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ECONOMIC AND ENVIRONMENTAL
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IN BULGARIA, CZECH REPUBLIC,
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and SLOVAKIA

Progress Report #1

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 Es -- environment, energy education and economics Through three complementary programs - the International Environment Forum (IEF) the International Environment and Development Service (IEDS) and the WEC Gold Medal for International Corporate Environmental Achievement - WEC serves as a bridge for exchange of information and expertise among the industry government non-governmental organizations and the community WEC is headquartered in New York City with offices in Bangkok Jakarta, Mexico City, Prague and Washington, D C

In its waste minimization programs WEC uses experts from U S organizations including the following companies that participate in the International Environment Forum

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ECONOMIC AND ENVIRONMENTAL BENEFITS OF INDUSTRIAL WASTE MINIMIZATION IN BULGARIA, CZECH REPUBLIC, HUNGARY, ROMANIA AND SLOVAKIA

Progress Report #1

1995

The WEC Waste Minimization Program is being implemented by a number of people and organizations Funds are provided to the program through a cooperative agreement with the United States Agency for International Development (USAID) Special thanks go to Mr Michael Kalinoski, Industrial Pollution Specialist USAID, Washington D C , the Ministries of Environment and the Ministries of Industry for Bulgaria Czech Republic Hungary, Romania and Slovakia and the employees of the companies participating in the WEC Waste Minimization Program

Milan Holub a journalist cooperating with Trend Papers clearly identified the long-term objective of the program in a report on the closing ceremony for a waste minimization demonstration project at Petrochema Dubova in Slovakia " *I would like to stress that the ecological revenue of the project is the priority, says Ing Jozef Sureb Production and Technical Director at Petrochema Dubova There is nothing in this statement to disagree with It is also proper to say that the WEC program, with the objective to provide assistance to the countries of Central and Eastern Europe in the sphere of harmful waste minimization has much wider impacts It radically changes the way in which people think about economy and ecology and it helps find a proper balance between the values of human life, allowing both individuals and the whole society to live a much better life* "

Should additional information be required please contact the WEC staff (see next page) in New York, the WEC In-Country Coordinator or the Pollution Prevention Center, in their respective countries

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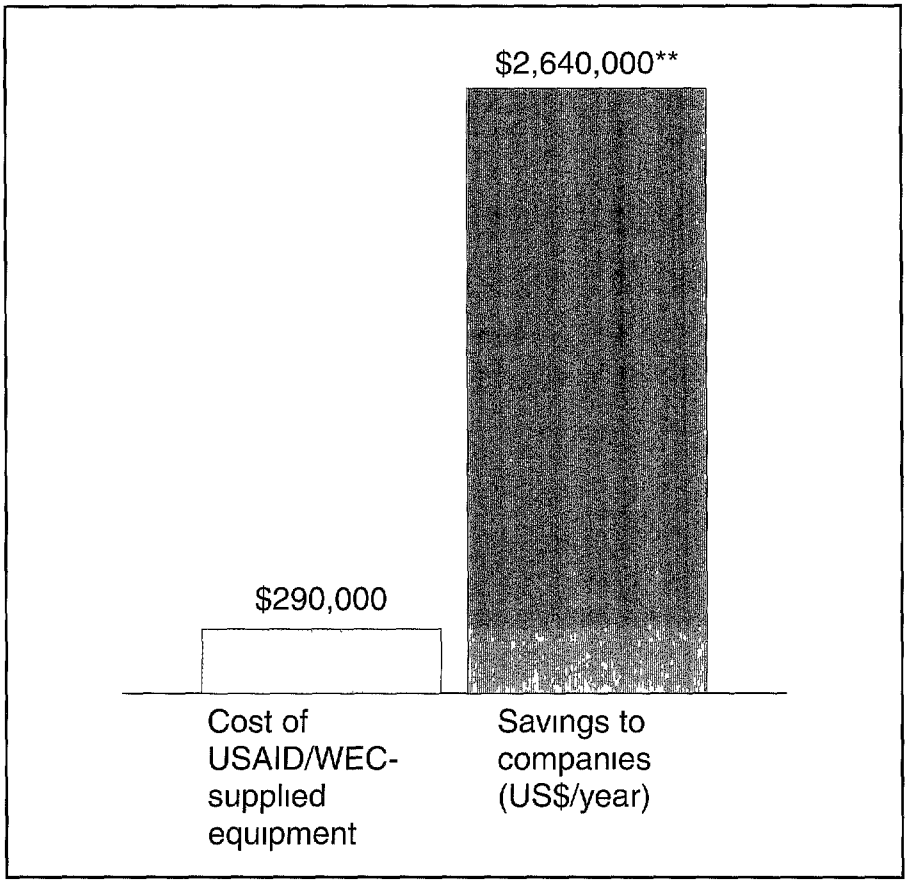
WASTE MINIMIZATION DEMONSTRATION PROJECT SUMMARY

The objective of the Waste Minimization Demonstration Project (WMDP) is to show managers and factory personnel that the concept of waste minimization works This pollution prevention concept of stopping or reducing pollution at its source, rather than treating it after the waste is generated results in decreased pollution, increased economic benefits, and reduced worker and community exposure to hazardous substances

The investment cost contained in this report refers only to the cost of the monitoring equipment supplied by WEC Payback period' refers to the recovery of the cost of the monitoring equipment only

The success of the WMDP has been communicated to other companies WEC developed the Waste Minimization Impact Program (WMIP) to incorporate those additional companies into the program The WMIP report is contained in the next section

Figure 1 Summary of Investments and Economic Benefits of Waste Minimization Demonstration Projects at 12 Plants*



* Twelve of the 13 participating companies have completed projects

** In one project the savings was $1,000,000

Figure 2 Estimates of Environmental Benefits of Waste Minimization Demonstration Projects at 12 Plants*

Environmental Media	Pollution Reduction (metric tons/year)
Air	5 827
Water	50 016**
Land	185**

* Twelve of the 13 participating companies have completed projects

** Incomplete data

Company	**Neftochim**	**City**	**Bourgas**
Industry	**Refinery & Petrochemical**	**Country**	**Bulgaria**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
30,300	570,000	2 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Volatile Organic Compounds	2,800 ton/year	-	-

Company Profile

The Neftochim complex is Bulgaria s largest petroleum and chemical facility It consists of an oil refinery and numerous downstream chemical operations The refinery process ten types of heavy crude imported from several countries

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in July 1993 The WEC team and Neftochim management selected the reduction of VOC emissions from equipment leaks

Equipment Organic vapor analyzer

Completion Date October 1995 (projected)

Company Pharmacia, A D
Industry Pharmaceutical

City Dupnica
Country Bulgaria

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
15,300	30,000	6 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Improve production of Vitamin C	-	5%	-

Company Profile

Pharmacia A D one of the three state owned manufacturers of pharmaceuticals in Bulgaria is located in the city of Dupnica approximately 70 kilometers southwest of Sofia The plant has been in operation since 1954 manufacturing numerous medical and health care products Manufacturing activities include both the chemical synthesis of active ingredients and the formulation of medicines

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in February 1994 The WEC and Pharmacia management targeted improvement of the process control in selected operations for manufacturing Vitamin C with the goal of reducing waste generation and increasing production yield

Equipment Densitometer

Completion Date November 1995 (projected)

Company	**Svilosa Company**	**City**	**Svistov**
Industry	**Chemical Fiber**	**Country**	**Bulgaria**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
12,400	50,000	3 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Carbon disulfide & hydrogen sulfide	90 ton/year	-	-

Company Profile

Svilosa Company founded in 1966 is located south of the Danube River Svilosa Company manufactures approximately 5 000 metric tons of textile-grade rayon per year It is the only manufacturer of rayon in Bulgaria Most of the rayon produced at Svilosa is targeted for export

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in October, 1993 The WEC team and Svilosa management selected the improvement of air quality in the Spinning Hall The goal is to reduce carbon disulfide and hydrogen sulfide releases in the Spinning Hall

Equipment Photoionization detector

Completion Date October 1995 (projected)

Company	**Chemopetrol**	**City**	**Litvinov**
Industry	**Refinery & Petrochemical**	**Country**	**Czech Republic**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
19,400	100,000	2 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Volatile Organic Compounds	970 ton/year	-	-

Company Profile

Chemopetrol is the largest refinery and petrochemical complex in the Czech Republic Primary products from the Chemopetrol refinery include gasoline diesel and fuel oils asphalt kerosene lube base stock LPG hydrogen gas aromatics (toluene and xylene) naphtha and sulfur

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in September 1992 The WEC team and Chemopetrol management selected the reduction of fugitive volatile organic compounds (VOCs) in the oil refinery

Equipment Organic vapor analyzer
Data logging monitor

Completion Date September 1993

Company	**Spolana A S**	**City**	**Neratovice**
Industry	**Chemical**	**Country**	**Czech Republic**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
26,000	300,000	1 month

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Volatile Organic Compounds	47 tons/year	-	-

Company Profile

Spolana A S is a chemical plant on the banks of the Elbe River approximately 35 kilometers north of Prague The plant produces pentachlorophenol and 2 4 5-T The products manufactured at Spolana A S include caprolactum (capacity of 40,000 tons/year) and viscose rayon (capacity of 40 000 tons/year)

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in October 1993 The WEC team and Spolana management selected the reduction of volatile organic compounds (VOCs) and ammonium sulfate into the air

Equipment Photoionization detector
On-line density meter

Completion Date November 1995 (projected)

Company	**Borsodchem Rt**	**City**	**Kazincbacika**
Industry	**Chemical**	**Country**	**Hungary**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
11,300	144,000	2 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Vinyl Chloride Monomer	240 ton/year	-	-

Company Profile

Borsodchem Rt established in 1949 manufactures plastics and chemicals and is located in the city of Kazincbarcika The company s main products are polyvinyl chloride (PVC) vinyl chloride monomer (VCM) chlorine and sodium hydroxide (chlor-alkali) and other polymers and chemicals as well as extruded products made of PVC

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in April 1994 The WEC team and Borsodchem management targeted the PVC plant The goal was to recapture VCMs released into the air from the steam stripper column

Equipment Thermoparamagnetic oxygen system analyzer
Sample conditioning system

Completion Date June 1995

Process Efficiency and Reduced Emissions

Company Magyar Viscosagyar
Industry Chemical Fiber
City Nyergesujfalu
Country Hungary

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
18,600	29,000	8 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Acrylic Powder	10 tons/year	16 tons/year	-

Company Profile

Magyar Viscosagyar (Viscosa) founded in 1941 is approximately 50 kilometers northwest of Budapest in the town of Nyergesujfalu adjacent to the Danube River Viscosa produces synthetic fiber products including acrylic fibers (comprising 60% of the plant s output) nylon 6 fiber carboxyl-methyl cellulose-Na and fabricated products such as nets screens and filter membrane modules

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in November 1993 The WEC team and Viscosa management selected the reduction of air emissions in the polymer powder dryer process

Equipment Continuous particulates monitor
Air velocity meter

Completion Date February 1995

Company	**Perion Akkumulatorgyar Rt**	**City**	**Budapest**
Industry	**Battery Manufacturing**	**Country**	**Hungary**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
26,000	72,000	5 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Potable Water	-	50,000 m^3/year	-

Company Profile

Perion Akkumulatorgyar Rt established over 100 years ago in Budapest Hungary is the largest producer of lead acid batteries in Hungary The company employs 650 people nationwide with 500 at the Budapest manufacturing facility

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in August 1993 The WEC team and Perion management chose the reduction of water usage including a decrease of wastewater flow and a reduction of quantitites of lead released into the environment

Equipment

Automatic wastewater samplers
Flowmeters for measuring water flows
Toxic gas detector and dyes for mapping waterflows

Completion Date March 1995

Company	**Acumulatorul S A**	**City**	**Bucharest**
Industry	**Battery Manufacturing**	**Country**	**Romania**

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
30,000	150,000	180,000	1,000,000	3 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Lead Oxide	1,300 ton/year	-	-

Company Profile

Acumulatorul S A the largest producer of lead acid batteries in Romania is located on the outskirts of Bucharest The Acumulatorul complex covers an estimated 35 acres and is a vertically integrated manufacturer of lead acid batteries for starting lighting, ignition stand by power railroad and motive power applications

The plant produces its own lead oxide from ingot and its own PVC battery plate separators The plant also recycles its own plant scrap in reverbatory furnances

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project in March 1993 The WEC team and Acumulatorul management identified the following two projects 1) to reduce emissions from lead oxide production and transport systems and 2) to improve ventilation in the battery assembly plant

Equipment

Vacuum system
Filter bags
Air sampling equipment
Air purifying respirators

Completion Date March 1995

Company	**Arpechim S A**	**City**	**Pitesti**
Industry	**Refinery & Petrochemical**	**Country**	**Romania**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
34,500	185,000	2 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Hydrocarbons	-	20%	-

Company Profile

Arpechim S A is a major refinery and petrochemical facility in the city of Pitesti approximately 110 kilometers west of Bucharest The facility has two atmospheric and vacuum distillation units that can process up to 3 5 million tons of crude per year It produces a wide range of petroleum products and feedstocks for the petrochemical industry

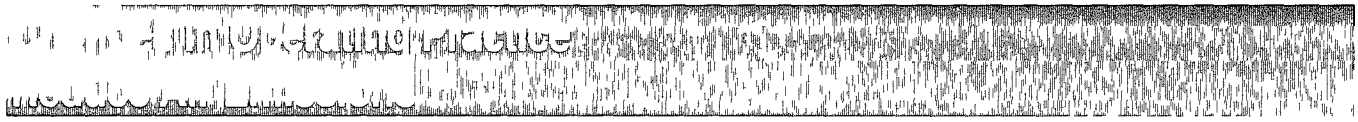
Waste Minimization Project

A WEC team and Arpechim management identified and initiated a waste minimization demonstration project The goal was to reduce the organic and inorganic contamination of steam A study of Arpechim records showed that approximately 70% of all condensate was diverted to the Arges River as a result of hydrocarbon contamination problems

WEC purchased and provided Arpechim with a total carbon analyzer in the condensate return to significantly reduce reaction time associated with Arpechim s present technique of manual sampling

Equipment Total carbon analyzer

Completion Date July 1995



Company Chemko Strazske
Industry Inorganic & Organic Chemical

City Strazske
Country Slovakia

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
8,300	125,000	1 month

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Volatile Organic Carbon	300 ton/year	-	-

Company Profile

Chemko Strazske is located in the easternmost part of the Slovakia approximately 60 kilometers from the Hungarian Polish and Ukrainian borders It was established in 1952 and presently produces 49 different products in 14 organic and eight inorganic production plants Chemko s major products are cyclohexanone urea and formaldehyde glues and nitric acid

Waste Minimization Project

A WEC team initiated a waste minimization demonstration project at Chemko Strazske in March 1993 The WEC team and Chemko management selected the cyclohexanone plant for the WMDP The goal was to reduce fugitive organic emission losses at the plant

Equipment Organic vapor analyzer

Completion Date October 1994

Improvements in Operating Practices at White Oil Plant

Company	**Petrochemia**	**City**	**Dubova**
Industry	**Petrochemical**	**Country**	**Slovakia**

Economic Benefits

USAID Investment	Savings (US$ / Year)	Pay Back Period
26,000	35,000	9 months

Environmental Benefits

Material	Reductions in Environmental Releases		
	Air	Water	Land
Sulfur dioxide	70 ton/year	-	185 ton/year

Company Profile

Petrochema is located in the westernmost part of Slovakia in the town of Dubova Products manufactured by the plant include propellants fuel oils dark oils transformer and condensor oils corrosion inhibited oils form oils refigerator oils agents for metal working and cutting white oil and textile auxiliary agents

Waste Minimization Project

WEC team and Petrochema management selected the White Oil Plant for the waste minimization demonstration project (WMDP) Two projects were identified 1) optimization of sulfur trioxide production and 2) neutralization of gourdron sludge to reduce the sulfur dioxide emission thereby complying with the new regulatory permit requirements

Equipment

SO_2 Analyzer
Heated Stack Filter
Sample Probe and Sample Cooler
Heat Line Hose

Completion Date October 1994

WASTE MINIMIZATION IMPACT PROGRAM IN BULGARIA, CZECH REPUBLIC, HUNGARY, ROMANIA AND SLOVAKIA

WASTE MINIMIZATION IMPACT PROGRAM SUMMARY

The objective of the Waste Minimization Implementation Program (WMIP) is to build, on the successful waste minimization demonstration projects a program for the expansion of waste minimization throughout the industry of each country

This is now being accomplished through training programs, the activities of the WEC Pollution Prevention Centers the WEC In-Country Coordinators' efforts the Ministries of Environment and Industry and the USAID missions

The first expansion of the program is in progress throughout the chemical/refinery sector of each country

Between October 23 and November 13th representatives from the companies participating in the WMIP will give a presentation in their respective countries about their implementation of the WEC Waste Minimization Program All major manufacturers in each country identified by the Ministry of Industry have been invited Also invited will be local Ministry of Environment Inspectorates consultants, research institutes and universities At these meetings invited companies will be requested to join the program thereby expanding it to a majority of (if not all) major manufacturers in the country

This report is the first of a series about the implementation of the WEC Ten-Point Waste Minimization Program, which requires minimal investment cost The information on the progress of the implementation of the WEC Waste Minimization Program at each company was obtained by WEC experts, who are familiar with the WEC approach and who were visiting the companies for the first time

In the preceding section on the waste minimization demonstration projects the manufacturing process and the measurable results of reduced pollution and economic benefit are readily attainable because of WEC s direct involvement in each project WEC provided environmental monitoring equipment and U S experts to assist participating companies in implementing waste minimization demonstration projects

The companies in the WMIP are implementing their own programs based on a study tour to the U S and two workshops At the conclusion of these workshops, WEC requested the companies to accomplish three assignments

1 To have the General Director issue a policy statement on waste minimization

2 To prepare a company-wide waste minimization implementation program by identifying waste minimization teams for appropriate areas of their factories

3 To begin the program by having one team identify five small projects which could be fully implemented within ninety days

The following pages report on the initial state of the implementation program at those companies

All General Directors have issued, or are actively developing a company policy statement on waste minimization There is some reluctance to issuing policy statements because of poor acceptance under former regimes Several companies have moved to organize company-wide waste minimization teams Others are in the process of doing so and a few need further encouragement

All are involved in projects which are a result of the WMIP It should be noted that most of the companies had begun some sort of environmental program before the WEC Waste Minimization Program was introduced However the companies credit the systemic approach of the WMIP for helping them better organize their own programs

The reader will note some projects are simple and the solution appears obvious However the problems now being corrected by the WMIP have existed for years and were not previously addressed until the implementation of the WMIP

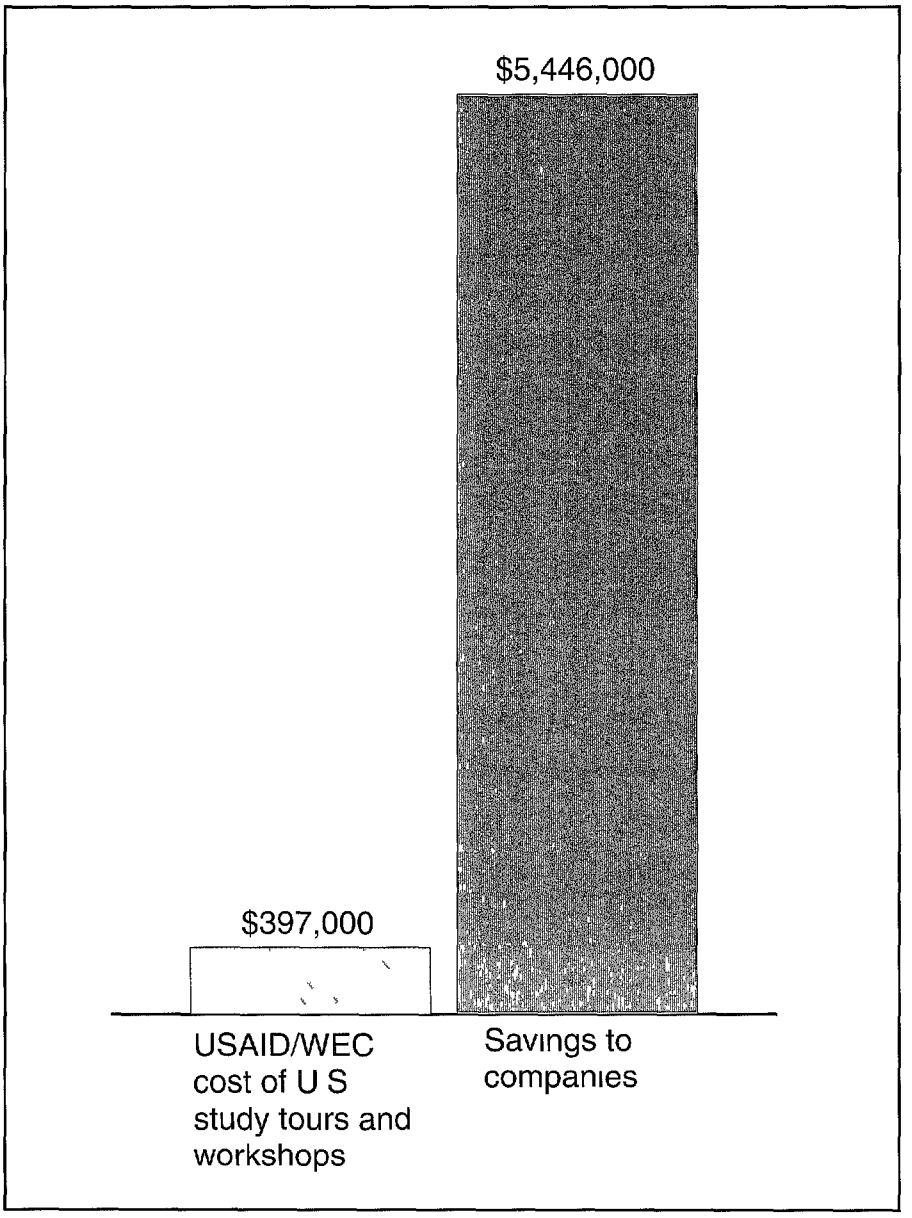
An important aspect of the WMIP is that factory workers are being educated to the value of small projects, i e , ones that may produce only a $500 savings per year and reduce a small amount of pollution However these are important because *thousands* of these small projects can be accomplished at little or no cost in a very short timeframe When these small projects are totaled at year-end the cumulative results are very impressive

Some projects do not list monetary savings This is a new concept for many of the workers and it will require a period of familiarization before this effective piece of information is routinely included in reports WEC expects that in future progress analysis more precise cost savings will be researched and recorded as workers gain more experience in waste minimization

In the interests of confidentiality and cooperation with participants WEC has not identified company names presented in this section of the report Therefore, they will be labeled by industry sector (such as 'chemical ' etc) and a letter i e A B C etc

It is recognized it will require several years for the program to become fully implemented at a company However all the companies presented in this report are committed to the program and most are making good progress in this initial phase of the WMIP There are some excellent examples One company is committing $10 000 000 to its environmental program Its waste minimization projects range from no cost to $220,000 Another company provides financial rewards to its employees sharing the savings generated from its waste minimization program in the form of bonuses

Figure 3 Summary of Investments and Economic Benefits of Waste Minimization Impact Projects at 12 Plants*



* Thirty of the 39 participating companies have provided reports on a total of 121 projects (completed, in progress or in planning stage) Savings indicated are those realized or projected by 15 companies As the WMIP progresses and more companies report environmental benefits, savings and investment costs will become more defined

WEC Ten-Point Waste Minimization Program

Approach and Timing

The acceptance and implementation of waste minimization by the chemical/refinery sector in each country indicates the program will be successfully expanded throughout the industry of each country

Approach

Waste and its cost should be clearly identified on the product's cost sheet

Waste minimization is best accomplished by applying common sense logic and a systematic approach to a problem The key to being effective is to research and compile correct information about the waste and its causes before applying a solution This process requires that appropriate people be involved in identifying the solution and is therefore, greatly enhanced by the involvement of 'teams

Timing

Waste minimization teams at companies must accept that not all projects can be accomplished at once The program should be divided into phases that correspond with the time necessary to start and complete an individual project

- For example, changes in job practices or procedures routinely applied in cleaning a process vessel can be changed immediately literally ***today***
- Something more involved, i e , changing the piping on a process vessel to reduce waste may require design procurement of materials fabrication and waiting for installation will require a completion date into the future - ***tomorrow or next month***
- Finally a major process change or the use of new ingredients may require considerable advance planning and budget consideration Such long-range plans are logistically projected well into the ***future***

These three time periods are logical divisions that WEC recommends companies adopt as a part of their program

Ten Points of the WEC Waste Minimization Program
Develop a Policy and Management Commitment
Establish the Waste Minimization Organization and Select a Site Steering Team
Divide the Plant Into Logical Areas for the Creation of Area Teams
Develop and Train the Area Teams
Identify and Account for the Waste
Cost Accounting
Establish Initial Priorities and Goals
Waste Minimization Analysis and Planning
Schedule for Implementation
Follow-up

BULGARIA

The following companies have agreed to participate in the WEC Waste Minimization Impact Program

CHIMCO

Chimco is located in the northwestern part of Bulgaria, near the town of Vratza Built in 1964 it produces ammonia argon catalysts for ammonia production, urea and a large range of gases for example krypton, welding gas mixtures and xenon Chimco has approximately 2,200 employees

NEOCHIM

Neochim is located in Dimitrovgrad Built in 1951 it produces ammonia, ammonium nitrate sulfuric acid and urea-formaldehyde There are approximately 3 200 employees

ORGACHIM

Orgachim is located in Rousse Built in 1901 Orgachim produces over 120 products including alkyd resins, amino resins electro-insulating varnishes, phtalatic and malefic anhydrides, plasticizers and polyester resins

PETAR KARAMINCHEV LTD

Petar Karaminchev Ltd is also located in Rousse Begun in 1928 as a small factory for the production of rubber articles it now produces a range of PVC products, including films, flooring upholstery and wall covering

SOPHARMA

Sopharma is located in Sofia Built in 1933 the Company now has four principle product lines They are pharmaceutical products, phytochemical products with a wide range of extracts and tinctures biotechnological products and finished products including tablets, ampoules, etc

PHARMACIA

Pharmacia is one of Bulgaria s three state-owned pharmaceutical manufacturers, located in Dupnica approximately 70 kilometers southwest of Sofia In operation since 1954 the Company manufactures numerous medical and health care products Manufacturing activities include both the chemical synthesis of active ingredients and the formulation of medicines

SVILOSA

Svilosa is located south of the Danube River in Svishtov Begun in 1966 the Company manufactures approximately 5 000 metric tons of textile-grade rayon per year It is the only plant manufacturing rayon in Bulgaria Most of the rayon produced in Svilosa is exported

VIDACHIM

Vidachim is located in Vidin and produces polyamide granulates and fibers, technical fabrics and tires for trucks and buses It exports to Africa, Asia Europe and South America

NEFTOCHIM

The Neftochim complex in Bourgas is Bulgaria's largest petroleum and chemical facility It consists of an oil refinery and numerous downstream chemical operations It refines three types of gasoline two types of diesel fuel fuel oil jet fuel and road bitumen There is a MTBF unit and a sulfuric acid alkylation unit Aromatic solvents benzene ortho para-xylenes and toluene are produced The Company employs approximately 12,000 people

COMPANY A

Industry Chemical
Country Bulgaria

This company presented a list of thirteen projects under the WEC Waste Minimization Program Some of them are expensive projects with a total estimated investment cost of approximately $10,000,000

WEC estimated seven of the projects were true waste minimization projects Of this number, four were short-term incurring little or no cost However, it is important to note all of these projects were presented as being developed under the WEC Waste Minimization Program

The adoption of the program was approved by the Company's Council of Directors

Of the thirteen projects Project Eight is a good example of the goals WEC is encouraging companies to accomplish first as they implement their waste minimization programs Project Eight required only forty days to implement and incurred virtually no cost

Unfortunately, the cost savings from the projects have not been calculated at this time The first four projects are capital intensive and are cited to show long-term future waste minimization The next nine projects are more in line with the WEC Waste Minimization Program However the Company did not determine the cost savings and it has been requested to make this determination

PROJECT 1

Capturing ammonia from waste gases by absorption This has resulted in a 99% recovery of ammonia Company investment $70,000

PROJECT 2

Reducing the carbonate dust and ammonia contents in the granulation process The result has been a reduction from 100-150mg/m^3 to under 30mg/m^3 Company investment $220 000

PROJECT 3

Constructing a new water preparation and evaporation installation in the power station The projected result would be no chemically-polluted wastewater from the installation Company investment $7 900,000

PROJECT 4

Raising the extent of the regeneration of sulfur from the waste gases of carbon disulfide production The projected result is that the cleaning of waste gases will be increased from ninety-three and one half percent to ninety-eight percent Company investment $1 200,000

PROJECT 5

Burning residual ammonia gases at the absorption installation This would eliminate ammonia emission during maintenance Company investment $10,000

PROJECT 6

Increasing the buffer volumes for concentrated drainage and washwater from repairs This would decrease in wastewater from emergency repairs by fifty percent Company investment $20,000

PROJECT 7

Washwater basins cleaned and repaired according to a schedule This will insure reliable operations Company investment None

PROJECT 8

Draining and washing equipment in preparation for repair The result has been a decrease in uncontrolled wastewater Company investment None

PROJECT 9

Reconstruct hydrolysis stripper section This will provide the ability to better treat wastewater and decrease NH content in carbonide (3 months to complete project) Company investment $50,000

PROJECT 10

Continuous monitoring of ammonia content in wastewater This will allow for more accurate ammonia content information Company investment $45,000

PROJECT 11

The secondary collection of process wastewater from the desorption section This will prevent the discharge of process water in the sewer during maintenance (2 months to complete project) Company investment None

PROJECT 12

A review and update of the operating manual for the desorption section This will allow simultaneous optimization of steam quantity and process water cleaning Company investment $5,000

PROJECT 13

Improve the system for Company management reporting (at least two times a year) to state authorities municipalities and the community for the execution of the Company s environmental program This will demonstrate responsible corporate citizenship Company investment None

COMPANY B

Industry Pharmaceutical
Country Bulgaria

The Company has prepared a list of twenty projects Translation into English is not yet completed Policy statement issued and waste management teams organized

Available information on five of the twenty projects is as follows

PROJECT 1

Purchasing Department preparing new specifications for foil, which will reduce or eliminate the 0 7 tons of foil waste created each month

PROJECT 2

Reduce or eliminate six tons per month of cardboard trimmings

PROJECT 3

The Machine Shop and Purchasing Department are jointly developing ways to reduce 50 kilograms per month of metal shavings

PROJECT 4

Developing plans to eliminate 0 5 cubic meters of waste wood by reuse and using unusable wood for fuel

PROJECT 5

Develop a plan to reduce or eliminate 175 kilograms per month of cardboard waste

The Company plans to produce radio broadcasts about their waste minimization program

This company is within the limits of environmental laws in Bulgaria

COMPANY C

Industry **Pharmaceutical**
Country **Bulgaria**

The Company has proposed these three projects

PROJECT 1

This project was begun before the implementation of the WEC Waste Minimization Program The goal is to reduce waste and lower the cost in handling hydrochloric acid (HCL)

Originally HCL was pumped through ceramic pumps These leaked and were subject to more breakage than pumps made from other materials The pumps have been replaced with pressurized tanks

PROJECT 2

To separate cardboard and foil for reuse

PROJECT 3

Separate polymer from liquid resins This is a waste management (not minimization) project because while it has saved money it has not reduced waste

This company is ideally suited for the WEC Waste Minimization Program because it rewards its employees for cost reduction ideas The "suggestor receives twenty-five percent of the first year's savings In 1994 employees received an average bonus of $50 each

COMPANY D

Industry Chemical
Country Bulgaria

The Company is slow in implementing the WEC Waste Minimization Program Support by management is demonstrated by its issuing of a waste minimization policy statement

The Company is developing five small waste minimization projects They probably have them identified and need to select them from their list of longer-term projects

The facility appears to be relatively environmentally friendly Management enthusiastically supports the program During the WEC visit a news reporter from a local station was present during the meeting and information about the Company's waste minimization program will be broadcast

COMPANY E

Industry Chemical
Country Bulgaria

The Company fully supports the WEC Waste Minimization Program Their primary concern is air emission which causes water and/or land pollution

Five projects were identified but no costs or environmental benefits were calculated

PROJECT 1

Install equipment to reduce losses and seconds by controlling the width of synthetic leather during drying Timing - three months

PROJECT 2

Shredding and reprocessing foam material into shoulder pads for garments Recovered 80% of waste foam Timing - one week

PROJECT 3

Stop all leakage of water throughout the factory Timing - continuous

PROJECT 4

Paper used to support foam in drying After the drying cycle the piece of foam is pulled from finished product and is discarded Paper is replaced with treated film Losses reduced from 8-10% to 2-3% Special film can be used eight times

PROJECT 5

Install barometric condensers to reduce steam water losses

COMPANY F

Industry Chemical
Country Bulgaria

The Company is slow in implementing the WEC Waste Minimization Program because it is in the process of being privatized The program should move more rapidly after privatization

Projects under consideration

PROJECT 1

Divert one wastewater acid stream to use as neutralizing stream for a basic stream coming from a batch process thus reducing the load on wastewater treatment

PROJECT 2

Precipitating solids from a process stream and recycling the stream to the process Previously the stream went to treatment

PROJECT 3

Recycle more water from wastewater streams However ways are needed to analyze wastewater to remove impurities

PROJECT 4

Separate toluene from wastewater and recover it

PROJECT 5

Separate inorganic materials from the wastewater and eliminate the surface impoundment

COMPANY G

Industry Fiber
Country Bulgaria

Management meets weekly to review the implementation of the WEC Waste Minimization Program

They are working on projects but did not submit a list However discussions indicate they are doing the following projects

PROJECT 1

Removing short fibers from their wastewater

PROJECT 2

Training workers on yarn handling to reduce yarn waste

PROJECT 3

Analyzing wastewater streams in order to separate so as to reuse water

PROJECT 4

Change system so that spinning solvent filter waste is collected as a solid waste and the water use is reduced

COMPANY H

Industry Chemical
Country Bulgaria

The Company is firmly committed to the WEC Waste Minimization Program

PROJECT 1

Separate water from the solids and oily materials that previously went to lagoons and landfills Water is now recycled

PROJECT 2

Separate trash from oily materials for recycling Previously the trash was disposed of in landfills

PROJECT 3

Water from nitrogen-oxygen separator now recycled to power station and used in steam generation Previously it was sent to the river Savings - approximately **$100,000** per year

PROJECT 4

Replace old leaking compressors with new non-compressing equipment thus eliminating leakage

PROJECT 5

Install leak detector and repair program using flame ionization detector

CZECH REPUBLIC

The following companies have agreed to participate in the WEC Waste Minimization Impact Program

Four of the eight participating companies have been visited by WEC to obtain information about their implementation of the WEC Waste Minimization Program Subsequent reports will include progress reports on all participating companies

Two of the four reporting companies had changes in senior management which required additional time for the introduction of the WEC Waste Minimization Program The new management expressed their support of the program

The waste minimization program at Chempetrol began late in 1992 and should continue to receive strong support from its new owners Conoco, Elf Aquitaine and Shell

CHEMPETROL

Chemopetrol, in Litvinov, started production in 1939 and is the largest refining and petrochemical complex in the Czech Republic Primary products from the Chemopetrol refinery include aromatics (toluene and xylene) asphalt diesel and fuel oils gasoline, hydrogen gas kerosene LPG lube base stock naphtha and sulfur It employs 10 000 people

SPOLANA, A S

Spolana A S , founded in 1905 is a chemical plant on the banks of the Elbe River in Neratovice approximately 35 kilometers north of Prague The plant produces pentachlorophenol and 2 4 5-T The products manufactured at Spolana, A S include captolactum (capacity of 40,000 tons/year) and viscose rayon (capacity of 40,000 tons/year) The Company employs approximately 4,600 people

MORAVSKE CHEMICKE ZAVODY

Located in Ostrava, Moravske Chemicke Zavody produces a broad range of fertilizers gases and pure chemicals (i e pure oxalic acid), glues, organic and inorganic chemicals phenol-formaldehyde resin and urea formaldehyde The Company employs about 1,600 people

SINDAT

Headquartered in Prague Sindat produces and distributes various chemicals which it ships from nine distribution centers throughout the Czech Republic

OSTRAMO

Located in Ostrava, Ostramo is a 100 year-old company, which now exclusively processes used oils for reuse

SPOLEK PRO CHEMICKOU

Located in Usti Nad Labem and established in 1856 Spolek Pro Chemickou is a large chemical producer with three basic divisions inorganic resin and dyestuffs Each division produces a broad range of products

FARMAKON

Farmakon produces raw material for further processing into pharmaceutical substances and disinfectants, and is located in Olomovc

LACHEMA

Located in Brno and started in 1951 Lachema was completely restructured in 1991 to form a joint-stock company which is a major producer of pharmaceutical and diagnostic preparations pure chemicals and special chemicals

COMPANY A

Industry **Chemical**
Country **Czech Republic**

This company does not have a clear understanding of the WEC waste minimization approach although it does have some waste minimization projects

PROJECT 1

Management is seeking ways to minimize the waste from the pheno-formaldehyde process and, therefore increase the amount of salable material

PROJECT 2

To reduce the amount of ammonia in the wastewater Ammonia is used to wash coke gas and extract hydrogen In the process, the wastewater is contaminated with ammonia Of special concern is the amount of contaminated water entering the municipal wastewater plant

The Company is considering changing the technology by using natural gas as opposed to coke gas This may reduce the amount of ammonia used by thirty percent Eliminating amines and other inhibitors of the nitrification process converts the ammonia to nitrate and lowers the ammonia concentration to a level set by the municipal waste treatment plant

COMPANY B

Industry **Pharmaceutical**
Country **Czech Republic**

The Company has undergone a change in senior management The previous General Director clearly understood the WEC Waste Minimization Program The new management has not devoted time to this program It may be a situation where other priorities require management's attention at present Nevertheless, the Company is working on several projects

PROJECT 1

Problem

High discharge of carbon to the wastewater system and then to the river Three hundred different products are being produced by batch process

Solution

Management is conducting a comprehensive review through material balance studies One study involves the heating reaction responsible for the high discharge of carbon material balances on products produced in amounts greater than 500 kilograms per year

Management is considering obtaining COD monitoring equipment for the five effluent streams in an effort to locate the main source of organic discharge

PROJECT 2

In the extraction of adamantine from the reaction mixture they have identified a new extraction solvent with a higher boiling point The benefits are that thirty-three percent of the solvent is saved at a cost savings of **$5,000** per year

PROJECT 3

This project involves improving the yield of the esterification process with the objective of decreasing the amount of contaminant in the esterol product

COMPANY C

Industry Pharmaceutical
Country Czech Republic

The Company has concentrated its waste minimization program on reducing air emissions It should be noted there has been a recent change in senior management which has affected implementation of the program New management has replaced the management personnel initially involved Management has identified four specific projects which it is pursuing

PROJECT 1

To reduce the emissions of thionyl chloride and the decomposition products (SO and HCL) from the aspirin chloride synthesis

PROJECT 2

To reduce the emissions from the synthesis of 2-(4-chlorobenzoyl) benzoic acid by ten percent

PROJECT 3

To reduce the emissions from the bio-aerations pond by fifty percent

PROJECT 4

To reduce the emissions by ten percent from the synthesis of Vitamin C

COMPANY D

Industry Chemical
Country Czech Republic

The Company s main concern is the sludge build-up which is high in heavy metals and unwanted hydrocarbon fraction This sludge is the result of the Company s reclamation process

Management has a clear understanding of the WEC Waste Minimization Program and is applying the techniques to try to find a solution

HUNGARY

Due to a greater amount of freedom under the previous regime, Hungarian companies had more contact with the West than other companies in Central and Eastern Europe and therefore are further ahead in management

All of the companies support the WEC Waste Minimization Program They appreciate the systematic approach of the Ten-Point Program in helping them organize their own environmental projects

A number of them are contenders for joint ventures or purchase In spite of this uncertainty they are devoting as much time to the program as is practical

The companies involved in the WEC Waste Minimization Program are

ALKALOIDA CHEMICAL COMPANY

This company is a diversified chemical and pharmaceutical manufacturer, established in 1927 Its main products are antacids anti-allergics and anti-asthmatics, cardiovascular non-steroid anti-rheumatics central nervous system drugs, fungicides, herbicides and insecticides The Company owns over 500 patents, markets its products in 80 foreign countries and has 1,950 employees

BORSODCHEM RT

The Company was founded in 1949 It produces active ingredients for agrochemicals auxiliary compounds, caustic soda industrial gases, organic and inorganic chemicals, polyurethane raw materials and end products and PVC resins It has 3 800 employees

BUDAPEST CHEMICAL WORKS

Founded in 1878, it is the oldest chemical company in Hungary It produces organic and inorganic fertilizers and products The Company employs about 1 000 people

CAOLA LTD

This company was privatized in December 1993 It is a major producer of cosmetics and household chemicals except it does not make washing powders It has 1,300 employees

MAGYAR VISCOSA RT

Established in 1941, Magyar Viscosa Rt is a shareholding company and is the leading producer of synthetic fibers in Hungary It employs 1 900 people

NITROKEMIA

Originally founded in 1921 as a gunpowder factory the Company now produces a broad range of products i e gunpowder and industrial explosives, non-exchange artificial resins organic and inorganic intermediates, pesticides and polyester resins It has 2,800 employees

TISZAI VEGYI KOMPBINAT

Tiszai Vegyi Kompbinat is one of the largest companies in Hungary, employing 5,300 people It produces a broad range of polyethylene and polypropylene resins The Company also has a flexible packaging plant a geotextile plant producing non-woven textiles and a plant producing ammonium nitrate fertilizer

UNITED CHEMICAL WORKS

This company is privately owned It produces household cleaners and detergents, industrial and institutional cleaners, and solvents and industrial specialty products

COMPANY A

Industry Chemical
Country Hungary

This company is practicing waste minimization and using environmental management systems to control their program and the other environmental programs in the plant It is obvious they understood the WEC information presented in the workshop and follow-up seminar and are applying it to waste problems They presented several plans

The Production Division and Environmental Department are preparing a joint plan for a review of technological processes, to establish action priorities regarding time, cost and employee involvement in implementing their waste minimization program

The team is preparing a similar plan for a maintenance program based on waste minimization

Specific projects identified for action include

PROJECT 1
Reduce number of batteries used

PROJECT 2
Reduce solid particle waste from the production of pesticide powders

PROJECT 3
Reduce mercury content of wastewater from electrolyte plant

PROJECT 4
Perform environmental review of organic hydrogenation and distilling plant

PROJECT 5
Study reuse of HCL generated in the CNB plant

COMPANY B

Industry Chemical
Country Hungary

This company is ISO9000 certified and wants ISO14000 certification when it is defined It is fully committed to the WEC Waste Minimization Program and is pursuing a number of projects but did not provide savings data or benefits to be realized

PROJECT 1

Reduce blow-down losses which occur during maintenance

PROJECT 2

Reduce the fibers that form in the extrusion equipment used for pellet making and are carried away by the cooling water stream and then caught in the sedimentation pool Subsequently they are collected and incinerated

PROJECT 3

Reduce the significant waste generated in the plastics plant

PROJECT 4

Review the metal can processing to reduce the significant waste generated during cutting, stamping and in appropriate process operation

COMPANY C

Industry Chemical
Country Hungary

By its own admission, this company has many environmental problems and has been slow to implement the WEC Waste Minimization Program The Company has developed a list of large projects which will reduce waste but will probably not result in cost savings

Management is now beginning to accept that small projects can produce effective cost savings and be environmentally beneficial The Company may now begin to consider them, especially in the area of maintenance Some small projects under consideration are

PROJECT 1

Reduce salt-containing wastewater discharges

PROJECT 2

Reduce pollution emitted as a by-product of the incineration plant

PROJECT 3

Reduce emissions from the polymer plant

PROJECT 4

Reduce the consumption of demineralized water

COMPANY D

Industry **Pharmaceutical**
Country **Hungary**

This company which uses a consultant to assist in implementing the WEC Waste Minimization Program knows how to perform waste reduction from a cost reduction point of view and has put small projects in motion with considerable success

It is ISO9000 certified and believes the effort in becoming certified changed employees attitudes towards quality The Company believes the WEC Waste Minimization Program has helped do the same for environmental awareness

PROJECT 1

Problem

The granule size of the pharmaceutical ingredient changes according to demands with smaller granule sizes The dry ingredient needs additional grinding at a remote location which entails material handling re-purchasing and analytical testing Packaging material cannot be reused is disposed of as waste

Solution

Installation of a hammer grinding mill under the sieve of the fluid drive

Benefits

Eliminate the need to purchase 800-100 fiber drums and PE sacks
Eliminate incinerating same amount of waste
Reduce transportation and labor costs
Reduce dust load on environment
Analytical costs reduced by fifty percent, saving **$30,000** per year

PROJECT 2

Problem

Chemically contaminated and uncontaminated packaging materials are collected in a closed four cubic meter container and disposed

Solution

Selective collection of paper wastes without chemical contamination

Benefits

Reduce waste
Uncontaminated wastes sold as secondary raw materials

PROJECT 3

Problem

Raw materials and additives sourced by a wide range of suppliers With some suppliers, each shipment needs full-scale analytical testing Others attach product certificates which do not require testing

Solution

Increase number of suppliers with product certification

Benefits

Eliminate costs of analytical testing
Save from $30 to $100 per sample
Reduce laboratory materials required for testing

PROJECT 4

Problem

Two hours of testing in a laboratory drying cabinet are necessary to indicate endpoint of drying operation

Solution

Use infrared device to determine solids content and indicate end point of drying operation

Benefits

Test performed in five minutes saving heat and electricity Cost savings of **$5,000**

PROJECT 5

Problem

Alkaline transmission pipeline supplies forty percent alkaline liquid to plant users from the central tank area Plugging due to freezing is a problem during winter

Solution

In-tank dilution of forty percent alkaline to twenty percent concentration to supply users in the plant, via the pipeline network

Benefit

Reduce number of freezing incidents
Eliminate all, or most of the need to use propellant steam

PROJECT 6

Problem

Pesticide formation equipment is cleaned using water or organic solvent, which is treated or incinerated afterwards

Solution

Reuse of wash-down liquid from pesticide formation equipment

Benefit

Option to sell wash-down liquid at discount price

COMPANY E

Industry Fiber
Country Hungary

The Company has concentrated waste minimization efforts on long-term projects They have been encouraged to look for short-term projects Progress is good considering the company is for sale

PROJECT 1

Install a Total Organic Content monitoring device to enhance the operation of the buffer pool prior to an oxgeneration operation in the plant affluent treatment system This will eliminate many of the peak loads and enable personnel to more quickly identify and stop spills

Cost of equipment $30,000 Pay back period is one and a half years

PROJECT 2

Install a viscosity meter on the liquid polymer prior to extrusion of the polyment through a spinneret to produce solid yarn This will control viscosity and reduce waste Estimated savings will result from reduced production time lost due to cleaning yarn waste out of the primary machines

PROJECT 3

Purchase an improved feeding system to reduce the amount of waste generated in producing the pellets which are later melted and used to produce yarn The waste generated is recycled so the waste reduction occurs in lower reprocessing costs

PROJECT 4

Purchase a waste incinerator for $1,000,000 and offer some use of the incinerator to the local municipality Estimated pay back period is three and a half years

COMPANY F

Industry Chemical
Country Hungary

This company is for sale and employees are nervous about future employment The Company is still committed to implementing waste minimization and expects to make more progress after purchase of the Company is complete

PROJECT 1

This project involves producing a new by-product and recovering raw material by treating a waste stream that is currently being disposed of by sewer

COMPANY G

Industry Chemical
Country Hungary

This is an employee-owned company and there appears to be no pending restructure Therefore the WEC Waste Minimization Program is more advanced here than at other companies visited in Hungary

Collection and sorting of discarded containers for reuse The Company receives approximately 110 tons per year of packaging material (70 tons paper and 40 tons plastic) All was previously landfilled Now paper is picked up by an outside company and plastic is compressed to one third of its original volume and is then landfilled Total cost savings is **$35,000** Pay back period is four and one fourth years

Replace 380 pump stuffing boxes with seals to prevent leaking Estimated yearly savings is **$167,000**

Installation of a recirculating line to eliminate blockages in production of a household detergent Cost was minimal and produced a savings of **$1,000** per year

ROMANIA

The following companies have agreed to participate in the WEC Waste Minimization Impact Program

Five of the companies have been visited to obtain information about the implementation of their waste minimization programs Subsequent progress reports will contain information about all participating companies

Several of the companies are reporting substantial progress in implementing their programs Four companies have twenty-three projects in various stages of implementation The reported overall economic savings of **$2,767,000** means an average **$120,000** per project in savings, per year

The environmental benefits are significant but their overall impact is only projected at present More time will be needed to fully demonstrate the dramatic improvements and effects on workers and their communities

ARPECHIM

This is a large integrated oil refinery and petrochemical complex with two refinery lines and two ethylene plants It produces a broad line of refined oil products and a number of petrochemicals and downstream petrochemical products There are approximately 7,000 employees

CHIMCOMPLEX

This is a very large, multi-product integrated chemical complex, which began operations in 1960 Approximately one third of the plant will be rebuilt and the design will incorporate WEC's waste minimization philosophy There are approximately 5,000 employees

PETRO BRAZI

This is a large-scale oil refinery and integrated petrochemical complex Products include a full range of refined oil products, petroleum coke and intermediate petrochemicals based on benzene xylene butadine, ethylene and propylene There are approximately 8,000 employees

PETROTEL

This is a large scale oil refinery and integrated petrochemical complex, which dates back to 1904 when it was founded as the Romanian-American Oil Company in an initiative with Standard Oil of New Jersey It produces a wide range of refined products and various downstream petrochemical products There are approximately 8 000 employees

RAFINARI DARMANESTI

This is a small oil refinery built in the late 1940s It produces a range of refined oil products from gasoline to fuel oils It also has a facility for the production of petroleum 'needle coke

OLTCHIM

Founded in 1966 this is one of the biggest chemical companies in Romania It produces over forty different types of products, ranging from basic chemicals to plastic resins

DERO

Founded in 1955 this is the largest producer of powder and liquid detergents in Romania It also is Romania s only producer of naphthenic acids Dero was recently purchased by Unilever LTD

ASTRA ROMANA

Built in 1880 this refinery is small compared to other Romanian refineries It processes bitumen and green petroleum coke and refines crude oil into fuel gasoline, lube oils and raw materials for petrochemical producers

COMPANY A

Industry Refinery
Country Romania

The Company has aggressively implemented the WEC Waste Minimization Program Senior management is actively involved All teams have been established and are identifying potential projects

PROJECT 1

Problem

At the dimethyl terephthalate factory methanol vapors are vented directly into the atmosphere

Solution

Before the waste minimization program was implemented, the plan was to import the necessary equipment at a cost of $700 000 and take three years to make it operational The waste minimization team developed a different scheme utilizing existing equipment that could be installed by plant personnel

Benefits

Reduction of methanol air emissions by 1 250 tons per year
Elimination of a $700 000 capital expenditure
Cost savings of **$320,000** per year which will double when the factory operates at full capacity

PROJECT 2

Problem

An the acrylonitrile plant, wastewater is stripped of the acrylonitrile before disposed of in a hazardous waste incinerator

Solution

Change the catalyst and modify the stripping columns to reduce the acrylonitrile waste and improve process reliability

Benefits

Reduce acrylonitrile losses
Improve process reliability
Reduce factory shutdowns
Cost savings of **$390,000** per year

PROJECT 3

Problem

Decoupling of lines between ammonia rail cars and pumps requires venting to a water scrubber which discharges into the factory's wastewater system

Solution

Collect the ammonia-contaminated water and recycle

Benefits

Collected water is used to replace an equivalent amount of purchased aqueous ammonia used in the treatment of refinery wastewaters Cost savings of **$16,000** per year

PROJECT 4

Problem

Start-up procedure of a cracking unit required to initiate the reactor and flaring the reaction products while the gas compressor and other downstream equipment was brought on line

Solution

Change start-up procedure by starting the compressor and downstream equipment on recycled gasses and then starting the cracking system

Benefits

Eliminates 70 tons of hydrocarbon emissions per year
Avoids the SO_x and NO_x associated with burning the hydrocarbon
Reduces start-up time by twenty-four hours
Cost savings of **$10,000** per year

PROJECT 5

Problem

Chlorine gas from railcar depression is vented to a scrubber that converts the chlorine to sodium hypochloride which is then discharged into the wastewater system

Solution

Collect the sodium hypochloride and use it in the treatment of NaCN wastewaters

Benefits

Sodium hypochloride is reused and is no longer discharged into the wastewater system
Cost savings of **$11,000** per year

PROJECT 6

Problem

Leaks from NaCN pumps collected and destroyed by reaction with sodium hypochloride

Solution

Recover the NaCN by recycling to an existing steam stripper

Benefits

Reduce NaCN losses by three tons per year
Cost savings of **$5,000** per year

PROJECT 7

Problem

Laboratory product samples disposed of by discharging into the factory wastewater system

Solution

Gasoline, glycol and gas oil samples are now collected and returned to the appropriate storage system

Benefits

Reduction of 3,000 liters of wastewater per year
Cost savings of **$500** per year

COMPANY B

Industry Refinery
Country Romania

This company has an excellent start to the WEC Waste Minimization Program primarily because of the very active involvement of the General Director

PROJECT 1

Problem

Plant 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

Benefits

Reduction in water required for waste treatment by 750m^3 per year
Reduction in energy requirements
Cost savings of **$37,000** per year

PROJECT 2

Problem

Periodic heat exchanger leak results in oil in the cooling tower basin of the coke plant This necessitates the need to periodically drain the gas into the wastewater treatment plant

Solution

Interim solution would be to install an oil separator in the tower basin to remove oil from the cooling water load To correct the problem all faulty heat exchangers should be replaced

Benefits

Reduces oil in contaminated cooling water air emissions
Reduces labor required to periodically drain the basin to the waste treatment plant Cost savings of **$8,000** per year

PROJECT 3

Problem

Water drained from the power plant is sent to the wastewater treatment plant because of the risk of oil contamination from leaks breaks and oil spills

Solution

Install an oil separator in the water discharge system and remove the oil at the power plant and discharge the water directly into the river

Benefits

Reduces quantity of oil in the wastewater system
Reduces amount of water requiring treatment
Cost savings of **$17,000** per year

PROJECT 4

Problem

Excessive crude oil losses and incoming oil with a high salt content

Solution

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

Benefits

Reduces crude oil losses
Reduces quantity of wastewater requiring treatment
Cost savings of **$110,000** per year

PROJECT 5

Problem

C3 - C4 streams are burned as fuel in the power plant or flared during the summer months when energy demand is lower

Solution

Activate a pipeline for the C3 - C4 streams that will allow the sale of C3 - C4 at prices in excess of the replacement cost of liquid fuels

Benefits

Reduces pollution from burning and flaring
Cost savings of **$221,000** per year

PROJECT 6

Problem

Excessive volume of sludge requiring disposal and high operating cost for waste treatment

Solution

Change from inorganic salts to polyelectrolytes as flocculants in the wastewater treatment plant

Benefits

Reduction in the amount of sludge requiring disposal
Improved efficiency of wastewater treatment plant
Cost savings estimated at **$372,000** per year

PROJECT 7

Problem

Process and corrosive flue gas heat not utilized in four process furnaces

Solution

Recover heat from flue gas and use to pre-heat combustion air NOTE Project being implemented at one furnace

Benefits

Energy savings from reduced fuel consumption
Cost savings estimated at **$222,000** per year

COMPANY C

Industry **Refinery**
Country **Romania**

The Company's waste minimization program is off to a slow start Quantification of cost versus savings is not currently a high priority Several projects indicate effective worker involvement It is expected the program will move more rapidly as more management and staff become involved

PROJECT 1

Problem

Use of inorganic salts as flocculant results in large quantity of sludge to be put into settling ponds

Solution

Use of polyectrolyte as a flocculant to reduce waste sludge

Benefits

Reduces waste sludge by thirty-five to forty percent
Reduces land required for settling ponds
Improves treatment plan efficiency

PROJECT 2

Problem

Fiber drums often leak at the assembly seam causing the faulty drum and material to be sold as waste

Solution

Work with purchasing department and drum supplier to develop better fiber drum

Benefits

Less faulty drums and material sold as waste
Reduces amount of oil leaking into the ground

PROJECT 3

Problem

In the power plant, water from the ion exchange resin regimentation must be neutralized prior to discharge Improper monitoring results in non-neutral solutions being discharged into the sewer system

Solution

Install an automatic on-line monitoring system

Benefits

Improves efficiency in the power plant
Reduces non-neutral solution being discharged into the sewer system

COMPANY D

Industry Refinery
Country Romania

Management understands the WEC Waste Minimization Program and its potential importance They are unsure about implementing some parts of the program, i e worker involvement, but are open and responsive to suggestions

Although cost savings from these two projects are impressive management has been slow to fully introduce the WEC Ten-Point Waste Minimization Program Management currently emphasizes reducing energy consumption by ten percent

PROJECT 1

Problem

Excessive sludge generation

Solution

Use of polyelectrolytes as flocculant prior to dissolved air flotation has reduced total sludge six hundred percent

Benefits

This reduction has made capacity available to burn high heat content tank bottoms that were being sent off site resulting in steam production Cost savings of **$590,000** per year

PROJECT 2

Problem

Poor operation of local oil separation systems Leaking heat exchanges leaking underground water piping systems contribute to the problem

Solution

Management emphasis and factory attention to the operation of the local oil separation systems

Benefits

Waste water treatment reduced by twenty percent and oil levels by forty percent
Cost savings of **$140,000**

COMPANY E

Industry Chemical
Country Romania

The Company has done an excellent job of laying the groundwork for a successful program Management is actively involved holds weekly meetings and seeks worker involvement

PROJECT 1

Problem

In the trichloroethane factory difficulty with reactor temperature control limited conversion of the trichloroethane reactant to ninety-five percent The remaining five percent was partially lost in subsequent steps

Solution

The addition of a double-pipe pre-heater to the reactor has improved temperature control and provided additional reactor volume

Benefits

Reduces amount of organic waste into sewer system
Reduces consumption of tetrachloroethane
Cost savings of **$75,000** per year

PROJECT 2

Problem

In the 2 4 D factory, excessive fresh water use in hydrogen chloride absorption and the need to recover 2,4 D from recycling water

Solution

Recycle a portion of the acid washwater to the hydrogen chloride absorption step

Benefits

Reduces use of fresh water and partially recovers 2,4 D from the recycled water Cost savings of **$73,000** per year

PROJECT 3

Problem

In the methylene chloride plant, 20 kilograms/hour of distillation bottoms containing carbon tet was being accumulated until incineration capacity was available to dispose of in the waste stream

Solution

Recycle the waste internally

Benefits

Waste used in another process
No longer burning distillation bottoms containing carbon tet
Cost savings of **$45,000** per year

PROJECT 4

Problem

In the linear alkyl benzene factory a steam stripping process was used to recover the heavy fractions This resulted in discharges to the waste treatment plant

Solution

Changed process to provide a light overhead cut

Benefits

Reduces heavy fractions to the waste treatment plant
Heavy fractions are sold as fuel
Cost savings of **$25,000** per year

PROJECT 5

Problem

In the chloride factory sludge containing iron oxide requires disposal

Solution

Apply acid dissolving and filtration steps to the sludge and return filtrate to the scrap iron in the dissolving step

Benefits

Reduces sludge by fifty percent Additional product recovery Cost savings of **$9,000** per year

SLOVAKIA

The companies participating in the WEC Waste Minimization Program represent the majority of chemical production in Slovakia

SLOVNAFT

This is the largest company in Slovakia employing approximately 5,000 workers Founded in 1895, the refinery produces gasoline heating oils, lube oils, waxes and greases bitumen, petrochemicals and plastics It owns retail filling stations throughout Slovakia

ISTROCHEM

Istrochem is a large, multi-product chemical plant in the city of Bratislava The Company was founded in 1873 by Alfred Nobel Industrial explosives continue to be one of the Company's many product lines Istrochem also produces viscose rayon, polypropylene fibers injection-molded plastics, plastic color concentrates rubber chemicals lube-oil additives, fertilizers and plant protection chemicals There are approximately 3,800 employees Istrochem s quality program has been certified under ISO 9002, since the autumn of 1994

DSULO

Duslo is a large-scale producer of ammonia and a series of ammonia-based fertilizers In addition, the Company produces anti-oxidants for the rubber industry polyvinylacetate polymers magnesium oxide and a number of specialty amine compounds The Company was started in 1955 It is a joint-stock company owned by the state, but plans are to shift fifty-one percent ownership to employees About eighty to eighty-five percent of the plant volume, mostly fertilizers, is exported It has 3,100 employees

CHEMES

This company produces and supplies energy and utilities in the form of heat, electricity coolant and nitrogen to the adjoining Chemlon facility It has 970 employees who own a majority of the stock

POVAZSKE CHEMICKE ZAVODY

This plant manufactures both organic and inorganic chemicals The main product lines include 6-caprolactum methyl methacrylate polymethyl methacrylate, polyamide-6 ammonium sulfate, sulfuric acid and several fine chemicals Based upon some of these products, the plant also manufactures floor coverings, window frames kitchen sinks and various injection-molded products The plant employs approximately 2,500 workers

CHEMOSVIT

Main production at Chemosvit is the printing of flexible packaging materials, based on cellophane polypropylene and polyethylene This constitutes approximately 80% of their business In addition the plant produces fibers, specialty synthetic films and packaging machinery Chemosvit employs approximately 3 600 workers and is a privatized company

NOVACKE CHEMICKE ZAVODY (NCHZ)

This Company produces a mixture of organic and inorganic chemicals The major product lines include caustic chlorine (using mercury cells) ethylene dichloride vinyl chloride monomer, polyvinyl chloride, hydrochloric acid polyvinyl acetate, acetylene and various surfactants The Company also produces several consumer products such as vinyl floor covering and vinyl window casings NCHZ has a work force of approximately 2 500 It has been a public company since 1994

CHEMOLAK

Chemolak is a major producer of paints lacquers varnishes and glue It is a joint-stock company employing 800 people It recently became ISO 9000 certified

COMPANY A

Industry Chemicals
Country Slovakia

The Company has implemented the WEC Waste Minimization Program supported by the General Director

PROJECT 1

Problem

In 1994, 4,500 metric tons of solid waste were shipped to the regional landfill, at a cost of $70,000, which is projected to reach $95 000 in 1995

Solution

Increase awareness of waste minimization, source segregation recycling and reuse of waste

Benefits

Plan targets reduction 40% in 1995, 20% in 1996 and 40% in 2000 Estimated savings in the year 2000 will be, at minimum **$400,000**

PROJECT 2

Problem

Plant generates approximately 4,500 metric tons of alkali sludge and incurs $7 000 a year in disposal costs

Solution

Hire outside experts to investigate possible uses for the sludge

Benefits

Last year, 1,500 metric tons were sold

PROJECT 3

Problem

Particulate emissions from fly ash caused by the burning of brown coal in the boilers

Solution

The waste minimization team developed five sub-projects to reduce fly ash emissions They are better control of airflow switching to alternative fuels improvement of refractory lining, installation of cyclone and/or electrostatic precipitator and improved process control by monitoring SO_2 NO and ash contents of the exit steam

Benefits

Installing a new cyclone at boiler #3 reduced fly ash and saved approximately **$9,000** per year

Installing electrostatic precipitator at boiler #4 increased efficiency by five percent

COMPANY B

Industry Chemicals
Country Slovakia

This is a privatized company with a highly-automated modern and impressive factory

PROJECT 1

Problem

During various gravure printings, paint residues are generated from roller troughs and roller and equipment clean-up operations Normally these residues are discarded as waste resulting in losses due to cost of raw materials and high disposal costs

Solution

Waste minimization team developed a scheme to segregate and recycle the paint

Benefits

Recovery ranges from 3,000 to 10,000 tons a month Cost savings of **$126,000** per year

PROJECT 2

Problem

Significant amounts of film waste are generated during the production of film packaging materials which are incinerated

Solution

Segregate the materials at the point of generation and recycle them back into processing

Benefits

Recycles fifty percent of the waste materials a savings of **$21,000** per year

PROJECT 3

Problem

The plant has eleven boilers that use oil or gas as fuel The plant is located in a pristine area of a national park and forest therefore the plant is subject to stringent emission limits for CO, NO_x, etc

Solution

Switch to natural gas

Benefits

Improved thermal efficiency by one-half percent at a savings of **$7,000** per year in fuel costs

PROJECT 4

Problem

During various flexographic printing operations, paint residues are generated from roller vanes and roller and equipment clean-up operations Normally these residues are discarded as waste, resulting in losses due to the value of raw materials and high disposal costs

Solution

Segregate and recycle

Benefits

Cost savings of **$53,000** per year

PROJECT 5

Problem

The plant uses calcium milk for neutralization of wastewater effluents Calcium milk is produced by the slaking of lump lime in the slaking drum A significant amount of residue is generated during the slaking operation due to the presence of high levels of inert impurities present in the solid lime At present, this is disposed of in landfills

Solution

The waste minimization team has been successful in identifying new suppliers of solid lime containing only 0 2% of inert materials (compared to 9% in the past)

Benefits

A reduction of 45 metric tons of lime so far resulting in a cost savings of **$2,300** per year

COMPANY C

Industry Chemicals
Country Slovakia

This plant has selected a large waste minimization project which focuses on the reduction of surfactants discharged into a river The surfactants are based upon ethoxy amines ethoxy fatty acids and ethoxy and propoxy aliphatic or aromatic compounds

The waste minimization team has estimated a potential savings of approximately **$35,000** per year by reducing surfactant discharge The team has been successful in optimizing the use of surfactants in the PVC emulsion reactor clean-up operation, resulting in estimated savings of **$18,000** per year One of the ideas implemented involves washing the reactor after every fifty batches instead of after every few batches as in the past, significantly reducing the quantity of surfactants in the effluent

COMPANY D

Industry **Chemicals**
Country **Slovakia**

The Company has been involved in the Norwegian Cleaner Production Program for one year

It has implemented the WEC Waste Minimization Program, with strong support from the General Director

PROJECT 1

Problem

During the depolymerization step of the polyamide manufacturing process significant amounts of residues are formed in the reactor and are subsequently sent to landfills after each batch Also, water solution of caprolactum from the depolymerization process contains various undesirable impurities which are absorbed in carbon beds The spent carbon is disposed of in landfills

Solution

The waste minimization team developed the following ideas to reduce the residues and impurities improvement of raw material quality, switching to better quality carbon for absorption, regeneration of carbon by steam, and process optimization to reduce residue formation

Benefits

It is estimated that the implementation of these ideas could eliminate as much as fifty percent of the waste generated from this process resulting in a savings of approximately **$140,000** per year The team has completed an excellent cost/benefit analysis using a spreadsheet to prioritize the actions

PROJECT 2

Problem

During the process of manufacturing methyl methacrylate and polymethyl methacrylate, liquid wastes are generated from the organic residues of the rectification and from the organic layer of storage tanks of the waste sulfuric acid Also a significant amount of solid waste is generated in the esterification reactor and from the storage tanks of the waste sulfuric acid At present all of these wastes are incinerated

Solution

The waste minimization team has developed the following recommendations for implementation a combination of waste acid with sulfur to produce sulfur dioxide, to be used in the process, an addition of inhibitor during the amidation reaction step to prevent pyrolysis of product a substitution of sealing materials to prevent formation of residues, and improvement of mixing in the reactor by streamlined nozzles

Benefits

The waste minimization team developed cost/benefit analysis and prioritized the options for implementation It is estimated that implementation of the first two options will save approximately **$21,000** per year

COMPANY E

Industry Chemicals
Country Slovakia

The Company's actions indicate a clear commitment to the WEC Waste Minimization Program, but that does not include a separate and clear policy statement There have been waste minimization training programs for site staff, from new employees to upper management There is a company newsletter which has been used to communicate the program and its status to all employees

PROJECT 1

Problem

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

Solution

Reduced emissions by decreasing the initial charge of carbon disulfide without having adverse effects on the quality of the viscose rayon product Experiments designed around reaction temperature and pressure, as well as experiments with various sources of pulp Heat exchange was incorporated to eliminate seasonal variation in the carbon disulfide temperature

Benefits

The changes have resulted in carbon disulfide use and emission reduction of 53 tons per year Approximately $1 800 was required to implement the project The cost savings are estimated at approximately **$18,500** per year

PROJECT 2

Problem

A series of projects aimed at decreasing the quantity of heated washwater and chemicals used in the 14-step counter current wash of the final viscose rayon product

Solution

Improvements in procedures and operating consistency adjustment of the washing floaters, elimination of leakage through repair of drains and piping and monitoring of concentrations at various steps of the process Approximately sixty production people were involved in the project

Benefits

A 15 6% reduction in the use of heated washwater or 53,000m^3 per year The cost to implement was approximately $3 500 Savings are estimated at approximately **$123,000** per year

PROJECT 3

Problem

Molar excess of alcohol used in the reaction process involving thiophosphoric acid

Solution

Process changed from continuous to batch

Benefits

A reduction in the molar excess of alcohol used in the reaction generating a cost savings of approximately **$17,000** per year

PROJECT 4

Problem

An oil additive Multaditu OB is made by reacting zinc oxide with the reaction product of alcohol and thiophosphoric acid The original process called for slurrying the zinc oxide with ethanol and pumping the slurry to the neutralization reactor

Solution

Change the process to allow addition of the zinc oxide directly in powder form to the neutralizer

Benefits

This project will result in ethanol use reductions of approximately 100 tons per year Savings in raw materials energy and disposal fees are projected to be approximately **$38,000** per year

PROJECT 5

In the Multaditu OB process an existing centrifuge will be utilized to remove unreacted zinc oxide and recycle it back to the neutralization step The first experimental batch using this technology has been successfully completed Projected cost savings are **$86,000** per year

PROJECT 6

Problem

To reduce chemical oxygen demand (COD) in the wastewater

Solution

In the Rubber Chemicals Department two distillation columns are being added to allow for recovery of cyclohexylamine from a wastewater stream This addition should be completed in November 1995 and will reduce COD by an estimated 27 5% tons per year The capital investment for this project is approximately **$211,000**

Benefits

The project is expected to result in raw material savings of 85 tons per year of aniline 81 tons per year of carbon disulfide and 30 tons per year of sulfur After deduction of the operating cost of the recovery equipment the net savings is estimated to be **$96,000** per year

PROJECT 7

Problem

To recover both cyclohexylamine and benzthiazole for recycling back into processing

Solution

A two-stage rotary evaporator has been added in the Rubber Chemicals Department to distill the bottom residue from the cyclohexylamines distillation column Equipment for this project was installed at a cost of $386 000 in August 1994 Problems with shaft sealing have been encountered and more work is needed to complete the project

Benefits

Net savings of approximately **$124,000** per year are projected once the project is fully implemented

OTHER PROJECTS

The viscose rayon plant is developing plans for recovery of the remaining unreacted carbon disulfide from the reaction step This will eliminate 50 tons per year of emissions involving a capital cost of approximately $350,000

Technology to recover carbon disulfide emissions from the viscose rayon spinning process has been developed No estimate of emission reduction was provided but the capital cost is estimated at $1,050 000 to $1 400 000

The Oil Additives Department is working on a project to reduce solid waste by selling a sand/zinc oxide mixture to the rubber industry

The Research Department is working on a project to purify a waste sodium sulfide stream for possible sale

COMPANY F

Industry Chemicals
Country Slovakia

No formal written policy on waste minimization as advocated by WEC was evident In fact it was apparent from the presentations and discussion that the elements of the WEC Waste Minimization Program were not disseminated beyond the environmental staff that had received the training

Despite this fact it was clear this company has a sophisticated environmental protection function and a strong dedication to minimizing their environmental impact A large chart showing major air emission reduction progress over time is displayed Water use and wastewater discharges are markedly reduced over the past years A mobile analytical laboratory is available for monitoring air emission Emission inventories reportedly exist for each of the fifty production units The Environmental Department sets limits on discharges from each of the units and the units pay for any excesses

It is obvious this company has both resources and dedication for reducing environmental impact and their efforts show positive results Because there were no operations staff in attendance there were limited examples of waste minimization projects However the ability of the fifty production units to respond to ever-decreasing acceptable emission levels suggests at least some level of success at waste minimization projects

Despite the high degree of environmental attention and concern the Company appears unwilling or not yet ready to begin to implement the WEC Waste Minimization Program Lack of knowledge or understanding by the new management may be a factor

COMPANY G

Industry Chemicals
Country Slovakia

This Company has a well-written and clearly stated policy of commitment to the WEC Waste Minimization Program The policy is signed by the Company's General Director They clearly understand the concepts and are utilizing a slow but steady approach to implementation As recommended by WEC, they have chosen to approach one production group at a time testing the concept as they progress To date, they have introduced waste minimization ideas to two production groups and seem satisfied with the program and the results

PROJECT 1

The PVAC plant is working on methods for reducing wastewater containing various levels of PVAC emulsion The Research and Development Department has defined ultrafiltration methods for concentrating the waste to 20% PVAC The waste minimization team is looking for ways to recycle to market this waste product Projected savings are about **$105,000** per year

PROJECT 2

The PVAC plant is working on ways to reduce the large amounts of raw material packaging that requires waste disposal

PROJECT 3

The anti-oxidant waste team researched methods for distilling a waste organic stream now requiring incineration A technique has been found and the required equipment has been identified at a capital cost of $130 000 Savings are estimated at **$175,000** per year

PROJECT 4

In the anti-oxidant plant, catalytic incineration with caustic scrubbing is being researched as a technology to eliminate an organic air emission containing chlorine Some difficulties have been encountered with the scrubbing technology No estimates of capital cost or net savings are yet available