLY SAVINGS RESULTS FROM

Reduced fuel and electrical costs due to the improved recycling of steam condensate.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy and Fresh Water.
OTHER: Reduced emissions of sulfur dioxide at the Steam Plant.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic pollutants.

BULGARIA
CHEMICAL
PROJECT NO. 73

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Reduce the carbamide dust and ammonia contents during granulation process of 100 tons/hour of carbamide from 150 mg/m³ to less than 30 mg/m³.

SOLUTION

To be determined.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced concentration of ammonia and dust emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to a toxic substance and dust.

**BULGARIA
CHEMICAL
PROJECT NO. 74**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce the quantity of pollutants in waste gases from the Carbon Disulfide Production Facility.

SOLUTION

Improve the cleaning of waste gases from 93.5% to 98%.

YEARLY SAVINGS RESULTS FROM

To be determined.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

BULGARIA
CHEMICAL
PROJECT NO. 75

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Eliminate/reduce discharge of ammonia vapors during maintenance downtime periods at the absorption unit.

SOLUTION

Install an incinerator to burn the residual ammonia gases from the absorption unit.

YEARLY SAVINGS RESULTS FROM

To be determined.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced toxic emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutants.

BULGARIA
CHEMICAL
PROJECT NO. 76

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Improve efficiency of treating the waste water containing high levels of ammonia.

SOLUTION

Provide instrument for continuous monitoring of the ammonia content in the waste water.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced concentration of ammonia in waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous pollutants.

BULGARIA
CHEMICAL
PROJECT NO. 77

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Prevent the discharge of waste and process water into the sewer during maintenance periods.

SOLUTION

Revise process to allow for a secondary collection of the process waste water from the desorption unit.

YEARLY SAVINGS RESULTS FROM

Reduced costs for process water.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.
OTHER: Reduced generation of waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

BULGARIA
REFINERY & PETROCHEMICAL
PROJECT NO. 78

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Reduce generation of waste material requiring disposal in landfills.

SOLUTION

Separate ordinary trash from oily materials to be recycled.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste materials.

BULGARIA
CHEMICAL
PROJECT NO. 79

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

At the sulfur grinding station, reduce the frequency of plugging of the dust collector filter bags.

SOLUTION

Purchase and install filter bags that are more resistant to plugging.

YEARLY SAVINGS RESULTS FROM

Reduced losses of sulfur.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced sulfur emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced pollutant emissions.

**BULGARIA
CHEMICAL
PROJECT NO. 80**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce the generation of waste water requiring treatment.

SOLUTION

Divert one waste water acid stream and use as neutralizing stream for a basic stream coming from the batch process, thereby reducing the load on the Waste Water Treatment Plant.

YEARLY SAVINGS RESULTS FROM

Reduced costs for operating the Waste Water Treatment Plant.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.
OTHER: Reduced generation of waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

BULGARIA
CHEMICAL
PROJECT NO. 81

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Reduce the quantity of process waste water requiring treatment.

SOLUTION

Precipitate the solids out of the process waste water and recycle back into the process.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Fresh Water.
OTHER: Reduced generation of waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

BULGARIA
RUBBER & PLASTIC
PROJECT NO. 82

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Eliminate/reduce water leaks in plant.

SOLUTION

Locate sources of leaks in underground piping and repair.

YEARLY SAVINGS RESULTS FROM

Reduced fresh water consumption.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.
OTHER: Reduced generation of waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

BULGARIA
RUBBER & PLASTIC
PROJECT NO. 83

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Reduce losses of foam during drying process.

SOLUTION

Replace the paper used to support foam with a film covered material which will reduce losses from 8%-10% to 2%-3%.

YEARLY SAVINGS RESULTS FROM

To be determined.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.

HEALTH & SAFETY BENEFITS

Reduced handling of waste materials.

BULGARIA
CHEMICAL & PHARMACEUTICAL
PROJECT NO. 84

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Hydrochloric acid is pumped using ceramic seal pumps. This type of pump is subject to excessive leaks and breakage.

SOLUTION

Replace ceramic seal pumps with mechanical seal pumps.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and plant maintenance.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced contamination of ground water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hydrochloric acid.

BULGARIA

REFINERY

PROJECT NO. 85

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce ammonia loss that presently amounts to approximately 30 tons/month.

SOLUTION

Locate source of leaks in process equipment and repair leaks.

YEARLY SAVINGS RESULTS FROM

Reduced ammonia emissions.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced ammonia emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

BULGARIA
REFINERY
PROJECT NO. 86

PROJECT IN PROGRESS

MONETARY DETAILS

TO BE FINALIZED

DESCRIPTION OF PROBLEM

Reduce leaks of hydrocarbons from the Refinery Plant.

SOLUTION

Provide an ultrasonic leak detector to detect equipment leaks.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.

OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

BULGARIA
CHEMICAL
PROJECT NO. 87

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Present purchase order specifications for PVC foil do not meet pharmaceutical industry requirements and result in excessive foil waste.

SOLUTION

Purchasing Department to develop tighter foil specifications to comply with industry requirements.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials equivalent to a foil loss of 0.7 tons/month, plus costs for waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.

HEALTH & SAFETY BENEFITS

Reduced handling of waste materials.

BULGARIA
CHEMICAL
PROJECT NO. 88

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Eliminate/reduce cardboard and paper waste due to poor quality of packaging materials.

SOLUTION

Monitor supplied packaging material to ensure compliance with government standards regarding storage and transportation.

YEARLY SAVINGS RESULTS FROM

Reduced cardboard and paper cuttings equivalent to 6 tons/month.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Material.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Reduced exposure to waste materials.

BULGARIA
CHEMICAL
PROJECT NO. 89

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Plant purchases and stocks excessive number of various metal shapes and sizes and some material does not meet government standards.

SOLUTION

Purchasing department to coordinate with all departments in order to optimize both quality and quantity of material requirements. In addition, ferrous and non-ferrous metal wastes are to be separated for environmental protection.

YEARLY SAVINGS RESULTS FROM

Reduced metal costs equivalent to 50 kg/month.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Reduced exposure to waste materials.

BULGARIA
CHEMICAL
PROJECT NO. 90

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Eliminate/reduce waste of wood which totals approximately 0.5 m³/month.

SOLUTION

Initiate program to use scrap wood in packing and utilize remaining wood scraps as fuel.

YEARLY SAVINGS RESULTS FROM

Reduced wood costs, equivalent to 0.5 m³ scrapped each month, and incineration costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Reduced exposure to waste materials.

BULGARIA

SYNTHETIC FIBER

PROJECT NO. 91

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce the present ammonia losses of 120 tons/year from the cooling system.

SOLUTION

Provide and install a photo-ionization detector to locate and repair leaks.

YEARLY SAVINGS RESULTS FROM

Reduced losses of ammonia.

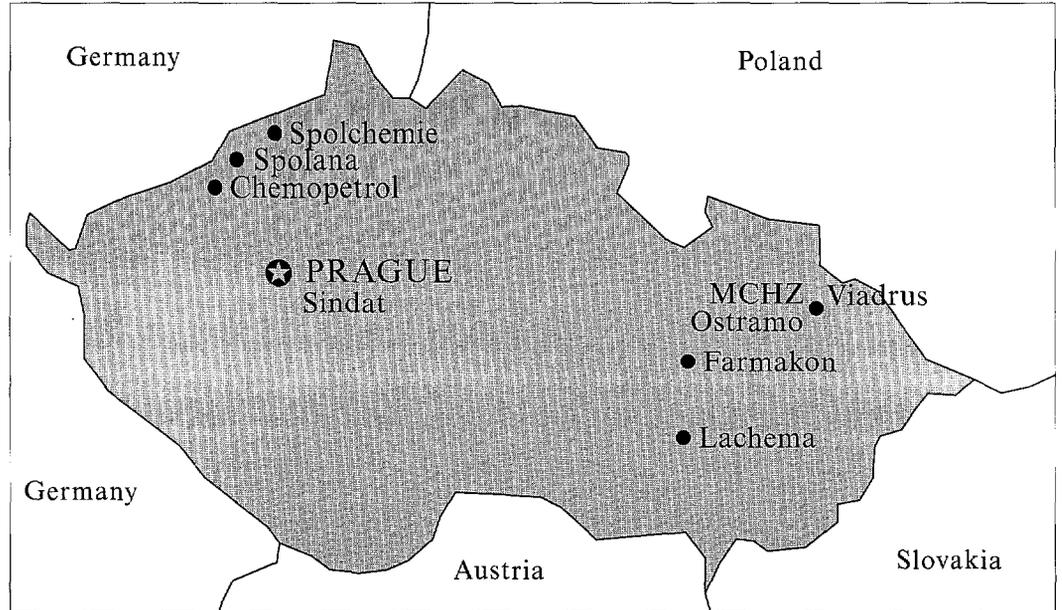
ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced emissions of ammonia.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

CZECH REPUBLIC



COMPANIES PARTICIPATING IN THE WASTE MINIMIZATION IMPACT PROGRAM

| | |
|--|-----------------------|
| CHEMOPETROL | LITVINOV |
| FARMAKON | OLOMOUC |
| LACHEMA | BRNO |
| MORAVSKE CHEMICKE ZAVODY (MCHZ) | OSTRAVA |
| OSTRAMO | OSTRAVA |
| SINDAT | PRAGUE |
| SPOLANA | NERATOVICE |
| SPOLCHEMIE | USTI NAD LABEM |
| VIADRUS | BOHUMIN |



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CZECH REPUBLIC

CHEMICAL

PROJECT NO. 6

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$2,500 |
| TOTAL YEARLY SAVINGS | \$320,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Stop the use of landfills for the storing of liquid and semi-liquid wastes from the refinery operations and presently disposed of in the existing lagoons—some of which have been there since 1942.

SOLUTION

Utilize storage tank farms for separating the oil and waste water. The oil will be recovered and recycled to the refinery and the contaminated water will be discharged into the waste water system. The plant has made arrangements to sell the recovered oil from the lagoons to another company to be used as a fuel source. The balance of the semi-liquid will be solidified using a process developed by the plant, mixed with coal and used as a fuel at the Power Plant.

YEARLY SAVINGS RESULTS FROM

Sale of the recovered oil to a cement manufacturer and the use of waste oil with solidified waste as fuel at the Power Plant, plus reduced waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy and Landfill Sites.
 OTHER: Reduced volatile organic compound emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced volatile organic compound emissions and eliminated a potential fire hazard at the oil saturated lagoons.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 7

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$15,000 |
| TOTAL YEARLY SAVINGS | \$500,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

The production of epoxy resins is based on the double dehydrochlorination of epichlorohydrin. Epichlorohydrin lost in the waste water undergoes hydrolytic decomposition yielding glycerol, which in turn raises the waste water COD by 450 tons/year. The plant's goal is to prevent/minimize the pollution of waste waters by the glycerol.

SOLUTION

Modify the manufacturing process so that the waste water with the epichlorohydrin is diverted into a separate stream so that it can be recovered and recycled.

YEARLY SAVINGS RESULTS FROM

Recovered epichlorohydrin.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced COD of the waste water by 450 tons/year.

HEALTH & SAFETY BENEFITS

Improved water quality due to reduction of the COD.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 8

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,000 |
| TOTAL YEARLY SAVINGS | \$19,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

The production of naphthol results in the formation of 300 tons/year of tar which must be disposed of.

SOLUTION

This byproduct tar can be used as an additive in road-paving asphalt. A firm willing to haul away this waste product gratis has been located and shipments have already been started.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved quality of subsurface water due to reduced contaminants.

**CZECH REPUBLIC
PHARMACEUTICAL
PROJECT NO. 9**

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,500 |
| TOTAL YEARLY SAVINGS | \$19,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Urea peroxyhydrate is manufactured by adding a 35% solution of hydrogen peroxide to urea, followed by product crystallization and separation. The mother liquors formed contain approximately 11% urea peroxyhydrate. These liquors are disposed of by discharging directly into the waste water system.

SOLUTION

Revise the manufacturing process to increase the hydrogen peroxide concentration from 35% to 50%. This will reduce the water concentration in the reaction mixture, lower the solubility of the product and increase the reaction yields from 60% to 90%.

YEARLY SAVINGS RESULTS FROM

Higher yields obtained on a production rate of 50 tons/year of urea peroxyhydrate.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced organic contamination of the waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to potential hazardous waste materials.

CZECH REPUBLIC

FOUNDRY

PROJECT NO. 10

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$16,000 |
| TOTAL YEARLY SAVINGS | \$210,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

In the production of casting cores, approximately 350 tons/month of hazardous waste are generated. Waste from the core mixture and organic binder material are toxic and must be disposed of in a hazardous landfill site.

SOLUTION

The hazardous wastes were reduced from 350 tons/month to 10 tons/month by revising formulation of the core mixture to eliminate phenol and formaldehyde.

YEARLY SAVINGS RESULTS FROM

Recycling of the wastes for use as a secondary raw material, plus reduced waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced toxic emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic wastes and emissions.

**CZECH REPUBLIC
PHARMACEUTICAL
PROJECT NO. 11**

| | |
|---------------------------------------|----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$400 |
| TOTAL YEARLY SAVINGS | \$4,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Adamantane is extracted from the reaction mixture using a high volatility gasoline with a boiling point of 80°-160°C. During this stage of the process, some of the gasoline is trapped in the mother liquor which is disposed of by incineration. Additional gasoline is lost in the product separation and the drying process because of the high volatility gasoline.

SOLUTION

Utilize a more suitable fraction of gasoline with a higher boiling point of 140°-160°C without unsaturated hydrocarbons and aromatics. In addition, decaline, a byproduct from the isomerization of trimethylene noborname, is used as a substitute for the high volatility gasoline.

YEARLY SAVINGS RESULTS FROM

Reduced use of high volatility gasoline, and incineration costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutant emissions from incineration.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced pollutant emissions.

CZECH REPUBLIC**OIL RECOVERY****PROJECT NO. 12**

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,500 |
| TOTAL YEARLY SAVINGS | \$14,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

The ground under the plant is contaminated with the oily residues resulting from the use of outdated oil-reclamation techniques. The plant waste water has a high concentration of hydrocarbons and other contaminants which are discharged into three open-surface lagoons located immediately adjacent to residential areas. At the present time, about 250,000 m³ of waste water, contaminated with heavy metals and hydrocarbons, are stored in the lagoons. The plant has permission to use the existing waste water treatment procedures only until July 1996.

SOLUTION

Treat the hazardous waste water utilizing a bleaching clay aeration procedure and the addition of sulfuric acid. The plant also proposes to remove the oil from the lagoons and establish a preventative maintenance program.

YEARLY SAVINGS RESULTS FROM

A 5% savings in raw materials, plus reduced costs for treating the toxic wastes and maintenance costs for the Waste Water Treatment Plant.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced waste products and pollutants discharged into the subsurface water and environment.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water and minimized potential fire hazards at the oil-saturated lagoons.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 13

| | |
|---------------------------------------|----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$2,000 |
| TOTAL YEARLY SAVINGS | \$8,000 |
| PAYBACK PERIOD IN MONTHS | 3 |

DESCRIPTION OF PROBLEM

Reduce solid wastes containing heavy metals as a result of the partial oxidation of the refractory liners in the POX reactors.

SOLUTION

Separate the inside layer of the refractory liners saturated with heavy metals and dispose of in a landfill for hazardous wastes. The balance of the spent refractory liner can be disposed of in the ordinary solid waste landfill.

YEARLY SAVINGS RESULTS FROM

Reduced waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.

OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous waste materials.

**CZECH REPUBLIC
PHARMACEUTICAL
PROJECT NO. 14**

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$9,000 |
| TOTAL YEARLY SAVINGS | \$52,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

In the manufacturing process for glycerine esterification using acetic anhydride, acetic acid is generated as a by-product. Most of the resulting acetic acid cannot be reused in esterification, and the surplus acid is sold separately.

SOLUTION

Revise the manufacturing process to utilize a reaction mixture distilled from the previous batch. Then, distilling out the reaction water will result in a partial glycerine esterification. With the addition of acetic anhydride, the esterification process is completed and will result in a mixture with the required composition.

YEARLY SAVINGS RESULTS FROM

Reduced consumption of acetic anhydride by 60 tons/year in producing 300 tons/year of esterol.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced organic compound contamination in the waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous pollution.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 15

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$37,000 |
| TOTAL YEARLY SAVINGS | \$192,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

Chlorine emissions from the process lines are absorbed in water and yield approximately 9,000 tons/year of a weak sodium hypochlorite solution containing 20-60 grams of available chlorine. This waste solution does not have any value.

SOLUTION

One part of the waste solution will be further saturated with chlorine to an available chlorine content of 120 grams/liter. The remaining weak solution will be used for the chemical pretreatment of the plant's daily production of waste water. This will allow the organic compounds in the water to be destroyed before it reaches the treatment plant.

YEARLY SAVINGS RESULTS FROM

Reduced costs of oxidizing agents for the waste water chemical pretreatment.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Improved water quality due to reduced contaminants.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

CZECH REPUBLIC**CHEMICAL****PROJECT NO. 16**

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$74,000 |
| TOTAL YEARLY SAVINGS | \$370,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

The electrolytic method used for producing chlorine and sodium/potassium in mercury cells generates 2,500 tons of sludge/year. The sludge is a product of the impurities in the sodium/potassium chloride used in the process and 1 kg of dry sludge contains 50 mg of mercury.

SOLUTION

Revise the manufacturing process to use recrystallized salts with a higher purity (99.9%) instead of the natural chlorides presently specified. This process change will minimize the production of mercury contaminated sludge.

YEARLY SAVINGS RESULTS FROM

Reduced costs for sludge disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Eliminated the production of 2,500 tons/year of mercury contaminated sludge.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic mercury.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 17

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$10,000 |
| TOTAL YEARLY SAVINGS | \$40,000 |
| PAYBACK PERIOD IN MONTHS | 3 |

DESCRIPTION OF PROBLEM

In the production of sodium/potassium hydroxide by electrolysis in mercury cells, approximately 250 kg/year of mercury escapes to pollute the atmosphere.

SOLUTION

Establish a preventative maintenance program to: monitor mercury concentrations in the emissions; locate possible leaking joints; segregate the waste water containing mercury; and install mercury traps in the waste water system.

YEARLY SAVINGS RESULTS FROM

Reduced mercury losses by approximately 250 kg/year.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced mercury discharges into the environment by 15%.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic mercury.

**CZECH REPUBLIC
PHARMACEUTICAL
PROJECT NO. 18**

| | |
|---------------------------------------|----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$4,000 |
| TOTAL YEARLY SAVINGS | \$8,000 |
| PAYBACK PERIOD IN MONTHS | 6 |

DESCRIPTION OF PROBLEM

The production of chlorobenzoyl-benzoic acid generates hydrogen chloride gases which are then captured in an absorber. The absorption equipment is inefficient and allows some of the hydrogen chloride gas to escape into the environment.

SOLUTION

Replace the existing absorption equipment with a more efficient type. Recover the hydrochloric acid vapors and use in subsequent operations.

YEARLY SAVINGS RESULTS FROM

Reduced costs for preparing absorption solution and reduced hydrochloric acid consumption.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced plant emissions and a lower salinity content in the waste water. Dissolved substances are reduced by 10 tons/year of which 3 tons are chlorides.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic waste materials.

**CZECH REPUBLIC
PHARMACEUTICAL
PROJECT NO. 19**

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$5,500 |
| TOTAL YEARLY SAVINGS | \$10,000 |
| PAYBACK PERIOD IN MONTHS | 7 |

DESCRIPTION OF PROBLEM

In the manufacture of ascorbic acid, acetone vapors are generated and escape during the drying operation.

SOLUTION

Modify the hot air drying unit to capture the acetone vapors. The recycled acetone will then be used in other production processes. The entire plant, including the drying unit, is being refurbished and modernized.

YEARLY SAVINGS RESULTS FROM

Recovered and recycled acetone.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced acetone emissions by approximately 20 tons/year.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

CZECH REPUBLIC**CHEMICAL****PROJECT NO. 20**

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$30,000 |
| TOTAL YEARLY SAVINGS | \$44,000 |
| PAYBACK PERIOD IN MONTHS | 8 |

DESCRIPTION OF PROBLEM

The volatile organic compound emissions from the production of synthetic resins are adsorbed on charcoal and later released by desorption. This vapor containing epichlorohydrin is waste and therefore burned in the Incinerator.

SOLUTION

Collect the various waste streams before the adsorption step and combine into two separate streams. The stream containing the epichlorohydrin is frozen and the recovered epichlorohydrin is recycled. The remaining gases are absorbed and burned in the Incinerator.

YEARLY SAVINGS RESULTS FROM

Recovered and recycled epichlorohydrin.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to volatile organic compound emissions.

**CZECH REPUBLIC
PHARMACEUTICAL
PROJECT NO. 21**

| | |
|---------------------------------------|-------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$900 |
| TOTAL YEARLY SAVINGS | \$1,000 |
| PAYBACK PERIOD IN MONTHS | 11 |

DESCRIPTION OF PROBLEM

Production of hydroxycumarin generates emissions of aspirin chloride, petroleum ethers, hydrogen chloride and sulfur dioxide. These emissions are toxic and endanger worker health and safety, as well as that of the community.

SOLUTION

Modify existing production facilities and improve the manufacturing processes to include the neutralization of mother liquors, thereby eliminating emissions of ethers, hydrogen chloride and sulfur dioxide.

YEARLY SAVINGS RESULTS FROM

Reduced heating costs. Note, because of reduced production requirements savings are presently minimal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.
OTHER: Reduced toxic emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic emissions.

CZECH REPUBLIC**CHEMICAL****PROJECT NO. 22**

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$925,000 |
| TOTAL YEARLY SAVINGS | \$633,000 |
| PAYBACK PERIOD IN MONTHS | 18 |

DESCRIPTION OF PROBLEM

Ammonia emissions from the Urea Plant result from: equipment flange leaks during production, opening process tanks prior to inspection and decomposition of urea. At present, 3,680 tons/year of ammonia vapor at the Urea Plant is dissipated into the atmosphere.

SOLUTION

Reducing the vapor in the pipe line connecting the urea and ammonia storage tanks reduces ammonia emissions. On the basis of analysis of the separate ammonia emissions in urea production, the plant started the minimization of ammonia emissions in such units that are the most major sources of ammonia pollution.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and energy.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.
OTHER: Reduced toxic emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to ammonia emissions.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 92

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Various processes in the production of phenol-formaldehyde resins generate large quantities of waste water containing phenol. The waste water is distilled to remove the phenol but this process still leaves about 1,000 tons/year of solid residue that is stored on site. Maximize the amount of saleable product and at the same time minimize the waste generated.

SOLUTION

In 1996 the present dephenolization unit will be replaced with an extraction technology that will reduce the waste resins by 90% to 100 tons/year. At the present time the plant does not have a technology to utilize waste resins. The project for remediation of the site where the phenol water was disposed of in the past was worked out and the project is expected to start in 1996.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced waste generation and pollutants contaminating the subsurface water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic substances.

CZECH REPUBLIC
CHEMICAL
PROJECT NO. 93

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

The production of nitrobenzene and other amines produces a residue in the distillation column which requires special handling. The plant presently produces about 600-700 tons/year of residue that has to be incinerated. The incineration operation generates air emissions that exceed regulatory limits. The plant has government permission to use the present Incinerator until 1998.

SOLUTION

Construction of a new Incinerator to handle the accumulated residues as well as present production. The new Incinerator is expected to be in operation by 1998.

YEARLY SAVINGS RESULTS FROM

To be determined after the new Incinerator is on-line.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutant emissions and neutralization of non-usable residues.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 94

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

The plant uses ammonia to wash the coke oven gas to extract hydrogen. In the process, the waste water becomes contaminated with nitrogen oxide. Of the 176 tons/year of nitrogen oxide produced, 97 tons go into the river, 41 tons go to the landfill and approximately 38 tons go into the waste water system. The 38 tons going into the Waste Water Treatment Plant is the problem in that it exceeds the limit for waste over the 20 mg/liter limit.

SOLUTION

Manufacture hydrogen using natural gas instead of coke oven gas.

YEARLY SAVINGS RESULTS FROM

To be determined after the process change.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.

OTHER: Reduced quantities of ammonia discharged into the waste water and river.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic gas emissions.

CZECH REPUBLIC
CHEMICAL
PROJECT NO. 95

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

In producing the products epichlorohydrin, tetrachloroethane and perchlorethylene, some useless and heavier chlorinated hydrocarbons are formed. The Czech Republic no longer permits the manufacture of these environmental polluting products.

SOLUTION

Manufacture of the above products contributing to the pollutant problem has been discontinued.

YEARLY SAVINGS RESULTS FROM

Not applicable.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Eliminated environmental pollutants.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 96

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

In producing epichlorohydrin, approximately 600 tons/year of COD and 120 tons/year of chlorine, in the form of absorbable chlorinated organic compounds, are discharged into the waste water system.

SOLUTION

Plant proposes to chemically treat the waste water before the Biological Treatment Plant and the organic matter will either be oxidized chemically or be exposed to UV light.

YEARLY SAVINGS RESULTS FROM

To be determined after plant decides which corrective procedure they are going to use.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutants include: COD by 80%; absorbable chlorinated organic compounds by 99%; and soluble inorganic salts by 15%.

HEALTH & SAFETY BENEFITS

Improved water quality in the Labe River due to reduced pollutants.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 97

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce/minimize required solvents and spent liquids generated in the production process.

SOLUTION

Initial step is to use spent caustic soda as an alkaline reagent in non-demanding applications.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Fresh Water.
OTHER: Reduced high salt content in waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic waste water.

CZECH REPUBLIC

CHEMICAL

PROJECT NO. 98

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce spent solid adsorbent wastes by changing the inorganic and organic materials used for dessicants, sorbents and catalysts in refinery and petrochemical processes.

SOLUTION

Revise process and change from molecular sieves and activated carbon to less expensive atapulgite clay or bentonite.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic waste materials.

CZECH REPUBLIC
CHEMICAL
PROJECT NO. 99

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Eliminate/minimize the soot and cyanide waste from the remaining oil after the vacuum distillation in the partial oxidation unit.

SOLUTION

The plant proposes to make a feasibility study to evaluate the possibility of treating the waste waters. The commercial utilization of several components from the waste waters: soot; heavy metals; etc., will be worked out in 1996. The solution will minimize the toxic wastes which at the present time are treated and deposited in a landfill site.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste disposal, plus sale of heavy metals.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous waste materials.

**CZECH REPUBLIC
PHARMACEUTICAL
PROJECT NO. 100**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

In operating the Waste Water Treatment Plant, solvent contaminants are released from the bio-aeration tank. In addition, the pre-treatment unit at the Waste Water Treatment Plant does not always function properly.

SOLUTION

For an immediate temporary solution, the plant will install a bio-filter unit to capture the solvent emissions. In the future, the plant is planning to replace the first stage treatment with an anaerobic unit at a cost of approximately \$1 million.

YEARLY SAVINGS RESULTS FROM

Reduced costs for operating the Waste Water Treatment Plant.

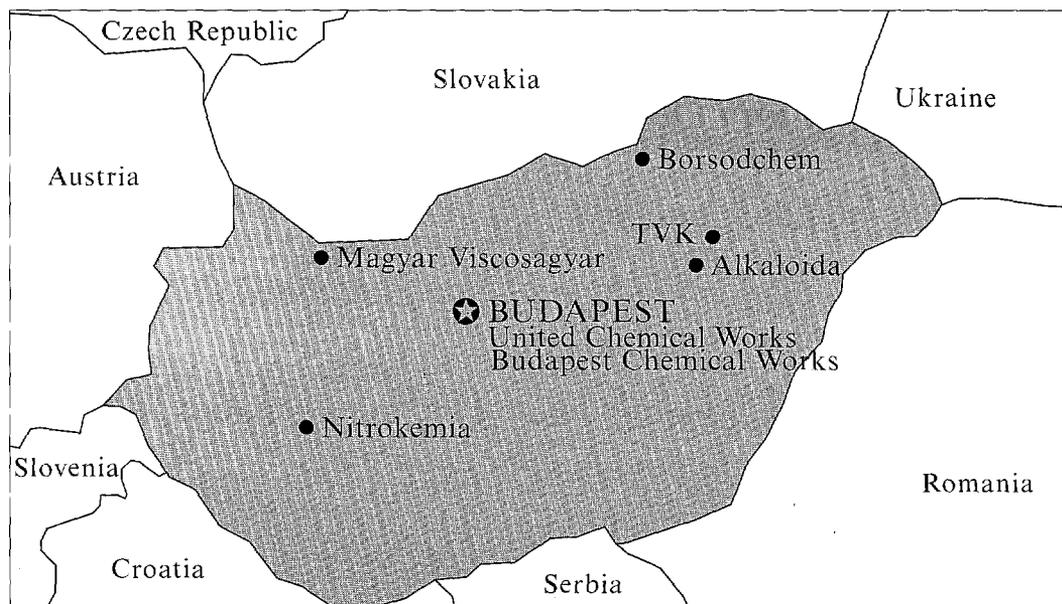
ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced contaminated emissions.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to solvent contaminants.

HUNGARY



COMPANIES PARTICIPATING IN THE WASTE MINIMIZATION IMPACT PROGRAM

| | |
|------------------------------------|-----------------------|
| ALKALOIDA | TISZAVASVARI |
| BORSODCHEM | KAZINCBARCIKA |
| BUDAPEST CHEMICAL WORKS | BUDAPEST |
| MAGYAR VISCOSAGYAR | NYERGESUJFALU |
| NITROKEMIA | FUZFOGYARTELEP |
| TISZAI VEGYI KOMBINAT (TVK) | TISZAUJVAROS |
| UNITED CHEMICAL WORKS | BUDAPEST |



**HUNGARY
 CHEMICAL
 PROJECT NO. 23**

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,500 |
| TOTAL YEARLY SAVINGS | \$217,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce the approximately 110 tons/year of paper and plastic waste requiring disposal in a landfill.

SOLUTION

Separate the paper from the plastic waste and recycle the useable paper. The plastic can be compressed to approximately one-third of its original volume prior to disposal in a landfill.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
 OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Reduced exposure to solid waste materials.

HUNGARY

CHEMICAL

PROJECT NO. 24

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,000 |
| TOTAL YEARLY SAVINGS | \$13,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Eliminate/reduce the extensive analytical testing of raw materials procured from suppliers having varied quality control standards.

SOLUTION

Purchase raw materials only from suppliers that are ISO 9000 certified, and who can furnish a product certificate of analysis for every product.

YEARLY SAVINGS RESULTS FROM

Reduced costs for analytical testing.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced laboratory generated waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic testing materials.

HUNGARY

CHEMICAL

PROJECT NO. 25

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$4,200 |
| TOTAL YEARLY SAVINGS | \$15,000 |
| PAYBACK PERIOD IN MONTHS | 3 |

DESCRIPTION OF PROBLEM

Eliminate/reduce the requirement for the grinding of dry pharmaceutical ingredients at remote locations.

SOLUTION

Install a hammer-grinding mill under the drier sieve.

YEARLY SAVINGS RESULTS FROM

Reduced costs for the various packaging materials, incineration of waste, analytical testing, transportation, labor and packaging.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
 OTHER: Reduced dust emissions during the grinding operation of the solid waste and the incineration of waste packaging materials.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to dust emissions.

HUNGARY
CHEMICAL
PROJECT NO. 26

| | |
|---------------------------------------|----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$4,200 |
| TOTAL YEARLY SAVINGS | \$7,000 |
| PAYBACK PERIOD IN MONTHS | 7 |

DESCRIPTION OF PROBLEM

The end-point of the drying operation is presently determined by the use of a laboratory drying cabinet which can require up to two hours to reach the required constant weight.

SOLUTION

Determine the solids content and end-point of the drying operation by utilizing an infra-red instrument.

YEARLY SAVINGS RESULTS FROM

Reduced testing time from two hours to five minutes, with a corresponding saving in heat and electricity.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.

HEALTH & SAFETY BENEFITS

Reduced exposure to laboratory testing operations.

**HUNGARY
CHEMICAL
PROJECT NO. 27**

| | |
|---------------------------------------|----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$500 |
| TOTAL YEARLY SAVINGS | \$1,000 |
| PAYBACK PERIOD IN MONTHS | 6 |

DESCRIPTION OF PROBLEM

Waste is generated when the alkylbenzene sulfonic acid line is blocked due to the solidification of the liquid during required shut-down periods.

SOLUTION

Install a return line from the alkylbenzene sulfonic acid injection point back to the storage tank allowing the liquid to be recycled.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials, plus improved production efficiency.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic liquid.

HUNGARY

CHEMICAL

PROJECT NO. 28

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$25,000 |
| TOTAL YEARLY SAVINGS | \$21,000 |
| PAYBACK PERIOD IN MONTHS | 14 |

DESCRIPTION OF PROBLEM

The alkaline distribution pipe network supplies a 40% alkaline solution from a central storage tank. Plugging up of the pipe line due to freezing can be a problem during the winter months.

SOLUTION

Dilute the 40% alkaline solution in the central storage tank to a concentration of 20%. The lower concentration will reduce the number of freezing incidents and eliminate all or most of the need for propellant steam.

YEARLY SAVINGS RESULTS FROM

Reduced steam requirements, plus improved production efficiency.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced generated waste during system down-time.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to a very strong alkaline solution.

HUNGARY
SYNTHETIC FIBER
PROJECT NO. 29

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$125,000 |
| TOTAL YEARLY SAVINGS | \$84,000 |
| PAYBACK PERIOD IN MONTHS | 18 |

DESCRIPTION OF PROBLEM

Reduce quantity of waste polymer pellets requiring reprocessing due to the malfunctioning of the volumetric feeding device.

SOLUTION

Install a weight controlled feeding system which measures additional input quantities of pigment, additives and raw materials when producing various pellet types and reduces off-specification pellets.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and reprocessing of waste pellets, plus an improved diversification of product mix.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Reduced exposure to waste materials.

HUNGARY

SYNTHETIC FIBER

PROJECT NO. 30

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$30,000 |
| TOTAL YEARLY SAVINGS | \$20,000 |
| PAYBACK PERIOD IN MONTHS | 18 |

DESCRIPTION OF PROBLEM

The process effluent is collected and then sent to an aeration pond for reduction of the BOD and COD content. The oxygen needs of the effluent vary considerably while the oxygenation capacity of the aeration pond is essentially constant. This results in a situation where the aeration requirements and the aeration pond capacity are not necessarily compatible.

SOLUTION

Install a continuous total organic compound (TOC) monitoring device so that a holding pond can be monitored. When the TOC of the material in this pond reaches a predetermined level, the contents of the holding pond will be sent to the aeration pond. This will reduce the extremes in treatment required in the aeration pond and provide a more effective aeration treatment of the effluent.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and electricity. Production efficiency was also improved.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.
OTHER: Reduced the BOD and COD in the effluent discharged into the river.

HEALTH & SAFETY BENEFITS

Improved quality of river water due to reduced BOD and COD content of the waste water.

HUNGARY
CHEMICAL
PROJECT NO. 31

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$100,000 |
| TOTAL YEARLY SAVINGS | \$56,000 |
| PAYBACK PERIOD IN MONTHS | 21 |

DESCRIPTION OF PROBLEM

In the manufacture of the pesticide, dimethyl phosphite, the by-product methyl phosphite is formed and discharged into the waste water system.

SOLUTION

Treat the waste water stream to hydrolyze the methyl phosphite and recover the ortho phosphorus acid and methanol.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutants being discharged into the waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to pollutants.

HUNGARY

CHEMICAL

PROJECT NO. 32

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$133,000 |
| TOTAL YEARLY SAVINGS | \$68,000 |
| PAYBACK PERIOD IN MONTHS | 24 |

DESCRIPTION OF PROBLEM

At the Polymer Facility, reduce the consumption of demineralized water.

SOLUTION

Install a mother liquor collection unit at the filtration section to permit the recycling of the mother liquor as a polymerizer wash water.

YEARLY SAVINGS RESULTS FROM

Reduced consumption of demineralized water by approximately 65,000 tons/year.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.

HEALTH & SAFETY BENEFITS

Reduced discharge of waste water from plant.

HUNGARY
CHEMICAL
PROJECT NO. 101

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

At the polymerisation unit, eliminate/reduce the salt contaminated waste water.

SOLUTION

Reduce hourly usage of sodium hydroxide by 130 kgs.

YEARLY SAVINGS RESULTS FROM

Reduced consumption of sodium hydroxide.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of salt contaminated waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic chemicals.

HUNGARY
CHEMICAL
PROJECT NO. 102

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

At the Polymer Facility, reduce the vinyl chloride discharges.

SOLUTION

Install a stripping unit on the production line.

YEARLY SAVINGS RESULTS FROM

Recovered vinyl chloride discharges at the stripping unit.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

**HUNGARY
CHEMICAL
PROJECT NO. 103**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

At the vinyl chloride monomer by-product Incinerator, reduce the pollutants discharged into the atmosphere.

SOLUTION

Install an oxygen analyzer in the vent-gas line to operate the air feed control valve to ensure the required oxygen content of the vent gas.

YEARLY SAVINGS RESULTS FROM

Reduced costs for the vent gas and process air to the Incinerator.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced free chlorine and total organics in the vent gas.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

HUNGARY
CHEMICAL
PROJECT NO. 104

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

In the vinyl chloride monomer unit, reduce the quantity of salt contaminated waste water.

SOLUTION

Install a heat exchanger and modify the stripper operating conditions.

YEARLY SAVINGS RESULTS FROM

Reduced costs for steam generation of about 400 kg/hour.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced sulfur dioxide discharged at the Steam Plant.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

HUNGARY
CHEMICAL
PROJECT NO. 105

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Pesticide formation equipment is cleaned using fresh water or an organic solvent which afterwards requires treatment or incineration.

SOLUTION

Store wash-down liquids until the next production cycle for re-use in the manufacturing process or possible sale.

YEARLY SAVINGS RESULTS FROM

Reduced costs for wash-down liquids, plus sale of surplus wash-down liquids.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Fresh Water.
OTHER: Reduced generated liquid waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic solvents.

HUNGARY
CHEMICAL
PROJECT NO. 106

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Chemically contaminated and uncontaminated packaging materials are presently collected and stored in the same waste bin.

SOLUTION

Separate contaminated and uncontaminated packaging materials into different waste bins.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste incineration, plus sale of uncontaminated secondary raw material.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced generated waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste materials.

HUNGARY
SYNTHETIC FIBER
PROJECT NO. 107

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Reduce quantity of waste fibers after the spinning operation.

SOLUTION

Install a viscosity meter before the spinning operation.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced waste fiber dust.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced pollutant emissions.

HUNGARY

SYNTHETIC FIBER

PROJECT NO. 108

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce the quantity of waste material requiring incineration by an outside contractor.

SOLUTION

Install an on-site Incinerator to burn the generated waste as a fuel source for plant's heat requirements.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste disposal and fuel for plant's heating requirements.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy and Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to possible toxic waste materials.

HUNGARY
CHEMICAL
PROJECT NO. 109

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

The operating pumps in the plant have stuffing boxes which have a tendency to leak.

SOLUTION

Replace pump stuffing box with mechanical seals.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials, plus improved production efficiency.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions around pumps.

**HUNGARY
CHEMICAL
PROJECT NO. 110**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Some surfactants are stored in carbon steel tanks, which have a tendency to corrode, resulting in the surfactant being discarded as waste.

SOLUTION

Store surfactant in glass lined tanks and modify the existing carbon steel tanks by installing a fiber glass reinforced plastic liner.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

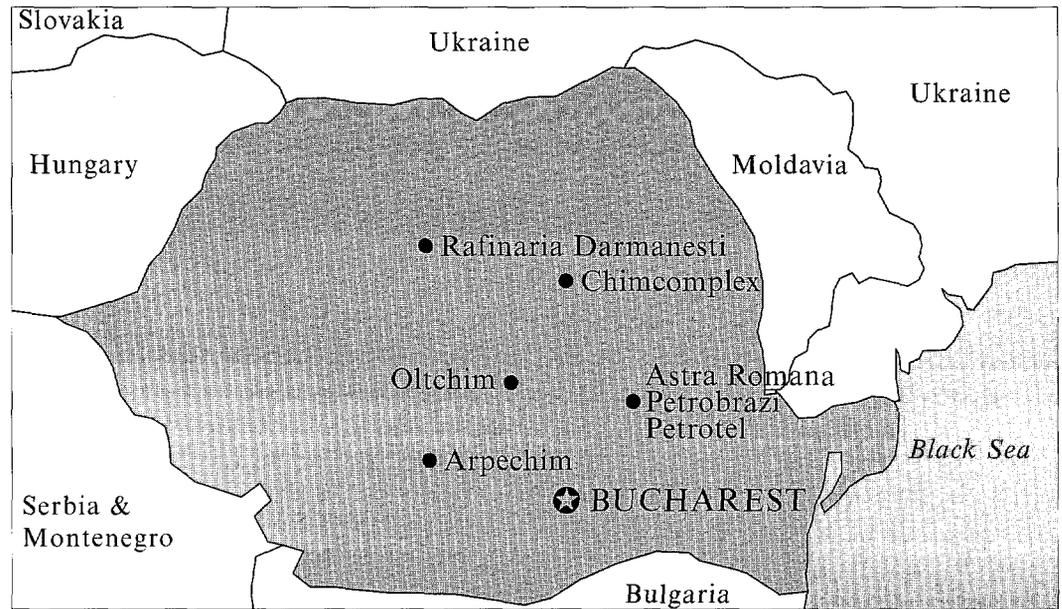
ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generated waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste streams.

ROMANIA



COMPANIES PARTICIPATING IN THE WASTE MINIMIZATION IMPACT PROGRAM

ARPECHIM

PITESTI

ASTRA ROMANA

PLOIESTI

CHIMCOMPLEX

ONESTI

OLTCHIM

RAMNICU VALCEA

PETROBRAZI

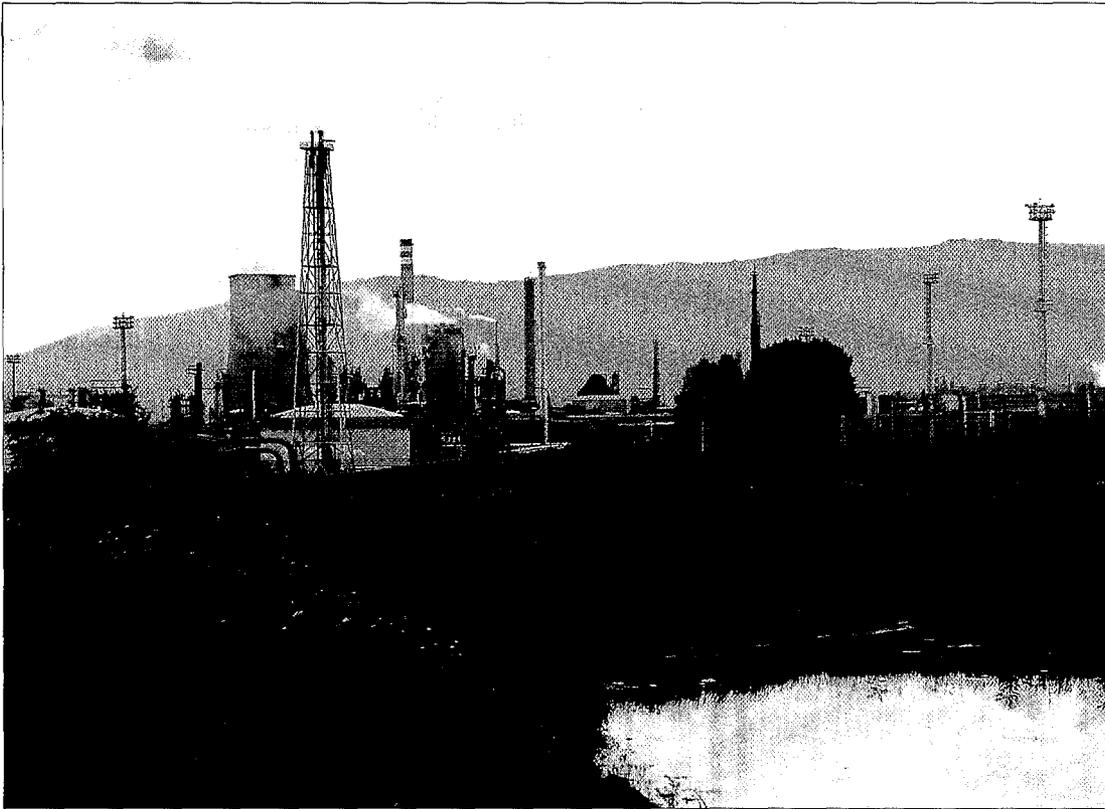
PLOIESTI

PETROTEL

PLOIESTI

RAFINARIA DARMANESTI

DARMANESTI



**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 33**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$2,000 |
| TOTAL YEARLY SAVINGS | \$590,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

The Waste Water Treatment Plant produces a large volume of sludge requiring incineration with resulting pollution problems.

SOLUTION

Total sludge reduced by 20% when using polyelectrolytes as a flocculant prior to dissolved air flotation.

YEARLY SAVINGS RESULTS FROM

Reduced wet sludge cake requiring incineration by 3,700 tons/year has made additional capacity available to burn high heat content tank bottoms that were previously sent off-site as waste. Plus, reduced costs for steam production and calcium hydroxide.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy and Landfill Sites.
OTHER: Reduced generation of sludge and pollutant emissions from Incinerator.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to contaminated emissions.

ROMANIA
CHEMICAL
PROJECT NO. 34

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$1,000 |
| TOTAL YEARLY SAVINGS | \$99,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce the quantities of heavy and light fractions during the distillation of dichloroethane.

SOLUTION

Change the process temperature in the cracking oven.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced sulfur dioxide emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

**ROMANIA
CHEMICAL
PROJECT NO. 35**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$1,500 |
| TOTAL YEARLY SAVINGS | \$72,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Excessive quantities of fresh water are consumed in the hydrogen chloride absorption process in the 2,4D unit.

SOLUTION

Recycle a stream from the acid wash water to the hydrogen chloride absorption step.

YEARLY SAVINGS RESULTS FROM

Reduced costs for fresh water.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.

HEALTH & SAFETY BENEFITS

Reduced exposure to contaminated waste water.

**ROMANIA
CHEMICAL
PROJECT NO. 36**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$2,000 |
| TOTAL YEARLY SAVINGS | \$45,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Distillation bottoms from the Methylene Chloride Facility containing carbon tetrachloride have to be stored until incineration capacity is available.

SOLUTION

Recycle distillation bottoms to another process unit.

YEARLY SAVINGS RESULTS FROM

Reduced costs for incineration.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced carcinogenic emissions from Incinerator.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to carcinogenic emissions.

ROMANIA**REFINERY****PROJECT NO. 37**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$3,000 |
| TOTAL YEARLY SAVINGS | \$37,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Plant presently condenses the vapor stream from the initial warm-up of the coke drums and sends it back to the low grade product storage for recycling to the refinery.

SOLUTION

Revise the process to force the overhead stream back to the vaporizer where it is recycled back to the coke drum.

YEARLY SAVINGS RESULTS FROM

Reduced energy requirements and water required for waste treatment of 750 tons/year, plus improved production efficiency.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy and Fresh Water.

HEALTH & SAFETY BENEFITS

Reduced exposure to pollutant emissions.

ROMANIA

REFINERY & PETROCHEMICAL

PROJECT NO. 38

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$1,500 |
| TOTAL YEARLY SAVINGS | \$33,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce excessive use of steam during the winter months.

SOLUTION

Provide a connection between the refinery and the oil chemistry facilities and use 4 bars steam instead of 16 bars steam.

YEARLY SAVINGS RESULTS FROM

Reduced steam consumption by 4,600 tons.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced emissions from steam boilers.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 39**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$3,500 |
| TOTAL YEARLY SAVINGS | \$30,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce consumption of fresh water in the manufacturing process.

SOLUTION

Recycle the treated waste water by pumping it into the subsurface water that supplies water to the cutting coke system, the cooling system and the coke cooling chambers.

YEARLY SAVINGS RESULTS FROM

Reduced costs for fresh water equivalent to 475 tons/year.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.
OTHER: Reduced waste water by 475 tons/year.

HEALTH & SAFETY BENEFITS

Reduced handling of waste water.

**ROMANIA
CHEMICAL
PROJECT NO. 40**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$2,500 |
| TOTAL YEARLY SAVINGS | \$25,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

In the Linear Alkyl Benzene Plant, the steam-stripping process is used to recover the heavy fractions. This is a difficult process and periodically, problems would result in discharges into the Waste Water Treatment Plant.

SOLUTION

Revise the process to provide a light overhead cut with the heavy bottoms sold as a fuel.

YEARLY SAVINGS RESULTS FROM

Recovery of heavy fractions plus reduced cost for steam generation.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

**ROMANIA
REFINERY
PROJECT NO. 41**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$4,000 |
| TOTAL YEARLY SAVINGS | \$17,000 |
| PAYBACK PERIOD IN MONTHS | 3 |

DESCRIPTION OF PROBLEM

Water drained from the Power Plant is sent back to the Waste Water Treatment Plant because of possible oil contamination from leaks, pipe fractures and oil spills.

SOLUTION

Install an oil separator in the water discharge system to remove the oil at the Power Plant and discharge the water directly into the river.

YEARLY SAVINGS RESULTS FROM

Recovery of the oil from the separator.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

ROMANIA

REFINERY & PETROCHEMICAL

PROJECT NO. 42

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$3,000 |
| TOTAL YEARLY SAVINGS | \$16,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

Implement a procedure to recover 95% of the oil product content of the solids in the storage containers and the API waste water separators by dissolving and dispersing the depositions with a heated solvent.

SOLUTION

Removal of stripped deposits with high oil content was achieved manually in the storage containers and the API waste water separators.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
 OTHER: Reduced discharges of oil products.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous solid waste materials.

ROMANIA**REFINERY****PROJECT NO. 43**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$1,800 |
| TOTAL YEARLY SAVINGS | \$18,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Improve efficiency of the heat exchangers optimization at No. 1 Furfurol Solvation Facility.

SOLUTION

Installation of serial heat exchange devices and change of flows.

YEARLY SAVINGS RESULTS FROM

Reduced costs for energy.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic emissions.

**ROMANIA
CHEMICAL
PROJECT NO. 44**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$8,000 |
| TOTAL YEARLY SAVINGS | \$75,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

In the Trichloroethylene Facility, difficulty with the reactor temperature control limited complete conversion of the tetrachloroethane reactant to 95% and the remaining 5% is lost in subsequent process steps.

SOLUTION

Provide and install a double pipe preheater to develop higher temperatures.

YEARLY SAVINGS RESULTS FROM

Reduced consumption of raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced quantities of organic waste discharged into the waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to organic waste materials.

**ROMANIA
REFINERY
PROJECT NO. 45**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$4,000 |
| TOTAL YEARLY SAVINGS | \$8,000 |
| PAYBACK PERIOD IN MONTHS | 6 |

DESCRIPTION OF PROBLEM

Periodic heat exchanger leaks result in oil in the Coke Plant cooling tower necessitating the need to periodically drain the oil into the waste water treatment system.

SOLUTION

Interim solution, install an oil/water separator at the tower basin to remove oil from the cooling water load. As a permanent solution, all faulty heat exchangers will be replaced.

YEARLY SAVINGS RESULTS FROM

Reduced oil consumption and labor required to periodically drain the basin at the Waste Water Treatment Plant.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced contamination of waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 46**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$178,182* |
| TOTAL YEARLY SAVINGS | \$1,210,000* |
| PAYBACK PERIOD IN MONTHS | 2* |

DESCRIPTION OF PROBLEM

The manufacturing of carbon black leaves traces of product in the residual gas used for steam generation in the process steam boiler. When the steam boiler is shut down, the residual gases escape into the atmosphere.

SOLUTION

Tie-in the individual steam lines into one common header line allowing the residual gases to bypass any particular unit's shut down boiler.

YEARLY SAVINGS RESULTS FROM

Reduced costs for fuel.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to carbon black emissions.

Note: * Totals are for plant's 8 projects, Nos.: 46-53

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 47**

| EQUIPMENT PURCHASED BY COMPANY | FOR TOTALS |
|---------------------------------------|---------------------------|
| TOTAL YEARLY SAVINGS | SEE PROJECT NO. 46 |
| PAYBACK PERIOD IN MONTHS | |

DESCRIPTION OF PROBLEM

Polymer manufacturing generates off-spec pellets, which are usually stored on the ground until removed for destruction. While stored on the ground, the pellets contribute to ground contamination.

SOLUTION

Redesign process equipment and piping to allow for recovery and recycling of the off-spec pellets.

YEARLY SAVINGS RESULTS FROM

Recovery and recycling of product.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced ground contamination.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste materials.

ROMANIA

REFINERY & PETROCHEMICAL

PROJECT NO. 48

| | |
|---------------------------------------|---------------------------|
| EQUIPMENT PURCHASED BY COMPANY | FOR TOTALS |
| TOTAL YEARLY SAVINGS | SEE PROJECT NO. 46 |
| PAYBACK PERIOD IN MONTHS | |

DESCRIPTION OF PROBLEM

The manufacture of dimethylterephthalate results in a viscous residue mixed with more valuable substances that cannot be separated and contributes to ground contamination.

SOLUTION

Incinerate waste to generate steam.

YEARLY SAVINGS RESULTS FROM

Reduced costs for steam generation.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced ground contamination.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste materials.

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 49**

EQUIPMENT PURCHASED BY COMPANY **FOR TOTALS**
TOTAL YEARLY SAVINGS **SEE PROJECT NO. 46**
PAYBACK PERIOD IN MONTHS

DESCRIPTION OF PROBLEM

Waste waters from the production of acrylonitrile contain traces of the final product. The waste waters are presently collected and incinerated creating nitrogen oxide pollutants.

SOLUTION

Redesign the bottom trays in the stripping-recovery column to reduce loss of product in the waste waters.

YEARLY SAVINGS RESULTS FROM

Reduced loss of raw material by 660 tons/year.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic emissions.

ROMANIA

REFINERY & PETROCHEMICAL

PROJECT NO. 50

| | |
|---------------------------------------|---------------------------|
| EQUIPMENT PURCHASED BY COMPANY | FOR TOTALS |
| TOTAL YEARLY SAVINGS | SEE PROJECT NO. 46 |
| PAYBACK PERIOD IN MONTHS | |

DESCRIPTION OF PROBLEM

The chlorine gas from depressurization is vented to a scrubber that converts the chlorine to sodium hypochlorite, which is presently discharged into the waste water system.

SOLUTION

Recover the sodium hypochlorite and recycle for use in the treating of the sodium cyanide waste water.

YEARLY SAVINGS RESULTS FROM

Reduced costs for operating the Waste Water Treatment Plant.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.
OTHER: Reduced generation of waste water.

HEALTH & SAFETY BENEFITS

Reduced exposure to contaminated waste water.

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 51**

| EQUIPMENT PURCHASED BY COMPANY | FOR TOTALS |
|---------------------------------------|---------------------------|
| TOTAL YEARLY SAVINGS | SEE PROJECT NO. 46 |
| PAYBACK PERIOD IN MONTHS | |

DESCRIPTION OF PROBLEM

Methanol vapors are presently released into the environment during the condensation of dimethylterephthalate after the ester paratoluic separation.

SOLUTION

Substitute steam condensate for the methanol as the cooling agent.

YEARLY SAVINGS RESULTS FROM

Reduced methanol consumption by 1,250 tons/year.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced methanol emissions by 1,000 tons/year.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic emissions.

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 52**

| EQUIPMENT PURCHASED BY COMPANY | FOR TOTALS |
|---------------------------------------|---------------------------|
| TOTAL YEARLY SAVINGS | SEE PROJECT NO. 46 |
| PAYBACK PERIOD IN MONTHS | |

DESCRIPTION OF PROBLEM

Petroleum based laboratory samples are disposed of directly into the waste water system and contribute to operating problems in the Waste Water Treatment Plant.

SOLUTION

Segregate laboratory samples and recycle whenever possible.

YEARLY SAVINGS RESULTS FROM

Minimal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced load on waste water treatment system by 3.3 tons/year.

HEALTH & SAFETY BENEFITS

Reduced handling of waste water.

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 53**

EQUIPMENT PURCHASED BY COMPANY FOR TOTALS
TOTAL YEARLY SAVINGS SEE PROJECT NO. 46
PAYBACK PERIOD IN MONTHS

DESCRIPTION OF PROBLEM

The demineralized water that is used as a pump washing and sealing fluid in the acrylonitrile units, contains acrylonitrile and cyanhydric acid derivatives and the resulting waste water must be disposed of by incineration.

SOLUTION

Substitute fresh water for demineralized water.

YEARLY SAVINGS RESULTS FROM

Reduced costs for demineralized water and incineration.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.
OTHER: Reduced nitrogen oxides and sulfur dioxide emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic emissions.

**ROMANIA
REFINERY
PROJECT NO. 54**

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$6,000 |
| TOTAL YEARLY SAVINGS | \$40,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

Recover the thermal energy in the Incinerator stack gas.

SOLUTION

Install a heat exchanger to recover the thermal energy in the Incinerator stack gas.

YEARLY SAVINGS RESULTS FROM

Reduced heating costs by 15%.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced generation of fuel gas emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced pollutant emissions.

**ROMANIA
CHEMICAL
PROJECT NO. 55**

| | |
|---------------------------------------|----------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$20,000 |
| TOTAL YEARLY SAVINGS | \$131,000 |
| PAYBACK PERIOD IN MONTHS | 2 |

DESCRIPTION OF PROBLEM

Reduce the volume of ethylene presently discharged in the off-gas during the manufacture of dichloroethane.

SOLUTION

Chlorine gas will be replaced by chlorine evaporated from liquid chlorine having a higher concentration.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw materials.
OTHER: Reduced discharges of organic materials.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

ROMANIA

REFINERY & PETROCHEMICAL

PROJECT NO. 56

| | |
|---------------------------------------|----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$3,250 |
| TOTAL YEARLY SAVINGS | \$9,000 |
| PAYBACK PERIOD IN MONTHS | 4 |

DESCRIPTION OF PROBLEM

Recycle the oil products in the waste water.

SOLUTION

Install three dams to control the waste waters that are drained into the Teleajen River.

YEARLY SAVINGS RESULTS FROM

Recovered oil products from the waste water.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollution of the river.

HEALTH & SAFETY BENEFITS

Reduced contamination of the waste water.

**ROMANIA
REFINERY
PROJECT NO. 57**

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$10,700 |
| TOTAL YEARLY SAVINGS | \$18,000 |
| PAYBACK PERIOD IN MONTHS | 7 |

DESCRIPTION OF PROBLEM

Reduce energy requirements when motors operate at lower production capacity.

SOLUTION

Provide and install variable frequency drives on all motors.

YEARLY SAVINGS RESULTS FROM

Reduced cost for electrical energy.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced toxic pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

**ROMANIA
REFINERY & PETROCHEMICAL
PROJECT NO. 111**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce the sludge from the Waste Water Treatment Plant.

SOLUTION

Revise the manufacturing process to use the organic polymer flocculation agents at the test stage.

YEARLY SAVINGS RESULTS FROM

Reduced waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to waste materials.

**ROMANIA
REFINERY
PROJECT NO. 112**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Utilize the heat energy from the fuel gas discharged from the four (4) process furnaces.

SOLUTION

Recover the heat from fuel gas and use to preheat the combustion air. Project is now scheduled to be implemented in one (1) furnace.

YEARLY SAVINGS RESULTS FROM

Reduced energy consumption.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced toxic air emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic pollutant emissions.

ROMANIA
REFINERY
PROJECT NO. 113

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Reduce the extensive corrosion in the plant's heat exchangers.

SOLUTION

Provide equipment to remove the sulfur from the fuel gas.

YEARLY SAVINGS RESULTS FROM

Reduced maintenance costs, plus improved production efficiency.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

**ROMANIA
REFINERY
PROJECT NO. 114**

PROJECT IN PROGRESS

MONETARY DETAILS

TO BE FINALIZED

DESCRIPTION OF PROBLEM

Eliminate/reduce excessive crude oil losses due to the high salt content of the incoming crude oil.

SOLUTION

Install a high efficiency emulsion breaker to remove the salt from the incoming crude oil.

YEARLY SAVINGS RESULTS FROM

Reduced crude oil loss.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced contamination of the waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

**ROMANIA
CHEMICAL
PROJECT NO. 115**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

In the Calcium Chloride Facility, the waste water discharged into the waste water sewer contains undissolved solids, resulting in high levels of chloride salt in the waste water.

SOLUTION

Provide equipment to filter out the undissolved solids.

YEARLY SAVINGS RESULTS FROM

Reduced costs for operating the Waste Water Treatment Plant.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced chloride salt levels in the waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic chemicals in the waste water.

**ROMANIA
CHEMICAL
PROJECT NO. 116**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

In the Ferric Chloride Facility, sludge with iron oxide requires disposal.

SOLUTION

Incorporate acid dissolving and filtration to the sludge and return the filtrate to the scrap iron dissolving step.

YEARLY SAVINGS RESULTS FROM

Recovery of product plus a 50% reduction in sludge disposal costs.

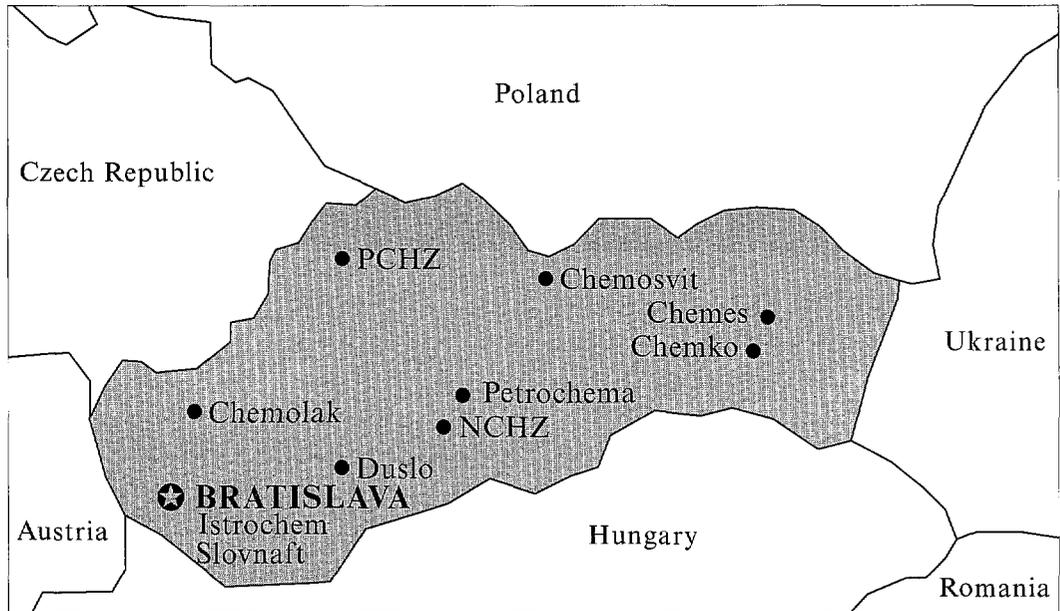
ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of sludge.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous waste materials.

SLOVAKIA



COMPANIES PARTICIPATING IN THE WASTE MINIMIZATION IMPACT PROGRAM

| | |
|--|-------------------|
| CHEMES | HUMENNE |
| CHEMKO | STRAZSKE |
| CHEMOLAK | SMOLENICE |
| CHEMOSVIT | SVIT |
| DUSLO | SALA |
| ISTROCHEM | BRATISLAVA |
| NOVACKE CHEMICKE ZAVODY (NCHZ) | NOVAKY |
| PETROCHEMA | DUBOVA |
| POVAZSKE CHEMICKE ZAVODY (PCHZ) | ZILINA |
| SLOVNAFT | BRATISLAVA |



SLOVAKIA
CHEMICAL
PROJECT NO. 58

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$2,500 |
| TOTAL YEARLY SAVINGS | \$126,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce ink wastes that are generated in roller troughs during equipment clean-up operations.

SOLUTION

Initiate procedure to segregate and recycle waste ink.

YEARLY SAVINGS RESULTS FROM

Recycling of ink, plus reduced waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Cleaner work station.

SLOVAKIA
CHEMICAL
PROJECT NO. 59

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$3,000 |
| TOTAL YEARLY SAVINGS | \$86,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

In the Multadit OB process, the unreacted oxide requires disposal.

SOLUTION

Utilize existing centrifuge to recover the unreacted zinc oxide and recycle it back to the neutralization step.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced handling of waste materials.

SLOVAKIA
CHEMICAL
PROJECT NO. 60

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$2,000 |
| TOTAL YEARLY SAVINGS | \$70,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce landfill requirements for solid waste products that include: paper; rags; plastics; steel; rubbish; etc. In 1994, plant generated and disposed of approximately 4,500 tons of solid waste in landfills at a cost of \$70,000, and estimates that the cost will be \$95,000 in 1995.

SOLUTION

Implement a waste minimization program to recover and recycle solid waste in the plant by segregating at the source and using the services of outside recyclers for handling the paper, glass and steel waste.

YEARLY SAVINGS RESULTS FROM

Recovery and recycling of waste materials, plus reduction in waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced handling of waste materials.

SLOVAKIA

CHEMICAL

PROJECT NO. 61

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$1,500 |
| TOTAL YEARLY SAVINGS | \$53,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce raw material and disposal costs resulting from the flexographic printing process. During printing operations, ink residues are generated in the roller vanes and during clean-up operations.

SOLUTION

Implement the procedure to recover, segregate and recycle the ink in the waste residue.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Cleaner work area.

SLOVAKIA
CHEMICAL
PROJECT NO. 62

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$3,500 |
| TOTAL YEARLY SAVINGS | \$38,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

The oil additive, Multadit OB, is manufactured by reacting zinc oxide with the reaction product of alcohol and thiophosphoric acid.

SOLUTION

Revise the manufacturing process to add zinc oxide in powder form to the neutralizer.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials, equivalent to approximately 100 tons/year of ethanol, and waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
 OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste materials.

SLOVAKIA
CHEMICAL
PROJECT NO. 63

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$3,500 |
| TOTAL YEARLY SAVINGS | \$123,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce the quantities of heated wash water and process chemicals in the 14-step countercurrent wash of the final viscose rayon product.

SOLUTION

Revise the process and operating procedures, establish/implement a preventative maintenance program and monitor chemical concentrations during the manufacturing process.

YEARLY SAVINGS RESULTS FROM

Reduced required heated wash water by 53,000 tons/year.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy and Fresh Water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic chemicals.

SLOVAKIA
CHEMICAL
PROJECT NO. 64

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$2,500 |
| TOTAL YEARLY SAVINGS | \$21,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Eliminate/reduce film waste generated during the manufacture of film packaging that is normally incinerated.

SOLUTION

Segregate the waste material at the point where generated and then recycle.

YEARLY SAVINGS RESULTS FROM

Recycling of waste, plus reduced waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved air quality due to reduced emissions from waste incineration.

SLOVAKIA

CHEMICAL

PROJECT NO. 65

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$5,000 |
| TOTAL YEARLY SAVINGS | \$17,000 |
| PAYBACK PERIOD IN MONTHS | 4 |

DESCRIPTION OF PROBLEM

In the oil additives facility, reduce the molar excess of alcohol used in the reaction process involving thiophosphoric acid and alcohols.

SOLUTION

Revise manufacturing procedure from a continuous to batch process.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous materials.

SLOVAKIA
CHEMICAL
PROJECT NO. 66

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$21,200 |
| TOTAL YEARLY SAVINGS | \$300,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

Reduce/eliminate ground water contamination.

SOLUTION

Establish a mitigation program by drilling 700 test wells to monitor the extent of groundwater contamination. Also, install a system of wells to allow the pumping of the polluted water into a Waste Water Treatment Plant that includes chemical, biological and solids separation. The hazardous waste solids would be incinerated.

YEARLY SAVINGS RESULTS FROM

Reduced costs for cooling water and disposal of waste water.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Fresh Water.

OTHER: Reduced contaminated waste water by 80% and generation of hazardous wastes.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to hazardous waste materials.

SLOVAKIA

CHEMICAL

PROJECT NO. 67

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$1,800 |
| TOTAL YEARLY SAVINGS | \$19,000 |
| PAYBACK PERIOD IN MONTHS | 1 |

DESCRIPTION OF PROBLEM

In the viscose rayon process, carbon disulfide is batch reacted with alkali cellulose in water cooled tanks with the excess, unreacted carbon disulfide, removed as a gas under vacuum.

SOLUTION

Revise process to decrease the initial charge of carbon disulfide without affecting product quality.

YEARLY SAVINGS RESULTS FROM

Reduced consumption of carbon disulfide by 53 tons/year.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced pollutants discharged into the air by 53 tons/year.

HEALTH & SAFETY BENEFITS

Improved air quality due to reduced exposure to pollutant emissions.

SLOVAKIA
CHEMICAL
PROJECT NO. 68

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$4,500 |
| TOTAL YEARLY SAVINGS | \$7,000 |
| PAYBACK PERIOD IN MONTHS | 8 |

DESCRIPTION OF PROBLEM

Reduce emissions of carbon monoxide and nitrogen oxide resulting from using oil or gas as a fuel. Plant is located in a pristine area and is therefore subject to stringent pollutant emission limits.

SOLUTION

Improve thermal efficiency by switching to natural gas and improving combustion efficiency. Modifications in one boiler unit resulted in an improvement of 0.5% in thermal efficiency, plus a savings in fuel costs. Plant intends to implement the same program in the ten other boilers, which would result in a savings of \$77,000.

YEARLY SAVINGS RESULTS FROM

Reduction in fuel costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced carbon monoxide and nitrogen oxide emissions.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced pollutant emissions.

SLOVAKIA

CHEMICAL

PROJECT NO. 69

| | |
|---------------------------------------|---------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$1,500 |
| TOTAL YEARLY SAVINGS | \$7,000 |
| PAYBACK PERIOD IN MONTHS | 3 |

DESCRIPTION OF PROBLEM

Reduce cost for disposing of approximately 4,500 tons/year of alkali sludge.

SOLUTION

Sell sludge as a fertilizer.

YEARLY SAVINGS RESULTS FROM

Sale of sludge as fertilizer, plus reduced waste disposal costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to alkali sludge.

SLOVAKIA
CHEMICAL
PROJECT NO. 70

| | |
|---------------------------------------|-----------------|
| EQUIPMENT PURCHASED BY COMPANY | \$10,000 |
| TOTAL YEARLY SAVINGS | \$27,000 |
| PAYBACK PERIOD IN MONTHS | 5 |

DESCRIPTION OF PROBLEM

Eliminate/reduce generation of paper bags contaminated with raw material powders and requiring incineration when a waste product.

SOLUTION

Recover and recycle clean bags.

YEARLY SAVINGS RESULTS FROM

Recovery and recycling of paper bags, plus reduced incineration costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality due to reduced pollutant emissions from the Incinerator.

SLOVAKIA
CHEMICAL
PROJECT NO. 71

| | |
|---------------------------------------|-------------------|
| EQUIPMENT PURCHASED BY COMPANY | EST. \$500 |
| TOTAL YEARLY SAVINGS | \$2,000 |
| PAYBACK PERIOD IN MONTHS | 3 |

DESCRIPTION OF PROBLEM

Reduce the waste residue generated in producing calcium milk by the slaking of lump lime. A significant amount of residue is generated due to the high levels of inert impurities present in the solid lime. At the present time the residue waste is disposed of in landfills.

SOLUTION

Use solid lime with only 0.2% of inert material content instead of the present 9%.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Landfill Sites.
OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to toxic wastes.

SLOVAKIA
CHEMICAL
PROJECT NO. 72

| | |
|---------------------------------------|------------------|
| EQUIPMENT PURCHASED BY COMPANY | \$130,000 |
| TOTAL YEARLY SAVINGS | \$175,000 |
| PAYBACK PERIOD IN MONTHS | 9 |

DESCRIPTION OF PROBLEM

Reduce quantity of waste in the organic vapor stream requiring incineration.

SOLUTION

Distill the waste organic stream instead of incinerating.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and incineration.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to pollutant emissions.

SLOVAKIA
CHEMICAL
PROJECT NO. 117

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

Plant presently burns brown coal in their boilers resulting in excessive quantities of fly ash with particulate emissions.

SOLUTION

Improve boiler efficiency by providing appropriate control equipment to monitor sulfur dioxide, nitrogen oxide and ash content of the emissions.

YEARLY SAVINGS RESULTS FROM

Reduced fuel costs.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Energy.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality due to reduced pollutant emissions.

**SLOVAKIA
CHEMICAL
PROJECT NO. 118**

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

Reduce the waste water contaminated with various levels of PVAC emulsion.

SOLUTION

Develop an ultrafiltration method for concentrating the waste to 20% PVAC. Plan to investigate possibility of selling or recycling waste product.

YEARLY SAVINGS RESULTS FROM

Reduced costs for waste disposal, plus sale of waste product.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Fresh Water.
OTHER: Improved water quality due to reduced contamination of the waste water.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to contaminated waste water.

SLOVAKIA
CHEMICAL
PROJECT NO. 119

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

At the anti-oxidant unit, eliminate/reduce emissions contaminated with chlorine.

SOLUTION

Investigate the possibility of utilizing catalytic incineration with caustic scrubbing to minimize emissions.

YEARLY SAVINGS RESULTS FROM

To be determined.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials.
OTHER: Reduced chlorine contaminated emissions.

HEALTH & SAFETY BENEFITS

Improved air quality due to reduced pollutant emissions.

SLOVAKIA
CHEMICAL
PROJECT NO. 120

PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED

DESCRIPTION OF PROBLEM

In manufacturing polyamide, significant amounts of residue are formed in the reactor. In addition, the caprolactam water solution contains impurities that are adsorbed on the carbon beds. Both the residues and spent carbon require disposal in landfills.

SOLUTION

Reduce residues and impurities by: improving quality of the raw materials, using steam for the regeneration of carbon, and optimizing of the manufacturing process.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and waste disposal.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Landfill Sites.

OTHER: Reduced generation of waste.

HEALTH & SAFETY BENEFITS

Improved working conditions due to reduced exposure to a carcinogenic pollutant.

SLOVAKIA

CHEMICAL

PROJECT NO. 121

**PROJECT IN PROGRESS
MONETARY DETAILS
TO BE FINALIZED**

DESCRIPTION OF PROBLEM

In manufacturing methylmethacrylate and polymethylmethacrylate, liquid wastes are generated from the organic residues during the rectification period and from the organic layer of storage tanks of the waste sulfuric acid. In addition, solid wastes are developed in the esterification reactor and the storage tanks of the sulfuric acid wastes. Both types of waste require disposal by incineration.

SOLUTION

Combine the waste acid with sulfur to produce sulfur dioxide to be used in the process and add an inhibitor during the amidation step.

YEARLY SAVINGS RESULTS FROM

Reduced costs for raw materials and incineration.

ENVIRONMENTAL BENEFITS

CONSERVED NATURAL RESOURCES: Raw Materials and Energy.
OTHER: Reduced pollutant emissions.

HEALTH & SAFETY BENEFITS

Improved air quality and working conditions due to reduced exposure to toxic wastes and pollutant emissions.

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