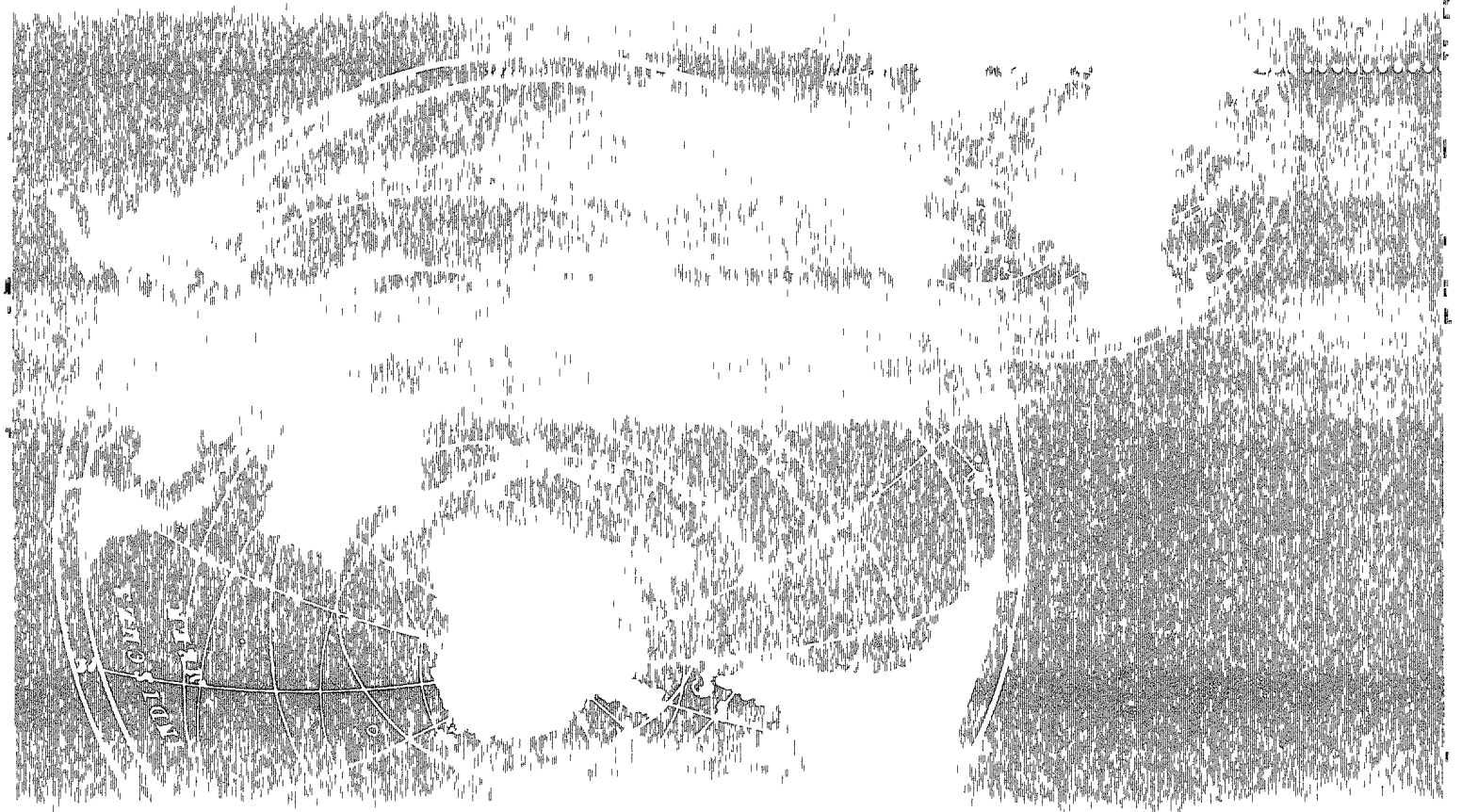
PN-ACD-241

98717



ECONOMIC AND ENVIRONMENTAL

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

Air Products and Chemicals, Inc
Akzo Nobel Inc
AlliedSignal Inc
Amoco Corporation
AMP Incorporated
Anheuser-Busch Companies, Inc
Apple Computer Inc
ABB Asea Brown Boveri
Ashland, Inc
AT&T
Baxter International
The BFGoodrich Company
BHP Minerals
The Black & Decker Corporation
Borden, Inc
The British Petroleum Co p l c
Bristol-Myers Squibb Company
CEMEX S A
Ciba-Geigy Limited
The Coca-Cola Company
Colgate-Palmolive Company
Compaq Computer Corporation
Digital Equipment Corporation
The Dow Chemical Company
Duracell Inc
Eastman Kodak Company
E I DuPont de Nemours & Co
Elf Aquitaine
Exxon Corporation
F Hoffman-La Roche AG
Ford Motor Company
General Electric Co
Glaxo Wellcome plc
Hoechst Celanese Corporation
IBM Corporation
ICI Americas Inc
Johnson & Johnson
Johnson Matthey p l c
LaFarge Coppee
Minerals Technologies
Mobil Oil Corporation
Noranda Inc
Nortel
Occidental Petroleum Corporation
Pfizer Inc
The Procter & Gamble Company
Rohm and Haas Company
Sandoz Corporation
Schering-Plough Corporation
S C Johnson & Son Inc
Solectron Corporation
STATOIL
Sun Microsystems Inc
Texaco Inc
3M
TRW Inc
United Technologies
Unocal Corporation
Volvo Cars of North America Inc
Warner-Lambert Company
Westvaco Corporation
Whirlpool Corporation
W R Grace & Co
ZENECA Limited

ECONOMIC AND ENVIRONMENTAL BENEFITS OF INDUSTRIAL WASTE MINIMIZATION IN ESTONIA, LATVIA AND LITHUANIA

1995

C

The Industrial Waste Minimization Program in the Baltic countries of Estonia Latvia and Lithuania is conducted by the World Environment Center (WEC) under the management of Romuald Michalek Vice President, Technical Programs WEC staff who contributed to the success of the program include Danello Cabico Project Assistant, Greg Cannon Project Coordinator, Karen Fidler Project Manager, Dr George Laszkiewicz, Project Manager Thomas Pluta Program Manager Prabodh Shah Project Manager Anne Randmer WEC Coordinator for Estonia Natalia Ladutko WEC Coordinator for Latvia and Dr Jonas Kapturauskas WEC Coordinator for Lithuania

Funding for the program is provided through a cooperative agreement with the United States Agency for International Development (USAID) In particular WEC acknowledges Mr Michael Kalinoski Industrial Pollution Specialist USAID Washington D C and USAID Mission staff in Estonia Latvia and Lithuania for their guidance and direction in the implementation of the program

EXECUTIVE SUMMARY

Since 1993, the World Environment Center (WEC) has worked in the Baltic countries of Estonia, Latvia and Lithuania to demonstrate the economic benefits of environmentally motivated low-cost waste minimization and cleaner production measures This report summarizes the results of 51 waste minimization projects implemented at 25 companies representing the metal finishing, chemical, dairy plastics cement meat processing oil shale refining textiles rubber, and leather tanning industrial sectors

WEC's Industrial Waste Minimization Program in the Baltic countries, with financial support from the United States Agency for International Development (USAID) saved the 25 participating companies over US $2 million per year Because savings of a similar magnitude will continue in future years the economic benefits gained by the companies are more appropriately expressed in terms of Net Present Value (NPV) Altogether the NPV of the economic benefits for the 51 waste minimization projects at the 25 companies has been calculated at $7 3 million This is based upon an average project life of eight years a dollar discount rate of 10 percent and a corporate tax iate of 30 percent

By decreasing the use of resources such as water energy, and raw materials, and by reducing the generation of waste materials the companies significantly improved their productivity environmental performance, and worker health and safety A summary of environmental benefits resulting from the 51 waste minimization projects is presented in Table 1 Indeed substantial reductions in releases to air, water, and land were achieved by the 25 companies Additional environmental benefits associated with decreased water energy, and raw material usage were also realized Information on specific environmental benefits of individual projects are presented in the main section of this report

The participating companies realized significant economic benefits from the 51 waste minimization projects as illustiated in Figure 1 To implement these projects WEC contributed about $258,000 for capital investment As a result of this investment companies achieved an estimated annual savings of approximately $1 million Moreover, most of the participating companies adopted the WEC waste minimization and cleaner production philosophy and methodology, investing an additional $213 000 in various waste minimization projects Company investments resulted in annual savings of over $1 million From the total investment of over $471 000, the total savings to the companies were over $2 million The investments made and the savings achieved by the companies demonstrate the success of WEC s program to "institutionalize" a waste minimization management culture in Baltic countries' industries

As shown in Figures 2 and 3 the benefits at the participating companies were achieved largely through activities requiring low-cost investments and short payback periods For example, 94 percent of investments were below $25,000 and 66 percent of projects had payback periods of less than six months The projects were implemented in 10 different industrial sectors, as shown in Table 2 The different types of waste minimization activities implemented are presented in Table 3

The main section of this report includes a summary list of the 51 waste minimization projects followed by one-page descriptions of these projects

The results of the WEC program provide a compelling financial case for waste minimization and cleaner production In the current phase of the program WEC is continuing the "institutionalization" of waste minimization activities in these and other industry sectors in cooperation with three Pollution Prevention Centers established in the Baltic region Not only will this strategy achieve environmental and economic benefits in the future, it will also contribute to the restructuring and privatization process of the Estonian Latvian, and Lithuanian industries

Table 1 Estimates of Environmental Benefits for 51 Waste Minimization Projects*

AIR

Air Pollutant	Emission Reduction (tons/year)			
	Estonia	Latvia	Lithuania	All Countries
Sulfur dioxide (SO_2)	-	210	62	272
Particulates	-	88	60	148
Nitrogen oxides (NO_x)	-	83	41	124
Carbon monoxide	-	14	35	49
Ammonia	-	12	30	42
Hydrocarbons	0 4	0 9	20	21
Hydrochloric acid	36	0	0	36

WATER

Water Pollutant	Discharge Reduction (tons/year)			
	Estonia	Latvia	Lithuania	All Countries
Wastewater (containing metals and other contaminants)	763,000	126,400	-	889,400
Chemical oxygen demand (COD)	84	-	-	84

LAND

Waste Material	Disposal Reduction (tons/year)			
	Estonia	Latvia	Lithuania	All Countries
Miscellaneous hazardous waste	1,780	140	-	1,920
Sludge	-	Significant[1]	-	-

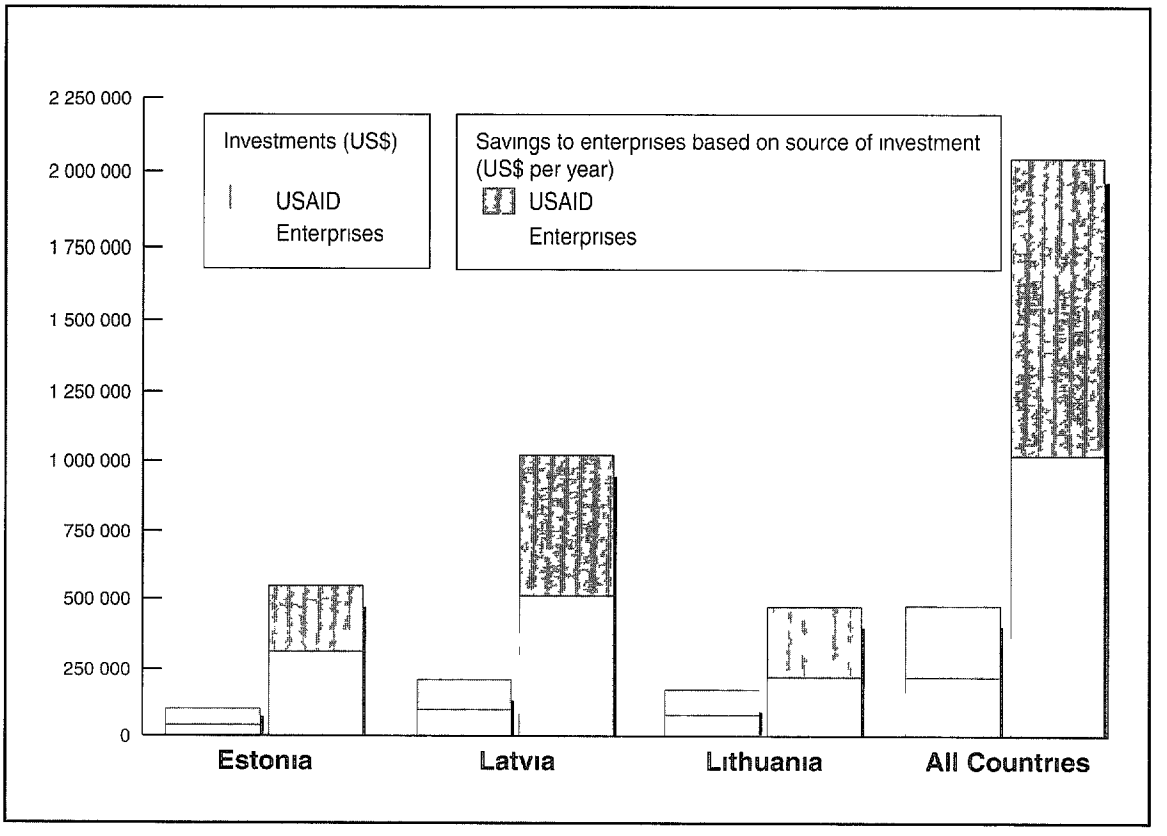
RAW MATERIALS

Raw Material	Savings (tons/year)			
	Estonia	Latvia	Lithuania	All Countries
Fresh water	770,700	126,400	-	897,100
Fuel oil	10	9 900	3,140	13,050
Solvents and other organics	4 430	23	170	4 620
Methane	-	-	490	490
Ammonia	-	12	30	42
Hydrochloric acid	36	-	-	36

[1] Actual estimates not available at this time

* The reductions in environmental releases to air, water, and land and raw material savings presented above reflect estimates based on available data for each of the 51 waste minimization projects Detailed information on specific environmental benefits of individual waste minimization projects are presented in the main section of this report

Figure 1 Summary of Investments and Economic Benefits for 51 Waste Minimization Projects*



Investments (US$)

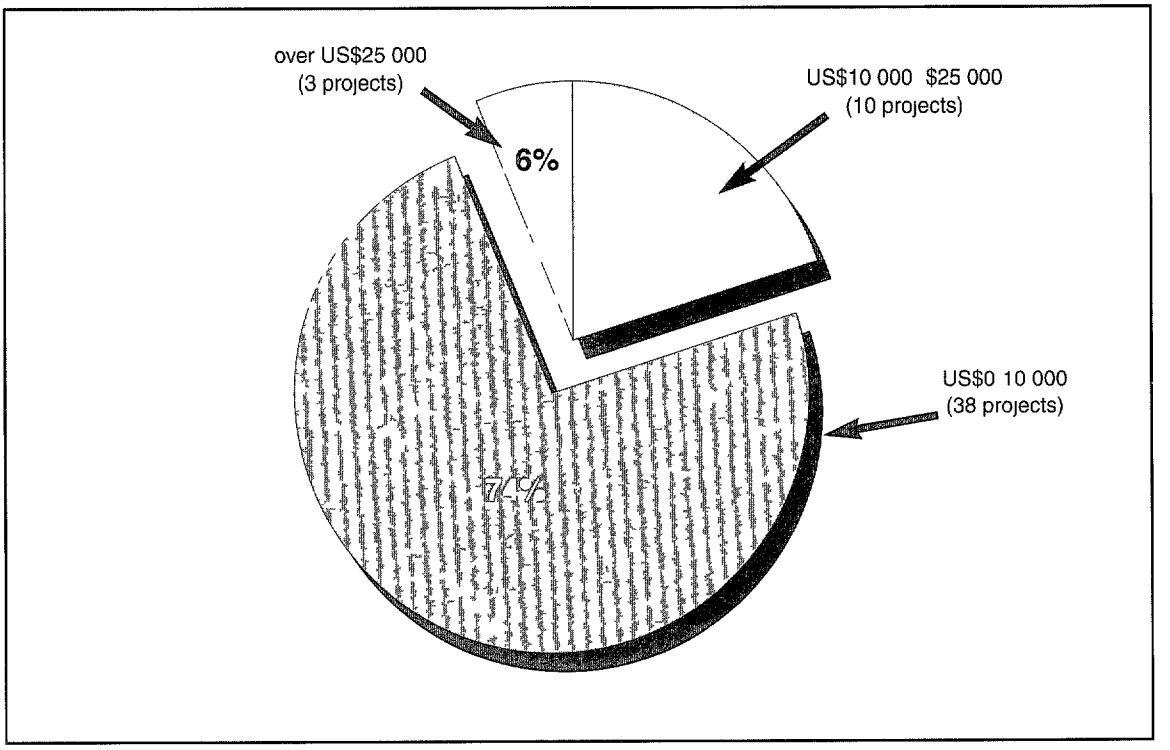
Source	Estonia	Latvia	Lithuania	All Countries
USAID	57,340	108,555	92,490	258,390
Enterprises	40,670	97,800	75,000	213,470
Total	98,010	206,355	167,490	471,860

Savings to Enterprises Based on Source of Investment (US$ per year)

Source	Estonia	Latvia	Lithuania	All Countries
USAID	243,750	510,440	258,000	1,012,190
Enterprises	309,230	510,610	215,130	1,034,970
Total	552,980	1,021,050	473,130	2,047,160

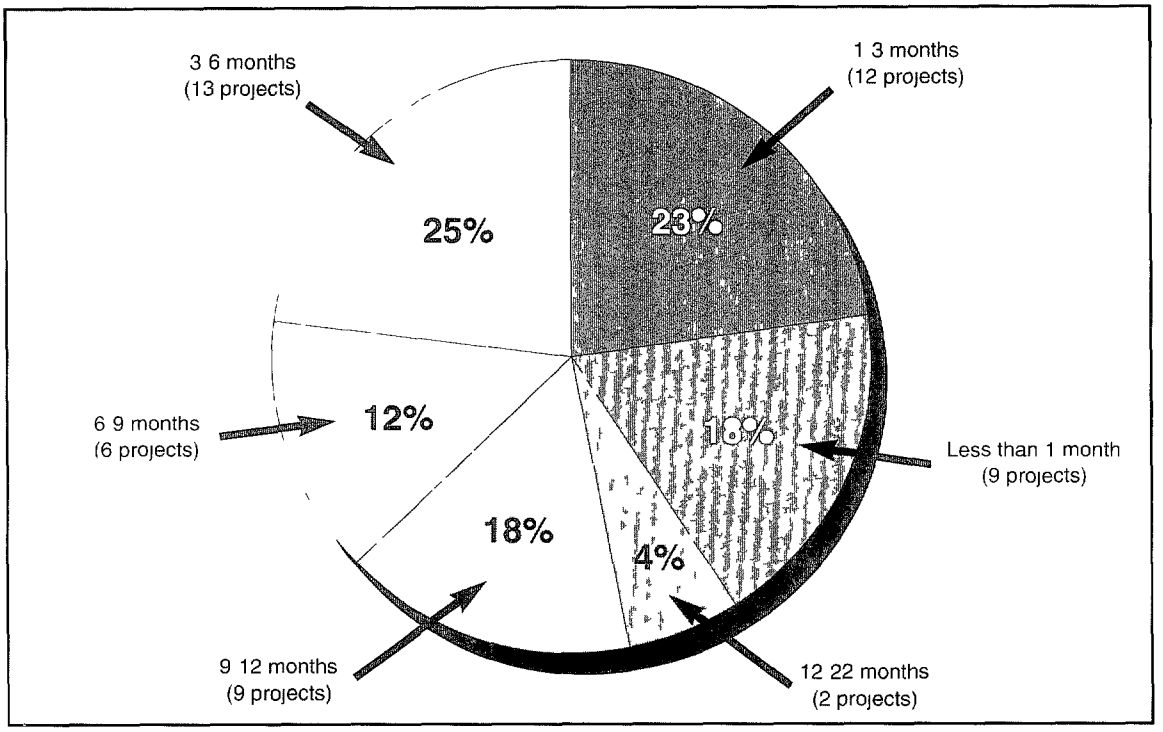
* This figure presents a summary of investments by U S Agency for International Development (USAID) and the enterprises for the 51 waste minimization projects along with the corresponding annual savings by the 25 enterprises in the first year following project implementation Savings of a similar magnitude will continue in future years The net present value (NPV) of the total savings is estimated to be US$ 7 3 million based on an average project life of eight years a dollar discount rate of 10 percent and a corporate tax rate of 30 percent

Figure 2 Range of Investments for 51 Waste Minimization Projects



Investment Range (US $1,000)	Number of Projects				% of Total Projects
	Estonia	Latvia	Lithuania	All Countries	
0 - 1	5	1	3	9	18
1 - 5	7	5	3	15	29
5 - 10	7	3	4	14	27
10 - 25	1	8	1	10	20
25 - 50	0	1	0	1	2
> 50	0	0	2	2	4
Total	20	18	13	51	100

Figure 3 Summary of Payback Periods for 51 Waste Minimization Projects



Payback Period (months)	Number of Projects				% of Total Projects
	Estonia	Latvia	Lithuania	All Countries	
< 1	4	4	1	9	18
1 - 3	8	2	2	12	23
3 - 6	3	5	5	13	25
6 - 9	2	0	4	6	12
9 - 12	3	5	1	9	18
12 - 22	0	2	0	2	4
Total	20	18	13	51	100

Table 2 Industrial Sectors Participating in Waste Minimization Projects

Industrial Sector	Number of Enterprises			
	Estonia	Latvia	Lithuania	All Countries
Metal Finishing	1	6	-	7
Chemical	1	1	2	4
Dairy	1	2	-	3
Plastics		-	3	3
Cement	-	1	1	2
Meat Processing	2	-	-	2
Oils Shale Refining	1	-	-	1
Textiles	-	1	-	1
Rubber	-	-	1	1
Leather Tanning	1	-	-	1
Total	7	11	7	25

Table 3 Types of Waste Minimization Activities Implemented

Waste Minimization Activity Type	Number of Activities Implemented[1]			
	Estonia	Latvia	Lithuania	All Countries
Process Control Improvement	6	9	8	23
Equipment Modification	6	11	0	17
Material Recycle	7	2	1	10
Change in Operating Practice	4	1	4	9
Process Modification	2	3	2	7
Raw Material Substitution	0	1	0	1

[1] Some of the 51 waste minimization projects involved more than one type of waste minimization activity

51 INDUSTRIAL WASTE MINIMIZATION PROJECTS

IN ESTONIA, LATVIA AND LITHUANIA

SUMMARY OF 51 INDUSTRIAL WASTE MINIMIZATION PROJECTS IN BALTIC COUNTRIES OF ESTONIA, LATVIA, AND LITHUANIA

1	RAS 'Kiviter Kohtla-Jarve Estonia	Oil Shale Refinery Reduces Air Emissions *Equipment Modification*	None[a] 40[b]	500	1
2	"	Oil Shale Refinery Saves Water *Material Reuse*	500[b]	7,500	< 1
3	"	Oil Shale Refinery Saves Raw Materials and Reduces Waste *Material Reuse*	1 500[b]	1 500	12
4	'	Oil Shale Refinery Saves Water and Reduces Wastewater Discharges *Material Reuse*	4 040[b]	125 000	< 1
5	"	Oil Shale Refinery Reduces Waste Disposal *Material Reuse*	5,400[b]	18,000	3
6	'	Oil Shale Refinery Saves Raw Materials *Material Reuse*	6 300[b]	9,300	8
7	"	Oil Shale Refinery Saves Raw Materials and Reduces Waste Disposal *Process Modification*	5,730[a] 2,070[b]	70 650	< 2
8	"	Oil Shale Refinery Saves Energy and Reduces Waste Disposal *Process Control Improvement*	19 000[a] 3,650[b]	27 300	10
9	AS 'NitroFert' Kohtla-Jarve Estonia	Fertilizer Plant Reduces Water Consumption and Wastewater Discharges *Process Control Improvement*	6 800[a] 1 100[b]	51,000	2
10	Rakvere Meat Processing Plant Rakvere Estonia	Meat Processing Plant Reduces Wastewater Discharges *Material Reuse*	1 447[a] 1,000[b]	11 600	< 3
11	"	Meat Processing Plant Saves Water and Reduces Wastewater Discharges *Process Modification*	1 447 1 400[b]	9 500	< 4
12		Meat Processing Plant Saves Water *Equipment Modification Change in Operating Practice*	1 447 3,670[b]	114,000	< 1

[a] Investment by USAID
[b] Investment by Enterprise

SUMMARY OF 51 INDUSTRIAL WASTE MINIMIZATION PROJECTS IN BALTIC COUNTRIES OF ESTONIA, LATVIA, AND LITHUANIA (CONT'D)

13	Parnu Meat Processing Plant Parnu Estonia	Meat Processing Plant Reduces Waste *Change in Operating Practice Material Reuse*	3 000	14 100	< 3
14	"	Meat Processing Plant Saves Water and Reduces Waste *Equipment Modification Change in Operating Practice*	4 700	36,400	< 2
15	Nakro State Joint Stock Company Narva Estonia	Tannery Plant Saves Energy and Reduces Waste *Process Control Improvement*	600	4 130	2
16	"	Tannery Plant Saves Raw Materials and Reduces Wastewater Discharges *Process Control Improvement*	900	7 500	< 2
17	"	Tannery Plant Reduces Raw Material Usage and Wastewater Discharges *Process Control Improvement*	4 935	6 000	10
18	Tartu Dairy Tartu Estonia	Dairy Plant Saves Water and Reduces Wastewater Discharges *Equipment Modification*	6 450	10 400	< 8
19	NORMA Collective Enterprise Tallinn Estonia	Metal Finishing Plant Reduces Water Consumption *Equipment Modification Process Control Improvement*	880	2 600	4
20	"	Metal Finishing Plant Saves Raw Materials *Equipment Modification Change in Operating Practice*	10 000[b]	26,000	< 5
21	State Firm DauER Daugavpils, Latvia	Metal Finishing Plant Reduces Fuel Consumption *Equipment Modification*	25 000[b]	57,000	< 6
22		Metal Finishing Plant Saves Water and Reduces Wastewater *Process Modification Equipment Modification Process Control Improvement*	9 300	10 550	< 11

Investment by USAID
[b] Investment by Enterprise

SUMMARY OF 51 INDUSTRIAL WASTE MINIMIZATION PROJECTS IN BALTIC COUNTRIES OF ESTONIA, LATVIA, AND LITHUANIA (CONT'D)

		Waste Minimization Project	Investment	Savings	Payback
23	Riga State Electric Motors Building Works Riga Latvia	Metal Finishing Plant Reduces Fuel Consumption *Equipment Modification*	2,000[b]	46,400	< 1
24	"	Metal Finishing Plant Reduces Water Usage and Wastewater *Equipment Modification Process Control Improvement*	10 145[a] 2,000[b]	11,600	12
25	State Joint Stock Company Lokomotive, Daugavpils Latvia	Equipment Cleaning Plant Saves Water and Reduces Wastewater Discharges *Material Reuse*	4 500[b]	10 600	< 6
26	"	Metal Finishing Plant Saves Water *Process Modification Equipment Modification Process Control Improvement*	9,862[a]	11 000	< 11
27	State Riga Plant of Autoelectro-apparatus Riga Latvia	Metal Finishing Plant Reduces Fuel Consumption *Equipment Modification*	10 500[b]	213 100	< 1
28	"	Metal Finishing Plant Saves Water and Reduces Wastewater *Equipment Modification Process Control Improvement*	6 750[a]	50 600	< 2
29	State Stock Company Riga Carriage Building Works Riga Latvia	Metal Finishing Plant Reduces Water Use *Process Modification Equipment Modification Process Control Improvement*	12 300[a]	13,900	< 11
30		Metal Finishing Plant Reduces Air Emissions and Other Wastes *Equipment Modification*	4 800[b]	4 000	< 15
31	Joint Stock Company ARTA-F Riga Latvia	Metal Finishing Plant Saves Water and Reduces Wastewater *Equipment Modification Process Control Improvement*	13,900[a]	7,900	< 22

[a] Investment by USAID
[b] Investment by Enterprise

SUMMARY OF 51 INDUSTRIAL WASTE MINIMIZATION PROJECTS IN BALTIC COUNTRIES OF ESTONIA, LATVIA, AND LITHUANIA (CONT'D)

32	Joint Stock Company Dauteks Daugavpils, Latvia	Fibers Plant Saves Raw Materials and Reduces Waste *Process Control Improvement*	30 200	151 000	< 3
33	Joint Stock Company Broceni Broceni Latvia	Cement Plant Saves Energy and Reduces Air Emissions *Process Control Improvement*	10 000 4 000[b]	336 000	< 1
34	Joint Stock Company Lauma Liepaja Latvia	Textile Plant Reduces Wastewater Discharges *Raw Material Substitution*	None[a,b]	5 600	0
35		Textile Plant Conserves Fuel and Reduces Wastewater Discharges *Material Reuse*	20 000[b]	26 000	< 10
36	"	Textile Plant Reduces Fuel Consumption *Equipment Modification*	25 000[b]	50 000	6
37	Daugavpils Piena Kombinats Daugavpils Latvia	Dairy Plant Reduces Water Consumption and Wastewater Discharges *Process Control Improvement*	3 100[a]	6 500	< 6
38	Joint Stock Company 'Kurzemes Piens Liepaja Latvia	Dairy Plant Reduces Air Emissions *Change in Operating Practice*	3 000	9 300	< 4
39	Kedainiai State Chemical Plant Kedainiai Lithuania	Monoammonium Phosphate Plant Saves Raw Materials and Reduces Air Emissions *Process Control Improvement*	700	4 400	2
40	"	Fertilizer Plant Reduces Fuel Consumption *Change in Operating Practice*	900	1 700	< 7
41	"	Fertilizer Plant Improves Product Quality and Worker Health and Safety *Change in Operating Practice*	1 000	26 000	< 1
42	"	Fertilizer Plant Reduces Fuel Consumption *Process Control Improvement*	2 000[a]	4,600	< 6

[a] Investment by USAID
[b] Investment by Enterprise

SUMMARY OF 51 INDUSTRIAL WASTE MINIMIZATION PROJECTS IN BALTIC COUNTRIES OF ESTONIA, LATVIA, AND LITHUANIA (CONT'D)

43	Kedainiai State Chemical Plant Kedainiai Lithuania (Cont d)	Fertilizer Plant Saves Energy and Reduces Air Emissions *Change in Operating Practice*	5 000[a]	7 200	< 9
44	"	Fertilizer Plant Reduces Fuel Consumption and Air Emissions *Process Control Improvement*	10 000[a]	22 000	< 6
45	Joint Stock Company ACHEMA Jonava Lithuania	Fertilizer Plant Saves Raw Materials and Reduces Emissions *Process Modification Process Control Improvement*	24 000[a] 29,000[b]	168 000	4
46	Joint Stock Company Litoda Plunge Lithuania	Plastics Plant Reduces Fuel Consumption *Material Reuse*	1,390[a]	1 710	10
47	"	Plastics Plant Reduces Air Emissions *Process Modification Process Control Improvement*	8 000[a]	11,600	8
48	Joint Stock Company Vilniaus Buitine Chemija ' Plunge Lithuania	Plastics Plant Reduces Energy Usage *Change in Operating Practice*	10 500[a]	21 200	6
49	AB Plasta Plastics Manufacturing Company Vilnius Lithuania	Plastics Plant Saves Energy and Raw Materials and Reduces Air Emissions *Process Control Improvement*	9 500[a]	41 500	3
50	Joint Stock Enterprise INKARAS Kaunas Lithuania	Rubber Plant Reduces Air Emissions *Process Control Improvement*	9 500	13 220	< 9
51	Stock Company Akmenes Cementas, Akmenes Lithuania	Cement Plant Saves Fuel and Reduces Air Emissions *Process Control Improvement*	10,000[a] 46,000[b]	150,000	5

[a] Investment by USAID
[b] Investment by Enterprise

Equipment Modification at Oil Shale Refinery Reduces

Company RAS "Kiviter" **City** Kohtla Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	40	40	500	1 month

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Butyl acetate	0 38 tons/yr	-	-	0 38 tons/yr

Company Profile

RAS 'Kiviter' (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood oil coke bitumen and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers and reclaiming oil In the past the company also produced non-shale products such as benzene/toluene ammonia urea sulfuric acid, and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4,000 workers

Waste Minimization Project

At 'Kiviter some equipment in the dephenolization processing area including three tanks and three coolers is vented directly to the atmosphere This practice resulted in releases of butyl acetate and phenol to the atmosphere in the past

During the waste minimization project methods for eliminating emissions from this equipment were evaluated It was determined that emissions could be reduced by utilizing an existing vent system in the first dephenolization section of the recovery plant The existing vent system is equipped with a condenser that removes organic materials in the vent stream To implement the project the three tanks and three coolers were connected to the existing vent system As a result of the project the facility eliminated 0 38 tons/year of butyl acetate emissions

Equipment Piping
Cost - $40 (by Kiviter)

Completion Date June 1994

Company RAS "Kiviter" **City** Kohtla-Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	500	500	7,500	< 1 month

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	6,200 m^3/yr

Company Profile

RAS Kiviter (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood oil coke bitumen and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers and reclaiming oil In the past the company also produced non shale products such as benzene/toluene ammonia urea sulfuric acid and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4 000 workers

Waste Minimization Project

At "Kiviter groundwater stormwater runoff and leakage from buried pipelines in the area of the benzoic acid plant were previously collected and discharged to the facility s wastewater treatment plant At the same time the facility used local lake water for process cooling purposes

During the waste minimization project an investigation was undertaken to determine if the collected stormwater could be used in place of fresh water for process cooling Chemical analysis of the stormwater indicated that its was sufficiently clean for use as process cooling water To implement the project the facility installed piping to allow the stormwater to be pumped to the cooling water system As a result of the project the facility reduced its fresh water consumption by 6 200 m^3/year

Equipment Piping
Cost - Equipment $40 labor $425 (by Kiviter)

Completion Date December 1994

Material Reuse at Oil Shale Refinery Saves Raw Materials

Company RAS "Kiviter" **City** Kohtla-Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	1,500	1,500	1,500	12 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Oil		-	-	10 tons/yr
Contaminated sand	-	-	40 tons/yr	-

Company Profile

RAS 'Kiviter (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood oil coke bitumen and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers and reclaiming oil In the past the company also produced non-shale products such as benzene/toluene, ammonia urea sulfuric acid and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4 000 workers

Waste Minimization Project

At 'Kiviter leaking oil pumps at a pumping station release about 10 tons/year of oil on the ground In the past sand was place on the ground in the area of the leaking oil pumps to absorb the leaked oil When saturated the sand was removed and combined with fuses produced by the retorting process and disposed of as waste This procedure was labor intensive and added to the fuse disposal burden by about 40 tons/year

During the waste minimization project alternative methods for handling the oil from the leaking pumps were evaluated A decision was made to install a drainage system around the pumps to collect and store the spilled oil The oil is then recycled for use in the process As a result of the project the facility recovered 10 tons/year of oil for reuse and reduced the amount of contaminated sand disposed as waste

Equipment Drainage system Supplier - local
Cost - $1 500 (by Kiviter)

Completion Date August 1994

Material Reuse at Oil Shale Refinery Saves Water and Wastewater Treatment

Company RAS "Kiviter" **City** Kohtla Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	4,040	4,040	125,000	< 2 weeks

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	91,000 m^3/yr
Wastewater	-	91,000 m^3/yr	-	-

Company Profile

RAS 'Kiviter (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood oil coke bitumen and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers and reclaiming oil In the past the company also produced non-shale products such as benzene/toluene ammonia urea sulfuric acid and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4 000 workers

Waste Minimization Project

At 'Kiviter " vaporized heavy and light oils produced during the pyrolysis of oil shale are cooled and condensed as they exit the retorts These fractions are then extracted with water to remove phenols present in the oils The condensing system consists of indirect air coolers (for the heavy oil fraction) water cooled condensers and water sprays Recycled phenol water is utilized in the water sprays

During the waste minimization project the process was reviewed to identify opportunities to reduce water consumption and wastewater treatment costs Data were collected to determine which retorts were producing excess phenol water The project was implemented in three parts First leaks of recycled water from the condensation equipment were eliminated reducing water consumption by 8 000 m^3/year Second the quantity of recycled phenol water and middle fraction oil used to spray and condense heavy oil was optimized reducing water consumption for spraying oil separators by 35 400 m^3/year Third recycled phenol water was substituted for a portion of the phenol water used to spray oil separators reducing water consumption by 47 600 m^3/year As a result of the project the plant reduced water consumption by a total of 91 000 m /year and reduced wastewater discharges by the same amount

Equipment Pumps piping Supplier - local
Cost - $4 040 (by ' Kiviter)

Completion Date September 1993

Material Reuse at Oil Shale Refinery Reduces

Company RAS "Kiviter" **City** Kohtla Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	5,400	5,400	18,000	3 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Retort fuses	-	-	1,300 tons	-

Company Profile

RAS 'Kiviter" (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood, oil coke bitumen, and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers, and reclaiming oil In the past the company also produced non-shale products such as benzene/toluene ammonia urea, sulfuric acid and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4,000 workers

Waste Minimization Project

Fuses a mixture of oil shale dust oil and water are produced during retorting at 'Kiviter" In 1992 almost 4 500 tons of this material was produced Due to high disposal costs and the economic value of the lost shale oil product the company was interested in finding ways to reuse the fuses

During the waste minimization project options for reusing the fuses were evaluated A decision was made to produce a salable product from the fuses for use as a supplement in road paving material A cyclical demand for road paving materials exists based on the allocation of road building funds To implement the project the facility installed equipment to homogenize the fuses As a result of the project the facility sold 1,300 tons of homogenized fuses for road building purposes in 1993 In addition to sales revenues the facility also experienced savings from avoided disposal costs

Equipment Fuse homogenization equipment Supplier - local
Cost - $5 400 (by "Kiviter)

Completion Date October 1993

Company RAS "Kiviter" **City** Kohtla Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	6,300	6,300	9,300	8 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Benzoic acid	-	-	22 tons/yr	22 tons/yr

Company Profile

RAS Kiviter (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood oil coke bitumen and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers and reclaiming oil In the past the company also produced non-shale products such as benzene/toluene ammonia urea sulfuric acid and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4 000 workers

Waste Minimization Project

Kiviter" operates a system to recover benzoic acid formed by catalytic oxidation of toluene However in the past about 22 tons/year of solid benzoic acid collected in the recovery system due to equipment operational problems and the properties of benzoic acid

During the waste minimization project methods were evaluated for recovering the solid benzoic acid for reuse It was determined that the solid benzoic acid wastes could be collected melted and recycled to the benzoic acid distillation process To implement the project a separator was installed and connected to the tanks which supply benzoic acid for purification distillation The separator is aspirated to remove low boiling point impurities from the melted benzoic acid waste The remaining melt is then dropped to the tank supplying filtered benzoic acid for distillation As a result of the project the facility saved 22 tons/year of benzoic acid

Equipment Separator pneumatic valve piping and fittings fan and tank Supplier - local Cost - $6 300 (by Kiviter')

Completion Date June 1994

Process Modification at Oil Shale Refinery Saves Raw Materials and Reduces Waste Disposal

Company RAS "Kiviter" **City** Kohtla-Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
5,730	2,070	7,800	70,650	< 2 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Benzoic acid	-	-	157 tons/yr	157 tons/yr

Company Profile

RAS Kiviter (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood oil coke bitumen and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers and reclaiming oil In the past the company also produced non-shale products such as benzene/toluene ammonia, urea sulfuric acid and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4 000 workers

Waste Minimization Project

The distillation step to recover benzoic acid at Kiviter generates about 600 tons/year of distillation bottoms waste This waste is composed of 50 percent benzoic acid and small amounts of catalyst, benzoyl benzoate and terephthalic acid In the past the distillation bottoms were collected and disposed in a waste pile on-site

During the waste minimization project methods were evaluated for recovering the benzoic acid from the distillation bottoms It was determined that the amount of benzoic acid could be reduced from 50 percent to 30 percent or less by mixing the distillation bottoms with hot water at 96 to 98 C To implement the project a steam control valve and temperature measurement and control equipment (thermocouple insertion tube and temperature recorder/controller) were installed along with a steam flow measuring device to enable precise temperature control As a result of the project the facility recovered 157 tons/year of benzoic acid for reuse

Equipment Automatic temperature sensing and steam control system Supplier - Honeywell Minneapolis MN
Cost - Equipment $5 730 (by USAID) labor $2 070 (by Kiviter')

Completion Date May 1994

Better Process Control in Oil Shale Refinery Saves Energy

Company RAS "Kiviter" **City** Kohtla-Jarve
Industry Oil Shale Refining **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
19,000	3,650	22,650	27,300	10 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Energy	-	-	-	10 8 Gcal/yr
Retort fuses	-	-	257 tons/yr	-

Company Profile

RAS "Kiviter' (formerly Oil Shale Processing Association) began operation in 1924 The company refines Kukersite oil shale from Estonia for use in power production and in the manufacture of a wide variety of chemical products Products refined from the crude oil include boiler fuel impregnation oil for wood, oil coke bitumen, and scrubber naphtha The raw shale oil and retort water also contain significant amounts of water soluble phenols which are used to produce adhesives tannin rubber plasticizers and reclaiming oil In the past the company also produced non-shale products such as benzene/toluene ammonia urea sulfuric acid and mineral fertilizers Some of these products have been eliminated due to changed economic conditions and the sale of certain production units to other companies The plant employs about 4 000 workers

Waste Minimization Project

At 'Kiviter ' Kukersite oil shale is heated at high temperature to release oil A fuel gas byproduct is also produced This fuel gas in turn is burned with air to produce the high temperature for the oil shale retort process The air/fuel ratio must be precisely controlled to ensure optimum temperatures are maintained Because of variability in oil shale composition used at 'Kiviter ' the composition of the fuel gas produced from the oil shale is variable In the past the process did not operate at optimum conditions due to the lack of a method for fast reliable analysis of the fuel gas

During the waste minimization project an investigation was undertaken to identify methods for analyzing the fuel gas produced by the oil shale retort process It was determined that a gas chromatograph (GC) would enable rapid analysis of the gas exiting the retort This information could be used by operators to adjust air/fuel ratios to optimally process the oil shale based on actual fuel gas composition As a result of the project oil shale yield increased by 180 tons/year The facility also reduced energy consumption and the amount of fuses disposed as waste

Equipment Gas chromatograph Supplier - Hnu Systems
Cost - $19 000 (by USAID), $3 650 (by ' Kiviter)

Completion Date May 1995

Better Process Control at Fertilizer Plant Reduces Water Consumption and Wastewater Discharges

Company AS "NitroFert" **City** Kohtla-Jarve
Industry Chemical **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
6,800	1,100	7,900	51,000	2 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	273,000 m^3/yr
Wastewater	-	273,000 m^3/yr	-	-

Company Profile

AS "NitroFert is a chemical plant which manufactures ammonia urea ammonia water gaseous carbon dioxide, nitrogen and oxygen The company exports a large amount of ammonia-based fertilizer The plant, now privatized, was formerly part of a larger chemical manufacturing complex and thus shares some common facilities, including utilities and waste treatment facilities The plant employs about 600 workers

Waste Minimization Project

"Nitrofert' owns and operates two artesian wells which supply water for internal use and for use by two outside companies Altogether water from the two wells supply a total of nine major process units In the past water use was monitored at the wells but not at the nine process units Because of large volumes of wastewater discharges and high treatment costs the company was interested in implementing a water use reduction program

During the waste minimization project a two-part water conservation program was implemented First, water losses between the wellhead and the nine process units due to leaking pipes were reduced This was accomplished using a contactless flow meter to identify leaks followed by repair and/or replacement of leaking pipes Second measurements of water use by each of the nine process units were implemented to enable water costs to be charged back to each user To implement this part of the water conservation program permanent flowmeters were installed at each of the user points In addition, an employee awareness program was conducted at the plant site to raise awareness about the cost of purchasing and treating water wastewater treatment costs and disposal fees As a result of the project water use was reduced by 40 percent

Equipment

Portable contactless flow meter Supplier - Controlotron, NY
Cost - $6,800 (by USAID)
Permanent water flow meters Supplier - local
Cost - $1 100 (by Nitrofert)

Completion Date

December 1994

Reuse of Wastewater at Meat Processing Plant Reduces

Company Rakvere Meat Processing Plant
Industry Meat Processing
City Rakvere
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
1,447	1,000	2,447	11,600	< 3 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Chemical oxygen demand	-	54 tons O_2/yr	-	-

Company Profile

Rakvere Meat Processing Plant constructed in 1990 is a full line red meat plant processing pork beef and some lamb Plant operations include 1) slaughtering with separate pig and cattle processing lines 2) manufacturing of edible by-products including fresh cut packaging cooked hams and sausage and 3) a technical department for by-products processing water treatment and wastewater pretreatment The plant has an average daily production capacity of 42 tons of sausage products and 17 tons of semi-manufactured products Annual value of all products is about $25 million The plant employs about 950 persons

Waste Minimization Project

At Rakvere inedible solids from the slaughtering process are rendered in the technical department The wastewater discharge from the fat separation step known as ' glue water has a fat content ranging from 8 to 30 percent In the past this wastewater was discharged to the wastewater treatment facility contributing to high biological oxygen demand (BOD) loadings

During the waste minimization project an evaluation was performed to identify opportunities to reuse wastewater streams with high BOD Using a chemical oxygen demand (COD) analyzer it was determined that the 'glue water" stream had a high COD content and was a good candidate for recovery and reuse A decision was made to install a pump to divert and recover the 'glue water" for use by farmers as feed As a result of the project the facility reduced COD levels in its wastewater by 54 tons O /year

Equipment

Spectrophotometer DR 2000 Supplier - HACH Chemical Company
Loveland CO
Cost - $1 447 (by USAID)
Note the actual equipment cost was $4 400 Since the equipment has been utilized in two other waste minimization projects only one-third of the cost is assigned to this project
Pump system piping, Supplier - local
Cost - $1,100 (by 'Rakvere')

Completion Date

September 1994

Process Modification at Meat Processing Plant Saves Water and Reduces Wastewater Discharges

Company Rakvere Meat Processing Plant
Industry Meat Processing
City Rakvere
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
1,447	1,400	2,847	9,500	< 4 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	22,000 m^3/yr
Wastewater	-	22,000 m^3/yr	-	-
Chemical oxygen demand	-	9 tons O_2/yr	-	-

Company Profile

Rakvere Meat Processing Plant constructed in 1990 is a full line red meat plant processing pork beef and some lamb Plant operations include 1) slaughtering with separate pig and cattle processing lines 2) manufacturing of edible by-products including fresh cut packaging cooked hams and sausage and 3) a technical department for by-products processing water treatment and wastewater pretreatment The plant has an average daily production capacity of 42 tons of sausage products and 17 tons of semi-manufactured products Annual value of all products is about $25 million The plant employs about 950 persons

Waste Minimization Project

At Rakvere processing of cattle stomachs to recover salable products such as tripe requires extensive handling and cleaning of stomachs which contain manure In the past the cattle stomachs underwent two washings after removal of manure To increase the value of the product a third wash step was added The wastewater from all washing steps were sent to a manure press to concentrate solids before discharge to the wastewater treatment plant The stomach cleaning and washing procedure was performed on a flat surface which increased the amount of handling and water required

During the waste minimization project an evaluation was performed to identify opportunities to reduce the volume of wastewater streams with high biological oxygen demand (BOD) Using a chemical oxygen demand (COD) analyzer it was determined that the wash water from cattle stomach cleaning operations had a high COD content and was a good candidate for reduction A decision was made to construct a "birdcage' on which cattle stomachs could be stretched during washing This device facilitated handling exposed more stomach area for cleaning and reduced water use In addition screens were added to the wash drums to recover organic solids from the final two wash steps As a result of the project the facility reduced COD levels in its wastewater by 9 tons O /year and reduced fresh water consumption

Equipment

Spectrophotometer DR 2000 Supplier - HACH Chemical Company
Loveland CO
Cost - $1 447 (by USAID)
Note the actual equipment cost was $4 400 Since the equipment has been utilized in two other waste minimization projects, only one-third of the cost is assigned to this project
Squeegees nozzles, Supplier - local
Cost - $1,400 (by 'Rakvere')

Completion Date

September 1994

Company Rakvere Meat Processing Plant
Industry Meat Processing
City Rakvere
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
1,447	3,670	5,117	114,000	< 3 weeks

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-		316,800 m^3/yr
Wastewater	-	316,800 m^3/yr	-	-

Company Profile

Rakvere Meat Processing Plant constructed in 1990 is a full line red meat plant processing pork beef and some lamb Plant operations include 1) slaughtering with separate pig and cattle processing lines 2) manufacturing of edible by-products including fresh cut packaging cooked hams and sausage and 3) a technical department for by-products processing water treatment and wastewater pretreatment The plant has an average daily production capacity of 42 tons of sausage products and 17 tons of semi-manufactured products Annual value of all products is about $25 million The plant employs about 950 persons

Waste Minimization Project

At Rakvere cleanup of the slaughtering lines involved extensive use of water to hose solids into sewers leading to the wastewater treatment plant Many hoses were not equipped with shutoff nozzles and were left running when not in use These practices resulted in excessive water use and high operating costs

During the waste minimization project an evaluation was performed to identify opportunities to reduce the volume of wastewater streams with high biological oxygen demand (BOD) Using a chemical oxygen demand (COD) analyzer it was determined that the wastewater generated from cleanup of slaughter lines had a high COD content and was a good candidate for reduction To accomplish this a training program for supervisors and workers was implemented to emphasize the importance of water conservation and good operating practices In addition dry cleanup procedures using squeegees and clean as you work methods were introduced Finally a program was undertaken to ensure timely repair of leaking nozzles and replacement of missing nozzles As a result of the project the facility reduced water usage by 316 800 m^3/year

Equipment

Spectrophotometer DR 2000 Supplier - HACH Chemical Company, Loveland, CO
Cost - $1 447 (by USAID)
Note the actual equipment cost was $4 400 Since the equipment has been utilized in two other waste minimization projects only one-third of the cost is assigned to this project
Squeegees, nozzles, Supplier - local
Cost - $3,670 (by 'Rakvere')

Completion Date

September 1994

Change in Operating Practice and Material Reuse at Meat Processing Plant Reduces Solid Waste

Company Parnu Meat Processing Plant
Industry Meat Processing
City Parnu
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
3,000	0	3,000	14,100	< 3 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Biological oxygen demand	-	21 tons O_2/yr	-	-
Solid wastes	-	-	Yes[a]	-

[a] Actual estimates not available at this time

Company Profile

Parnu Meat Processing Plant constructed in 1897 is a full line red meat plant processing cattle hogs, and some sheep The plant is organized into three operating areas 1) slaughtering 2) manufacturing of edible by-products including fresh cut packaging cooked hams and sausage and 3) a technical water treatment and wastewater pretreatment plant Products are sold to distributors The annual value of manufactured products is about $3 million The plant employs about 250 persons

Waste Minimization Project

At Parnu various operations in the slaughter line resulted in uncontrolled discharges to the municipal wastewater treatment plant containing high organic loadings This practice resulted in high pollution discharge fees and penalties for exceeding biological oxygen demand (BOD) standards

During the waste minimization project an evaluation was performed to identify opportunities to reduce the volume of wastewater streams with high BOD Using a chemical oxygen demand (COD) analyzer a sampling protocol was developed to identify processes which had the highest COD loadings To reduce organic loadings, a training program was implemented to increase employee awareness of the purchase and treatment costs for water This was coupled with an incentive program to share savings from improved water management practices with employees In addition the facility implemented changes in operating practices including dry cleanup procedures and recovery of solid edibles for reuse as animal feed at a fox farm As a result of the project the facility reduced BOD loadings by 21 tons O /year and reduced land disposal of solid waste

Equipment Spectrophotometer DR 2000 Supplier - HACH Chemical Company
Loveland CO
Cost - $3,000 (by USAID)

Completion Date August 1995

Modifications to Equipment and Operating Practices to Meat Processing Plant Save Water and Reduce Waste

Company Parnu Meat Processing Plant
Industry Meat Processing
City Parnu
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
4,700	0	4,700	36,400	< 2 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-		30,000 m^3/yr
Energy	-	-	-	9%
Wastewater	-	28,500 m^3/yr	-	-
Solid waste	-	-	12%	-

Company Profile

Parnu Meat Processing Plant constructed in 1897 is a full line red meat plant processing cattle hogs and some sheep The plant is organized into three operating areas 1) slaughtering 2) manufacturing of edible by products including fresh cut packaging cooked hams and sausage and 3) a technical water treatment and wastewater pretreatment plant Products are sold to distributors The annual value of manufactured products is about $3 million The plant employs about 250 persons

Waste Minimization Project

In the past Parnu performed slaughtering operations two days per week Separate startup and cleanup procedures were conducted during each day that slaughtering operations were performed

During the waste minimization project an evaluation was performed to identify opportunities to reduce the volume of water consumed during startup and cleanup procedures As a result of the evaluation several operational changes were identified and implemented First a review of production levels indicated that the entire production schedule could be completed in one day instead of two days This operational change reduced water use lowered energy consumption to heat process water and reduced wastewater treatment and discharge fees Second a training program was implemented to emphasize the increasing costs of purchasing water and treating wastewater and the need to make improvements in work habits Third dry cleanup procedures were adopted to minimize the discharge of solids into the drains Fourth water supply hoses were equipped with nozzles and pistol guns to reduce water losses due to running water when hoses were not in use Finally installation of high pressure washers improved the efficiency of cleaning process equipment with a combination of hot water detergent and pressure As a result of the project the facility reduced water use by 30 000 m^3/year and reduced wastewater discharges by an almost similar amount Other benefits included lower energy use and reduced land disposal of solid waste

Equipment

High pressure washers Supplier Tuff Cat Littleton MA
Nozzles Supplier - Strahman Valves Florham Park NJ
Spray guns Supplier - Gunjet Spraying Systems Company Wheaton Illinois
Squeegees, Supplier - local
Cost - $4 700 (by USAID)

Completion Date

August 1995

Better Process Control at Tannery Plant Saves Energy and

Company Nakro State Joint Stock Company
Industry Tannery
City Narva
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
600	0	600	4,130	2 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Energy	-	-	-	Yes[a]
Wastewater	-	Yes[a]	-	-
Waste hides	-	-	2,600 m^2	-

[a] Actual estimates not available at this time

Company Profile

The Nakro State Joint Stock Company built in 1984 is the largest tannery in Estonia The company s primary product is chrome-tanned leather for lining and upper shoe parts Other products are used in the manufacture of garments gloves and handbags and other leather products The plant has an annual production capacity of 187 million square decimeters of finished product In addition to the tannery Nakro s subsidiary operations include sheepskin processing and manufacturing facilities for leather goods Some products are sold to the domestic market while others are exported to Russia Finland Italy and Germany The company owns three retail shops in Narva Export products include CRUST and WET BLUE leather raw hides, and leather residues Nakro employs about 800 people

Waste Minimization Project

At Nakro controlling the moisture content of hides is critical for optimizing product yield the use of treatment and finishing chemicals energy requirements for drying and labor and material costs for reprocessing rejects In the past moisture content determinations were conducted in the laboratory and required about 2 hours to complete As a result information on moisture content was not available to make frequent adjustments to the tanning process

During the waste minimization project methods for obtaining faster moisture determinations were evaluated A decision was made to use portable moisture meters at various points in the tanning process with back-up quality control checks by the laboratory This approach would provide operators with rapid information about the moisture content of hides and allow for more timely adjustments to various process operations As a result of the project the facility lowered energy costs by reducing drying time reduced the concentration of contaminants in wastewater discharges by decreasing use of treatment and finishing chemicals and generated less solid waste by producing fewer rejects

Equipment Portable moisture meters Supplier - Delmhorst, Towaco, NJ
Cost - $600 (by USAID)

Completion Date September 1995

Company Nakro State Joint Stock Company **City** Narva
Industry Tannery **Country** Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
900	0	900	7,500	< 2 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Treatment chemicals	-	-	-	4 250 kg/yr
Wastewater	-	Yes[a]	-	-

[a] Actual estimates not available at this time

Company Profile

The Nakro State Joint Stock Company built in 1984 is the largest tannery in Estonia The company s primary product is chrome tanned leather for lining and upper shoe parts Other products are used in the manufacture of garments gloves and handbags and other leather products The plant has an annual production capacity of 187 million square decimeters of finished product In addition to the tannery Nakro s subsidiary operations include sheepskin processing and manufacturing facilities for leather goods Some products are sold to the domestic market while others are exported to Russia Finland Italy and Germany The company owns three retail shops in Narva Export products include CRUST and WET BLUE leather raw hides and leather residues Nakro employs about 800 people

Waste Minimization Project

At Nakro precise determination of pH in hide finishing operations is critical for optimizing use of treatment and finishing chemicals and for reducing the concentration of contaminants in wastewater discharges to the wastewater treatment plant In the past pH measurements were performed using pH paper This method was imprecise and resulted in excess chemical use and contaminants in wastewater discharged from the tanning process

During the waste minimization project methods for obtaining fast accurate pH determinations were evaluated A decision was made to use portable pH meters to measure pH levels As a result operators have access to timely reliable information on pH levels which enables them to better control the hide finishing process The project reduced the amount of treatment chemicals used and the concentration of contaminants in wastewater discharged

Equipment Portable pH meters Supplier - OMEGA Engineering Stamford CT
Cost - $900 (by USAID)

Completion Date April 1995

Better Process Control at Tannery Plant Reduces Raw Material Usage and Wastewater Discharges

Company Nakro State Joint Stock Company
City Narva
Industry Tannery
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
4,935	0	4,935	6,000	10 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Treatment chemicals	-	-	-	Yes[(a)]
Wastewater	-	58 m^3/yr	-	-

[(a)] Actual estimates not available at this time

Company Profile

The Nakro State Joint Stock Company built in 1984 is the largest tannery in Estonia The company's primary product is chrome tanned leather for lining and upper shoe parts Other products are used in the manufacture of garments gloves and handbags and other leather products The plant has an annual production capacity of 187 million square decimeters of finished product In addition to the tannery Nakro's subsidiary operations include sheepskin processing and manufacturing facilities for leather goods Some products are sold to the domestic market while others are exported to Russia Finland Italy and Germany The company owns three retail shops in Narva Export products include CRUST and WET BLUE leather raw hides and leather residues Nakro employs about 800 people

Waste Minimization Project

At Nakro tanning operations generate wastewater streams with high organic loadings This wastewater is discharged to a central wastewater treatment plant In the past the facility relied upon manual methods to sample and analyze wastewater streams from different process locations and to measure the quality of the effluent leaving the treatment plant These methods were time consuming and inaccurate

During the waste minimization project alternative methods for analyzing wastewater composition were evaluated A decision was made to use a chemical oxygen demand (COD) analyzer to perform fast, accurate analyses of organic loadings in wastewater streams As a result of the project information is available to operators to allow more timely adjustments to dosages of treatment chemicals The facility has lowered its use of treatment chemicals and reduced the amount of contaminated wastewater discharged to the wastewater treatment plant

Equipment Spectrophotometer Supplier - HACH Company Loveland CO
Cost - $4 935 (by USAID)

Completion Date May 1995

Equipment Modification at Dairy Plant Saves Water and Money

Company Tartu Dairy
Industry Dairy
City Tartu
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
6,450	0	6,450	10,400	< 8 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-		-	30,000 m^3/yr
Wastewater	-	30,000 m^3/yr	-	-

Company Profile

Tartu Dairy located in Tartu is a regional dairy cooperative supplied by over 9 000 farmers In addition to pasteurized milk the dairy produces cheese butter curd and packaged ice cream Products are sold primarily within the regional market Surplus milk and milk that fails bacterial count is processed to manufacture casein Casein is exported to Germany for use in the manufacture of certain types of plastic and glue The dairy processes approximately 130 000 liters of milk per day

Waste Minimization Project

At Tartu milk delivery trucks and whey delivery trucks are washed once per day with a combination of hot and cold water Process equipment storage tanks and process and milk delivery areas are also washed once per shift with hot and cold water In the past all cleaning operations were performed using open ended rubber hoses Operators used fingers at the discharge end of the hose to develop a spray for cleaning Spray created manually was relatively inefficient for effective cleaning Because the hoses were not equipped with shut-off nozzles the water was often left running for periods of time until the operators had time to shut off the needle valves located on the walls

During the waste minimization project methods for reducing water use were investigated and implemented High pressure washers connected directly to water supply lines were purchased for cleaning of trucks production areas and equipment Open ended rubber hoses were equipped with shut-off spray nozzles As a result of the project consumption of water was reduced by 30 000 m^3/year and wastewater discharges were reduced by the same amount

Equipment

High pressure washers Suppliers - Tuff-Cat Littleton MA Northern Equipment, Inc Burnsville MN
Strahman automatic water saver spray nozzles Supplier - Spraying Systems Company, Randolph NJ
Cost - $6 450 (by USAID)

Completion Date

March 1995

Equipment Modifications and Better Process Control at Metal Finishing Plant Reduce Water Consumption

Company NORMA Collective Enterprise
Industry Metal Finishing
City Tallinn
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
880	0	880	2,600	4 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	1,600 m^3/yr
Wastewater	-	1,600 m^3/yr		

Company Profile

NORMA Collective Enterprise established in 1891 as a manufacturer of tin boxes and high quality tin products has evolved into a modern manufacturing facility producing a wide line of products These include automotive safety belts and other metal and plastic molded parts for the automotive industry, household goods and toys from sheet metal plastic toys and photo flash equipment Seat belts account for more than 90 percent of current production volume The production facility occupies about 60,000 m of floor space Main production lines include automatic zinc nickel and chrome electroplating lines automatic powder painting lines, injection molding machines and lithographing and heat treating equipment The plant employs about 1 600 skilled workers

Waste Minimization Project

At NORMA water flow to the electroplating tank on the alkaline zinc line was manually controlled by operators in the past During nonproduction periods the water valves to the electroplating tanks were often left open or water was added at higher than necessary flow rates This practice resulted in excess water consumption and discharges of wastewater to the wastewater treatment plant

During the waste minimization project alternative methods for controlling water flow to the electroplating tank were evaluated It was determined that conductivity was an important criterion for determining the quality of the rinse water To implement the project conductivity meters coupled to automatic flow controllers were installed in the tanks When the conductivity meter set point is reached the flow controller adds water until acceptable conductivity levels are reached As a result of the project the facility reduced fresh water consumption by 32 percent or 1 600 m^3/year and decreased operating costs

Equipment Conductivity meters Supplier - Myron L Company Carlsbad CA
Cost - $880 (by USAID)

Completion Date September 1994

Company NORMA Collective Enterprise
City Tallinn
Industry Metal Finishing
Country Estonia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	10,000	10,000	26,000	< 5 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Hydrochloric acid	36 tons/yr		-	36 tons/yr

Company Profile

NORMA Collective Enterprise established in 1891 as a manufacturer of tin boxes and high quality tin products has evolved into a modern manufacturing facility producing a wide line of products These include automotive safety belts and other metal and plastic molded parts for the automotive industry household goods and toys from sheet metal plastic toys and photo flash equipment Seat belts account for more than 90 percent of current production volume The production facility occupies about 60 000 m of floor space Main production lines include automatic zinc nickel and chrome electroplating lines automatic powder painting lines injection molding machines and lithographing and heat treating equipment The plant employs about 1 600 skilled workers

Waste Minimization Project

Hydrochloric acid is used extensively at NORMA In the past hydrochloric acid was purchased from sources outside the country and shipped in improperly equipped tank cars to an off site location where it was reloaded and transported to the plant There were significant evaporative losses of hydrochloric acid during transfer operations and a high potential for spills during unloading and transportation

During the waste minimization project an investigation was undertaken to reduce losses of hydrochloric acid during transfer and handling operations First alternative suppliers who met more stringent shipping container criteria were identified and a new acid supplier was selected Second an on-site acid storage facility equipped with vapor control and spill protection equipment was constructed As a result of the project shipping and transfer operations improved and interim transfer and storage steps were eliminated Annual losses of hydrochloric acid were reduced by an estimated 18 3 percent, or 36 tons/year

Equipment Storage tanks, piping Supplier - local
Cost - $10,000 (by NORMA)

Completion Date September 1994

Equipment Modification at Metal Finishing Plant

Company State Firm DauER
Industry Metal Finishing
City Daugavpils
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	25,000	25,000	57,000	< 6 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	800 tons/yr
Sulfur dioxide	16 tons/yr	-	-	-
Nitrogen oxides	6 4 tons/yr	-	-	-

Company Profile

The State Firm DauER is the largest manufacturer of industrial grade hand tools in Latvia The company produces electric and pneumatic hammers drills and saws Products are sold domestically and to Eastern and Western countries Production operations at DauER include ferrous metal casting, mechanical treatment plastic molding electroplating polymer plating and painting In 1994 DauER employed 1,690 people including 1,350 production workers

Waste Minimization Project

Electroplating operations at DauER involve the following steps alkaline degreasing, hydrochloric acid pickling, plating and rinsing In the past alkaline degreasing baths certain plating baths and rinse baths were heated by steam Steam was supplied to the electroplating operations from the boiler house located some distance away The steam supply lines were old and not well insulated resulting in significant energy losses and high operating costs

During the waste minimization project methods for improving the heating efficiency of the electroplating baths were evaluated Repairs to existing steam supply lines and insulation were considered but not implemented because of high costs Instead the company investigated alternative energy sources for supplying the necessary heat to the electroplating baths It was concluded that installation of electric heaters next to the electroplating baths would significantly decrease the heat losses previously experienced from the steam supply lines Furthermore the cost of installing electric heaters was significantly less than the cost of repairing and reinsulating the existing steam lines

By installing electric heaters next to the electroplating baths the company eliminated the energy losses associated with the steam supply lines As a result of the waste minimization project the company reduced its fuel oil consumption by 800 tons/year

Equipment Portable electric heaters Supplier - local
Cost - $25 000 (by DauER)

Completion Date May 1995

Process and Equipment Modifications and Better Process Control at Metal Finishing Plant Save Water

Company State Firm DauER
Industry Metal Finishing
City Daugavpils
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
9,300	0	9,300	10,550	< 11 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	21 000 m^3/yr
Wastewater	-	21,000 m^3/yr	-	-
Sludge containing heavy metals	-	-	50 %	-

The State Firm DauER is the largest manufacturer of industrial grade hand tools in Latvia The company produces electric and pneumatic hammers drills and saws Products are sold domestically and to Eastern and Western countries Production operations at DauER include ferrous metal casting mechanical treatment plastic molding electroplating polymer plating and painting In 1994 DauER employed 1 690 people including 1 350 production workers

Waste Minimization Project

Electroplating operations at DauER consume large amounts of fresh water for rinsing of parts The wastewater generated from rinsing operations is chemically treated to remove heavy metals In the past the rinsing operations and the wastewater treatment process were inefficient resulting in excessive water consumption wastewater discharges, and sludge generation

During the waste minimization project a comprehensive evaluation of the rinsing operations and wastewater treatment plant at DauER was conducted to identify opportunities for reducing water consumption wastewater discharges and sludge generation Several simple low cost equipment modifications changes in operating practices and process control improvements were identified and implemented First countercurrent rinsing methods were adopted to improve water use efficiency Second conductivity controllers were installed on rinse water baths to supply water only when conductivity exceeds preset parameters Third rinse water feed spargers (perforated pipes) were installed for better mixing of fresh water to the rinse water bath Fourth, dwell time over electroplating tanks was increased to reduce carry over of plating solution into the rinse baths Fifth flow meters were installed on water lines to measure and control the flow rate of water to the rinse tanks Sixth a pH meter was installed in the wastewater treatment plant to improve separation of heavy metals and reduce sludge volumes Finally a sludge level detector was installed to eliminate accidental discharges of sludge into the wastewater stream As a result of the waste minimization project the company reduced fresh water usage by 21 000 m^3/year and decreased wastewater discharges by the same amount The amount of sludge containing heavy metals was also reduced by 50 percent

Equipment

Conductivity controllers Supplier - Myron L Company Carlsbad CA
Spargers flow meters, Supplier - Utilities Supply Company Medford MA
pH meter, Supplier - Great Lakes Instruments Milwaukee WI
Sludge level detector Supplier Ecolotech La Grange IL
Cost - $9 300 (by USAID)

Completion Date

May 1995

Equipment Modification at Metal Finishing Plant Reduces

Company Riga State Electric Motors Building Works **City** Riga
Industry Metal Finishing **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	2,000	2,000	46,400	2 weeks

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	660 tons/yr
Sulfur dioxide	13 tons/yr	-	-	-
Nitrogen oxides	5 3 tons/yr	-	-	-

Company Profile

Riga State Electric Motor Building Works (EMBW) is a large manufacturer of various sizes of electric motors, generators compressors motor controls structural components machining tools steel and non-ferrous castings, and consumer washing and drying machines The facility is vertically integrated with extensive electroplating and metal finishing operations metal working shops and electrical shops The plant employed about 2,700 people in 1994

Waste Minimization Project

Certain electroplating baths at EMBW are maintained at elevated temperatures In the past the baths were heated by steam supplied from the boiler house located some distance away The extensive network of steam supply lines were poorly maintained and insulated resulting in excessive steam and energy losses through leaks in pipes fittings and broken insulation Steam losses were estimated to exceed 50 percent

During the waste minimization project it was determined that repairing and reinsulating or replacing the existing steam supply lines was not feasible due to high cost Alternative heating systems for the electroplating baths were evaluated and a decision was made to install electric heaters next to the process tanks This approach was simple to implement and significantly less expensive than repairing or replacing the existing steam lines As a result of the project the company eliminated energy losses associated with the steam supply lines and reduced its fuel oil consumption by 660 tons/year

Equipment Portable electric heaters Supplier - local
Cost $2 000 (by EMBW)

Completion Date May 1995

Equipment Modification and Improved Process Control at a Metal Finishing Facility Reduce Water Use and Wastewater

Company Riga State Electric Motors Building Works
City Riga
Industry Metal Finishing
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
10,145	2,000	12,145	11,600	12 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	800 m^3/yr
Wastewater	-	800 m^3/yr	-	-
Sludge containing heavy metals	-	Yes	Yes	-

Company Profile

Riga State Electric Motor Building Works (EMBW) is a large manufacturer of various sizes of electric motors generators compressors motor controls structural components machining tools steel and non ferrous castings, and consumer washing and drying machines The facility is vertically integrated with extensive electroplating and metal finishing operations metal working shops and electrical shops The plant employed about 2 700 people in 1994

Waste Minimization Project

EMBW operates two large electroplating lines which consume large volumes of water for rinsing of electroplated parts The wastewater generated from the rinsing operations is collected and chemically treated to remove chemicals and heavy metals In the past the rinsing operations and the wastewater treatment process were inefficient resulting in excessive water consumption and discharges of heavy metals

During the waste minimization project a comprehensive evaluation of the rinsing operations at EMBW was conducted to identify opportunities for reducing water consumption and wastewater discharges Similarly the wastewater treatment process was evaluated to identify opportunities for reducing levels of heavy metals in wastewater discharged from the plant Several simple low cost equipment modifications and process control improvements were identified and implemented First conductivity controllers were installed on rinse water baths to supply water only when conductivity exceeds preset parameters Second rinse water feed spargers (perforated pipes) were installed for better mixing of fresh water to the rinse water bath Third flow meters were installed on water lines to measure and control the flow rate of water to the rinse tanks Fourth a pH meter was installed in the wastewater treatment plant to improve separation of heavy metals and reduce sludge volumes Finally a sludge level detector was installed to eliminate accidental discharges of sludge into the wastewater stream As a result of the waste minimization project, the company reduced fresh water usage by 800 m^3/year and decreased wastewater discharges by the same amount The project also reduced the amount of heavy metals discharged to water and land and decreased the amount of fees paid by the plant

Equipment pH meter Supplier - Great Lakes Instruments Milwaukee WI
Conductivity controllers Supplier - Myron L Company Carlsbad CA
Sludge level detector, Supplier - Ecolotech LaGrange IL
Cost $10 145 (by USAID) $2 000 (by EMBW)

Completion Date May 1995

Use of Treated Wastewater at Equipment Cleaning Plant
Reduces Water and Reduces Wastewater Discharges

Company State Joint Stock Company "Lokomotive" **City** Daugavpils
Industry Metal Finishing **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	4,500	4,500	10,600	< 6 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	20,000 m^3/yr
Wastewater	-	20,000 m^3/yr	-	-

Company Profile

Founded in 1866 the State Joint Stock Company Lokomotive is a large plant that builds and refurbishes diesel locomotives from Central and Eastern European customers The plant is vertically integrated and includes operations for manufacturing and remanufacturing electric motors steel casting, forging machine shops electrical shops and electroplating Lokomotive employs over 2 700 persons including 2,200 production workers

Waste Minimization Project

As part of the refurbishing operations at Lokomotive the locomotives are cleaned with steam and hot water in a specially designed booth Wastewater generated from the cleaning operations is contaminated with oil grease paint and solid materials The wastewater is sent to the plant's wastewater treatment facility before discharge to the city sewer In the past the steam and hot water used in the cleaning operations were generated from the plant's fresh water supply Costs associated with this practice include the cost of fresh water, wastewater treatment costs and environmental fees based on the amount of contaminated wastewater discharged from the plant

During the waste minimization project it was determined that treated effluent water from the company s electroplating operations could be used in place of fresh water for locomotive cleaning (Previously, the electroplating effluent water was treated and discharged to the city sewer) To implement the project the company installed water storage tanks, piping and other related equipment The majority of the necessary equipment was available on-site As a result of the project the company reduced its fresh water consumption by 20 000 m^3/year and reduced its wastewater discharges by the same amount

Equipment Water storage tanks and piping (available at plant)
Cost - $4 500 (by Lokomotive)

Completion Date May 1995

Company State Joint Stock Company "Lokomotive" **City** Daugavpils
Industry Metal Finishing **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
9,862	0	9,862	11,000	< 11 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	8,700 m^3/yr
Wastewater	-	8,700 m^3/yr	-	-
Sludge containing heavy metals	-	Yes	Yes	-

Company Profile

Founded in 1866 the State Joint Stock Company Lokomotive is a large plant that builds and refurbishes diesel locomotives from Central and Eastern European customers The plant is vertically integrated and includes operations for manufacturing and remanufacturing electric motors steel casting forging machine shops electrical shops and electroplating Lokomotive employs over 2 700 persons including 2 200 production workers

Waste Minimization Project

Lokomotive operates an electroplating shop as part of its locomotive building and refurbishing operation In the past the facility consumed excessive amounts of water and discharged large amounts of wastewater because it lacked up-to-date processes equipment and procedures for rinsing of parts

During the waste minimization project a comprehensive evaluation of the rinsing operations at Lokomotive was conducted to identify opportunities for reducing water consumption and wastewater discharges Several low cost process and equipment modifications changes in operating practices and process control improvements were identified and implemented First countercurrent rinsing methods were adopted to improve water use efficiency Second conductivity controllers were installed on rinse water baths to supply water only when conductivity exceeds preset parameters Third rinse water feed spargers (perforated pipes) were installed for better mixing of fresh water to the rinse water bath Fourth dwell time over electroplating tanks was increased to reduce carry over of plating solution into the rinse baths Finally flow meters with hand controls and hand-operated valves were installed on water lines to measure and control the flow rate of water to the rinse tanks As a result of the waste minimization project the company reduced fresh water usage by 8 700 m^3/year and decreased wastewater discharges by the same amount The project also reduced the amount of heavy metals discharged to water and land and decreased the amount of environmental fees paid by the plant

Equipment

Conductivity controllers Supplier - Myron L Company Carlsbad CA
Flow meters Supplier - Burt Process Equipment Hamden CT
Spargers Supplier - Utilities Supply Company Medford MA
Cost $9,862 (by USAID)

Completion Date

May 1995

Equipment Modification at Metal Finishing Plant Reduces

Company State Riga Plant of Autoelectroapparatus
Industry Metal Finishing
City Riga
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	10,500	10,500	213,100	< 3 weeks

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	3,100 tons/yr
Sulfur dioxide	62 tons/yr	-	-	-
Nitrogen oxides	25 tons/yr	-	-	-

Company Profile

State Riga Plant of Autoelectroapparatus (RAE) is a large manufacturer of electronic subassemblies for the automotive and truck industry The company produces windshield wipers and wiper motor assemblies, instrument panels liquid level gauges and control/switch assemblies The plant is vertically integrated with large metal working electroplating/metal finishing and electric shops The company employs approximately 2,500 people

Waste Minimization Project

Certain electroplating baths at RAE are maintained at elevated temperatures In the past, the baths were heated by steam supplied from the boiler house located some distance away The extensive network of steam supply lines were poorly maintained and insulated resulting in excessive steam and energy losses through leaks in pipes, fittings and broken insulation Steam losses were estimated to exceed 50 percent

During the waste minimization project it was determined that repairing and reinsulating or replacing the existing steam supply lines was not feasible due to high cost Alternative heating systems for the electroplating baths were evaluated and a decision was made to install electric heaters next to the process tanks This approach was simple to implement and significantly less expensive than repairing or replacing the existing steam lines As a result of the project the company eliminated energy losses associated with the steam supply lines and reduced its fuel oil consumption by 3 100 tons/year

Equipment Portable electric heaters Supplier - local
Cost $10 500 (by RAE)

Completion Date March 1995

Company	**State Riga Plant of Autoelectroapparatus**	**City**	**Riga**
Industry	**Metal Finishing**	**Country**	**Latvia**

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
6,750	0	6,750	50,600	< 2 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	53,000 m^3/yr
Wastewater	-	53,000 m^3/yr	-	-
Sludge containing heavy metals	-	Yes	Yes	-

Company Profile

State Riga Plant of Autoelectroapparatus (RAE) is a large manufacturer of electronic subassemblies for the automotive and truck industry The company produces windshield wipers and wiper motor assemblies instrument panels liquid level gauges and control/switch assemblies The plant is vertically integrated with large metal working electroplating/metal finishing and electric shops The company employs approximately 2 500 people

Waste Minimization Project

RAE s manufacturing operations include electroplating/metal finishing lines In the past the facility consumed excessive amounts of water and discharged large amounts of wastewater because it lacked up-to-date processes equipment and procedures for rinsing of parts Moreover the facility s wastewater treatment plant was inefficient resulting in high levels of heavy metals discharged from the plant

During the waste minimization project a comprehensive evaluation of the rinsing operations and wastewater treatment plant operations at RAE was conducted to identify opportunities for reducing water consumption and wastewater discharges Several simple low cost equipment modifications and process control improvements were identified and implemented First conductivity controllers were installed on rinse water baths to supply water only when conductivity exceeds preset parameters Second rinse water feed spargers (perforated pipes) were installed for better mixing of fresh water to the rinse water bath Third flow meters were installed on water lines to measure and control the flow rate of water to the rinse tanks Fourth a pH meter was installed in the wastewater treatment plant to improve precipitation of heavy metals and reduce sludge volumes Finally, a sludge level detector was installed to eliminate accidental discharges of sludge into the wastewater stream As a result of the waste minimization project, the company reduced fresh water usage by 53 000 m^3/year and decreased wastewater discharges by the same amount The facility also reduced the amount of heavy metals discharged to water and land and paid less environmental fees

Equipment

pH meter and controller Supplier - Great Lakes Instruments Milwaukee WI
Conductivity controllers Myron L Company Carlsbad CA
Sludge level detector Supplier - Ecolotech LaGrange IL
Spargers Supplier - Utilities Supply Company Medford MA
Cost $6,750 (by USAID)

Completion Date

May 1995

Process and Equipment Modifications and Better Process Control at Metal Finishing Plant Reduce Water Use

Company State Stock Company Riga Carriage Building Works **City** Riga
Industry Metal Finishing **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
12,300	0	12,300	13,900	< 11 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	8,000 m^3/yr
Wastewater	-	8,000 m^3/yr	-	-
Sludge containing heavy metals	-	Yes	Yes	-

Company Profile

The State Stock Company Riga Carriage Building Works (RVR) is a large facility that builds and refurbishes railway passenger carriages The company s primary customers are the former Soviet Union countries Major operations at the facility are steel melting and casting metal cutting hot and cold stamping welding wire pulling wood working painting and electroplating RVR produced over 1,480 tons of steel castings in 1993 Currently the company employs about 3 000 workers

Waste Minimization Project

Electroplating operations at RVR include cyanide zinc nickel and chromium plating and rinsing In the past the facility consumed excessive amounts of water and discharged large amounts of wastewater because it lacked up-to-date processes equipment and procedures for rinsing of parts Moreover the facility s wastewater treatment plant was inefficient resulting in high levels of heavy metals discharged from the plant

During the waste minimization project a comprehensive evaluation of the rinsing operations and wastewater treatment plant at RVR was conducted to identify opportunities for reducing water consumption and wastewater discharges Several simple low cost equipment modifications and process control improvements were identified and implemented First conductivity controllers were installed on rinse water baths to supply water only when conductivity exceeds preset parameters Second rinse water feed spargers (perforated pipes) were installed for better mixing of fresh water to the rinse water bath Third flow meters and totalizers were installed on water lines to allow operators to monitor and control the flow rate of water to the rinse tanks Fourth, countercurrent rinsing methods were adopted to improve water use efficiency Finally a sludge level detector was installed to eliminate accidental discharges of sludge into the wastewater stream As a result of the waste minimization project the company reduced fresh water usage by 8 000 m^3/year and decreased wastewater discharges by the same amount The facility also reduced the amount of heavy metals discharged to water and land and paid less environmental fees

Equipment

Spargers Supplier - Utilities Supply Company, Medford, MA
Conductivity controllers, Supplier - Myron L Company Carlsbad, CA
Flow meters and totalizers flow sensors Supplier - Burt Process Equipment Hamden CT
Sludge level detector Supplier - Ecolotech, LaGrange, IL
Cost $12 300 (by USAID)

Completion Date

June 1995

Company State Stock Company Riga Carriage Building Works **City** Riga
Industry Metal Finishing **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	4,800	4,800	4,000	< 15 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Solvents	900 kg/yr	-	-	900 kg/yr
Paint waste	-	-	1,700 kg/yr	1,700 kg/yr

Company Profile

The State Stock Company Riga Carriage Building Works (RVR) is a large facility that builds and refurbishes railway passenger carriages The company's primary customers are the former Soviet Union countries Major operations at the facility are steel melting and casting metal cutting hot and cold stamping welding wire pulling wood working painting and electroplating RVR produced over 1 480 tons of steel castings in 1993 Currently the company employs about 3 000 workers

Waste Minimization Project

Railcar painting operations at RVR consume large amounts of paint and result in significant releases of organic vapor emissions to the atmosphere In the past the facility used high pressure air spray guns for painting

During the waste minimization project alternative painting methods were evaluated for reducing solvent emissions to air A decision was made to replace the high pressure air spray guns with hydraulic pressure spray guns The hydraulic pressure spray guns use less paint generate less waste and produce better quality results As a result of the project the facility reduced the amount of paint solvents released to the atmosphere by 900 kg/vear and the amount of paint waste generated during painting operations by 1 700 kg/year

Equipment High pressure hydraulic spray guns Supplier - local
Cost $4 800 (by RVR)

Completion Date June 1995

System Modification and Better Process Control at Metal Finishing Plant Save Water and Reduce Wastewater

Company Joint Stock Company ARTA F
City Riga
Industry Metal Finishing
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
13,900	0	13,900	7,900	< 22 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	3,600 m^3/yr
Wastewater	-	3,600 m^3/yr	-	-
Sludge containing heavy metals	-	Yes	Yes	-

Company Profile

The Joint Stock Company ARTA-F located in Riga is a medium-sized manufacturer of metal and plastic consumer accessories for the fashion and garment industries

Waste Minimization Project

ARTA-F operates an electroplating shop as part of its manufacturing facility In the past the facility consumed excessive amounts of water and discharged large amounts of wastewater because it lacked up-to-date processes equipment and procedures for rinsing of parts Moreover the facility s wastewater treatment plant was inefficient resulting in high levels of heavy metals discharged from the plant

During the waste minimization project a comprehensive evaluation of the rinsing operations and wastewater treatment plant at ARTA-F was conducted to identify opportunities for reducing water consumption and wastewater discharges Several simple low cost equipment modifications and process control improvements were identified and implemented First conductivity controllers were installed on rinse water baths to supply water only when conductivity exceeds preset parameters Second rinse water feed spargers (perforated pipes) were installed for better mixing of fresh water to the rinse water bath Third flow meters and totalizers were installed on water supply lines to allow operators to monitor and control the flow rate of water to the rinse tanks Fourth, in-line static mixers were installed in the line feeding the wastewater pre-treatment tank for better mixing of wastewater with sodium hydroxide reagents Fifth an additional precipitation tank was added to increase retention time of wastewater with reagents Finally a pH meter was installed in the wastewater treatment plant to improve separation of heavy metals and reduce sludge volumes and a sludge level detector was installed to eliminate accidental discharges of sludge into the wastewater stream As a result of the waste minimization project the company reduced fresh water usage by 3 600 m^3/year and decreased wastewater discharges by the same amount The facility also reduced the amount of heavy metals discharged to water and land and paid less environmental fees

Equipment

pH meter pH controller Supplier - Great Lakes Instruments Milwaukee WI
Conductivity controllers Supplier - Myron L Company Carlsbad CA
Sludge level detector Supplier - Ecolotech, LaGrange IL
In-line static mixers Supplier - EMI Incorporated Clinton CT
Spargers Supplier - Utilities Supply Company, Medford MA
Sludge level detector Supplier - Ecolotech LaGrange, IL
Flow meters and totalizers Supplier Burt Process Equipment, Hamden CT
Cost $13 900 (by USAID)

Completion Date

November 1994

Company Joint Stock Company Dauteks
City Daugavpils
Industry Chemical
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
30 200	0	30,200	151,000	< 3 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	270 tons/yr
Caprolactum monomer	-	-	-	20 tons/yr
Organic wastes	-	35 tons/yr	-	-
Solid wastes	-	-	138 tons/yr	-
Sulfur dioxide	5 4 tons/yr	-	-	-
Nitrogen oxides	2 2 tons/yr			

Company Profile

The Joint Stock Company Dauteks is a large chemical manufacturing facility specializing in production of Nylon 6 from caprolactum The plant supplies technical and textile grade yarn for tire cord fishing lines nylon stockings carpets curtains and utility bags The manufacturing facility processes more than 50 000 tons of caprolactum per year and employs over 2 000 people

Waste Minimization Project

At Dauteks, capron fiber is produced from polycaproamid which in turn is produced by polymerization of caprolactum monomer Measurement and control of viscosity in the polymerization reaction is critical for higher yield high quality product and decreased waste generation In the past the polymerization process did not operate at optimum conditions resulting in generation of large amounts of waste containing unreacted monomer and low molecular weight compounds The amount of solid waste generated was unnecessarily high due to the lack of ability by operators to continuously monitor the changing viscosity and adjust the process by controlling nitrogen flow to the reactor Previously operators monitored viscosity by taking periodic off-line measurements The off-line viscosity measurements required several hours and as a result process adjustments could only be made periodically

During the waste minimization project alternative methods for measuring viscosity were evaluated It was concluded that an on-line viscosity meter would provide operators with information necessary to control the polymerization reaction at optimum conditions As a result of the project operators are now able to maintain the process at optimum conditions resulting in less generation of waste Discharges of organic wastes to water decreased by 35 tons/year and generation of other solid wastes was reduced by 138 tons/year In addition the project reduced the facility s fuel oil consumption by 270 tons/year and raw material usage by 20 tons/year

Equipment Viscometer AR806HPHT Supplier - Nametre Company Metuchen NJ
Cost $30 200 (by USAID)

Completion Date November 1994

Company Joint Stock Company "Broceni" **City** Broceni
Industry Cement **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
10,000	4,000	14,000	336,000	2 weeks

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	4,800 tons/yr
Particulates	88 tons/yr	-	-	-
Sulfur dioxide	96 tons/yr	-	-	-
Nitrogen oxides	38 tons/yr	-	-	-
Carbon monoxide	14 tons/yr	-	-	-

Company Profile

The Joint Stock Company 'Broceni ' is a large cement plant located about 120 kilometers from Riga The plant is designed to process wet slurry and has a production capacity of 600 000 tons of cement per year Other products include lime ceramic and corrugated cement tiles and limestone The company employs about 650 people

Waste Minimization Project

At ' Broceni ' the cement kilns are fired with heavy oil In the past a portable analyzer was used to measure the composition of the kiln s exhaust gases This information did not allow operators to adjust frequently the air-to-fuel ratio necessary for optimum firing efficiency Under these operating conditions it was necessary to keep a high oxygen concentration in the exhaust gas to prevent explosions in the electrostatic precipitators This resulted in high fuel consumption and high particulate and sulfur dioxide emissions to the atmosphere The average fuel consumption was 180 kg/ton of clinker produced

Experimental data collected during the waste minimization project indicated that the fuel consumption could be decreased to 160 kg/ton of clinker if the oxygen concentration in the exhaust gas is continuously maintained at 1 3 to 1 5 percent Under these operating conditions additionally significant decreases in exhaust gas volume and emissions of particulates and sulfur dioxide would be achieved Based on these experimental data a decision was made to install a continuous oxygen/carbon monoxide analyzer

As a result of the project operators now have access to continuous measurements of oxygen and carbon monoxide gas levels which enable them to maintain an optimum air-to-fuel ratio in the cement kiln The project has decreased the facility s fuel consumption by 4 800 tons/year and reduced emissions of particulates sulfur dioxide nitrogen oxides and carbon monoxide

Equipment Oxygen/carbon monoxide analyzer Supplier - AMETEK Inc Pittsburgh PA
Cost $14 000 ($10,000 by USAID $4,000 by "Broceni")

Completion Date October 1995

Company Joint Stock Company Lauma **City** Liepaja
Industry Textile **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	0	0	5,600	immediate

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Dye	-	3,900 kg/year	-	-

Company Profile

The Joint Stock Company Lauma is a large manufacturer of polyester and cotton fabrics and women s foundation apparel The company sells products primarily to Central and Eastern European countries More than 2 000 workers are employed at the plant

Waste Minimization Project

Fabric dying operations at Lauma are performed in a closed horizontal vessel A roll of fabric consisting of several thousand cubic meters of material is placed in the vessel and dye solution is added Approximately 70 percent of the dye in the solution is absorbed in the fabric At the completion of the process cycle the dye solution containing 30 percent of the original dye loading is discharged untreated into the sewer

During the waste minimization project the plant evaluated alternative black dyes in order to identify a dye that would have higher absorptivity in the fabric As a result of the evaluation a substitute dye was identified that could be used as a replacement for the black dye used previously at the facility Over 93 percent of the new dye is absorbed by the fabric The cost of the substitute dye was equivalent to the dye that was replaced The project reduced the amount of dye discharged by the plant into the sewer by 3 900 kg/year and decreased the amount of environmental fees paid by the plant

Equipment None required

Completion Date May 1995

Use of Treated Wastewater at Textile Plant Conserves Fuel

Company Joint Stock Company Lauma
City Liepaja
Industry Textile
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	20,000	20,000	26,000	< 10 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	100 %	-	260 tons/yr

Company Profile

The Joint Stock Company Lauma is a large manufacturer of polyester and cotton fabrics and women's foundation apparel The company sells products primarily to Central and Eastern European countries More than 2 000 workers are employed at the plant

Waste Minimization Project

At Lauma several oil-fired boilers are operated that supply steam and hot water to the plant and to residences in the neighborhood Soil around the plant is contaminated with oil from past operations The company anticipates that future regulations will require them to collect and treat rain water from the plant site to remove oil contamination

During the waste minimization project alternative methods for treatment and possible reuse of the contaminated rainwater were investigated A decision was made to utilize a Russian technology to emulsify the oil in the contaminated rain water The finely dispersed emulsion could then be mixed with virgin fuel oil and used as boiler fuel As a result of the project the plant saved 260 tons/year of fuel oil and eliminated the oil contaminated wastewater discharged into the sewer The project also reduced the amount of environmental fees paid by the plant

Equipment SDM fuel oil emulsification system, Supplier - Russian
Cost $20 000 (by Lauma)

Completion Date May 1995

Company Joint Stock Company Lauma
City Liepaja
Industry Textile
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
0	25,000	25,000	50,000	6 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-		715 tons/yr
Sulfur dioxide	14 tons/yr	-	-	-
Nitrogen oxides	5 7 tons/yr	-	-	-

Company Profile

The Joint Stock Company Lauma is a large manufacturer of polyester and cotton fabrics and women s foundation apparel The company sells products primarily to Central and Eastern European countries More than 2 000 workers are employed at the plant

Waste Minimization Project

The Lauma plant occupies 11 5 hectares under a single roof which includes manufacturing maintenance and administrative offices A single heating system was used for both the offices and maintenance area In addition to normal office working areas this heating system was operated during the second shift and weekends when the production lines were running in order to provide heat to the maintenance area However this resulted in wasted energy by heating the unoccupied offices during evenings and weekends

During the waste minimization project an investigation was undertaken to determine if energy savings could be achieved by separating the single heating system into two systems one system for the maintenance area and a second system for the offices Separation of the heating systems would allow the facility to heat the maintenance area after normal office working hours without heating unoccupied offices It was determined that two separate heating loops could be installed at reasonable expense The new heating systems are controlled by thermostats and zone valves As a result of the project the facility saved 715 tons/year of fuel oil

Equipment Thermostats and zone valves Supplier - local
Cost $25 000 (by Lauma)

Completion Date May 1995

Better Process Control at Dairy Plant Reduces Water Consumption and Wastewater Discharges

Company Daugavpils Piena Kombinats
Industry Dairy
City Daugavpils
Country Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
3,100	0	3,100	6,500	< 6 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fresh water	-	-	-	11,300 m^3/yr
Wastewater	-	11,300 m^3/yr	-	-

Company Profile

The Daugavpils Dairy is a regional dairy located in northeast Latvia In addition to milk the dairy produces cultured milk butter several types of cheeses yogurt cream sour cream pressed curd, cottage cheese, varieties of ice cream and casein Except for casein which is exported to Germany all the dairy products are sold within Latvia in the regional market The dairy processes approximately 110 metric tons of milk daily About 300 people were employed by the dairy in 1994

Waste Minimization Project

The dairy discharges process wastewater including whey to the municipal wastewater treatment plant To comply with city discharge regulations for biological loading the dairy needed to dilute the whey prior to discharge Due to lack of instrumentation to measure the biological oxygen demand (BOD) levels in the wastewater, the dairy was adding more water than necessary to assure compliance with the regulations In the past, BOD measurements took up to five days and, as a result they could not be used to optimize water addition to the whey

During the waste minimization project a conclusion was reached that the addition of water to the whey could be optimized if a fast reliable method for measuring BOD was available This was accomplished by purchasing a chemical oxygen demand (COD) analyzer Using the COD meter, information on biological load in the wastewater is now available every hour As a result of the project the dairy has reduced water addition to the whey by 33 percent In addition to fresh water savings of 11,300 m^3/yr, the facility reduced wastewater discharges by the same amount

Equipment COD analyzer Supplier - Hach Company, Loveland, CO
Cost $3,100 (by USAID)

Completion Date April 1995

Company Joint Stock Company "Kurzemes Piens" **City** Liepaja
Industry Dairy **Country** Latvia

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
3,000	0	3,000	9,300	< 4 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Ammonia	12 tons/yr	-	-	12 tons/yr

Company Profile

The Joint Stock Company Kurzemes Piens is a regional dairy with five plants located in the Liepaja region The dairy s main products are milk yogurt cottage cheese kefir sour cream and butter The plant processes about 100 metric tons of milk per day The main dairy unit located in the city of Liepaja employed 54 people in 1994

Waste Minimization Project

The five dairies operated by Kurzemes Piens are supported by three refrigeration plants The refrigeration units are over 50 years old In the past each refrigeration plant was estimated to lose approximatelv 4 tons of ammonia refrigerant per year through leaky piping systems The dairy usually repaired major and obvious leaks However manual inspections for leaks were unsafe due to the toxicity of ammonia gas Consequently minor leaks often were not detected and repaired

During the waste minimization project it was determined that rebuilding the refrigeration plants was not cost-effective Instead portable ammonia detectors were purchased for use at each of the three refrigeration plants Using these detectors the plants have been able to detect and repair virtually all ammonia leaks and maintain the refrigerant systems in leak-free condition As a result of the project a total of 12 tons/vear of ammonia emissions into the atmosphere have been eliminated from the three refrigeration plants and worker health and safetv has been improved

Equipment Portable ammonia detectors Supplier - U S Industrial Products Co Buena Park, CA
Cost $3,000 (by USAID)

Completion Date November 1994

Better Process Control at Monoammonium Phosphate Plant Saves Raw Materials and Reduces Air Emissions

Company Kedainiai State Chemical Plant
City Kedainiai
Industry Chemical
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
700	0	700	4,400	2 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Ammonia	30 tons/yr	-	-	30 tons/yr

Company Profile

Kedainiai Chemical Plant located about 100 km northwest of Vilnius is one of the largest chemical plants in Lithuania The company manufactures sulfuric acid phosphoric acid monoammonium phosphate (MAP) and aluminum fluoride Intermediate and finished products are exported to Eastern and Western European countries and Japan The plant employed 1 384 people in 1994

Waste Minimization Project

In the manufacture of monoammonium phosphate (MAP) at Kedainiai ammonia and phosphoric acid are reacted under controlled pH conditions Failure to maintain pH at optimum levels results in process upsets and excessive emissions of unabsorbed ammonia into the atmosphere In the past pH levels were measured every 20 minutes using pH paper The accuracy of pH measurements using this method was poor Therefore to ensure that the pH levels were sufficient the reaction was controlled at a higher pH level than necessary This was accomplished by overformulation of the product resulting in excess ammonia concentrations in the final MAP product

During the waste minimization project methods for obtaining more accurate and timely pH measurements were investigated It was determined that a laboratory pH meter would provide pH measurements more quickly and accurately than the previous method Installation of a pH meter has resulted in fewer process upsets and ammonia emissions to the atmosphere Better process control has also improved process efficiency and reduced the amount of ammonia consumed in the MAP reaction

Equipment pH meter, Supplier - Orion Hillsboro, OR
Cost $700 (by USAID)

Completion Date October 1994

Company Kedainiai State Chemical Plant **City** Kedainiai
Industry Chemical **Country** Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
900	0	900	1,700	< 7 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	30 tons/yr
Sulfur dioxide	0 6 ton/yr	-	-	-
Nitrogen oxides	0 24 ton/yr	-	-	-

Company Profile

Kedainiai Chemical Plant located about 100 km northwest of Vilnius is one of the largest chemical plants in Lithuania The company manufactures sulfuric acid phosphoric acid monoammonium phosphate (MAP) and aluminum fluoride Intermediate and finished products are exported to Eastern and Western European countries and Japan The plant employed 1 384 people in 1994

Waste Minimization Project

The production processes at Kedainiai are supported by a thermoelectric power plant using four oil-fired boilers each burning 50 tons per hour of fuel The boilers generate steam to drive turbines for electricity and also provide steam and hot water for process requirements and domestic use Oil-fired burners generate soot and carbon which coat the steam generating heat exchanger pipes This in turn reduces the heat transfer between the hot flue gas from the boiler and the cold water running through the heat exchanger pipes Poor heat transfer results in energy losses To keep the heat exchanger surfaces clean soot build-up is removed periodically by a blast of steam in a procedure called boiler 'blow down In the past the effectiveness of the blow down was determined by measuring the salinity of the blow down water in a laboratory Because the results of this analysis were not immediately available, they could not be used to effectively control the blow down process and reduce the energy losses occurring due to poor heat transfer in the heat exchanger

During the waste minimization project alternative methods for analyzing salinity of the blow down water were investigated A decision was made to install a conductivity meter which could instantaneously measure the water salinity As a result of the project frequent measurements of blow down water salinity are available allowing boiler operators to clean the heat exchanger effectively and maintain it in good condition The project resulted in lower fuel consumption and decreased emissions of sulfur dioxide and nitrogen oxides

Equipment Conductivity/TDS meter CDH-42 Supplier - OMEGA International
Stanford, CT
Cost $900 (by USAID)

Completion Date October 1994

Change in Operating Practice at Fertilizer Plant Improves Product Quality and Worker Health and Safety

Company Kedainiai State Chemical Plant
Industry Chemical
City Kedainiai
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
1,000	0	1,000	26,000	2 weeks

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Radiation	Yes[a]	-	-	-

[a] Actual estimates not available at this time

Company Profile

Kedainiai Chemical Plant located about 100 km northwest of Vilnius is one of the largest chemical plants in Lithuania The company manufactures sulfuric acid phosphoric acid, monoammonium phosphate (MAP) and aluminum fluoride Intermediate and finished products are exported to Eastern and Western European countries and Japan The plant employed 1,384 people in 1994

Waste Minimization Project

Phosphate rock and sulfur are two raw materials used in Kedainiai s processes Phosphate rock is imported from Russia and sulfur is imported from the Ukraine Some of these raw materials contain radioactive contamination Because customers do not accept finished products that are radioactive Kedainiai must monitor their raw materials for radioactivity In the past the facility sent samples periodically to an outside laboratory for analysis

During the waste minimization project methods for more rapid detection of radioactivity in raw materials were evaluated A decision was made to purchase and use a portable radioactivity meter on-site to screen raw materials for radioactive contamination before they are used in production The meter can also be used to check and certify that final products are free of radioactivity before shipment to customers As a result of the project, the plant increased its export sales and improved worker and customer health and safety by reducing exposure to radioactive materials

Equipment Portable radioactivity meter Supplier - Technology Associates
Cost $1 000 (by USAID)

Completion Date October 1994

Company Kedainiai State Chemical Plant
Industry Chemical
City Kedainiai
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
2,000	0	2,000	4,600	< 6 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	50 tons/yr
Sulfur dioxide	1 ton/yr	-	-	-
Nitrogen oxides	0 4 ton/yr	-	-	-

Company Profile

Kedainiai Chemical Plant located about 100 km northwest of Vilnius is one of the largest chemical plants in Lithuania The company manufactures sulfuric acid phosphoric acid monoammonium phosphate (MAP) and aluminum fluoride Intermediate and finished products are exported to Eastern and Western European countries and Japan The plant employed 1 384 people in 1994

Waste Minimization Project

The production processes at Kedainiai are supported by a thermoelectric power plant using four oil-fired boilers each burning 50 tons per hour of fuel The boilers generate steam to drive turbines for electricity and also provide steam and hot water for process requirements and domestic use Water fed to the boiler is pre-treated to remove dissolved oxygen High levels of dissolved oxygen in water cause corrosion and deposits on the inside of the piping in the steam generating heat exchangers This in turn reduces the heat transfer between the hot flue gas from the boiler and the cold water running through the heat exchanger pipes Poor heat transfer results in energy losses The deposits must be manually removed by maintenance personnel Pipes and fittings that are severely damaged must be replaced This process is both expensive and time consuming Therefore effective removal of dissolved oxygen from water is critical to extend heat exchanger life lower maintenance costs and reduce energy losses from inefficient heat transfer In the past dissolved oxygen levels were measured periodically in a laboratory Because the results of this analysis were not immediately available they could not be used to effectively control the water treatment process

During the waste minimization project alternative methods for analyzing dissolved oxygen in the boiler feed water were investigated A decision was made to install a portable dissolved oxygen meter in the water treatment plant As a result of the project, frequent measurements of dissolved oxygen are available Using this information, operators are able to maintain low levels of oxygen in the boiler feed water The project resulted in more efficient boiler operation lower maintenance costs and decreased fuel consumption

Equipment Dissolved oxygen meter PHDG-80 HH Supplier - OMEGA International Stanford CT
Cost $2 000 (by USAID)

Completion Date October 1994

Change in Operating Practice at Fertilizer Plant Saves [illegible]

Company Kedainiai State Chemical Plant
Industry Chemical
City Kedainiai
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
5,000	0	5,000	7,200	< 9 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	52 tons/yr
Sulfur dioxide	1 ton/yr	-	-	-
Nitrogen oxides	0 4 ton/yr	-	-	-

Company Profile

Kedainiai Chemical Plant located about 100 km northwest of Vilnius, is one of the largest chemical plants in Lithuania The company manufactures sulfuric acid phosphoric acid monoammonium phosphate (MAP) and aluminum fluoride Intermediate and finished products are exported to Eastern and Western European countries and Japan The plant employed 1 384 people in 1994

Waste Minimization Project

The production processes at Kedainiai are supported by a thermoelectric power plant using four oil-fired boilers, each burning 50 tons per hour of fuel The boilers generate steam to drive turbines for electricity and also provide steam and hot water for process requirements and domestic use Utilities are distributed to the facility through an extensive network including over 10 km of steam hot water vacuum and air supply lines Many of these supply lines are old and require continuous maintenance for repair of leaks In the past, plant personnel conducted visual and audible inspections for leaks and conducted repairs when leaks were detected However, many leaks went undetected due to inaccessibility of piping and high background noise levels in the process areas Excessive steam and water losses resulted from undetected leaks in piping In addition vacuum and high pressure air leaks resulted in increased power demand and higher fuel consumption

During the waste minimization project alternative methods for leak detection were evaluated It was determined that an ultrasonic leak detector could quickly locate steam water and air leaks from a distance of up to 3 meters and could also detect vibrations from bearings that are misaligned or in need of repair Use of the ultrasonic leak detector not only detects small leaks but also eliminates hazards associated with manual inspections of high pressure high temperature lines As a result of the project plant personnel have been able to reduce losses from leaks in utility lines and reduce equipment maintenance costs In addition the facility reduced fuel consumption by 52 tons/year and emissions of sulfur dioxide and nitrogen oxides

Equipment Ultraprobe 2 000 leak detecting system Supplier - UE Systems Elmsford NY
Cost $ 5 000 (by USAID)

Completion Date October 1994

Company Kedainiai State Chemical Plant
City Kedainiai
Industry Chemical
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
10 000	0	10,000	22,000	< 6 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	360 tons/yr
Sulfur dioxide	7 tons/yr	-	-	-
Nitrogen oxides	2 9 tons/yr	-	-	-

Company Profile

Kedainiai Chemical Plant located about 100 km northwest of Vilnius is one of the largest chemical plants in Lithuania The company manufactures sulfuric acid phosphoric acid monoammonium phosphate (MAP) and aluminum fluoride Intermediate and finished products are exported to Eastern and Western European countries and Japan The plant employed 1,384 people in 1994

Waste Minimization Project

The production processes at Kedainiai are supported by a thermoelectric power plant using four oil-fired boilers each burning 50 tons per hour of fuel The boilers generate steam to drive turbines for electricity and also provide steam and hot water for process requirements and domestic use The fuel oil burned in the boilers contains as much as 2 5 percent sulfur The burners are old and lack the controls necessary to assure efficient burning of fuel This results in excessive fuel consumption and significant emissions of sulfur dioxide to the atmosphere

During the waste minimization project an investigation was undertaken to improve the efficiency of the boilers It was determined that a combustion gas analyzer would provide useful information to operators to enable more efficient boiler operation For example a combustion gas analyzer could be used to measure the oxygen and carbon monoxide in the boiler exhaust on a regular basis This information in turn could be used by operators to adjust the air/fuel ration for optimum burning efficiency To implement the project a portable stack gas analyzer was purchased and installed As a result of the project the facility reduced its fuel consumption by 360 tons/year and emissions of sulfur dioxide and nitrogen oxides

Equipment Portable stack gas analyzer Model 33 Supplier - Testo Term Co Flanders, NJ
Cost $10,000 (by USAID)

Completion Date October 1994

Process Modification and Better Process Control at Ammonia Plant Save Raw Materials and Reduce Emissions

Company Joint Stock Company ACHEMA
City Jonava
Industry Chemical
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
24,000	29,000	53,000	168,000	4 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Methane	-	-	-	488 tons/yr
Catalyst	-	-	-	8 %
Nitrogen oxides	16 tons/yr	-	-	-

Company Profile

Joint Stock Company ACHEMA located about 120 kilometers northwest of Vilnius, manufactures nitro fertilizers Major products manufactured are ammonia urea ammonium nitrate methanol formalin carbamide formaldehyde resins nitric acid and various types of fertilizers ACHEMA employs about 2,200 people

Waste Minimization Project

ACHEMA operates six nitric acid production units Nitric acid is produced by burning ammonia in air across a catalyst bed to form nitrogen oxides (NO_x) These oxides are cooled and absorbed in water to form nitric acid Regulatory laws limit the amount of NO emissions to the atmosphere In order to reduce NO_x emissions into the environment unabsorbed NO_x is heated and reacted with methane over a platinum catalyst to form nitrogen gas In the past, the catalytic conversion of NOx to nitrogen was maintained at temperatures higher than necessary to assure maximum conversion of oxides to nitrogen to meet regulatory guidelines Reaction at higher temperatures increased methane consumption and reduced the life of the expensive catalyst

During the waste minimization project methods were investigated for reducing the reaction temperature to save methane and catalyst materials It was determined that an on-line gas analyzer could be used to continuously measure the amount of NO in the stack gases This information could be used by operators to maintain the catalytic conversion reaction at optimum levels thereby reducing methane use and extending the life of the catalyst To implement the project a gas analyzer was installed which continuously and sequentially measures NO levels in the exit gases of the six production units As a result of the project the facility has improved process efficiency saved raw materials and reduced NO emissions

Equipment Stack emissions analyzer PF 41/PC 9531 Supplier - Rosemount Analytical Inc La Habra, CA
Cost $53 000 ($24,000 by USAID $29,000 by ACHEMA)

Completion Date September 1995

Reuse of Treated Wastewater at Plastics Manufacturer

Company Joint Stock Company Litoda
City Plunge
Industry Plastics
Country Lithuania

Economic Benefits

Investment ($)			Savings	Payback
USAID	Company	Total	($/Year)	Period
1,390	0	1,390	1,710	10 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material
	Air	Water	Land	Savings
Fuel oil	-	-	-	7 tons/yr

Company Profile

Joint Stock Company Litoda located in northwest Lithuania is a large manufacturer of artificial leather The artificial leather is used in the manufacturing of consumer goods such as luggage handbags gloves and upholstery Litoda s export market is limited to the Central and Eastern European countries The plant has an annual production capacity of 20 million square meters of artificial leather and employs about 500 people

Waste Minimization Project

At Litoda, artificial leather is produced by gluing and laminating PVC film with fabric or jersey on calendar rolls After calendaring the material is painted and dried The paint contains about 90 percent dimethyl acetamide solvent Most of this solvent is exhausted into the atmosphere during the drying operations The regional environmental regulatory agency has identified about 1 400 m of the plant property that is contaminated with organics emitted from the process The property is also contaminated with oil from past operations To meet regulatory requirements, Litoda must collect and treat rain water that falls on this property to remove oil and organics contamination In the past the rain water was collected and shipped offsite for treatment This practice cost the plant about $1 200 per year

During the waste minimization project it was determined that about 6 m^3 of oil was present in the contaminated rain water A decision was made to separate the oil from the contaminated water and use it as fuel in the boiler house To implement the project, a belt driven oil skimmer was installed on the water collection tank In addition to savings realized in fuel oil recovery the project also reduced the company's environmental fees and liabilities

Equipment Oil skimmer, Supplier - Abnaki Corp Chagrin Falls OH
Cost $1 390 (by USAID)

Completion Date September 1995

Process Modification and Better Process Control at

Company Joint Stock Company Litoda
City Plunge
Industry Plastics
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
8,000	0	8,000	11,600	8 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Dimethyl acetamide	7 5 tons/yr	-	-	7 5 tons/yr

Company Profile

Joint Stock Company Litoda located in northwest Lithuania, is a large manufacturer of artificial leather The artificial leather is used in the manufacturing of consumer goods such as luggage, handbags gloves, and upholstery Litoda's export market is limited to the Central and Eastern European countries The plant has an annual production capacity of 20 million square meters of artificial leather and employs about 500 people

Waste Minimization Project

Litoda operates six painting and finishing lines The paint contains about 90 percent dimethyl acetamide solvent Most of this solvent is exhausted into the atmosphere as the concentration of the solvent in the exhaust is too low to burn or recover without major capital expenditure

During the waste minimization project an investigation was undertaken to reduce the amount of solvent in the paint formulation After laboratory tests and pilot runs it was determined that the plant could reduce the solvent level in the paint by 1% However due to the strict product requirements and short processing time, precise control of the paint formulation became critical as the solvent content of the paint was reduced Therefore, a fast and precise measurement technique was required to allow operators to control the paint formulation at precise levels To accomplish this a gas chromatograph (GC) was purchased and installed The GC measures the solvent/dye ratio in the paint formulation and also measures organic levels in the exhaust gas As a result of the project the plant reduced the amount of organics emitted into the atmosphere by 7 5 tons/year The project also reduced the amount of environmental fees paid by the plant

Equipment Gas chromatograph SRI model 8610 Supplier - Alltech Associates, Inc , Deerfield IL
Cost $8 000 (by USAID)

Completion Date September 1995

Company Joint Stock Company "Vilniaus Buitine Chemija" **City** Plunge
Industry Plastics **Country** Lithuania

Economic Benefits

Investment ($)			Savings	Payback
USAID	Company	Total	($/Year)	Period
10,500	0	10,500	21,200	6 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material
	Air	Water	Land	Savings
Fuel oil	-	-		108 tons/yr
Sulfur dioxide	2 tons/yr	-	-	-
Nitrogen oxides	0 8 tons/yr	-	-	-

Company Profile

The Joint Stock Company Vilniaus Buitine Chemija located in Vilnius manufactures personal care products and household cleaners such as hair sprays air fresheners deodorants car care products detergents and cleaners The products are sold primarily in the domestic market Main process lines at the plant are formulation aluminum can extrusion and painting and liquid paste and powder packaging and painting The company employs about 650 people

Waste Minimization Project

At 'Vilniaus Buitine Chemija aluminum cans are painted inside and outside with solvent-based paints Printing on plastic and metals containers is also done using solvent-based paints The facility is subject to regulations governing solvent vapor concentrations in work areas To assure compliance with these regulations in the past the plant maintained higher than necessary levels of building exhaust rates It was estimated that the number of air exchanges in the process area were about twice the frequency needed to meet the limits High exhaust rates increased the amount of outside make up air drawn into the building In colder weather this make up air must be heated As a result of excessive exhaust rates energy was wasted for unnecessary make up air heating

During the waste minimization project methods for measuring concentrations of individual solvent vapors in the production area and for measuring the exhaust rates were investigated It was determined that a gas chromatograph and an air velocity meter would allow the engineers to optimize the exhaust rates to meet the regulatory limits for each chemical As a result of the project air samples in the working area are collected in sample tubes and analyzed for individual chemical concentrations The air velocity meter is used to optimize exhaust rates The plant has realized a reduction in fuel consumption and is able to maintain a safer workplace The project also reduced the amount of environmental fees paid by the plant

Equipment

Model 8610 gas chromatograph and integrating microprocessor Supplier - Alltech Associates, Inc , Deerfield IL
Cost $9 400 (by USAID)
Portable air velocity meter Supplier - OMEGA International Stanford CT
Cost $1 100 (by USAID)

Completion Date

September 1995

Better Process Control at Plastics Plant Saves Energy and Reduces Gaseous Emissions

Company AB Plasta Plastics Manufacturing Company
Industry Plastics
City Vilnius
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
9,500	0	9,500	41,500	3 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	37 tons/yr
Polyethylene, other	-	-	-	160 tons/yr
Organics	12 tons/yr	-	-	-
Sulfur dioxide	0 74 tons/yr	-	-	-
Nitrogen oxides	0 3 tons/yr	-	-	-

Company Profile

AB Plasta Plastics Manufacturing Company produces polyethylene sheet bags and high density polyethylene (HDPE) products such as pipes buckets and other industrial and consumer products The plant also operates a process that recycles plastic bags imported from Germany to manufacture plastic industrial and consumer products for nonsanitary use Products are sold primarily to the domestic market and the former Soviet Union countries Major operations at Plasta are plastic extrusion molding blowing painting and packing

Waste Minimization Project

At AB Plasta Plastics recycled plastic bags are manually sorted washed shredded, and thermoprocessed to produce polyethylene pallets The thermoprocessing and extrusion of plastic bags are significant sources of odor and air pollution Process emissions include formaldehyde phenols acetaldehyde carbon monoxide and styrene These compounds are regulated in accordance with both indoor and ambient air quality standards In the past the extrusion process was adjusted based on nonquantitative indications of odor levels in the process area

During the waste minimization project it was determined that the ability to quantitatively measure individual airborne compounds would provide essential information to allow operators to make necessary temperature and pressure adjustment Such adjustments would result in higher product yield and improved compliance with regulatory limits for fugitive emissions To implement the project, a gas chromatograph was installed which measures concentration of individual organic compounds in the air samples As a result of the project the plant has increased its product yield by 2 percent reduced its fuel oil consumption by 37 tons/year and reduced consumption of raw materials by 160 tons/year The project also reduced organic emissions from the facility by 12 tons/year

Equipment Gas Chromatograph model 8610 GC and integrator Supplier - Alltech Associates Inc Deerfield IL
Cost $9 500

Completion Date September 1995

Company Joint Stock Enterprise "INKARAS" **City** Kaunas
Industry Rubber **Country** Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
9,500	0	9,500	13,220	< 9 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Organics	Yes[a]	-	-	Yes[a]

[a] Actual estimates not available at this time

Company Profile

INKARAS is a large manufacturer of industrial and consumer rubber products Industrial product lines include sheet and custom designed industrial gaskets and other products Consumer product lines include athletic footwear and boots In a separate product line the company also manufactures polyethylene syringes and intravenous systems Rubber products are sold primarily in Lithuania and other Central and Eastern European countries Syringes are sold to Western European countries as well The plant employs about 1 200 people

Waste Minimization Project

Finished rubber is made by mixing organic compounds and vulcanizing the mixed polymer at elevated temperatures either in molds or on rollers The vulcanization process generates large amounts of organic vapor emissions most of which are exhausted into the atmosphere with some escaping into the process area These compounds are regulated in accordance with both indoor and ambient air quality standards In the past the exhaust systems became coated with vulcanization by-products and needed to be cleaned frequently

During the waste minimization project it was determined that measurement of compounds in the exhaust gas would allow the facility to achieve higher yield while reducing emissions to the atmosphere To implement the project a gas chromatograph (GC) was installed to measure concentrations of compounds in exhaust gases As a result of the project operators are able to maintain the vulcanization process under optimum conditions thereby producing less vapors and reducing the labor costs associated with frequent cleaning and reconditioning of exhaust ducts and fans

Equipment

Gas Chromatograph model 8610 GC and integrator Supplier Alltech Associates, Inc , Deerfield IL
Cost $9,500 (by USAID)

Completion Date

September 1995

Better Process Control at Cement Plant Saves Fuel and

Company Stock Company Akmenes Cementas
Industry Cement
City Akmenes
Country Lithuania

Economic Benefits

Investment ($)			Savings ($/Year)	Payback Period
USAID	Company	Total		
10,000	46,000	56,000	150,000	5 months

Environmental Benefits

Material	Reductions in Environmental Releases			Raw Material Savings
	Air	Water	Land	
Fuel oil	-	-	-	2,500 tons/yr
Particulates	60 tons/yr	-	-	-
Sulfur dioxide	50 tons/yr	-	-	-
Carbon monoxide	35 tons/yr	-	-	-
Nitrogen oxides	20 tons/yr	-	-	-

Company Profile

Stock Company Akmenes Cementas is located in Akmenes, about 80 kilometers northwest of Vilnius It is a wet processing cement plant with a production capacity of over 3 million tons of cement per year Akmenes sells cement to Eastern and Western European countries The plant employs over 1 400 people when operating at capacity

Waste Minimization Project

Cement is produced by feeding a slurry of limestone clay iron oxides and silica into a rotary kiln which moves the feed towards the discharge end The burner is located at the kiln discharge end generating intense heat which travels upstream towards the feed end of the kiln When exposed to heat, the slurry forms cement compounds of silica iron aluminum and calcium The kilns use substantial amounts of fuel Small improvements in firing efficiency can result in significant savings from reduced fuel consumption

During the waste minimization project methods were evaluated for improving burner efficiency by measuring combustion gases and temperatures in the kiln It was determined that measurements of oxygen and carbon monoxide could be used by operators to optimize burner efficiency by adjusting the air/fuel ratio to maintain the gas values within a narrow desirable range Temperature measurements could be used to verify the air/fuel ratio adjustments to assure maximum energy output from the fuel To implement the project, a gas analyzer was installed which continuously measures oxygen and carbon monoxide in the exhaust gases In addition, a pyrometer was installed to measure temperature at six points in the burning zone As a result of the project the plant reduced fuel oil consumption by 2 500 tons/year and reduced emissions of particulates sulfur dioxide, carbon monoxide and nitrogen oxides

Equipment

Gas analyzer 350 Supplier - Testo Term Inc , Flanders NJ
Cost 17 000 (9 000 by USAID $8 000 by Akmenes)
Pyrometer Supplier - Quadtek Redmond WA
Cost $39 000 ($1 000 by USAID $38 000 by Akmenes)

Completion Date

September 1995

WEC Pollution Prevention Centers in Estonia, Latvia and Lithuania

PPC at Estonian Management Institute
Anne Randmer, Director
Sutiste 21, Room 253
Tallinn EE0034, Estonia
Phone +372-2-52-16-29
Fax +372-6-392-112
E-mail anne@emi estnet ee

PPC at Riga Business Advisory Service
Mrs Natalia Ladutko, Director
Perses Street 2-518
Riga, LV 1011, Latvia
Phone +371 782 8250
Fax +371 782 8251
E-mail natalia@lppc org lv

PPC at Kaunas University of Technology
Prof Dr Jurgis Staniskis, Director
Institute of Environmental Engineering
Donelaicio 20-307
3000 Kaunas, Lithuania
Phone +370 7-20 9372
Fax +370 7-22 1003
E-mail ppc kaunas@apini ktu lt