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WORLD ENVIRONMENT CENTER

UKRAINE

WASTE MINIMIZATION DEMONSTRATION PROJECT

AT

"STIROL" CHEMICAL PLANT

IN GORLOVKA

Final Report

USAID/WEC COOPERATIVE AGREEMENT
NO. ANE-0004-A-00-0048-00

World Environment Center
419 Park Avenue South, Suite 1800
New York, New York 10016

SEPTEMBER 1997

Project Description:	Reduction of ammonia losses and improved recycle of condensate from manufacturing facilities
Project Type:	Waste Minimization Demonstration Project
Country:	Ukraine
Industrial Sector:	Chemical
Funding Source:	United States Agency for International Development
Participants:	"Stirol" Chemical Plant and World Environment Center
Project:	Improvement to process control at ammonium nitrate and sodium nitrate manufacturing facilities

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Philip Breese

Julius Greenburg

File

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I. INTRODUCTION

In September 1995, an amendment was added to the United States Agency for International Development's (USAID's) and World Environment Center's (WEC's) Cooperative Agreement No. ANE-0004-A-00-0048-00 to include Ukraine as one of the additional countries to receive WEC's technical assistance, training and information dissemination services related to urban and industrial pollution control.

WEC activities in Ukraine are implemented in two phases as follows:

Phase I - Initiated in October 1995. Under this phase, the program focuses on reduction of environmental pollution caused by industrial activities through waste minimization. This includes better utilization of natural resources and conservation of energy, with emphasis on financial benefits. Waste Minimization Demonstration Projects (WMDP) were established at four industrial enterprises in the Donetsk region. The goal was to demonstrate to these enterprises the cost savings and reduction in environmental pollution from waste minimization and to encourage the incorporation of this program into the permanent policy of plant management.

Phase II - Initiated in September 1996. This program is similar to Phase I, with additional emphasis on energy conservation, specifically on reduction of natural gas consumption. Six Waste Minimization/Energy Conservation Demonstration Projects (WM/ECDP) are being implemented at various plants in Donetsk and Dnipropetrovsk regions.

This report describes the benefits achieved from implementing three demonstration projects at the "Stirol" Chemical Plant, which was one of the four enterprises selected for a WMDP under Phase I in the Donetsk region. The project was initiated in October 1995 and concluded in July 1997 with a close-out meeting at the plant.

Final findings and benefits resulting from this Waste Minimization Demonstration Project are presented in this report. Highlights of the close-out ceremony are also described.

II. EXECUTIVE SUMMARY

Pursuant to the technical assistance program for Central and Eastern European countries by the United States Agency for International Development, the World Environment Center (WEC) conducted a Waste Minimization Demonstration Project (WMDP) at the "Stirol" Chemical Plant in Gorlovka, Donetsk region, in Ukraine.

WEC teams conducted two visits to the "Stirol" facility in November 1995 and in August 1996 and jointly with the plant management recommended implementing 3 demonstration projects with significant potential monetary and raw material benefits which met WEC guidelines. These projects, described below, have been implemented and benefits confirmed by "Stirol" management. Total monetary benefits amount to about $440,000 per year.

Project Description	**Equipment Provided by WEC**	**Final Estimate of Benefits**	
		Monetary	**Environmental/ Energy Conservation**
Project #1 Reduction of ammonium nitrate losses at Ammonium Nitrate Plant	pH Analyzer - Controller & Conductivity Analyzer @ cost of $6,000	**$145,000/year** (includes $17,000/year for reduced usage of energy Payback less than 1 month	Prevention of **250 tons/year** of ammonia from discharge into wastewater
Project #2 Improvement to quality of condensed vapors at Sodium Nitrate/Nitrite Plant	Conductivity Analyzer @ cost of $2,000	**$135,000/year** (includes $58,000/year for reduced usage of energy) Payback less than 1 week	Savings of **90,000 m^3/year** of chemically treated (high purity) water including substantial amount of energy
Project #3 Reduction of ammonia losses at Ammonia Plant	Conductivity Analyzer @ a cost of $2,200	**$159,000/year** Payback less than 1 week	Prevention of **280 tons/year** of ammonia from discharge into wastewater

A close-out ceremony was conducted on July 22, 1997 at the "Stirol" plant which summarized the achievements of the three projects and the progress made by the "Stirol" plant in minimizing wastes. Formal ownership of the WEC-supplied instrumentation was transferred to the "Stirol" plant during the close-out meeting.

"Stirol" management has implemented an active waste minimization program and continues to identify additional projects with significant monetary and energy conservation benefits for subsequent implementation.

III. GENERAL BACKGROUND

The first plant at this location was begun in 1933, producing ammonia from coke gas. Over the years, plants were installed to produce nitric and sulfuric acids, sulfates and ammonium nitrate (AN). In 1975, the company was reorganized as "Styrol" or "Stirol". Today, the plant is a world class nitrogen fertilizer plant that can produce 1,350,000 tons/year ammonia in 3 plants, 330,000 tons/year prilled urea using two plants, 660,000 tons/year of prilled AN using 4 AN reactors and 3 prilling towers, and nitric acid required for AN. Liquid fertilizer from urea and AN is also produced for export to the U.S. In addition, the complex, now a "Joint Stock Company", produces sulfuric acid and oleum, sodium nitrate, nitrous oxide and many forms of styrene and polystyrene.

IV. DESCRIPTION OF PROJECTS

During the visit of the WEC team to "Stirol" from November 13-18, 1995, a series of technical discussions was conducted with "Stirol" personnel and the following projects were jointly selected for implementation:

Project #1 - To install a continuous in-line conductivity meter and a pH analyzer controller to reduce the amount of ammonium nitrate and ammonia or nitric acid lost overhead from Stirol's ammonium nitrate reactors. The new installation supplemented the exisisting 30 year old pH measuring system which had a response lag time of more than one hour.Equipment provided was a conductivity analyzer to detect excess losses and a pH analyzer/controller to improve process control. Benefits originally estimated at $83,000/year from reducing ammonia losses by 240 tons/year.

Project #2 - To analyze condensed vapors from the sodium nitrite/sodium nitrate reaction systems by means of a conductivity analyzer. When condensate is suitably pure, it is used as boiler feed water, saving chemically treated boiler feed water and heat energy in the condensate. Benefits originally estimated at $152,000/year from reducing losses of sodium nitrite by 5 tons per year and recycling 86,000 m^3/year of condensate.

Project #3 - To reduce the loss of ammonia from the ammonia plant by the use of a conductivity analyzer to determine when excess losses must be curtailed by prompt action, rather than waiting four hours for a laboratory analysis to become available. In addition, costs of chemical treatment of effluents would be reduced drastically. Benefits originally estimated at $156,000/year from reducing ammonia losses by 272 tons per year.

V. PERSONNEL

During the plant visits and during subsequent engineering effort, the key participants included:

Stirol	-	Alexander V. Turgolukov, Technical Director Sergei Lizenko, Deputy Technical Director Vitali Skliarov, Manager of AN Plant Yuri Rodonov, Sodium Nitrite/Nitrate Manager Victor Titov, Chief Engineer, Ammonia Plant
WEC	-	Dr. Raymond L. Feder, WEC Consultant Julius Greenburg, Consulting Engineer Gennady Merkhelevitch, WEC In-Country Coordinator

VI. CHRONOLOGY OF PROJECT

October 1995	-	Reconnaissance visit by WEC team to Stirol
November 1995	-	Follow-up visit by WEC team to identify waste minimization demonstration projects
January 1996	-	Recommendations issued for instrumentation for 3 projects
May 1996	-	WEC issued purchase orders for instrumentation
August 1996	-	Instrumentation arrival at Stirol
November 1996	-	Instrumentation installed at Stirol and collection of data initiated
May 1997	-	Estimate of annual benefits prepared
July 1997	-	Close-out of projects

VII. CLOSE-OUT CEREMONY

On July 22, 1997 a close-out ceremony was held at the "Stirol" Chemical Plant to formally conclude the demonstration project. There were 25 participants representing the "Stirol" management and the municipal and regional administration, the U.S. Agency for International Development, The World Environment Center and the local press and radio

The ceremony was chaired by Mr. Alexander Tugolukov, Technical Director, who in his opening statement, expressed his great satisfaction with the results of the demonstration project, which he considered as a first step in implementing plant-wide waste minimization. Also he indicated the company's great interest in future cooperation with the WEC, specifically on the Impact Program. Mr. Tom McGrath of the World Environment Center outlined current and upcoming programs in Ukraine, and thanked the plant management for their interest and cooperation.

Mr. Michael Kalinoski from the U.S. Agency for International Development expressed the Agency's appreciation for "Stirol" Chemical Plant's participation in the program. Also, he briefly described other funded assistance activities by USAID in Ukraine.

A short presentation of the completed demonstration project, including its environmental and financial benefits was made by Mr. Sergey Lizenko, Deputy Technical Director at the "Stirol" Chemical Plant. At the conclusion of the ceremony, Mr. Kalinoski, on behalf of USAID transferred ownership of the equipment to the "Stirol" Chemical Plant and presented the plant with a Certificate of Recognition.

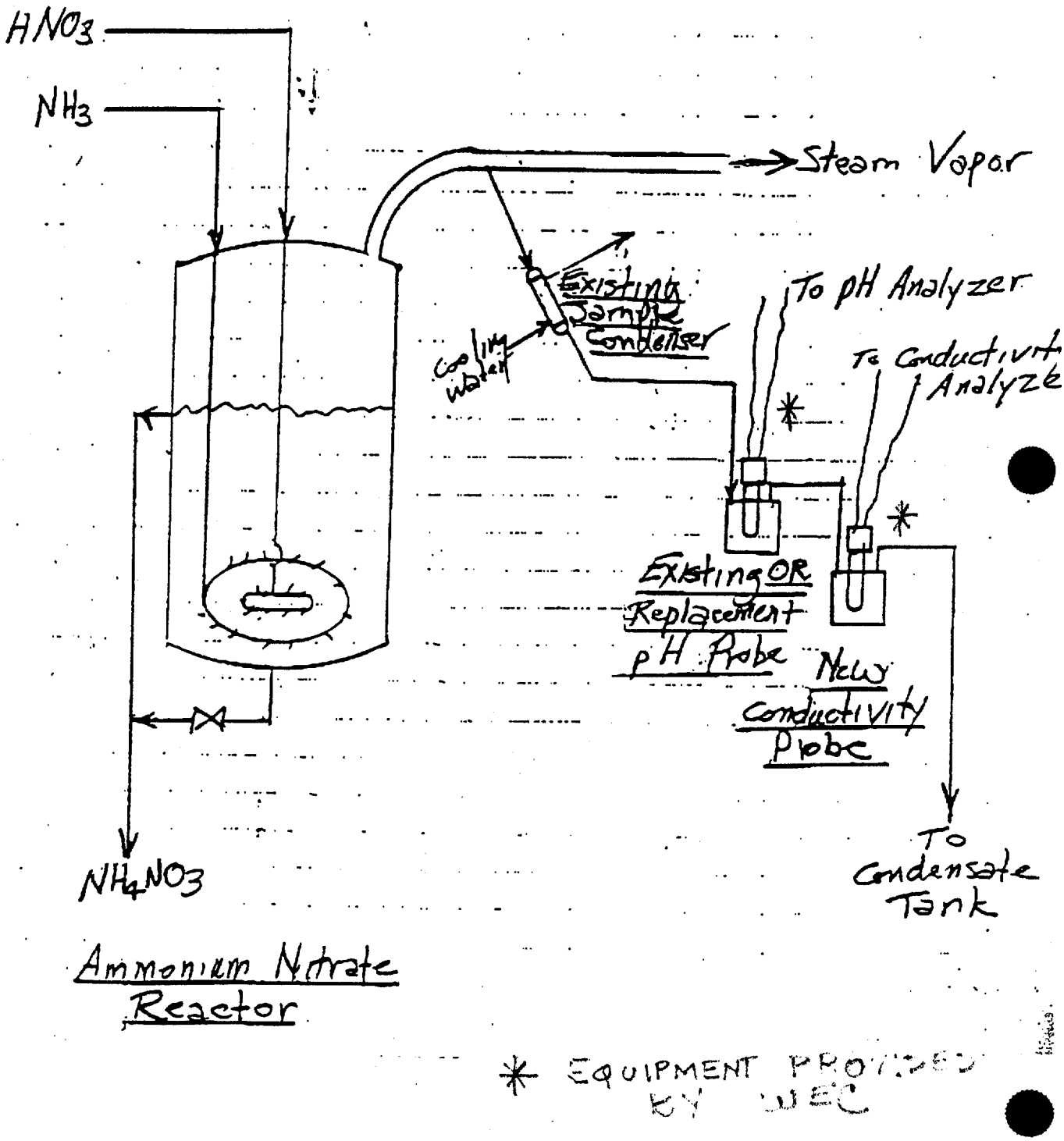
The list of close-out ceremony participants is included in Appendix 3.

APPENDIX 1

DIAGRAM OF INSTALLATION FOR PROJECT #1

PROJECT #1

Installation of Conductivity and New pH Analyzers



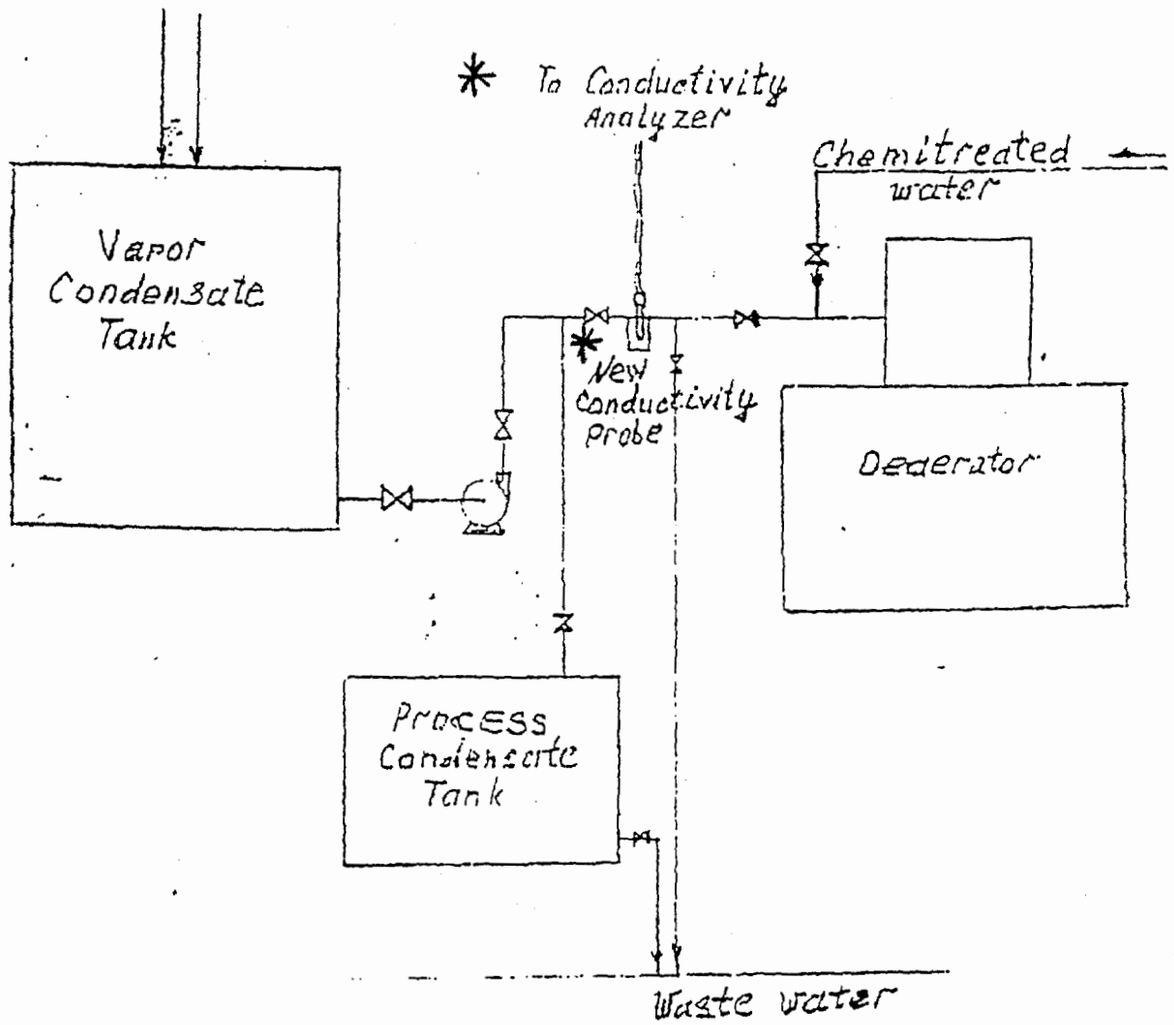
* EQUIPMENT PROVIDED BY WEC

APPENDIX 2

DIAGRAM OF INSTALLATION FOR PROJECT #2

PROJECT #2

Installation of conductivity Analyzer at the sodium nitrite plant.



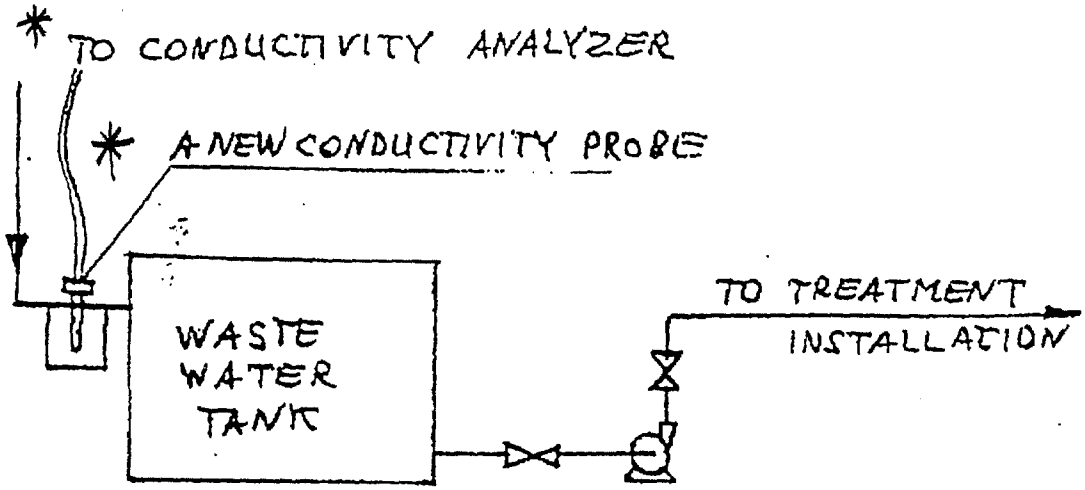
* EQUIPMENT PROVIDED BY WEC

APPENDIX 3

DIAGRAM OF INSTALLATION FOR PROJECT #3

PROJECT #3

INSTALLATION OF A CONDUCTIVITY ANALYZER AT THE LIQUID AMMONIA PLANT



* EQUIPMENT PROVIDED BY WEC

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APPENDIX 4

"STIROL" ESTIMATE OF BENEFITS FOR PROJECT #1

PROJECT#1

FACILITY: **Granulated Ammonium Nitrate Plant**

Calculation of Saving after Improvement through Usage of an Instrument to Measure Quality of Liquor Vapor Condensate

Purpose of the Project:
A continuous in-line automatic conductivity meter was installed on August 30, 1996, to analyze samples of the vapor condensate form the AN reactors for producing ammonium nitrate, with free ammonia as a by-product.

Saving Estimate:
Based on 1995 experience, the average concentration of free ammonia in waste water discharged is 0.38KG/CM, and for ammonium nitrate it is 1.11 KG/CM.
After the new instrument has been istalled, the average concentration of free ammonia in the waste water discharged was 0.26KG/CM, and for ammonium nitrate it was 0.480KG/CM in 1996.
Total annual savings for 1996 were calculated as follows:

Reduced NH3 and NH4NO3 losses.....$ 4,617.31;
Reduced chemical treatment costs.....$11,590.51;
Total Savings: $16,207.79

In 1996, for a three month period, 51,831 tons of ammonium nitrate was produced. Last November the plant was out of operation.
According to the plant design, when 1 ton of ammonium nitrate is produced, 0.8CM of the vapor condensate is developed, and 0.73CM of that amount is to be discharged to a biological treatment plant for purification purposes.
Based on the analyses made during 10 months in 1995, the concentration of ammonia in liquid vapor condensate was 384mg/l, while contents of ammonium nitrate amounted to 1111mg/l. When optmum process operation conditions were developed the concentration of NH3 was reduced to 260mg/l, and the one of ammonium nitrate was reduced to 480mg/l. Under the above operating conditions the amounts of the raw material saved were as follows:

PROJECT #1

FACILITY: **Granulated Ammonium Nitrate Plant**

Calculation of Anticipated Benefit for 1997 Due to Improvement through Usage of a Conductivity Analyzer to Monitor Quality of the Vapor Condensate

The conductivity analyzer was installed on August 30, 1996, to monitor quality of the vapor condensate in ИТН N1 reactor. It was adjusted and tested last September.
To make comparison in results,data were used which were collected during plant operation in 1995, and the same data have been used to estimate anticipated monetary saving.
For 1995 average concentration of ammonia in the waste water discharged from the plant was 0.88mg/l(KG/CM), and the one for ammonium nitrate was 1.11mg/l(KG/CM).
After the conductivity analyzer had been installed, the content of ~~NH4NO3~~ was 0.26mg/l(KG/CM), and concentration of nitrates was 0.48KG/CM.
Anticipated annual ammonium nitrate output for 1997 is 360,000 tons.
0.8 CM of vapor condensate is developed when 1 ton of ammonium nitrate is produced, and 0.73 CM of that amount is to be discharged to a biological treatment plant for purification.
Subsequently, a drop of ammonia and ammonium nitrate content in the vapor condensate to be discharged to a treatment plant for purification that will result in saving the above products in the following amounts:

NH3.....360,000 × 0.73 × 0.124 × 1.29 = 42.04 tons;

NH4NO3.....360,000 × 0.73 × 0.830 × 1.29 = 213.58 tons.

Basis on the above, the monetary saving for ammonia, with its cost as 135.61 USD/t, will be as follows:

$135.61 × 42.04 = $5701.04,

and the same for ammonium nitrate, with its cost 123.46 USD/t, will be:

$123.46 × 213.58 = $26368.59.

761.18

Costs for purification of 1 ton of ammonia and ammonium nitrate , at time when the calculations were made, were 761.18 grivnas. Costs for purification of 255.62 tons of ammonia and ammonium nitrate are as follows:

761.18 × 255.62 = 194,572.83 : 1.87 = $104,049.84.

TOTAL SAVING is as follows:

5,701.04 + 26,368.59 + 104,049.84 = **$138,119.27** .*

* The total savings for Project #1 as reported in the Executive Summary was adjusted to $145,000 by adding on $14,700 for energy savings not included in the above presentation (see Fax 3/31/97) and by subtraction of $8000 by WEC Consultant, Julius Greenburg for revisions to above calculation.

Contents of NNH4+ and NO3 in the waste water discharged from the ammonium nitrate plant

Date	NNH4+ Contents, mg/l	NO3 Contents, mg/l	Date	NNH4+ Contents, mg/l	NO3 Contents, mg/l
December, 1996			January, 1997		
12/12	557	1920	01/01	212	304
	133	512		252	336
	207	608	01/02	129	352
12/13	377	160		127	304
	398	576	01/03	64	288
12/14	133	416		148	320
	239	240	01/04	265	256
12/15	239	384		326	384
	583	336	01/05	345	416
12/16	318	1080		278	200
	398	880	01/06	239	320
12/17	265	880		345	288
	371	640	01/07	292	288
12/18	252	760		252	384
	212	576	01/08	305	416
12/19	186	680		252	384
	159	384	01/09	225	122
12/20	305	760		278	240
	252	880	01/10	126	268
12/21	265	720		223	164
	318	608	01/11	265	120
12/22	330	560		143	136
	298	680	01/12	154	160
12/23	345	760		305	360
	133	512	01/13	265	820
12/24	153	270	01/13	358	720
	143	288		318	480

Facsimile Cover Sheet

To: RAYMOND FEDER
Company: WEC
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Fax: (212)6834745

From: Gennady V. Merkhelevitch.
Company: In-Country Coordinator
Phone: (0822)352081 9-011-380-622-353-148
Fax: (0822)352081

Date: 03/31/97
Pages including this cover page: 2
CC: DR. BOHDAN AFTANAS
COMMENTS: Status of the Project at "Stirol"

DEAR RAY,
BELOW PLEASE FIND REPLY TO YOUR QUESTION#3 RAISED IN YOUR LAST FAX.
"USAGE OF THE CONDUCTIVITY METER TO CONTROL THE CONDENSATE QUALITY MAKES IT POSSIBLE TO DECREASE CONSUMPTION OF THE HEAT ENERGY PREVIOUSLY USED FOR THE SECOND EVAPORATING PURPOSES, BECAUSE THEY DO NOT NEED TO DO IT AFTER THEY HAVE STARTED USING THE INSTRUMENT. PREVIOUSLY, THEY HAD TO HEAT UP 10 TONNES OF CONDENSATE PER 1 HOUR TO INCREASE THE TEMPERATURE OF THAT AMOUNT OF CONDENSATE BY 1 THEY HAD TO SPEND 10 KCAL (1 KCAL/KG). THEY HAD TO HEAT IT FROM +90°C TO +100°C.
TO HEAT UP 10 TONNES OF CONDENSATE BY 10°C FOR ITS SECOND EVAPORATION AND 1 HOUR

THEY HAD TO WASTE 0.1 GCAL PER HOUR. CONSEQUENTLY, IT AMOUNTS TO 2.4 GCAL PER DAY AND 72 GCAL PER MONTH. 1 GCAL COSTS 31.84 GRIVNAS. SO THE MONTLY EXPENSES AMOUNT TO:

$72 \times 31.84 = 2,292$ GRN : 1.86 =

= $ 1,232.

THUS, FOR 12 MONTHS IT WILL AMOUNT TO $ 14,690.

THE ABOVE HAS NOT BEEN INCLUDED IN THE SAVING ESTIMATE, FOR AT THE TIME THE CALCULATIONS WERE MADE THEY DID NOT START USING EVAPORATION SYSTEM YET, AND NOT THE ABOVE ANNUAL FIGURE CAN BE ADDED TO THE ESTIMATE PREVIOUSLY MADE.

SINCERELY,

GENNADIY F. MERKUSHEVITCH

ATTACHMENT Project #1

CALCULATION

of economic benefit from the installation of the instrument for quality control and monitoring of liquor vapor condensate at the plant producing granulated ammonium nitrate

(developed by "Stirol" personnel)

Purpose of Project:

To install a continuous in-line automatic titrimeter or conductivity meter to analyze samples of condensed vapors from the AN reactors for ammonium nitrate and free ammonia.

Present Condition:

At the present time the only instrumentation on these reactors is an in-line pH measuring system approximately 30 years old which is not adequate for minimization of discharge from the reactors.

The new installation will supplement the existing system which has a response lag time of more than 1 hour before corrective action could be taken.

Projected Operation:

The automatic titrimeter would be manifolded installed to analyze condensed vapor samples from each of the four reactors on approximately 2 minute intervals allowing significantly reduced reaction time and resulting in reduced losses of ammonium nitrate to waste water discharge. Alternately, a conductivity meter will be installed to alert operators for rapid response to off specification operating conditions.

Projected Benefits:

Based on 1995 experience the average concentration of free ammonia in waste water discharge is 0,38 kg/m^3, nitrate

ammonia 1,11 kg/m^3.

It is anticipated that following the installation of this new instrument, the average concentration of free ammonia in the waste water discharge will in 1996 average 0,1 kg/m^3, nitrate ammonia 0,811 kg/m^3.

Total benefits in 1996 are estimated at:

Reduced NH3 & NH4NO3 losses	$21150,3
Reduced chemical treatment costs	$43311,13
Reduced energy consumption	$17503,46
Reduced maintenance and labor costs	$1357,51
Total benefits	**$83322,4**

During 10 months of 1995 145 488 t of ammonium nitrate were produced, compared to the design capacity of 591 667 t per 10 months.

According to plant regulations 0,8 m^3/t of liquor vapor condensate is produced, while 0,73 m^3/t of it is go to purification.

According to the data of analytic control during 10 months of 1995 the concentration of ammonia in liquor vapor condensate was 384 mg/l while ammonium nitrate content amounted to 1111 mg/l. With optimum process operation conditions the concentration of NH3 must be reduced to 10 mg/l and the concentration of ammonium nitrate should be reduced to 811 mg/l. Due to the upset process operating conditions the losses were as following:

NH3.....145488 * 0,73 * 0,284 - 30,2 t

NH_4NO_3.....145488 * 0,73 * 0,3 - 31,9 t

With plants load scheduled for 1996 aiming at producing 350000 t of product each, the amount of the discharged ammonia will be:

350 000 * 0,73m^3/t * 0,284kg/m^3/1000 - 72,6t/y

while the amount of the discharged ammonium nitrate will be:

350 000 * 0,73m^3/t * 0,3kg/m^3/1000 - 76,7t/y

The loss of product due to:
- the cost of ammonia $170/t will be 170 * 72,6 - $12335,5
- the cost of ammonium nitrate $115/t will be 115 * 87,6 - $8814,8

Purification costs of 1 t of ammonia and ammonium nitrate are 74 956 324 karb.

Purification costs of 149,3 t will be
74 956 324 * 149,3 -11 190 979 167 karb. - $82172,11

Total costs are 21150,3 + 82172,11 - $83322,4

With process control and the absence of free ammonia and ammonium nitrate in discharged waste water (liquor vapor condensate) economic benefit would be $83322,4.

November 16, 1995

APPENDIX 5

"STIROL" ESTIMATE OF BENEFITS FOR PROJECT #2

TO: Mr.Thomas McGrath,
Vice President,
World Environment Center

CC: Mr.Gennady V.Merkhalevitch,
In-Country Coordinator,
World Environment Center

Dear Mr.McGrath,

We are happy to inform you, that the annual saving for the Project 2 is estimated to be 135,413 US Dollars provided that the plant operates at 89% of its rated capacity.

The above conclusion is made on the basis of the estimate made for the calorimeter applied to control the vapor condensate quality at the Sodium Nitrite/Nitrate Plant.

Sincerely,

Alexander Tugolukov,
Technical Director,
"Stirol" Concern

Project #2
Page 1

Донецк, факс 92-51-72

CALCULATION

of economic benefit from the installation of the instrument for quality control and monitoring of liquor vapor condensate at the plant producing sodium nitrite, sodium nitrate

Purpose of Project:

To install a continuous in-line automatic conductivity meter to analyze samples of condensed vapors from the reactors for sodium nitrite and sodium nitrate.
To decrease energie consumption decrease in production of nitric acid. Elimination of sodium nitrite discharge.

The present state:

At the present time the vapor condensate quality control instruments are absent. so due to a probability of evaporation system contamination by sodium nitrite and sodium nitrate the vapor condensate in amount of 40 m3/h is directed to :

- reflux absorbtion column;
- collector for liquor vapor condensate. then to canalization.

The amount of vapor condensate is determined by analytical method 2 times/day.

Projected Operation:

A conductivity meter will be installed to vapor condensate inlet pipe. connected salt section and deaerator of acid section. for continuous water control. This conductivity meter is to control the condensate purity and to provide a signal, when its contamination is above limits. inhibited its use for waste-heat boilers.

Projected Benefits:
The installation of this new instrument makes possible to direct the vapor condensate in amount of 86 000 m3 for make-up. to reduce the chemitreated water intake and sodium nitrite discharge with waste water.

Total benefits during the year are estimated at:

Reduction of chemitreated water consumption	$ 91250
Reduction of superheated vapour consumption	$ 58762
Expulsion of water pollution payment	$ 2150
Total benefits	**$152152**

due to the reduction of chemitreated water consumption:

- chemitreated water consumption decrease - 10 m³/h - 86,400 m³/y;
  (replacement by vapor condensate)
- cost of 1 m³ of chemitreated water - 211.235 carb.

- economic effect will be:
  86.400 m³/y * 211.235 carb. = 18250704000 = $91 250
  ($1=200000carb.)

due to the reduction of superheated vapour consumption, used for chemitreated water heating before deaerator :

- t1 of chemitreated water at entry to plant = 40 C.
- t2 of chemitreated water after vapor heater = 80 C.
- t of vapor condensate = 80 C.
- M, the amount of vapor condensate feed during the year = = 86400 m³ = 86400 t.
- c, heat capacity of chemitreated water = 1 kcal/kg * * degree.

Reduction of vapour consumption by replacement of 10 m³/h chemitreated water by the same amount of vapour condensate will be :

Q = M * c * (t2 - t1) = 86400000kg * 1 * (80 - 40) = = 345,6*10⁷ kcal = 3456 Gcal.

- cost of 1 Gcal of vapour = 3 400 000 carb.
- economic effect will be :

3456 * 3 400 000 = 11 750 400 000 carb. = $58752

reduction of sodium nitrite discharge with waste water to waste water disposal system will be about 5 t/y

payment for discharge of sodium nitrite with waste water in amount of 1 t is 86 000 000 carb./y :

86 000 000 * 5 = 430 000 000/200000 = $ 2150

Total costs are 91250 + 58752 + 2150 = $152150

Purification costs of 149,3 t will be

With process control and the absence of sodium nitrite and in discharged liquor vapor condensate economic benefit would be $152150.

5. Measuring limits:
0 - 19.99 mikrosimens/cm
Cell Constant 0.1
from 5 to 100 mkg/kg of sodium nitrite in vapor condensate.

6. Probe liquid composition:
NaNO2: от 0 до 100 mkg/kg.
NaNO3: от 0 до 100 mkg/kg.
t = 50 - 100°C.

Sergei Lizenko,
Deputy Technical Direktor

April 8. 1996

2/4/97 YG-FYI

97 FEB -4 PM 2:27

Facsimile Cover Sheet

To: Dr. Bohdan Aftanas
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Phone: 011-380-622-352081, 911746
Fax: 011-380-622-352081, 353148

Date: 02/04/97
Pages including this cover page: 4

CC: Thomas McGrath, Raymond Feder

COMMENTS: Status of WMDP at STIROL

Dear Bohdan,

Below please find information about the status of WMD projects at STIROL which I have just received from Sergey Lizenko.

PROJECT#2

1. FACILITY: **Ammonium Nitrate and Nitrite Production Plant. Calculation of monetary saving after improvement through usage of a conductivity analyzer to measure contamination of the vapor condensate**

The conductivity analyzer was installed on August, 1996. Its field test and adjustment was made last september. Within last October the plant was out of operation because of it's being under repair. Within last November and December 2,320 CM of the vapor condensate was reused for production purposes. The above resulted in total savings for November and December, 1996, as follows:

-Reduction of the chemitreated water consumption.....-$4251.24;

-Reduction of the overheated water consumption.....$1597.16;

Total Savings: $5848.40

Reuse of the vapor condensate for production purposes has resulted in decrease of the chemitreated water consumption by 2,320 CM. with the cost of 1CM of the chemitreated water as 3.39grivnas, the estimated saving is as follows:

2,320×3.39 : 1.85 = $4,251.24.

The following quantities of the chemitreated water were saved owing to the temperature differential of the vapor condensate and the chemitreated water:

-t1=40°C, temperature of the chemitreated water incoming the plant;

-t2=80°C, temperature of the chemitreated water going out of the vapor heater;

-t2=80°C, temperature of the vapor condensate;

-M=2,320CM=2,320tons, amount of the vapor condensate reused for production purposes for 2 month;

-c=1Kc/KG×t°C, heat capacity of the chemitreated water.

After 2,320CM of the chemitreated water is replaced by the same amount of the vapor condensate, there will be reduction in vapor consumption as follows:

$$Q = M \times c \times (t2 - t1) = 2320 \times 1 \times (80 - 40) = 92.8 \text{ GCal};$$

With the cost of 1 GCal of the vapor as 31.84 grivnas, the saving is as follows:

92.8 × 31.84 : 1.85 = $1597.16

Total costs are

$4251.24 + $1597.16 = 5848.40

Since the above conductivity analyzer to measure the concentration of sodium nitrite in the vapor condensate discharged was applied the saving reached was $5848.40, with sodium nitrite as well as free ammonia not available in the condensate

PROJECT#2

Quality of the vapor condensate at the Sodium Nitrite and Sodium Nitrate Plant to be pumped to the Acid Plant

Data for only 11 days

TIME: December16 thrgh
December 22, 1996

Date	Time	Analysis Findings for NaNO2, mg/CM	Analysis Findings for NaNO3, mg/CM	Vapor Condensate pumped (YES) or not pumped (NO) to the Denerator
12/16/96	10-45a.m.	N/A	N/A	YES
12/17/96	11-00a.m.	N/A	N/A	YES
12/18/96	10-00a.m.	N/A	N/A	YES
12/19/96	10-00a.m.	.006	N/A	NO
12/19/96	10-00p.m.	.0005	N/A	NO
12/20/96	3-00p.m.	N/A	N/A	YES
12/20/96	11-00p.m.	N/A	N/A	YES
12/21/96	1-00p.m.	N/A	N/A	YES
12/21/96	10-15p.m.	N/A	N/A	YES
12/22/96	11-30a.m.	.10	.07	NO
12/22/96	9-50a.m.	N/A	.01	YES

P.M.

APPENDIX 6

"STIROL" ESTIMATE OF BENEFITS FOR PROJECT #3

CALCULATION

of economic benefit from the installation of the instrument for quality control and monitoring of waste water at the plant producing liquid ammonia.

Purpose of Project:
To install a continuous in-line automatic conductivity meter to analyze samples of waste water from the ammonia plant for free ammonia.
Project Benefits: on 9 month 1997 year.

Based on 1995 experience the average concentration of free ammonia in waste water discharge is 0,396 kg/m³.

In March concetration N NH_4 was 0,080 kg/m³,
while waste water on 9 month 583200 m³.

583200 * (0.396 - 0.080) = 184291 kg = 184,291 t N NH_4,
or 184,291 * 1,21 = 222,992 t NH_3.

Purification costs of 1 t of ammonia are 761,18 grv.

Purification costs in 9 month:
761,18 * 222,992 = 169737,13 grv : 1,84 = $ 92248,44
761,18 * 48,642 = 37025,32 grv : 1,84 = $ 20122,46

The loss of product due to: the cost of ammonia $170/t will be 170 * (222,992 + 48,642) = $46177,78

Total costs are 92248,44 + 20122,46 + 46177,78 = $158548,68

With process control and the absence of free ammonia in discharged waste water economic benefit would be $158548,68.

Sergei Lizenko,
Deputy Technical Director

Average	280	632		240	327

PROJECT#3

FACILITY: **Ammonia Plant**

Calculation of Savings after Improvement through Usage of an Instrument to Measure Quality of Waste Water

Purpose of the Project:
To install a continuous in-line automatic conductivity meter to analyze samples of waste water discharged for free ammonia.
The instrument was installed on December 3, 1996. For the plant was put into operation after a long downtime followed by frequent discharges of waste water, it was not possible to to effectively use the insrument before January 12, 1997, because of extreme contamination of the waste water.

Savings Estimate:
The saving was calculated for the period January12 through January31, 1997. The relevant data of NH4 contents are tabulated and attached.
Based on 1995 experience , the average concentration of free ammonia in the waste water discharged is 0.396 KG/CM.
During the above period average concentration of NH4 in the waste water was 0.123KG/CM.
Quantity of the water discharged to the water treatment plant for the above 20 days was 45,828CM for purification purposes.
According to the analyses made during 1995, the concentration of ammonia in the waste water was 0.123 mg/l (KG/CM).
Thus, the amount of NH4, dischrged to the treament plant was reduced by the following number:

45,828CM × (0.396 - 0.123) = 12,511KG = 12.511 tons.

Expenses to purify ! t of ammonia are 761.18 grivnas.
Total purification costs for 12.511 t can be calculated as follows:

761.18grv × 12.511 = 9523.12grv : 1.87 = $5,092.58.

Three times, 12 hours each, during the period the instrument was used for, overcontamination of the waste waterof total volume 1146CM took place, therefore the water was utilized to prepare ammonia solution to be used as final product for production purposes.
Thus, the amount of ammonia utilized for production was as follows:

1,146 × 2.625KG/CM = 3,039KG = 3.039 t;

1,146 × 2.188 KG/CM = 2,508 KG = 2.508 t;

1,146 × 1.485 KG/CM = 1,702KG = 1.702 t.

The total amount of NH4 was 7,248 t, or 7,248 × 1.21= 8,77t of ammonia.
With the price on ammonia as 135.61USD/ t, the saving will be as follows:

$135.61 × 8.77 = $1189.30

Total savings are :

$5092.58 = $1189.30 = $6281.88.

Since the above instrument was applied the saving being arrived at is $6,281.30.

WASTE IN THE WATER

PROJECT #3

DATE	N NH4+ mg/L	WHERE DISCHARGED
JANUARY 1997		
12	72	TO TREATMENT PLANT
13	88	" "
	19	" "
14	90	" "
	270	" "
15	159	" "
16	133	" "
	239	" "
	398	" "
17	68	" "
	491	" "
18	69	" "
	185	" "
19	80	" "
	90	" "
20	120	" "
21	74	" "
	175	" "
22	80	" "
	2652	UTILIZED FOR PRODUCTION 12 HOURS
23	2188	
	66	
24	148	" "
25	110	" "
	69	" "
	43	" "
26	58	" "
	32	" "
27	37	" "
28	19	" "
29	79	" "
	1485	UTILIZED FOR PRODUCTION, 12 HOURS
30	32	TO TREATMENT PLANT
	191	" "
	175	" "
31	101	" "
AVERAGE	288	
	123	

AVERAGE FOR TREATMENT

С.М. Лизешко

4 of 4

APPENDIX 7

LIST OF CLOSE-OUT CEREMONY PARTICIPANTS

PARTICIPANTS
to
CLOSE OUT CEREMONY AT "STIROL" PLANT
in Gorlovka

DATE: July 22, 1997
PROJECT: WMD Projects No1,2 &3

Participants to the Ceremony:

1.WEC:

Thomas McGrath	Vice President
Bohdan Aftanas	Project Manager
Gennady Merkhalevitch	In-Country Coordinator

2.USAID:

Michael Kalinovsky	Project Officer

3.Regional Administration:

Mark Rymar	Head of Energy Distribution & Energy Conservation Department
Svyatoslav Kurulenko	Head of Regional Environmental Inspectorate
Vladimir Litvinenko	Head of City Environment Inspectorate
Nickolas Retinsky	Chief Ecologist of City Municipality
Vladimir Yutshenko	Chairman of Environment Protection Committee under City Municipality

4."Stirol" and Other Companies:

Alexander Tugolukov	Technical Director
Sergey Lizenko	Deputy Technical Director,
Alexander Yermak	General Manager of "Granas" Plant
Vladimir Reznikov	Technical Director of "ARPI" Company
Yuri Rodionov	Manager of MMC Station
Leonid Bugayev	Manager of Ammonia Plant No1
Victor Titov	Manager of OAZ Plant

Press:

Lyudmila Tkatchenko	"Azotchik" and "Vechernyaya Gorlovka" Newspapers, Broadcasting Company
Svyetlana Golovina	"Kochegarka" Daily.

APPENDIX 8

CERTIFICATE OF RECOGNITION

WORLD ENVIRONMENT CENTER

under its cooperative agreement with the

United States Agency for International Development

presents its

Certificate of Recognition

to

"Stirol" Chemical Plant

Gorlovka, Ukraine

For Participation In Waste Minimization Demonstration Projects
Saving 500 Tons Per Year of Ammonia and 5 Tons Per Year of Sodium Nitrite

August 1996 to July 1997

"Every Day is Earth Day"

Antony G. Marcil, President & CEO